Assessing a Free College Opportunity for Students in Disadvantaged Schools

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Abstract

In Fall 2007, the University of Tennessee, Knoxville (UTK) initiated the Flagship Scholarship program. Flagship offers a "free college" opportunity to students from designated high schools if they are admitted to UTK, reducing many of the obstacles of application complexity and cost uncertainty while targeting aid toward students who are likely to be economically disadvantaged. We study how the introduction of the Flagship scholarship affected college enrollment outcomes for eligible students. Findings suggest that Flagship did not change the likelihood that students enrolled in college, but increased the likelihood they enrolled in UTK by up to 75% and the likelihood of earning UTK Bachelor's degree by 54%. Flagship-eligible students appear to have chosen UTK over less selective 4-year colleges and universities. The program's effect on Black student enrollment could have accounted for close to one quarter of the incoming Black student population at UTK.

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1 Introduction

Postsecondary education typically yields higher income for students in the long run (Card, 1999; Hoekstra, 2009; Oreopoulos & Petronijevic, 2013; Baum et al., 2013; Zimmerman, 2014). However, high tuition and fees generate financial burden, which may dissuade academically qualified students from applying to selective colleges (Hoxby & Avery, 2013; Dynarski, 2003). Furthermore, the high price of postsecondary education may lead students to put less effort into high school studies and give up further education opportunities. Educational attainment gaps between students from more advantaged versus less advantaged backgrounds reinforce and perpetuate lower incomes as students move into adulthood (Machin & Vignoles, 2004).

There are numerous scholarship opportunities available from both federal and state governments to alleviate the financial burden of higher education. In addition, colleges and universities provide institutional aid to students. Despite these efforts, low-income students remain underrepresented in higher education. Studies have shown a persistent gap in college enrollment rates between students from low-income and high-income families (Carneiro & Heckman, 2002; Belley & Lochner, 2007; Bailey & Dynarski, 2011; Chetty et al., 2017).

Attending college is costly, but unlike other large investments, it is very difficult for students and their families to learn what college will cost before taking several steps toward actually enrolling: applying to college, applying for financial aid, verifying financial aid application details if asked, and finally, receiving and interpreting financial aid award letters. One possible reason for the low enrollment rate of low-income students is the complexity and uncertainty of this process. Awareness of financial aid opportunities, and assistance taking advantage of those opportunities, can play an important role in students' college decisions (Bettinger et al., 2012; Dynarski & Scott-Clayton, 2006, 2008, 2013; Page & Scott-Clayton, 2016). But many financial assistance programs add uncertainty to those decisions with separate ap-

plications, income verification, or awards that are not guaranteed or known *ex ante* (Bell, 2021; Poutré & Voight, 2018; Scott-Clayton et al., 2022; Burland et al., 2023).

We examine the effect of a program that simultaneously reduces the obstacles of application complexity, cost uncertainty, and inequitable access to information about the cost of college, all while targeting aid toward students who are likely to be economically disadvantaged. The Flagship Scholarship program was implemented by the University of Tennessee, Knoxville (UTK) starting in fall 2007 (Collins, 2006). Flagship followed the end of the *Geier* consent decree regarding racial desegregation in Tennessee higher education (Collins, 2006; González, 2017) and the termination of the ability to award scholarships based on race.

The Flagship Scholarship's goal was to enhance the university's outreach and socioeconomic diversity by helping students from disadvantaged schools attain high-quality post-secondary education. Students who attend Flagship high schools in Tennessee are awarded this scholarship if they are admitted to UTK, the state's flagship college. No additional effort is required to receive and retain Flagship aside from filing a Free Application for Federal Student Aid (FAFSA), which is also required for the state's "HOPE" merit-based scholarship.[1] The Flagship Scholarship initially provided "up to $5,800 per year for four years when combined with the HOPE and other university scholarships" (Collins, 2006), which would have covered almost all of the $5,932 bill for in-state tuition and required fees (U.S. Department of Education, 2007). Since the vast majority of students admitted to UTK qualify for the HOPE scholarship (including 92% of Flagship students), Flagship was conveyed to potential students as a four-year free ride. Note, however, that mandatory fees do not include room and board.[2] The dollar value of Flagship rose over time to keep pace with the sum of tuition and fees. After making their way to UTK, Flagship

[1]The Tennessee HOPE scholarship was available to in-state students who scored at least 21 on the ACT or who had at least a 3.0 high school GPA.

[2]Students with family income below $27,000 would have been additionally eligible for the Pledge scholarship, which "guarantees qualified students can attend UT for four years without incurring debt" (Collins, 2006).

students needed to maintain a 2.0 grade point average (GPA) to renew their scholarship, i.e., maintain "satisfactory academic progress" that is also required for federal aid, state aid, and UTK graduation.[3]

UTK selected the original 35 Flagship schools based on two criteria: Economic disadvantage and historic rates of UTK enrollment.[4] The university targeted the most disadvantaged schools in the state for Flagship status, and particularly those where a low number of students enrolled in UTK. Students from these high schools were more likely to encounter financial obstacles when applying to college, were historically less likely to enroll in any college after high school, and if they did enroll, they were more likely to be first-generation college students (Collins, 2006).

Flagship students might have learned about the program through the university's media release (Collins, 2006), and more directly through admissions counselors. Then and now, each UTK admissions counselor works with a dedicated set of high schools. They promote the university to students, faculty, and staff at those schools, and they field questions about enrollment applications, financial aid, and life on campus. Admissions counselors would have conveyed information about Flagship and other aid opportunities through in-person visits, over email, and by phone.

We use state administrative data from school years 2005-06 through 2008-09 to evaluate the effect of the Flagship Scholarship on students' postsecondary enrollment and attainment. Specifically, we take on three research questions. First, does Flagship eligibility increase the likelihood of enrolling in UTK or any other college? Second, conditional on enrolling in college immediately after high school, does the program alter students' choice of college and the selectivity of where they enroll? Finally,

[3]There were no post-enrollment supports specifically targeted at Flagship students, although the program emerged during a time when UTK was increasingly focused on student retention and graduation (Blakely, 2010). If Flagship students were more at risk of dropping out, they may have encountered campus-wide efforts to increase persistence and completion.

