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*Losing HOPE: Financial Aid
and the Line Between College
and Work*

CELESTE K. CARRUTHERS
AND UMUT ÖZEK

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Celeste K. Carruthers
University of Tennessee-Knoxville

Umut Özek
American Institutes for Research

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Carruthers (corresponding author): Department of Economics, Stokely Management Center, University of Tennessee. Knoxville, TN 37996-0570. Email: carruthers@utk.edu. Özek: Center for Analysis of Longitudinal Data in Educational Research, American Institutes for Research. 1000 Thomas Jefferson Street, NW, Washington, D.C. 20007. Email: uozek@air.org.

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Celeste K. Carruthers and Umut Özek

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Abstract

Although a wealth of research has shown that financial aid reduces hurdles to college enrollment, relatively little is known about how aid affects students after they are enrolled, much less how students react to the common occurrence of losing aid midway through their college careers. Using longitudinal data on four cohorts of Tennessee public college students, we find that failing to renew merit scholarships decreases credit loads, decreases the likelihood of declaring a major, increases labor force participation and earnings while enrolled, and increases the likelihood of leaving college without a degree for the workforce. Together, findings suggest that losing financial aid weakens students' engagement with college, particularly at the extensive margin.

1 Introduction

Students in public colleges and universities rarely face the full cost of their enrollment. In addition to public subsidies that flow directly to colleges and universities, students themselves are subsidized with an assortment of financial aid packages and low-interest loans. These subsidies, generally financed by state and federal governments, are motivated by multifaceted positive externalities of higher education as well as the credit constraints that pose hurdles to college enrollment. Financial aid policies are intended to increase access to college, increase persistence and progression through college, and increase the likelihood of college completion. Voluminous research has shown that financial aid awards can affect the extensive margin of initial college enrollment and significantly increase the likelihood that a student attends college,¹ although this is certainly not true of all financial aid vehicles.² In a review of this area of research, Deming & Dynarski (2009) point to transparent financial aid programs as being the most effective at increasing college enrollment.

A smaller but quickly expanding literature examines how financial aid affects student persistence, behavior, and graduation, conditional on postsecondary enrollment. Castleman & Long (2012) find that need-based eligibility for Florida Student Assistance Grants significantly increases credit accumulation and degree receipt. By contrast, Sjoquist & Winters (2012) find no effect of exposure to broad-based merit aid on degree receipt. Cohodes & Goodman (2012) show that a Massachusetts scholarship for high-achieving students has the unintended effect of reducing the likelihood of degree receipt by incentivizing students to attend in-state public colleges rather than higher-quality private or out-of-state colleges. Scott-Clayton (2011) demonstrates that West Virginia's PROMISE scholarship has no local effect on students' persistence or in-school employment, but increases credits earned, grade-point averages, and the likelihood of receiving a bachelor's degree. The impact of PROMISE on persistence appears to be driven in part by

¹ *Inter alia*, Dynarski (2000); Seftor & Turner (2002); Dynarski (2003); Kane (2003); Cornwell et al. (2006)

² Hansen (1983); Rubin (2011); Bruce & Carruthers (2012)

structural incentives, because scholarship-holders are more likely to meet college credit and courseload benchmarks that are tied to scholarship renewal. A pre-post cohort analysis indicates that academic impacts generalize to higher-ability students, who also tend to reduce their earnings in response to PROMISE. These findings underscore the behavioral incentives introduced by discrete renewal criteria. Cornwell et al. (2005) show that renewal requirements for Georgia's HOPE scholarship result in strategic course withdrawals and credit reductions among marginal students.

Although it is clear that students respond to the threat of losing scholarships, surprisingly little is known about what happens after scholarship loss. Dee & Jackson (1999) and Henry et al. (2004) provide descriptive profiles of students who lose Georgia's HOPE scholarship. Scholarship loss tends to be associated with lower credit accumulation and a decreased likelihood of degree receipt (Henry et al., 2004), as well as more technical science, engineering, and computing programs (Dee & Jackson, 1999). Yet to date, it is unclear how financial aid affects the substitution of college for work, much less whether the loss of financial aid reverses that substitution. If college persistence and labor outcomes are not sensitive to scholarship loss, then the behaviors highlighted by Cornwell et al. (2005) and Scott-Clayton (2011) are likely to be driven by a non-pecuniary aversion to losing financial aid more so than financial pressure. This, in turn, would imply that building more "nudges" into scholarship programs would be more cost-effective than increasing the generosity of individual scholarships. But if losing one's scholarship results in substantially weaker engagement with college and a shift toward work, this would stand as evidence that scholarships relieve financial constraints to attending and progressing through college.

In this study we identify the effect of losing financial aid on students' engagement with college, as well as students' substitution of work for college. We focus on Tennessee public colleges and universities, where a large merit-based financial aid program has collected more than \$2 billion for a broad base of eligible students. College-going students in Tennessee can qualify for the state's HOPE scholarship – a fixed transfer which covers a large share of tuition and fees at in-state public and private colleges – with

modestly above-average high school performance or a modestly above-average ACT score. Although the merit thresholds for obtaining HOPE are well within reach for marginally college-ready students, the thresholds for *retaining* HOPE once enrolled are effectively much higher. Of the nearly 48,000 students who held lottery-financed HOPE scholarships between 2003 and 2008, 53 percent eventually lost their scholarship, usually by failing to meet benchmarks for cumulative grade point averages. We utilize two-way fixed effects models to estimate the effect of losing the HOPE scholarship on post-enrollment and labor outcomes, holding constant students' idiosyncratic ability and trends common to all students who lose HOPE.

This study does not speak to the normative value of scholarship retention policies, but rather, the untapped opportunity to learn about the role of postsecondary financial aid in shaping the tradeoff between college and work by examining student choices after financial aid is withdrawn. Put in other words, the event of losing one's HOPE scholarship provides unique identifying variation in financial aid after college enrollment. We find that losing merit aid has much larger bearing on the extensive margin of college enrollment *per se* than on the intensive margin of the college-work substitution for students who remain enrolled. Losing the HOPE scholarship has little impact on labor force participation but increases earnings by 6.4 percent of the mean in the term immediately following HOPE loss. The substitution of earnings for scholarship funds is hardly one-for-one, however: each \$1,000 reduction in annual scholarship aid results in \$54 in additional annualized earnings. Time spent working may crowd out time spent in coursework; credit loads fall by 7.6 percent of the mean in the first term without HOPE funds. If scholarships offset long-term debt, losing financial aid may push students into high-return majors. We find, however, that scholarship loss has no systematic effect on choice of particular majors, but decreases the likelihood of declaring *any* major. Most concerning, losing HOPE substantially increases the likelihood of shifting completely out of college, without a degree, and into the work force. Students are 7 percentage points more likely to leave college following loss of the scholarship, and each \$1,000 of aid reduction

increases the exit propensity by 1.3 - 1.7 percentage points. These findings are considerably more pronounced for students with family income under \$60,000.

We conclude that financial aid in the form of a HOPE scholarship helps to define the line between college and work, particularly at the extensive margin. These observations are not limited to students who stand to *lose* the scholarship. While losing HOPE leads to less engagement with college and more engagement with the labor force, the converse is true for members of the last entering cohort before HOPE who – unlike any student to follow – earned HOPE *after* enrolling.

The remainder of the paper is organized as follows. Section 2 describes the policy landscape surrounding this application. Section 3 describes the data and empirical strategy we use to address the question of how financial aid affects student engagement. Section 4 discusses findings, and Section 5 concludes.

2 Policy Background

The HOPE scholarship accounts for the bulk of the Tennessee Education Lottery Scholarship Program (TELS), which was initiated after a 2002 statewide referendum approved lottery-financed postsecondary scholarships. The first HOPE scholarships were distributed in the fall of 2004 to eligible entering freshmen as well as sophomores from the 2003 cohort who met the post-enrollment conditions of a one-time grandfather clause. This 2003 cohort who had the opportunity to *gain* the HOPE scholarship is important to our empirical strategy because their behavior sheds light on the extent to which results drawn from scholarship loss invert and generalize to students presented with financial aid after enrollment.

Beginning with 2004 entrants, students are eligible to receive a HOPE grant if they enroll in a Tennessee public college (two-year or four-year) or in an in-state private nonprofit college within 16 months of high school graduation. As of the 2008-2009 academic year, the basic HOPE scholarship

provided up to \$4,000 per year to eligible students attending four-year institutions and up to \$2,000 per year to students in two-year community colleges, covering about 70 percent of required tuition and fees. Students must attain either a 21 on the ACT or an overall weighted high school grade point average of 3.0 in order to be eligible for a HOPE scholarship. Part-time students are eligible for pro-rated HOPE grants, and \$1,000 - 1,500 supplements are awarded to lower-income students or high-achieving students with high school grade point averages of at least 3.75 and ACT scores of at least 29 points. Throughout the paper, we account for supplements in computing the value of each student's TELS aid package, but for simplicity, refer to all TELS awards as HOPE scholarships.

Over most of the window of time this study focuses on, college students retain the HOPE scholarship by maintaining continuous enrollment and a college GPA of 2.75 after 24 attempted hours and 3.0 after 48, 72, and 96 attempted hours, up to five calendar years from the date of initial enrollment. The GPA threshold for 48 accumulated credits was reduced from 3.0 to 2.75 beginning with the fall of 2008.³

3 Data and Empirical Strategy

3.1 Data

This study makes use of 2003-2008 longitudinal data on four cohorts of Tennessee postsecondary students who enter college between the summer of 2003 and the fall of 2006. Administrative data provided by the Tennessee Higher Education Commission (THEC) cover fall and spring terms for all two-year and four-year public colleges in the state. We omit students who appear to be dual-enrolled in high school and college, and we limit the analysis to college students who fit the profile of first-time freshman, the scholarship's target group. Specifically, we focus on students who are ever identified as "freshman" in one administrative field and who are no older than 21 upon entering college. The final sample tracks the

³ Additional criteria and exceptions applicable to the present-day TELS are described in full at <http://www.tn.gov/collegepays>.

enrollment and work behavior of 116,440 unique students enrolled between the fall 2003 term and the fall 2008 term, the last term for which we observe data on scholarship.

THEC enrollment files are used to identify postsecondary students' institution, attempted credit load, cumulative grade point average, ACT or SAT score, major, gender, race/ethnicity, distance between home and first college, and HOPE scholarship status. Quarterly earnings data from the Tennessee Department of Labor and Workforce Development are merged to students' postsecondary profile to identify labor force participation and earnings between 2003 and 2008, including quarters when students are not enrolled. Earnings data are limited to in-state employees covered by Unemployment Insurance, which excludes self-employed workers, federal workers, and some agricultural workers. These exceptions are much less likely to apply to traditional college students than the working population at large. We align spring terms with the first two quarters of each calendar year and fall terms with the last two quarters. We then merge the postsecondary panel with students' first Free Application for Federal Student Aid (FAFSA) record, which is available for 95 percent of the sample, as well as full histories of ACT exams dating back to 2002 (available for 79 percent on average, much less so for the earliest cohort). FAFSA and ACT data, together, provide rich detail on household income and self-reported high school GPA, which we use as controls and subgroup identifiers. Lastly, we identify required tuition and fees for each institution and academic year using the Integrated Postsecondary Education Data System.

Table 1 lists summary statistics for college and labor outcomes describing the panel of students. Outcome variables of interest are students' term-by-term attempted credit load, major, the likelihood of changing a major, the presence and quantity of earnings in a given term, and the likelihood of exiting college. Students attempt 13.2 hours per term, on average, and four-year students generally enroll for more credits than two-year students. Majors are observed as two-digit Classification of Instructional

Program (CIP) fields,⁴ with nearly one-quarter of students identifying as “undeclared.” We define major changers as students in term t whose primary declared major is a different two-digit CIP code from the previous term, $t - 1$. Changing majors is a frequent occurrence, with 14.9 percent of the panel in a new major each year. Of those, 39.0 percent switch from the null undeclared category to a specific field. The vast majority of student-terms are associated with earnings, with students typically earning \$2,648 per half-year. Among students with positive earnings, average half-year earnings are \$3,155 for four-year students and \$4,420 for two-year students. We organize two-digit CIP majors into thirteen broad fields including “undeclared.” The most popular majors, aside from the null undeclared option, are business, general studies (nearly unique to two-year schools), health-related fields, and social sciences. Exiting students in term t are defined as those who are observed working but not enrolled and not holding a degree in term $t + 1$. Table 1 shows that 11.9 percent of the panel describes an exiting student, and that exit is three times more common in two-year colleges than in four-year colleges.⁵

Losing the HOPE scholarship is fairly common, as illustrated by additional descriptive statistics found in Table 2. There, we show that 18.5 percent of the panel describes students who previously held the HOPE scholarship but lost it by failing to meet continuous enrollment, GPA, or credit load requirements. Note that this understates the propensity for first-time scholarship holders to lose the scholarship because just a small share of the 2003 cohort gain HOPE with their first-year college performance. Out of the nearly 48,000 students who ever hold the scholarship, 53 percent eventually lose HOPE support. The post-enrollment GPA criteria is most often the cause of HOPE loss, describing 77.5 percent of instances where a HOPE scholarship is withdrawn.⁶ Figure 1 plots typical college grade point

⁴ We observe the six-digit CIP code for each student’s major (e.g., “14.0701 Chemical Engineering”) but focus on broader two-digit majors (like “14. Engineering”) for the sake of comparability across institutions.

⁵ Across students, multiple exits are uncommon but not rare. We find that 28 percent of students exit once by this definition, while 8 percent leave college two or more times.

⁶ Other recorded reasons for scholarship loss include an unapproved change to part-time enrollment (5.6 percent of all who lose the scholarship) and non-continuous enrollment (1.8 percent). Since enrollment status and continuous

average of students who lose the HOPE scholarship, by the number of terms until or since their first term without the scholarship. Typically, a student who loses the HOPE scholarship does so after multiple terms performing well below the 2.75-point threshold required at 24-credit and 48-credit benchmarks.