[4]Five of the original Flagship schools closed or consolidated after 2007. We exclude cohorts from two schools that closed in 2008, midway through our sample window. The program expanded to add 8 new high schools in 2021 (Stephens & Payton, 2020). As of 2023, 38 public high schools in Tennessee were eligible for this scholarship.

does Flagship eligibility affect the probability that a student obtains a bachelor's degree? We employ difference-in-difference estimation models to compare postsecondary outcomes for students from designated Flagship high schools, before and after implementation of the program, to similar students who enrolled in ineligible high schools. We construct the control group in three ways to provide comparisons in more than one dimension: students who graduated from any non-Flagship public high school in Tennessee, students from non-Flagship high schools with low rates of college enrollment, and students from non-Flagship high schools that are most similar to Flagship schools in terms of graduation rates, attendance, racial composition, and students' Algebra I and English II standardized test scores.

We find that Flagship eligibility significantly increases enrollment in UTK immediately after high school graduation by 1.3 - 1.7 percentage points, equivalent to 61% - 75% of the pre-treatment UTK enrollment rate. Eligibility also increases the probability of earning a Bachelor's degree from UTK. However, it does not appear to alter students' decisions about going to college in general, does not significantly change their choice of college sector, and does not change their likelihood of earning a Bachelor's degree from any in-state public university. Among college-going students, we observe that Flagship eligibility leads students to enroll in more selective colleges with lower overall admission rates. Collectively, our findings suggest that Flagship eligibility shifted students to UTK from somewhat less selective 4-year colleges and universities.

2 Related Literature and Contribution

The effectiveness of financial assistance policies for students depends on many aspects. Generosity of aid is one leading factor, with each additional $1,000 corresponding to a 3 - 5 percentage point increase in the likelihood that a high school graduate enrolls in college (Leslie & Brinkman, 1988; Deming & Dynarski, 2010) and a 1.5 - 2 percentage point higher likelihood that a student completes college (Nguyen

et al., 2019). Awareness of financial aid and transparency of financial aid eligibility criteria are important as well (Dynarski & Scott-Clayton, 2013), helping students accurately project the cost of college. But accessing sufficient information about financial aid opportunities can be difficult, especially for economically disadvantaged students. Survey results show that more than 70% of high school graduates do not know what the FAFSA is used for, or how filing a FAFSA could help them afford college (Johnson et al., 2011).

Low-income students and their parents often perceive college expenses to be higher than they actually are due to the uncertainty surrounding scholarship availability and the lack of information regarding college costs (Grodsky & Jones, 2007; Horn et al., 2003). In one survey of Boston students, Avery & Kane (2004) report that students over-estimated actual college costs by a factor of 2 - 3. This misconception can discourage students from applying to selective colleges. Hoxby & Turner (2015) find that clear, personalized information about the likely net cost of attending college can increase enrollment rates among low-income students.

Even when students take the necessary step of applying for aid, the complexity of financial aid applications can generate serious barriers for low-income students, i.e., those most in need of help affording college (Reindl, 2015; Page & Scott-Clayton, 2016). In a field experiment, Bettinger et al. (2012) find that offering FAFSA assistance to low-income families significantly increases the likelihood their dependents apply for aid and ultimately attend college. Application complexity and post-application verification processes are shown to do little help but come with high costs, not only in terms of compliance and administrative expenses but also in social costs (Dynarski & Scott-Clayton, 2006, 2008, 2013; Guzman-Alvarez & Page, 2021).

In recent years, a number of institutions, communities, and states have tackled the problem of imperfect and inequitable information about the cost of college by introducing zero-tuition guarantees, often touted as "free college." Prominent examples from Tennessee, the setting for our study, include Knox Achieves and Tennessee

Promise, which cover a community college student's tuition balance after accounting for other sources of financial aid (Carruthers & Fox, 2016; Carruthers et al., forthcoming). Both programs were universally available to all high school graduates, including those from higher-income backgrounds or with greater awareness of college costs, who also tend to receive larger grants in "last dollar" funding models like Knox Achieves and Tennessee Promise. Last-dollar programs in general (which several other states introduced shortly after Tennessee) have been criticized for addressing just a small share of the cost of attending college (Jones et al., 2020). So-called "first dollar" Promise programs, such as Kalamazoo Promise, award grants equal to tuition irrespective of a student's other grants and scholarships, but at greater cost to funders (Bartik et al., 2016, 2021).

Dynarski et al. (2021) illustrate another way to pledge "free college" to prospective college students, but in a way that targets lower-income students to a much greater degree than universal Promise programs. The University of Michigan HAIL (High Achieving Involved Leader) Scholarship was offered at random to Michigan high school students who were identified as having low income and high achievement. Eligible students were notified about HAIL through University-branded mailers, and their parents and principals were notified separately. HAIL promised free tuition and fees if students applied and were admitted to the University of Michigan, with or without a FAFSA. Importantly, HAIL did not introduce new forms of aid: The university already offered full tuition discounts to low-income students, but this was not well known. By clearly communicating the individualized cost of attending college, HAIL significantly increased the likelihood that targeted students applied to and enrolled in the University of Michigan, and moreover, significantly increased the likelihood that they enrolled in any college.

The University of Tennessee's Flagship scholarship is not targeted at individual low-income students, but rather, at whole schools with large populations of low-income students. Like other tuition-free college guarantees, Flagship simplifies the eligibility process for students and conveys a clear message about the tuition cost of college.