Interestingly, GPA begins to rise steadily just prior to HOPE loss, and continues to rise for those students who stay enrolled after losing HOPE. This pattern indicates that HOPE loss is not typically preceded by declining college performance, but rather, persistently low grades followed by improvement that falls short of the renewal threshold.

The remainder of Table 2 describes time-varying and time-invariant characteristics of students. Nearly two-thirds of the panel is in a four-year college or university, and annual tuition and fees average close to \$5,000 for four-year students and \$2,400 for two-year students. Students' typical grade point average is 2.20. We might like to utilize grade point average data for sharp identification of scholarship loss, but this is not ideal. Grades are subject to student and institutional manipulation that can violate identification assumptions that rely on GPA or other thresholds. Indeed, the incentives built into scholarship retention schemes have been shown to affect students' course withdrawals and overall performance as they near renewal benchmarks (Cornwell et al., 2005; Scott-Clayton, 2011). Students who just fail to reach the 2.75-point GPA threshold at 24 credits, for instance, are not likely to be adequate counterfactuals to students who preserve their HOPE eligibility by just maintaining the required GPA. Instead, we use what information is available on college GPA to control for student performance and estimate the effect of scholarship loss on student outcomes, relative to students with similar GPAs at similar points in the college sequence. Specifically, regressions to follow interpolate or impute missing

enrollment are outcomes of interest in this study, the empirical strategy accounts for the simultaneity of scholarship loss and less than full-time enrollment by estimating the effect of scholarship loss on outcomes in the first term without scholarship support, i.e., at least one term after GPA or enrollment outcomes triggered scholarship withdrawal. Even so, results are robust to the exclusion of students who lose scholarship support for either a change in enrollment status or non-continuous enrollment.

GPA values,⁷ control for an indicator variable equal to one for imputed GPA values, and control for interactions between semester fixed effects, grade point average, and missing grade point average indicators.

In results to follow, we examine the effect of scholarship loss for the sample as a whole, but also for subgroups of students divided by family income, gender, race, and initial college sector. Categorical family income is ascertained from two sources. Primarily, we rely on adjusted gross income from students' first FAFSA record. Among the 95 percent of students with any FAFSA history, median adjusted gross income is close to \$60,000. For students without a FAFSA record or with missing adjusted gross income, we use students' self-reported estimates of parental income from ACT surveys to identify those with family income below \$60,000. We do not observe the family income of 8.3 percent of students.

3.2 Estimating the Effect of Losing HOPE on Postsecondary and Labor Outcomes

Across- and within-student variation in HOPE receipt is used to identify the effect of losing the scholarship on postsecondary and labor outcomes described in Section 3.1 and Table 1. Specifically, we stack cohort panels by students' sequence of enrollment and estimate the following:

$$Y_{it} = \alpha_0 + \alpha_i + \alpha_t + \delta 1(\text{losthope}_{it}) + Z_{it}\gamma + (t - t_0) * 1(\text{before})_{it}\eta_1 + (t - t_0) * 1(\text{after})_{it}\eta_2 + \alpha_t * GPA_{it} + \varepsilon_{it}, \quad (1)$$

where Y_{it} represents an outcome for individual i in his or her t^{th} semester. The parameter α_i is an individual fixed effect and α_t is a fixed effect for the t^{th} semester in students' time series. The treatment of interest,

⁷ GPA values are first imputed by linear interpolation within students' time series, ignoring first semesters. Next, any other missing GPA values are imputed using the median GPA for each cohort and semester sequence.

$1(\text{losthope})_{it}$, is equal to one in all terms after HOPE loss. That is, $1(\text{losthope})_{it}$ is equal to zero up to and including the last term with HOPE aid, and equal to one thereafter. Students who never receive the scholarship and students who never lose the scholarship have $1(\text{losthope})_{it} = 0$ for all terms. The vector Z_{it} contains time-varying student characteristics that might affect postsecondary progression and labor force participation: college grade point average, an indicator for missing grade point average, an indicator for fall terms, tuition and fees, and an indicator for enrollment in a four-year college. Z_{it} also contains a linear function of time to capture underlying trends in postsecondary outcomes that affect all students. We denote term t_0 as the first term without HOPE for students who lose the scholarship, such that parameters η_1 and η_2 estimate trends in student outcomes leading up to HOPE loss and following HOPE loss, respectively. Finally, $\beta_t * GPA_{it}$ controls for the interaction between semester fixed effects, college GPA, and the indicator for missing GPA. Equation 1 is limited to students in the 2004-2006 cohorts, who entered college when the HOPE merit scholarship program was fully implemented. Identifying variation stems from within-student changes in HOPE status (for these cohorts, the only change would be the loss of HOPE aid), conditional on α_t shocks common to all students in their t^{th} semester, as well as from across-student differences in HOPE status as of the t^{th} semester, conditional on α_i heterogeneity.

The coefficient on $1(\text{losthope}_{it})$ in Equation 1 returns the average importance of losing aid across scholarship holders within the 2004-2006 cohorts, but does little to quantify the impact of scholarship funds themselves. The basic HOPE grant is supplemented for low-income students as well as those who qualify with exceptionally high ACT scores and high school performance. Additionally, HOPE grants grew from \$1,500-\$4,000 to \$2,000-\$5,500 over the short window of time we consider. We exploit variation in the value of HOPE scholarships across students and time to identify the impact of each \$1,000 in merit aid. Specifically, we complement Equation 1 with the following:

$$Y_{it} = \alpha_0 + \alpha_i + \alpha_t + \delta H_{it} + Z_{it}\gamma + (t - t_0) * 1(\textit{before})_{it}\eta_1 + (t - t_0) * 1(\textit{after})_{it}\eta_2 + \alpha_t * GPA_{it} + \varepsilon_{it}, \quad (2)$$

where H_{it} is the amount of inflation-adjusted HOPE scholarship funds student i holds in term t , and other variables are defined as before. Equation 2 is estimated for the 2004-2006 cohort, but also the 2003 cohort in isolation. Unlike students who entered college later, the 2003 cohort had the opportunity to *gain* the HOPE scholarship beginning with the fall 2004 term, so long as they met the 24-credit 2.75-point GPA benchmark. Examining the 2003 cohort on its own allows us to test whether Equation 1 and 2 results are limited to the *loss* of aid, or rather, if findings generalize to include the award of aid as well.

It may be the case that students who lose the scholarship are of fundamentally lower ability and motivation than students who retain HOPE. Indeed, Figure 1 suggests that students have below-average grade point averages in the terms leading up to HOPE loss, so it is highly plausible that students who lose the scholarship are less prepared for college and more apt to substitute work for college. Student fixed effects control for time-invariant heterogeneity of this nature, and results for the 2003 grandfathered cohort help to describe the extent to which results generalize to students of higher ability. Another threat to internal validity, however, is the idea that students who lose the HOPE scholarship are following a fundamentally different trajectory than students who retain the scholarship, or that the loss of a scholarship coincides with other unobserved factors affecting college performance. We address this possibility in two ways. First, the interactions $\beta_t * GPA_{it}$ control for cumulative student performance as of semester t in each students' college sequence. Second, we address dynamic trends by controlling for $(t - t_0) * 1(\textit{before})_{it}$ and $(t - t_0) * 1(\textit{after})_{it}$ in Equations 1 and 2, that is, a local linear function of the gap between the current term and the first term without the HOPE scholarship. This function is set to zero for students who never lose the scholarship or who enter college without HOPE. Coefficients on these terms provide insight regarding the pre- and post-loss trajectory of student outcomes, and

moreover, allow the δ coefficient on $1(\text{losthope})_{it}$ to be identified as the immediate deviation from pre-loss trends in student outcomes.

4 Results

Figure 2 illustrates some of the stylized facts about student behavior in semesters proximate to HOPE loss. The figure plots mean, regression-adjusted attempted credits (panel I) and exit rates (panel II) for students who ever lose the HOPE scholarship, by the number of terms until or since their first term without the scholarship. Mechanically, the figures plot residuals v_{it} from the following:

$$Y_{it} = \alpha_0 + X_i\beta + Z_{it}\gamma + v_{it}, \quad (3)$$

where X_i and Z_{it} are observable student and institutional variables summarized in Table 2. Equation 3 adjusts nominal credits and exit propensities to account for student attrition and changes in the composition of students summarized by each point in the figure.⁸ Even when the composition of students is held constant over terms, an immediate decrease in credit load and immediate increase in exit behavior are evident, both coincident with the first semester without HOPE. This pattern lends support to the idea that losing financial aid decreases students' engagement with college. Equations 1 and 2 essentially test whether these observations are robust to additional controls for student characteristics, broad institutional factors and trends, and underlying student-level heterogeneity.

Table 3 lists Equation 1 and 2 estimates for the effect of HOPE loss and other time-varying factors on credits attempted per term and the linear probability of changing majors. Column I indicates that credit loads decline by 0.996 in a student's first term without HOPE support, representing 7.6 percent of the

⁸ Patterns of nominal credits and exit preceding and following scholarship loss are qualitatively similar to those in Figure 2.

13.2-credit mean. To some extent this is a reversal of pre-loss trends – as indicated by the positive coefficient on “Terms until HOPE loss.”⁹ For students who remain in the sample after losing HOPE, attempted credit hours rise by a comparatively small 0.067 credits each term after HOPE loss. Other results in Column I are worthy of note. Since Equation 1 includes student fixed effects, the coefficient on the “Four-year college” indicator is largely driven by students transferring from two-year to four-year institutions. Transferring is estimated to increase credit loads by 1.573 credits per term.

Our last observation from Column I is the result that a \$1,000 increase in tuition and fees increases credit load by 0.734 hours, controlling for student fixed effects. At face value, the effect of tuition appears to be an unconventionally positive price elasticity, but given the fixed costs of enrolling each term, this finding may indicate that higher tuition pushes students to accelerate their progress toward graduation. Similarly, enrolling in more classes can be a rational response to higher tuition when tuition schedules nonlinearly favor full-time enrollment. Pausing to consider this possibility, Figure 3 plots coefficients from 13 specifications of Equation 1, where the dependent variable is the likelihood of enrolling for h credits, $h \in [3, 15]$. Losing HOPE aid increases the propensity to enroll for 12 or fewer credits (up to and including the typical full-time threshold) and decreases the likelihood of enrolling for more than 12 credits. The shift in credit loads following scholarship loss appears to be somewhat concentrated at 12 credits, but otherwise smooth throughout the range of 3-15 credits. By contrast, higher tuition leads to substantial bunching at the full-time threshold.

Column II of Table 3 lists estimates from Equation 2, with the value of students’ HOPE scholarships representing the financial aid treatment in place of $1(\text{losthope}_{it})$. Like Column I results, Column II coefficients are limited to the 2004-2006 cohorts who enrolled when merit scholarships were fully implemented, and within-student identifying variation in financial aid is limited to scholarship loss. Each

⁹ Note that “terms until HOPE loss” is $(t - t_0) * 1(\text{before})_{it}$ in Equation 1, takes a negative value, and increases with proximity to the first term without HOPE. “Terms since HOPE loss” is $(t - t_0) * 1(\text{after})_{it}$ in Equation 1.

\$1,000 of withdrawn HOPE aid yields 0.684 *fewer* credits, on average, whereas each \$1,000 rise in required tuition and fees leads to 0.772 *additional* credits per term. From a personal finance standpoint, these results stand in disagreement with each other. Conditional on college enrollment, why would a reduction in grants have the opposite effect as an increase in price, since both imply additional out-of-pocket spending on college? The HOPE scholarship is a conditional cash transfer, and its withdrawal is expected to have a pure income effect on the intensive margin. Rising tuition, on the other hand, can conceivably result in more intense enrollment in the short term if full-time enrollment is incentivized in the tuition schedule and if taking on more credits per term reduces the number of future terms that students need to commit to college. A related idea is the notion that students who are more apt to lose HOPE, and thus, are contributing more to variation in the HOPE treatment, are perhaps *less* committed to completing college than the student body as a whole.

Column III of Table 3 lists estimates from Equation 2 for the subset of the panel that began college in 2003. A portion of these students were eligible for HOPE scholarships beginning with the fall of 2004, via a grandfather clause tied to completing 24 credits with at least a 2.75 grade point average. Thus, the 2003 cohort stood to gain and lose HOPE scholarships. For this cohort, each \$1,000 of HOPE funds leads to 0.334 additional credits, just less than half of the impact on later cohorts. Together, Columns I-III imply asymmetries in the impact of HOPE on credit loads: losing the scholarship has a more intense impact than gaining the scholarship. Regardless, the impact of aid on the intensive margin of college enrollment is fairly modest compared to the mean.

Turning to Columns IV - VI, we find little to no significant effect of HOPE loss on the likelihood of changing majors. Students are somewhat more likely to change majors in the semesters leading up to HOPE loss and somewhat less likely to do so immediately after HOPE loss (Column IV), but point estimates are very small in absolute and economic magnitude. Increasing aid by \$1,000 increases the likelihood of changing majors by a similarly small share (Columns V - VI). Results to follow add texture to these findings

by testing for the effect of HOPE aid on the likelihood of declaring majors in particular fields.

The basic HOPE scholarship covers over 70 percent of tuition and fees in Tennessee public colleges and universities over the window of time this study considers. If HOPE scholarships offset student borrowing, and if students are averse to holding debt, losing HOPE may induce students to favor majors with a higher perceived yield or more secure employment prospects in the labor market. Rothstein & Rouse (2011) show that the introduction of a “no loans” policy at a selective university increased participation in relatively low-yield public service fields. Variation in the “no loans” policy is across cohorts, however, and it is not clear *a priori* if an analogous substitution across fields will be observed for students who lose financial aid midway through college. Table 3, Columns IV - VI, indicate that the propensity to *change* majors is not meaningfully affected by changes in HOPE support, but it remains possible that losing HOPE decreases outmigration from particular majors. Table 4 reports results from Equation 1 for the likelihood of majoring in one of thirteen broad fields. The estimating sample includes the 2004-2006 cohorts, many of whom started college with HOPE aid. Losing HOPE has a small, negative, but statistically significant impact on the likelihood of majoring in engineering, general studies, health-related fields, and science. Conversely, losing HOPE has a small positive impact on the likelihood of declaring an education or recreation major. While the effect on education enrollment fits the story of a rational response to higher college costs (that is, in pursuit of more certain employment), we caution that the Column IV point estimate for “Lost HOPE” is very small.