The whole-school model is easier and less costly to administer than HAIL's more personalized tuition guarantee but nevertheless strikes a balance between making eligibility transparent while targeting aid toward needier students.[5] Two similar programs in Texas are the Longhorn Opportunity Scholarship (LOS) at the University of Texas at Austin and the Century Scholars (CS) at Texas A&M University – College Station. Both provide financial aid to students in targeted public high schools in Texas, which usually have more economically disadvantaged students and lower rates of enrollment in selective colleges.

Flagship, LOS, CS, as well as school-based admission criteria like Texas's "Top 10%" program, where students in the top 10% of their class are guaranteed admission to state universities, are intertwined with the history of affirmative action and race-based admission in U.S. colleges and universities. The Top 10% criteria as well as the LOS and CS programs were implemented after the 1996 *Hopwood v. Texas* decision, which ruled against using a student's race as a factor in college admissions. Similarly, the University of Tennessee introduced the Flagship scholarship in 2006 following the end of the *Geier* consent decree, and concurrently, the end of state funding for the school's African American Achievers Scholarship (Collins, 2006; Creekmore, 2018). Top percent criteria in Texas and California resulted in less diverse student bodies than affirmative action (Harris & Tienda, 2010; Bleemer, 2023). It is unknown if schoolwide programs like Flagship, LOS, or CS fare differently in terms of recruiting and enrolling racially and socioeconomically diverse students.

The Flagship scholarship offers us an opportunity to learn more about the effectiveness of school-based financial aid in increasing access to college for socioeconomically disadvantaged populations. In addition, Flagship is a less studied form of moderately targeted financial aid, i.e., aid made available to students who are likely

[5]Whole-school programs like Flagship may be more costly, *per low-income student*, than student-targeted scholarships such as HAIL, depending on the extent to which higher income students benefit from the program. Flagship-eligible cohorts had a high but not universal rate of eligibility for need-based free or reduced-price lunch, according to school-by-grade NCES data (69 - 75% over 2005 - 2008 versus 43 - 47% for other schools). We do not observe individual measures of income, and so do not know the extent of Flagship take-up among lower and higher income students.

to be lower income, while at the same time, communicated in a way that quickly resolves uncertainty about the tuition cost of college. We are starting to better understand the effects of clear and precisely targeted scholarships (Dynarski et al., 2021; Burland et al., 2023), and there is a growing body of work on clear and universal Promise-style aid (Carruthers & Fox, 2016; Bartik et al., 2021; Carruthers et al., forthcoming). Both appear to be more effective at increasing the likelihood that eligible students attend college than well-targeted, need-based Pell grants which entail opaque and lengthy application timelines (Kane, 1995; Carruthers & Welch, 2019). Our study assesses if a scholarship program can be effective when it tries to do it all: target aid toward needy students, make aid available to racially under-represented students, and do so in a clear and transparent way that reaches all students.

Most related to our work, Andrews et al. (2020) find that eligibility for the Texas LOS significantly increases the likelihood that a student enrolls in college as well as their earnings after college, while the effect of CS appears to be more limited. There are a few key programmatic differences between Flagship and LOS/CS that motivate our study, in addition to socioeconomic differences between Tennessee and Texas. In general, Flagship does more to resolve cost uncertainty at the beginning of a student's college search and application process, whereas LOS/CS include more support for awardees once they are enrolled in college. Both the LOS and CS programs require additional scholarship applications besides FAFSA, and a financial award is not guaranteed (The University of Texas at Austin, 2012; Texas A&M University LAUNCH: Learning Communities, 2023). For the LOS, all students who enroll in LOS-targeted high schools are eligible for academic support, but not necessarily financial aid (Andrews et al., 2020). For the CS, only selected students from CS high schools can receive the scholarship, and once they enroll, awardees need to maintain a 2.75 GPA, attend mandatory events, and complete seminar courses (Texas A&M University LAUNCH: Learning Communities, 2023). As a comparison, students in Flagship high schools are provided with a renewable free-tuition guarantee conditioned only on being admitted to UTK, filing a FAFSA, and maintaining

a 2.0 GPA. In this respect, Flagship is more similar to HAIL, but targeted to whole schools rather than individual students.

Ultimately, we find that Flagship eligibility increases the likelihood that a student enrolls in UTK by up to 75%, similar to what Andrews et al. (2020) report for the effect of LOS eligibility on UT-Austin enrollment (71%) and smaller than what Dynarski et al. (2021) find for the effect of HAIL notification, which more than doubled the likelihood a student enrolled at the University of Michigan. Flagship, LOS, and CS were all implemented before the Great Recession and the steep increase in tuition and fees that followed, whereas HAIL was introduced in 2015. This may help to reconcile the more potent effects of HAIL's free tuition guarantee. HAIL's FAFSA-optional policy and more personalized encouragement to apply are important points of differentiation as well. Applying for financial aid is a significant barrier for some students (Klasik, 2012; Bettinger et al., 2012), and HAIL's targeted, merit-based scholarships may have helped students see themselves as high achievers (Dynarski et al., 2021). Large effects from all three programs suggest that free-tuition aid does not need to be universal in order to sway student decisions about going to college. In follow-up work to Dynarski et al. (2021), Burland et al. (2023) show that resolving uncertainty about the cost of college is a key ingredient in the success of tuition-free guarantees.

Results to follow also support the idea that targeting aid toward students in disadvantaged high schools can effectively recruit racially under-represented students, albeit, to a small degree. We find that Flagship eligibility increases Black students' enrollment in UTK by as much or more than the estimated effect on White students, which is in agreement with what Andrews et al. (2020) report for LOS and Black or Hispanic students. The total number of affected students would have been a small share of incoming UTK cohorts but perhaps 23% of the Black student population at UTK. Zooming out from Flagship-eligibility margin, however, we note that the number and share of UTK freshmen who were Black changed very little in the years following Flagship.