The most striking feature of results reported in Table 4 is the effect of HOPE loss on the null “undeclared” major option. Although the terms leading up to HOPE loss are associated with a somewhat lower propensity to declare *no* major, the likelihood of being undeclared is 5.4 percentage points higher in the term immediately following failure to renew HOPE, representing 23 percent of the overall undeclared share of the panel. Moreover, the propensity to remain undeclared changes very little each term after loss of the scholarship. Given that HOPE loss has no measurable impact on the likelihood of changing majors or

selecting particular majors, its effect on the undeclared option is best characterized as a delay in choosing a field. Potential mechanisms behind this delay are not well understood,¹⁰ but delays in identifying a path through college can conceivably derail the completion of college itself. Together with the effects of HOPE loss on credit loads, the observation that losing HOPE delays major choice further shapes the conclusion that financial aid strengthens commitment to college, and losing financial aid weakens that commitment.

Findings reported in Table 3 indicate that losing HOPE decreases college engagement in terms of credit load, although the impacts are somewhat small. A sensible substitute to time spent in college is time spent in work. Table 5 shows that although losing HOPE is associated with very little change in labor force participation (Column I), the term following scholarship loss is linked to \$170 in additional earnings among those students who stay enrolled (Column IV). Although this is a large increase over pre-loss trends, the discrete change in earnings following HOPE loss is only 6.4 percent of mean half-year earnings. This appears especially small when evaluated in terms of the magnitude of scholarships. Columns V - VI show that each \$1,000 of HOPE aid withdrawn leads to just \$27-46 in additional earnings in the short term (\$54 - 92 at an annualized rate).

Results summarized by Tables 3 -5 show that students substitute credit loads for earnings in response to the loss of financial aid, but that impacts are generally small. On their own, Table 3 - 5 results do not indicate that financial aid is a particularly strong wedge between college and work. These insights are necessarily limited, however, to students who remain enrolled after losing the scholarship. It may be the case that HOPE loss affects both the intensive and extensive margin of college enrollment, leading some students to leave college entirely. Table 6 provides strong support for this possibility, indicating that losing HOPE support significantly increases the likelihood of leaving college without a degree but *not* leaving the Tennessee workforce. Column I of Table 6 shows that for students in the 2004-2006 cohort

¹⁰ A wealth of research has sought to identify the effect of future earnings on major choice (e.g., Wiswall & Zafar (2011); Zafar (2011)) but to our knowledge, no study has specifically examined the transition between undeclared terms and particular majors.

whose college career begins with HOPE support, the likelihood of leaving college and working without a degree increases 7.0 percentage points immediately after HOPE loss. This change in attrition propensity is statistically and economically meaningful, 59% above the average exit rate per term. Columns II and III indicate that each \$1,000 of aid decreases exit propensity by 1.3 - 1.7 percentage points. The negative coefficient for terms prior to HOPE loss implies that post-loss exit behavior is a reversal of pre-loss trends. The bulk of exiting due to HOPE loss occurs immediately. Terms following the first semester without HOPE are associated with a very small but statistically significant decline in exit propensity, in agreement with stylized facts depicted in Figure 2.

Finally, we turn to Table 7 for subgroup analyses of our main Equation 1 results. Table 7 lists “Lost HOPE” coefficient estimates for six subgroups of students, delineated by family income, gender, race, and initial college sector. For comparison, results for all students are listed in the top row. Our principle findings that losing HOPE decreases engagement with college and increases engagement with work holds for all subgroups. Credit reductions are significantly larger among the lower-income half of the sample with non-missing income, and at the same time, impacts on exit (Column V) are much larger for lower-income students. These findings suggest – sensibly – that students with lower family resources are more acutely vulnerable to credit and cash-flow constraints that hinder college persistence.

Other subgroup analyses reported in Table 7 are worthy of note as well. We find that females are more responsive to HOPE loss than males in terms of credit load, earnings, and exit behavior, although the difference for each is small. White students reduce credit loads and increase exit rates by much more than black students in light of scholarship withdrawal. And lastly, we compare results for students who start in community colleges versus those who start in four-year universities. HOPE loss effects a larger reduction in credits and a larger increase in exit behavior among two-year college students. Although a HOPE-induced shift out of college and into work is evident for all subgroups, Table 7 demonstrates that these findings are somewhat heterogeneous across dimensions of income, gender, race, and college sector.

5 Concluding Remarks

Tennessee is one of several states with generous merit aid packages available to a broad base of new enrollees but often withdrawn at stringent renewal benchmarks. The fact that many students lose merit aid before completing college is well-known, but to date no study has rigorously examined the impact of scholarship loss on student persistence or work behavior. Thus, our foremost intention is to break new ground in this area of higher education and policy research. Results shed light on the role of financial aid after enrollment by identifying student reactions to the frequent occurrence of *losing* financial aid. We identify the causal effect of scholarship loss on students' credit loads, major choices, and labor outcomes for several recent cohorts of students in Tennessee public colleges and universities. We find strong evidence that financial aid helps students define the line between college and work, and specifically, that losing financial aid shifts that line in such a way that students become less engaged with college and more engaged with work. Students attempt fewer credits after losing the scholarship and participate more in the workforce. Students do not appear to strategize their choice of major in response to HOPE loss. Instead, they are significantly less likely to declare *any* major, underscoring the idea that the loss of financial aid can erode commitment to college.

The impact of scholarships on the intensive margin of college enrollment appears to be very small, however: losing HOPE leads to a 7.6 percent reduction from mean credit loads and a 6.4 percent increase over mean earnings. More concerning is the impact of losing HOPE on the extensive margin of college. Students are much more likely to leave college after losing HOPE, and this exit behavior is pronounced for lower-income students. Collectively, these findings are consistent with credit and cash-flow constraints that necessitate a work-college substitution.

The operative constraints appear to be so binding in the short term – or, myopia is so pronounced among college students – that students sacrifice considerable lifetime earnings for small gains in

immediate earnings. The nominal value of a HOPE scholarship is worth much less than the “sheepskin” effects of degree completion (Jaeger & Page, 1996), or for non-completers, the returns to college persistence (Flores-Lagunes & Light, 2010). Thus, students who leave college in the wake of losing \$1,500 - \$5,500 in annual HOPE aid likely do so at great expense to future earnings. These findings have some policy implications for scholarship retention models, although we emphasize that parsing the motivational and strategic effects of renewal criteria is beyond the scope of this study. Rather, our findings have practical implications for how advisers and financial aid administrators can potentially improve student engagement after the loss of merit aid (by pointing students toward other aid options, for instance). More broadly, we provide evidence that merit scholarships have meaningful bearing on college engagement after enrollment, and furthermore, that this engagement appears to be driven by monetary need. Losing financial aid has the immediate effect of pushing students out of college – completely or partially – and into the workforce.

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Table 1: Descriptive statistics: 2003-2006 cohorts of Tennessee public postsecondary students

Sample	All	Four-year	Two-year
<i>Dependent variables</i>			
Credit load (attempted credits this term)	13.169 (3.444)	14.213 (2.676)	11.384 (3.855)
Different major from last term	0.149	0.166	0.121
Any earnings while enrolled (half-year)	0.725	0.695	0.775
Earnings while enrolled (half-year, thousands)	2.648 (3.178)	2.194 (2.947)	3.424 (3.401)
Exiting college: working but not enrolled next term	0.119	0.063	0.216
Undeclared major	0.233	0.296	0.127
Agriculture major	0.016	0.025	0.002
Business major	0.109	0.131	0.070
Education major	0.018	0.026	0.005
Engineering major	0.047	0.058	0.027
Health-related major	0.096	0.060	0.159
Humanities major	0.055	0.088	0.000
General studies major	0.206	0.005	0.550
Recreation major	0.013	0.020	0.000
Science major	0.049	0.074	0.007
Social science major	0.095	0.140	0.018
Skilled trades major	0.024	0.023	0.026
Visual/performing arts major	0.037	0.053	0.010
n_{it} (student-years)	584,925	369,044	215,881
n_j (students)	116,440	73,816	67,823

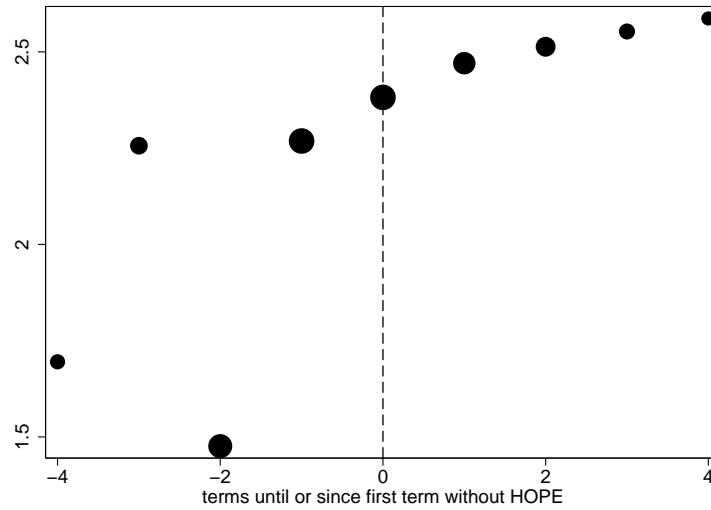
NOTES: Standard deviations are in parentheses below means of continuous variables. Earnings are in inflation-adjusted 2005 dollars.

Table 2: Descriptive statistics: 2003-2006 cohorts of Tennessee public postsecondary students

Sample	All	Four-year	Two-year
<i>Independent variables - time-varying</i>			
Lost HOPE	0.185	0.212	0.138
Scholarship value (in thousands)	1.392 (1.815)	1.954 0 (1.977)	430. (0.882)
Terms until HOPE loss (negative)	0.482 (1.291)	0.56 (1.384)	0.349 (1.101)
Terms since HOPE loss	0.311 (0.967)	0.384 (1.085)	0.186 (0.705)
Four-year public	0.631		
Cumulative GPA	2.203 (1.318)	2.382 (1.260)	1.896 (1.356)
Missing GPA	0.053	0.048	0.062
Tuition and fees (000s)	4.037 (1.328)	4.981 (0.599)	2.423 (0.196)
<i>Subgroup identifiers - time-invariant</i>			
Male	0.440	0.447	0.426
Black	0.164	0.174	0.147
White	0.781	0.769	0.800
Family income < 60,000	0.467	0.437	0.520
Missing family income	0.083	0.051	0.138
n_{it} (student-years)	584,925	369,044	215,881
n_i (students)	116,440	73,816	67,823

NOTES: Standard deviations are in parentheses below means of continuous variables. Other independent variables include indicators for spring or summer entrants, an indicator for fall terms, a linear trend, self-reported high school GPA (if known), and an indicator for missing high school GPA. Scholarship values are in inflation-adjusted 2005 dollars.

Figure 1: Descriptive statistics: College grade point average, relative students' first term without the HOPE scholarship



NOTES: $n_{it} = 204,727$ student-years with non-missing GPA for 33,831 students who ever lose the HOPE scholarship. The figure plots students' typical grade-point averages in terms proximate to the first term without HOPE support. Marker size is weighted by the number of students observed t terms before or after HOPE loss.



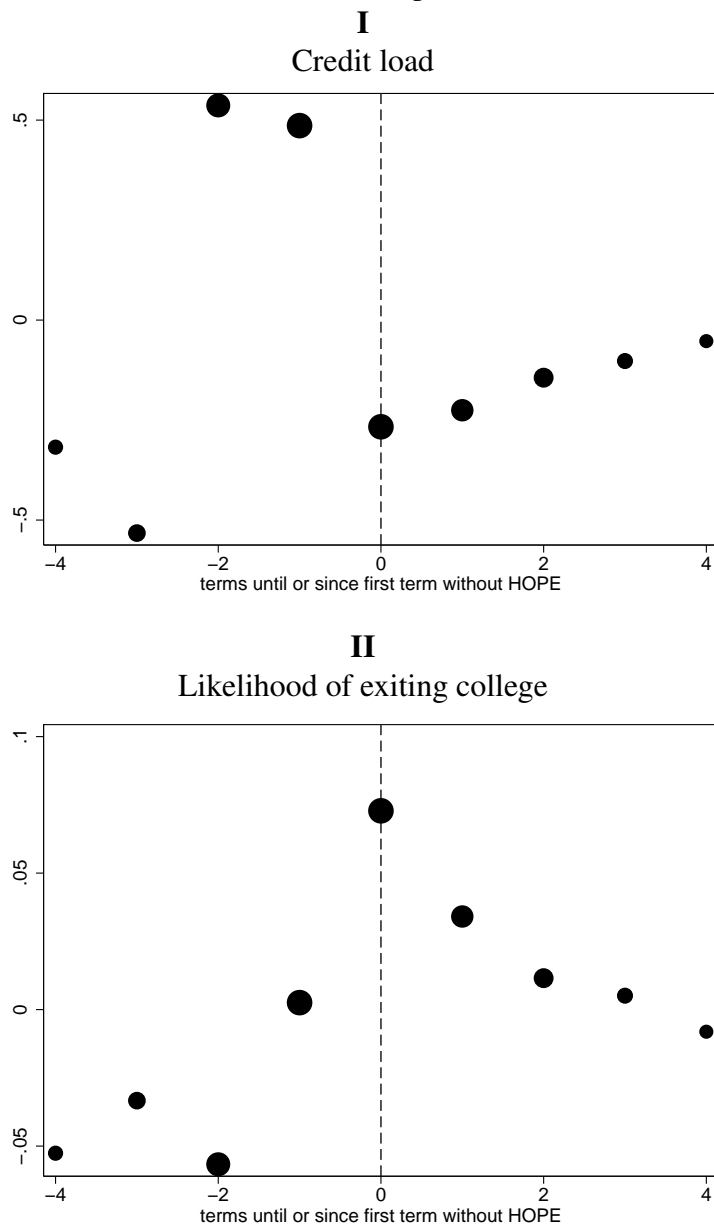
Table 3: The impact of losing HOPE on college credit load and the likelihood of changing majors