Scholarships like Flagship may unintentionally worsen students' postsecondary outcomes by directing them to a specific university or universities over higher quality alternatives. For example, the John and Abigail Adams Scholarship in Massachusetts provides a tuition waiver for high-achieving students if they attend one of the state's public colleges, and eligibility for the Adams Scholarship significantly increases the likelihood that they do so (Goodman, 2008). Massachusetts and the surrounding area have a number of high quality private colleges and universities, however, and Cohodes & Goodman (2014) show that Adams Scholarship eligibility unintentionally decreased on-time college completion. If Flagship-eligible students would have attended higher quality or better resourced colleges in the absence of the scholarship, its introduction may have similarly lowered their likelihood of graduating. Our findings counter this concern, and by contrast, Flagship eligibility appears to have led students to enroll in a more selective 4-year university than they would have otherwise.

3 Identification

To identify effects of the Flagship Scholarship, we estimate the following equation:

$$Y_{ist} = \alpha + \beta Flagship_{is} * Post_t + \gamma X_{ist} + \delta_s + \pi_t + \epsilon_{ist} \quad (1)$$

where Y_{ist} denotes postsecondary outcomes for student i from high school s and 12^{th} grade cohort t. For college enrollment outcomes (two-year, four-year, any college, or UTK), our main results encompass all public high school graduates in the state, classes of 2006 - 2009. For college quality outcomes (per-student college spending, admission rates, and graduation rates at the institution where student i enrolls), we estimate Equation 1 for college-going high school graduates.

$Flagship_{is}$ is a dummy variable that equals 1 if student i in high school s is eligible for the Flagship Scholarship. We limit our sample and define the control group in three

ways. First, in a statewide sample, we compare Flagship-eligible student outcomes to outcomes for all ineligible students in Tennessee. Second, since Flagship high school students tended to have lower college enrollment rates, we estimate Equation 1 for students attending schools with below-median college-going as recorded in 2005. This includes 26 of the 33 Flagship schools that we study. Third, we limit the sample to high schools that are comparable to Flagship schools in terms of student achievement, attendance, and graduation rates as reported in 2010 school profiles. Specifically, we use a logistic regression model to fit the probability of being a Flagship high school as a function of graduation rates, attendance rates, the percent of students who were Black, and the percent of students who scored "proficient" on Algebra I and English II end-of-course exams. We construct the control group as the top 25% of non-flagship schools in terms of predicted Flagship designation.

$Post_t$ is an indicator variable equal to 1 if high school graduation year t is greater than or equal to school year 2006-07, which is when the Flagship Scholarship was first introduced. X_{ist} represents a vector of individual-level characteristics, including gender, race/ethnicity, and type of high school diploma. The coefficient δ_s is a school fixed effect controlling for time-invariant, school-specific factors affecting postsecondary outcomes. The time fixed effect π_t absorbs time-varying shocks to all students. Finally, ϵ_{ist} represents an idiosyncratic error term. Standard errors are clustered at the high school level.

We can interpret $\hat{\beta}$ as the causal effect of Flagship eligibility on postsecondary enrollment under the assumption that eligible students would have followed a similar college-going trajectory relative to the control group, not necessarily in terms of college-going levels but in terms of changes in college-going from one cohort to the next. Importantly for this research design, Flagship designation did not depend on trends in enrollment.[6] And to our knowledge, Flagship schools were not the focus

[6]For example, if Flagship was meant to build on momentum from low but rising UTK enrollment, difference-in-difference results might be biased by pre-existing trends. Instead, persistently low UTK enrollment prior to Flagship appears to be a more likely scenario.

of other college-going initiatives in the mid-2000s, although UTK's scholarship was certainly not alone in trying to raise college enrollment for under-represented communities.[7] Counterfactual trends are unobserved, and standard robustness checks for models like Equation 1 assess the plausibility of our identification assumption by examining pre-implementation trends in outcomes between treatment and control groups. Unfortunately, available data on Tennessee classes of 2006 - 2009 include just one pre-Flagship cohort, so this check is not possible in our application.

Relying on the fact that Flagship schools were majority Black and accounted for about half of all Black high school graduates in Tennessee (46% in the class of 2005), we can indirectly assess the identification assumption by scrutinizing Black and White UTK enrollment trends prior to Flagship. If Flagship and non-Flagship students would have been on diverging postsecondary paths in the absence of the scholarship, we might expect to see Black and White UTK enrollment diverge before 2007. As we show in Appendix Figure A1, UTK data from 2002 - 2012 indicates that Black student enrollment was not significantly growing or declining prior to Flagship. This is not an ideal diagnostic for Equation 1 causal inferences but rules out a scenario where the Flagship scholarship emerged in the midst of an unrelated rise or fall in Black-White differences in UTK enrollment. We note, however, that Appendix Figure A1 does not suggest that Flagship preceded a long-term increase in Black freshmen enrollment in UTK. The scholarship may have altered individual decisions about where to enroll in college, but it had at best a small effect on long-term trends in the aggregate composition of UTK freshmen.

We are able to more closely examine a different assumption necessary for causal interpretation of $\hat{\beta}$. It is possible that Flagship status drew students to eligible schools

[7] To give one example from the broader policy landscape, Tennessee won a $3.5 million U.S. Department of Education "GEAR UP" grant in 2005, which was intended to increase college readiness and college enrollment among low income students. The state targeted 10 largely rural counties for its 2005 GEAR UP efforts. Flagship schools were predominantly located in the state's larger cities and did not overlap with GEAR UP areas. In this case, high schools in our control group potentially benefited from programs like GEAR UP, making our estimated effect of Flagship a lower bound of the actual effects.

who would have likely attended college (and UTK, specifically) with or without the scholarship. We assess this in two ways. First, we apply Equation 1 to characteristics of high school graduating classes in state administrative data, including size, demographic composition, the share of students receiving regular diplomas, and HOPE scholarship eligibility. As discussed in more detail in Section 5.2, we find evidence that eligible cohorts of graduates increased in size after Flagship was introduced, but not in a way that would lead us to expect higher rates of college-going.