Outcome	I	II	III	IV	V	VI
	<i>creditload_{it}</i>			<i>1(change major)_{it}</i>		
Equation	(1)	(2)	(2)	(1)	(2)	(2)
Cohorts	2004-2006	2004-2006	2003	2004-2006	2004-2006	2003
Lost HOPE	-0.996*** (0.025)			-0.006** (0.003)		
Scholarship value (000s)		0.684*** (0.007)	0.334*** (0.012)		0.012*** (0.001)	0.013*** (0.001)
Terms until HOPE loss (negative)	0.149*** (0.012)	0.390*** (0.012)	-0.040*** (0.012)	0.007*** (0.001)	0.014*** (0.001)	0.009*** (0.001)
Terms since HOPE loss	0.067*** (0.009)	0.167*** (0.009)	0.123*** (0.018)	-0.001 (0.001)	0.002* (0.001)	-0.003* (0.002)
Four-year public	1.573*** (0.117)	0.408*** (0.107)	1.579*** (0.165)	0.109*** (0.010)	0.088*** (0.010)	0.099*** (0.013)
Tuition and fees (000s)	0.734*** (0.045)	0.772*** (0.040)	0.413*** (0.070)	-0.010** (0.004)	-0.009** (0.004)	-0.008 (0.006)
Observations	421,615	421,615	163,310	421,615	421,615	163,310
Adjusted R-squared	0.13	0.18	0.11	0.11	0.11	0.11
<i>rho</i>	0.46	0.47	0.38	0.26	0.26	0.14

NOTES: The table lists coefficient estimates of Equations 1 and 2 for credit load, i.e., attempted credit hours, in term t as well as the linear probability of changing majors between term t and $t + 1$. Unlisted control variables include student and semester sequence fixed effects, cumulative GPA, interactions between semester sequence indicators and cumulative GPA, gender, race/ethnicity, low-income status, ACT, indicators for spring or summer entrants, an indicator for fall terms, a linear trend, self-reported high school GPA (if known), and indicators for missing data. See discussion of Equations 1 and 2. Robust standard errors, clustered at the student level, are reported in parentheses.

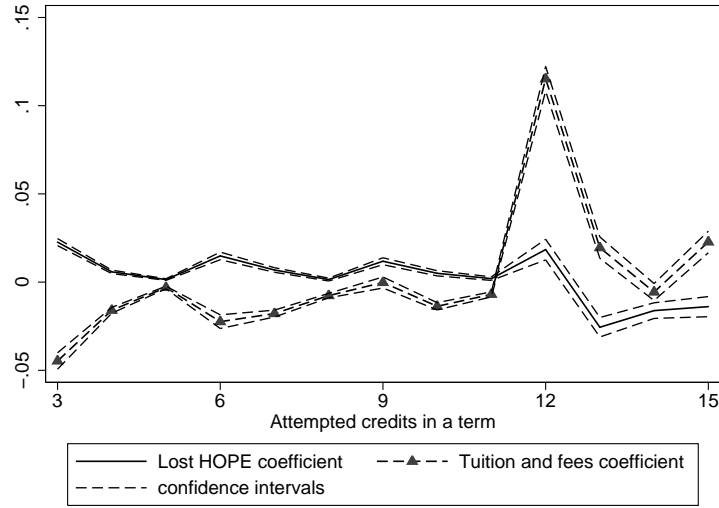
*** indicates statistical significance at 99% confidence (with respect to zero), ** at 95%, and * at 90%.

Figure 2: Descriptive statistics: Regression-adjusted credit load and college exit propensity, relative students' first term without the HOPE scholarship



NOTES: $n_{it} = 213,819$ student-years for 33,836 students who ever lose the HOPE scholarship. Figures plot regression-adjusted hours attempted (panel I) and the fraction of students who leave college (panel II), relative to their first term without the HOPE scholarship. See Equation 3 and related discussion. Marker size is weighted by the number of students observed t terms before or after HOPE loss.

Figure 3: The impact of HOPE loss versus the impact of a \$1,000 tuition increase on hours of enrollment



NOTES: $n_{it} = 584,925$ student-years spanning 116,440 students in the 2003-2006 cohorts. The figure plots coefficients and confidence intervals from 13 separate estimates of Equation 1, where the dependent variable is the likelihood of enrolling for h hours, $h \in [3, 15]$.

Table 4: The impact of losing HOPE on choice of major

	I	II	III	IV	V	VI	VII
Major	Undeclared	Agriculture	Business	Education	Engineering	General Studies	Health-related
Lost HOPE	0.054*** (0.003)	-0.001 (0.001)	-0.002 (0.002)	0.002** (0.001)	-0.008*** (0.001)	-0.022*** (0.002)	-0.015*** (0.002)
Terms until HOPE loss	-0.021*** (0.002)	0.001 (4.2E-04)	0.004*** (0.001)	0.001 (0.001)	0.003*** (0.001)	0.008*** (0.001)	0.004*** (0.001)
Terms since HOPE loss	-0.002* (0.001)	4.90E-04 (3.7E-04)	0.001 (0.001)	0.001 (0.001)	-0.003*** (0.001)	-2.7E-04 (0.001)	-0.003*** (0.001)
Adjusted R-squared	0.15	0.01	0.04	0.01	0.01	0.28	0.01
	VIII	IX	X	XI	XII	XIII	
Major	Humanities	Recreation	Science	Social science	Skilled trades	Visual/performing arts	
Lost HOPE	0.001 (0.002)	0.003*** (0.001)	-0.011*** (0.002)	1.80E-04 (0.002)	0.001 (0.001)	-0.001 (0.001)	
Terms until HOPE loss	-0.001 (0.001)	-0.001** (4.4E-04)	0.004*** (0.001)	-3.50E-04 (0.001)	-0.001 (4.0E-04)	-0.001* (0.001)	
Terms since HOPE loss	0.003*** (0.001)	0.001 (4.9E-04)	-0.003*** (0.001)	0.005*** (0.001)	0.001** (4.5E-04)	-1.00E-05 (0.001)	
Adjusted R-squared	0.03	0.01	0.01	0.05	2.0E-03	0.01	

NOTES: $n_{it} = 421,615$ student-years in the 2004-2006 cohorts. The table lists coefficient estimates of Equation 1 for the linear probability of having an undeclared major or declaring a major in one of twelve broad major groups. Unlisted control variables include student and semester sequence fixed effects, cumulative GPA, interactions between semester sequence indicators and cumulative GPA, gender, race/ethnicity, low-income status, ACT, indicators for spring or summer entrants, an indicator for fall terms, a linear trend, self-reported high school GPA (if known), and indicators for missing data. See discussion of Equation 1. Robust standard errors, clustered at the student level, are reported in parentheses.