Second, we use 2000 - 2011 school-level U.S. Department of Education NCES data to assess if 12^{th} grade enrollment in Flagship-eligible schools diverged from expectations before or after the program started. Results shown in Appendix Figure A2 indicate that 12^{th} grade enrollment was largely stable in Flagship schools prior to 2007 (with the exception of atypically high enrollment in 2003). After Flagship launched, eligible 12^{th} grade enrollment increased over 2007 - 2009 (the three treated cohorts we observe), but not significantly. Enrollment fell back to par in 2010 and 2011. This, combined with little to no student-level compositional changes in graduating cohorts, suggests that our estimated effects on UTK enrollment are likely not driven by endogenous enrollment into Flagship-eligible schools.

Finally, we estimate how the effects of Flagship eligibility may have changed over time using an event study specification:

$$Y_{ist} = \alpha + \sum_{\tau=q}^{-1} \beta_\tau Flagship_{is\tau} + \sum_{\tau=0}^{m} \beta_\tau Flagship_{is\tau} + \gamma X_{ist} + \delta_s + \pi_t + \epsilon_{ist} \qquad (2)$$

where τ represents the number of years until or since Flagship implementation in $\tau = 0 = 2006$, and q is the earliest time period before the implementation of program. However, we only have one cohort before treatment, so $q = -1$ in our application, and $Flagship_{is(-1)}$ is omitted for collinearity. Estimated post-treatment effects, $\hat{beta}_\tau$, are interpreted as conditional differences relative to the single pre-treatment period.

4 Data

Student-level records include high school graduating cohort (2005-06 to 2008-09), the name of the high school where students graduated, basic gender, race, and Hispanic ethnicity indicators, eligibility for the state's merit-based HOPE scholarship, and indicators for different types of college enrollment in the academic year immediately following high school graduation. We also observe an indicator for whether or not a student earned a regular high school diploma as opposed to an alternative, occupational, or special education diploma. Generally, a regular high school diploma is necessary for admission to colleges and universities. Finally, we identify postsecondary degrees that students earned from Tennessee public universities through 2020.

Most of these data come from statewide administrative records assembled by the Tennessee Higher Education Commission (THEC), who matched lists of Tennessee's public high school graduates to three sources of data on postsecondary enrollment: THEC enrollment records for the state's public colleges and universities, enrollment data from private institutions represented by the Tennessee Independent Colleges and Universities Association, and data on out-of-state or private enrollment as collected by the National Student Clearinghouse. Postsecondary enrollment data allow us to determine if students enrolled in college within the year following high school, the sector where they enrolled (two-year or four-year), and whether or not they enrolled in UTK.

We identify Flagship eligibility by matching students' high school name to Flagship program announcements. Of the 5 original Flagship schools that closed or consolidated, 2 did so in 2008, midway through our sample. We omit students who attended these schools from the analysis.

To assess the quality of institutions where students enrolled, and how this might have been affected by Flagship eligibility, we collect IPEDS data on per-student

spending, college admission rates, and graduation rates. Graduation rates measure the percent of a cohort who completed college within 150% of normal time, i.e., six years for four-year schools and three years for two-year schools. Admission rates, equal to the percent of applicants who are accepted, represent college selectivity. Unfortunately, admission rates are missing for 56% of colleges, including almost all two-year schools. We elect to leave this outcome as missing rather than impute (as 100% if missing, for example). In results not shown, we find that Flagship implementation is not associated with a significantly different likelihood of enrolling in a school with unknown admission rates. Missing admission rates, as well as higher admission rates if observed, both correspond with lower graduation rates, a lower likelihood of having a Carnegie research designation, and lower post-college earnings.

We include College Scorecard measures of college student earnings 10 years after initial enrollment as an additional measure of college quality. Although the cohorts included in the College Scorecard data overlap with our sample window, note that 10^{th}-year earnings are at the institution level, not the student level, and we are not able to assess the effect of Flagship on eligible students' earnings. Flagship students account for a small share of enrollees at a given institution (including UTK), so Scorecard measures largely reflect peers' post-college earnings. Finally, we merge information on students' high schools from publicly available NCES data, including school-level graduation rates, attendance rates, and Algebra I and English II end-of-course proficiency levels as recorded in 2010 (earlier data are not available). These school features allow us to construct a control group that shares similar features as Flagship high schools.

Table 1 columns (1) and (2) present summary statistics for high school graduates from 371 high schools in Tennessee, including 33 Flagship high schools. Panel A describes all high school students in the 2006-2009 classes. Students who were eligible for the Flagship Scholarship were less likely to enroll in college after high school than ineligible students from other schools. Just under half (48%) of students

who graduated from Flagship high schools enrolled directly in college, and 14% earned public in-state Bachelor's degrees by 2020. As a comparison, 59% of students from non-Flagship schools enrolled in public universities immediately after graduation, and 26% received Bachelor's degrees. Consistent with UTK's school selection criteria, Flagship students were much less likely than others to enroll in UTK (3% versus 6%). For the pre-program class of 2006, 111 students enrolled in UTK from soon-to-be Flagship schools. In terms of demographic characteristics, a large majority of Flagship high school graduates were Black (84%), compared with 16% in other schools. Flagship schools also had a slightly higher proportion of female and Hispanic students. Nearly all graduates across Flagship and non-Flagship schools earned regular high school diplomas.

Panel B presents descriptive statistics for the subset of graduates who immediately enrolled in college. College going students had a similar demographic profile as all high school graduates, but were more likely to be eligible for the state merit-based HOPE scholarship. Students in Flagship schools were much less likely to be HOPE eligible than students in other schools (37% versus 66%). Flagship-eligible students tended to enroll in colleges with lower expenditures, lower graduation rates, lower post-college earnings, but lower admission rates (if non-missing). Students from Flagship schools were close to three times more likely to enroll in a college or university without observed admission rates: 30% versus 11%

Columns (3) - (5) of Table 1 present summary statistics for two sub-samples of high schools that represent variations on the control group in regressions to follow. The first is the set of schools with below-median college-going, as presented in columns (3) - (4), by Flagship status. This includes 26 of the 33 Flagship schools (column 4). The second is the set of non-Flagship high schools that are most comparable to Flagship schools in terms of a logit-estimated function of achievement, attendance, racial composition, and graduation. Column (5) summarizes non-Flagship schools in the top 25% of Flagship propensity, which we compare with column (1) Flagship schools in some specifications of Equation (1). In both comparison samples, gaps

in characteristics between Flagship and non-Flagship schools are somewhat smaller, particularly regarding per-student expenditures at the colleges where graduates enroll and the likelihood of enrolling in UTK. But Flagship schools and students continue to stand out as distinct: less prepared for college, less likely to go to college, and more likely to go to lower quality colleges.[8]

5 Results

5.1 Main Results

Table 2 reports our main findings for Equation 1 estimates of the effect of Flagship eligibility on college going (Panel A) and college selectivity (Panel B). The column (1) specification includes the broadest sample of high school graduates, i.e., those from both Flagship and non-Flagship schools across the state. The model for column (2) limits the sample to schools with below-median college enrollment, which includes 26 of 33 Flagship-eligible schools. In column (3), we limit the control group to students from non-Flagship high schools that are most similar to Flagship schools in terms of racial composition and student success.

Results are generally consistent across the three samples. As shown in Panel A, we estimate that Flagship eligibility significantly increased the probability of enrolling in UTK by 1.3 to 1.7 percentage points, with the upper end of that range corresponding with the column (3) sample of Flagship and comparable schools. In the single pre-treatment cohort that we observe, 2.21% of students in soon-to-be-Flagship schools enrolled in UTK. Estimated treatment effects represent a 61 - 75% increase over that baseline mean.[9]

[8] These differences rule out matching as a research design. There is very little overlap between Flagship and non-Flagship groups, both at the school and student levels. The difference-in-difference research design described in Section 3 can accommodate level differences in student characteristics and their potential outcomes under the assumption that trends in potential outcomes would have been parallel in the absence of Flagship.

[9] We compute effect size estimates from coefficients measured out to five digits. The corresponding increase over the mean would be 59 - 77% from the three-digit estimates reported in Table 2.

Flagship does not appear to have affected whether eligible students enrolled in college at all, their choice over 2-year versus 4-year college sectors, or the likelihood of earning an in-state public Bachelor degree by 2020. We estimate a 0.9 percentage point increase in the likelihood of earning a UTK Bachelor's degree by 2020 (54% of the pre-treatment mean at Flagship schools), however, this effect is imprecise in the smaller column (2) and (3) comparison samples. This suggests that Flagship may have shifted students' college enrollment and degree completion to UTK from other 4-year schools, which could have been a detrimental substitution if Flagship students were unlikely to graduate from UTK. This does not appear to have been the case, however, since the marginal student's UTK graduation rate implied by column (1) is 56% (0.9/1.6), somewhat lower but within a standard error of 66% six-year graduation rates reported by UTK Office of Institutional Research and Assessment (2013).

Panel B results allow us to study this substitution in terms of college quality and selectivity to better understand how Flagship students' selected institution–and in particular, UTK–likely compares with their next-best alternative. The Panel B sample is limited to high school graduates who enroll immediately in college (a group whose membership does not appear to be endogenously determined by Flagship eligibility), and we report Equation 1 for per-student expenditures, admission rates, graduation rates, and 10^{th}-year peer earnings from the College Scorecard. Our findings suggest that Flagship eligibility encourages students to enroll in more selective colleges with lower admission rates, by 2.3 - 3.4 percentage points. This inference, combined with Panel A results for increased enrollment at UTK, suggests that Flagship led some students to choose UTK over a less selective 4-year institution. Nonetheless, we observe no significant upgrading in per-student college expenditures, graduation rates, or peers' typical post-college earnings, suggesting that UTK is similar to where Flagship students would have otherwise enrolled in those respects.

In addition to average treatment effects, we employ an event study design to under-

stand how Flagship program effects vary over time. Our results in Table 3 include Equation 2 estimates for three post-Flagship cohorts. We show there that each of the treated cohorts are significantly more likely to enroll in UTK relative to the single, omitted pre-treatment class of 2005-06. In addition, treatment effect estimates are slightly larger in the last observed Flagship cohort (2.0 percentage points for the class of 2009) than the first Flagship cohort (1.4 percentage points for the class of 2007). We observe this pattern across all three samples, as shown in Panels A, B, and C. Estimated treatment effects increase from 1.4 to 2.0 percentage points when we define all non-Flagship high schools as the control group (Panel A), from 1.2 to 1.7 percentage points when we limit the sample to students from schools with below-median college enrollment (Panel B), and from 1.5 to 2.0 percentage points when we limit the comparison group to schools that were quantitatively similar to Flagship schools.

Consistent with the positive effect on the likelihood of obtaining a UTK Bachelor's degree by 2020 as presented in Table 2 column (1), we observe the same effect for 2007-08 and 2008-09 cohorts when comparing with all non-Flagship schools. The magnitudes increase from 0.9 to 1.4 percentage points over time. However, this positive effect is only observed for the full sample (Panel A) and within the sample of schools with below-median college enrollment (Panel B). Within the Flagship-similar sample (Column C), eligibility is followed by an insignificantly higher likelihood of UTK degree receipt.

5.2 Mobility Tests

It is possible that the Flagship scholarship convinced students who intended to enroll in UTK to switch high schools to gain eligibility. This would be a threat to causal interpretations of Equation 1 and Equation 2 estimates, to the extent that higher rates of UTK enrollment were driven by students' pre-existing preferences rather than Flagship. We use Equation 1 to investigate if the size and demographic profile of cohorts in Flagship schools changed after the program was implemented.