*** indicates statistical significance at 99% confidence (with respect to zero), ** at 95%, and * at 90%.

Table 5: The impact of losing HOPE on labor force participation and earnings

Outcome	I	II	III	IV	V	VI
	$\mathbf{1}(\text{any earnings})_{it}$			earnings_{it} (000s)		
Equation	(1)	(2)	(2)	(1)	(2)	(2)
Cohort	2004-2006	2004-2006	2003	2004-2006	2004-2006	2003
Lost HOPE	-0.006* (0.003)			0.170*** (0.019)		
Scholarship value (000s)		0.001* (0.001)	-0.002 (0.001)		-0.027*** (0.004)	-0.046*** (0.008)
Terms until HOPE loss	0.005*** (0.002)	0.005*** (0.001)	-3.8E-04 (0.001)	0.022** (0.009)	0.042*** (0.008)	0.014 (0.010)
Terms since HOPE loss	0.002 (0.001)	0.002 (0.001)	0.001 (0.002)	0.021* (0.012)	0.032*** (0.012)	0.014 (0.018)
Four-year public	0.028** (0.011)	0.026** (0.011)	0.033* (0.017)	0.112 (0.073)	0.154** (0.074)	-0.006 (0.135)
Tuition and fees (000s)	-0.028*** (0.004)	-0.028*** (0.004)	-0.033*** (0.007)	-0.363*** (0.028)	-0.367*** (0.028)	-0.370*** (0.059)
Observations	421,615	421,615	163,310	421,615	421,615	163,310
Adjusted R-squared	0.02	0.02	0.01	0.09	0.09	0.12
ρ	0.51	0.51	0.47	0.62	0.62	0.61

NOTES: The table lists coefficient estimates of Equations 1 and 2 for the linear probability of having any earnings while enrolled and half-year earnings while enrolled. Unlisted control variables include student and semester sequence fixed effects, cumulative GPA, interactions between semester sequence indicators and cumulative GPA, gender, race/ethnicity, low-income status, ACT, indicators for spring or summer entrants, an indicator for fall terms, a linear trend, self-reported high school GPA (if known), and indicators for missing data. See discussion of Equations 1 and 2. Robust standard errors, clustered at the student level, are reported in parentheses.

*** indicates statistical significance at 99% confidence (with respect to zero), ** at 95%, and * at 90%.

Table 6: The impact of losing HOPE on the likelihood of departing college

Outcome	I	II	III
	$\mathbf{1}(\text{leave college})_{it}$		
Equation	(1)	(2)	(2)
Cohort	2004-2006	2004-2006	2003
Lost HOPE	0.070*** (0.002)		
Scholarship value (000s)		-0.017*** (4.5E-04)	-0.013*** (0.001)
Terms until HOPE loss	-0.034*** (0.001)	-0.029*** (0.001)	-0.017*** (0.001)
Terms since HOPE loss	-0.002*** (0.001)	0.001 (0.001)	-0.003*** (0.001)
Four-year public	0.174*** (0.007)	0.200*** (0.007)	0.141*** (0.010)
Tuition and fees (000s)	-0.108*** (0.003)	-0.110*** (0.003)	-0.101*** (0.005)
Observations	421,615	421,615	163,310
Adjusted R-squared	0.16	0.16	0.12
ρ	0.16	0.16	0.14

NOTES: The table lists coefficient estimates of Equations 1 and 2 for the linear probability of $\mathbf{1}(\text{leave college})_{it}$, a binary indicator equal to one for students who leave the postsecondary sector in the following term but remain in the sample of individuals with in-state earnings. Unlisted control variables include student and semester sequence fixed effects, cumulative GPA, interactions between semester sequence indicators and cumulative GPA, gender, race/ethnicity, low-income status, ACT, indicators for spring or summer entrants, an indicator for fall terms, a linear trend, self-reported high school GPA (if known), and indicators for missing data. See discussion of Equations 1 and 2. Robust standard errors, clustered at the student level, are reported in parentheses.

*** indicates statistical significance at 99% confidence (with respect to zero), ** at 95%, and * at 90%.

Table 7: The impact of losing HOPE on college and labor outcomes, by student subgroup

	I	II	III	IV	V
Outcome	$creditload_{it}$	$\mathbf{1}(change\ major)_{it}$	$\mathbf{1}(any\ earnings)_{it}$	$earnings_{it}$ (000s)	$\mathbf{1}(leave\ college)_{it}$
Subgroup					
All students $n_{it} = 421,615$ students-years $n_i = 90,187$ students	-0.996*** (0.025)	-0.006** (0.003)	-0.006* (0.003)	0.170*** (0.019)	0.070*** (0.002)
Family income < 60,000 $n_{it} = 197,764$ students-years $n_i = 44,228$ students	-1.092*** (0.038)	-0.011** (0.005)	-0.004 (0.005)	0.150*** (0.027)	0.090*** (0.004)
Family income \geq 60,000 $n_{it} = 196,249$ students-years $n_i = 37,948$ students	-0.949*** (0.036)	-0.004 (0.004)	-0.008 (0.005)	0.199*** (0.028)	0.054*** (0.003)
Male $n_{it} = 185,111$ students-years $n_i = 40,128$ students	-0.993*** (0.038)	-0.016*** (0.005)	-0.004 (0.005)	0.165*** (0.029)	0.067*** (0.003)
Female $n_{it} = 236,504$ students-years $n_i = 50,059$ students	-1.002*** (0.034)	0.003 (0.004)	-0.008* (0.004)	0.171*** (0.026)	0.073*** (0.003)
White $n_{it} = 327,755$ student-years $n_i = 68,979$ students	-1.090*** (0.029)	-0.007** (0.003)	-0.006 (0.004)	0.192*** (0.022)	0.075*** (0.003)
Black $n_{it} = 69,625$ student-years $n_i = 15,701$ students	-0.513*** (0.063)	-0.003 (0.008)	-0.007 (0.009)	0.178*** (0.047)	0.054*** (0.006)
Started in a four-year college $n_{it} = 239,831$ students-years $n_i = 43,927$ students	-0.667*** (0.028)	-0.008** (0.004)	-0.005 (0.004)	0.184*** (0.025)	0.050*** (0.003)
Started in a two-year college $n_{it} = 175,917$ students-years $n_i = 44,345$ students	-1.561*** (0.056)	-0.006 (0.005)	-0.019*** (0.005)	0.116*** (0.033)	0.114*** (0.005)

NOTES: The table lists coefficient estimates of the “lost hope” parameter in Equation 1, by student subgroups. Unlisted control variables include student and semester sequence fixed effects, cumulative GPA, interactions between semester sequence indicators and cumulative GPA, gender, race/ethnicity, low-income status, ACT, indicators for spring or summer entrants, an indicator for fall terms, a linear trend, self-reported high school GPA (if known), and indicators for missing data. See discussion of Equation 1. Robust standard errors, clustered at the student level, are reported in parentheses.

*** indicates statistical significance at 99% confidence (with respect to zero), ** at 95%, and * at 90%.