Specifically, we replace student-level enrollment outcomes in Equation 1 with several school-level variables: The total number of graduates in a cohort, the percentage of students in each demographic group, the percentage of students who graduated with regular diplomas, and HOPE scholarship eligibility.

Table 4 shows that Flagship implementation is linked to a significantly larger graduating cohort size in two of the three samples (Column 1). The number of students who graduated from designated Flagship high schools increased by 16.5 students, or about 11% of the pre-treatment average. This is what we would expect if Flagship drew more students to enroll in eligible schools, although estimated effects on cohort size are not statistically significant (Panel B) or only weakly significant at the 10% level (Panel C) when we define control groups more narrowly. We see a similar (but imprecise) increase in the number of 12th graders, graduating or not, shown in Figure A2. Conditionally larger graduating classes do not suggest that new students in Flagship schools were more or less likely to attend college. Looking back to Table 1, there are a few student characteristics associated with higher rates of college-going. Women, Asian students, White students, HOPE eligible students, and students who earned regular high school diplomas are more likely to enroll in college. We do not see economically large or statistically significant changes in 12th grade demographic profiles along these lines,[10] or in the rate of eligibility for HOPE merit-based scholarship eligibility after Flagship implementation (Columns 2 - 7 and Column 9 of Table 4). We do, however, find that Flagship implementation is associated with lower rates of regular diploma receipt, by 2.5 - 3.0 percentage points. Given near-universal rates of regular diploma receipt in these data, this represents about a 3% decrease.

We also estimate Equation 2 event study regressions for demographic, diploma, and HOPE eligibility characteristics. Results are reported in Table A2 and enrich the overall post-treatment estimates shown in Table 4. Event study breakouts show de-

[10]One exception is a weakly significant 2.1 percentage point increase in the proportion of White students in the sample where we define the control group as Flagship-comparable schools (Panel C).

clines in regular diploma receipt across all three post-treatment cohorts, particularly the second of the three that we observe. We also show in Column 8 that Flagship eligibility is tied to a 2.9 percentage point increase in students' HOPE eligibility for the first but not subsequent cohorts. It is unclear if Flagship attracted more HOPE-eligible students to eligible schools, if the scholarship incentivized students to improve their grades and ACT scores to gain HOPE eligibility, or if HOPE eligibility increased for other reasons. Either way, the effect was short-lived and HOPE eligibility rates returned to par for the second and third Flagship cohorts.

Looking across Table 4 results, it appears that the introduction of the Flagship Scholarship coincided with more students graduating from designated high schools, but based on the limited amount of information we have on 12th graders in these data, we do not find evidence that student composition changed to favor more *ex ante* college going, especially in the two specifications that are limited to schools with below-median college enrollment or schools with similar student characteristics. Nevertheless, we bound estimated enrollment effects under two extremes of endogenous mobility: 100% and 0% post-Flagship cohort growth from UTK-bound students. Results are reported in Appendix Table A3. In the scenario where students who plan to attend UTK drive post-Flagship cohort growth in eligible schools, estimated gains in UTK enrollment remain positive and at least weakly significant for incumbent students, at 0.5 - 0.7 percentage points. If all post-Flagship growth is from students not planning to attend UTK, treatment effects are as large as 2.2 percentage points.

5.3 Heterogeneous Effects

We divide the student sample into subgroups by gender and race and re-estimate Equation 1 for each group. Results are reported in Table 5. Relative to ineligible students from non-Flagship schools or earlier cohorts, we find that both male and female Flagship-eligible students exhibit a significant increase in UTK enrollment and the probability of earning a UTK Bachelor's degree by 2020. Black students'

UTK enrollment and UTK Bachelor's degree receipt also rise with Flagship eligibility, by 1.7 and 0.9 percentage points, respectively. Although estimated effects on UTK enrollment are larger in magnitude for women than for men, and for Black students than for White, these are not statistically significant differences. White, Flagship-eligible students are more likely to enroll in UTK, a two-year college, or a four-year college, by large but statistically insignificant magnitudes. The "any college" outcome, however, increases by a significant 7.5 percentage points for White, Flagship-eligible students.

When evaluating college quality, we find that effects on female, male, and Black students are consistent with our main estimates, in that Flagship may lead them to choose colleges with lower admission rates. White students at Flagship schools likewise enroll in more selective colleges, to a similar but less precise degree than other demographic groups.[11]

Our Table 5 findings suggest that Flagship may have played a large role in recruiting Black students to UTK and increasing the probability of earning a UTK Bachelor's degree. Based on pre-Flagship enrollment decisions, perhaps 2.0% of Black students attending Flagship schools would have attended UTK without the scholarship, or about 400 students in total across the graduating classes of 2006 - 2009. Our results suggest that that another 1.7% (343) might have enrolled in UTK because of Flagship. This latter figure corresponds with only 2.1% of the freshman classes from 2006 - 2009, but perhaps 22 - 28% of Black students enrolling in UTK (UTK Office of Institutional Research and Assessment, various years).

Next, we estimate Equation 1 for gender and racial subgroups graduating from our focal subsamples of Tennessee high schools: those with below-median college en-

[11] Results for Asian and Hispanic subgroups are reported in Appendix Table A1. There are about 1,000 Asian or Hispanic students in Flagship schools (4% of total enrollment), and we omit these results from our main analysis out of concern that they may reflect small-sample estimation error. Nevertheless, results suggest that Flagship-eligible Hispanic students are more likely to enroll in 4-year colleges and UTK specifically, and that they tend to enroll in colleges with much higher admission rates (by 10.9 percentage points). For Asian students, postsecondary enrollment outcomes are not significantly different with Flagship eligibility.

rollment (Table 6) and those that are statistically similar to Flagship schools in terms of attendance rates, graduation rates, and student achievement (Table 7).

Results for schools with low college enrollment are consistent with the full sample for females, males, and Black students. Each subgroup is significantly more likely to enroll in UTK after gaining Flagship eligibility, likely shifting from another 4-year university, as we detect no significant change in their overall college enrollment or in their choices over 2-year and 4-year sectors. Unlike Table 5 results for the statewide sample, Flagship eligibility does not significantly increase White students' overall college enrollment. The increase in the probability of earning a UTK Bachelor's degree by 2020 only applies to Black students in the low college-going sample. In terms of college quality, we find that only Flagship-eligible female students tend to enroll in colleges with lower admission rates and the effects are weakly significant.

Finally, Table 7 lists heterogeneity results for the sample of comparable high schools. Results are similar to findings in Table 5, in that the likelihood of UTK enrollment significantly increases for female and Black students. Different from the full sample analysis, narrowing the focus to comparable schools reveals that Flagship eligibility does not alter male students' college enrollment decisions. Instead, it may increase White students' likelihood of enrolling at UTK, in 4-year college, and college overall. Notably, we see no significant effects on the likelihood of earning a UTK Bachelor's degree in the comparable high school sample analysis. Also unlike Table 5, we do not observe any significant effects on college selectivity for Black students (in terms of admission rates), and the estimates for female and male students are smaller in magnitude and weaker in significance (Panel B).

Looking across Tables 2 and Table 5 - 7, our conclusion is that Flagship eligibility generally increased the likelihood of UTK enrollment. On average, affected students appear to have substituted away from other, less selective 4-year universities. We also find that, for Black students, eligibility corresponds with a higher probability of earning a UTK Bachelor's degree. Different comparison groups add nuance

to these takeaways. For example, when comparing students from similar schools based on observable K-12 outcomes – such as achievement, attendance, and graduation – Flagship eligibility may have led more White students to enroll in college (if not UTK). In this specification, the effect on earning a UTK Bachelor's degree for Black students also diminishes. Our finding that students substituted to UTK from less selective universities appears to have been driven by differences in college choices between Flagship students and those from other high schools with low rates of college enrollment.

6 Conclusion

We evaluate effects of the University of Tennessee Flagship Scholarship, which provides a full tuition guarantee to any student from one of the state's most disadvantaged high schools, conditional on their admission to the university. This is an example of "place-based" financial aid, in the spirit of Promise programs for entire communities or states, but more targeted toward students who are likely to be economically disadvantaged. We find that Flagship significantly increases the likelihood that targeted students enroll in UTK immediately after high school by 1.3 to 1.7 percentage points, and increases the likelihood of earning UTK Bachelor's degree by 0.9 percentage points. Eligibility did not significantly correspond with a higher or lower likelihood of attending any college, or of attending a four-year college, suggesting that Flagship led some students to attend and graduate from UTK rather than another four-year university. UTK appears to have been more selective than schools where Flagship students would have otherwise enrolled, in terms of admission rates, although Flagship-eligible students did not attend schools with significantly higher graduation rates or post-college earnings.

Estimated treatment effects are large. Flagship high school graduates enrolled in UTK at a 2.21% rate in the single pre-treatment year we observe. A 1.7 percentage point effect accounts for a small number of students (perhaps 85 per cohort or 2-3 per

school), but nevertheless a 75% increase relative to the pre-treatment mean. These large gains in enrollment at a targeted institution are reasonable given the research literature on other programs that took a balanced approach between targeting aid toward needier students and communicating a clear message about guaranteed aid. As a comparison, the Longhorn Opportunity Scholars (LOS) increased the likelihood of enrolling at the University of Texas at Austin by 71% (Andrews et al., 2020). Dynarski et al. (2021) find that the HAIL Scholarship notification increased the likelihood of University of Michigan enrollment by more than 100%. Aspects of the HAIL scholarship may improve the effectiveness of whole-school scholarships like Flagship: specifically, FAFSA waivers or assistance, and personalized recognition for high achievers.

UTK implemented the Flagship scholarship following the end of the *Geier* consent decree, which required the state to spend $75 million annually toward improving racial diversity at Tennessee colleges and universities (Creekmore, 2018). Part of Tennessee's *Geier* allocation funded UTK scholarships for Black students, a practice which ended along with the consent decree. The Flagship scholarship awarded aid based on attendance at an economically disadvantaged school rather than an individual's race, but given the concentration of Black students at disadvantaged schools, eligible students were likely to be Black. Our estimates suggest that Flagship increased the likelihood that Black students enrolled in UTK by 1.4 - 1.8 percentage points, which could have accounted for 22 - 28% of freshman cohorts in the years we study. That being said, Appendix Figure A1 indicates that in the aggregate, Flagship did not lead to persistent growth in the number of Black freshmen enrolling in UTK after Flagship.

The whole-school scholarship design may overcome multiple barriers that students encounter during their college preparation: A lack of awareness of UTK as a post-secondary option, uncertainty about tuition and financial aid, and complexity in applying for financial aid. It is difficult to disentangle the unique effect of addressing each of these barriers, but related research suggests that they each play a role in

our findings. The Flagship program is one form of recruiting and outreach, and we know from prior work that students respond to colleges' recruiting efforts (Smith et al., 2022). We also know that students value certainty in the tuition cost of college (Burland et al., 2023), and that they respond to clear promises of "free college" (Bartik et al., 2021; Carruthers & Fox, 2016; Dynarski et al., 2021).

Our analysis was limited to the first three years of Flagship, and we do not observe data on student preparation for college. i.e., their course selections, achievement, ACT scores, and so on. It may be the case that Flagship and similar school-wide programs improve student outcomes in these domains before they start applying to college. We also do not observe longer-term effects of Flagship on labor market outcomes or student borrowing, which would permit a fuller view of the welfare effects of a whole-school scholarship model. There are large returns to flagship university attendance in other contexts (Hoekstra, 2009), but it is unclear whether UTK Flagship eligibility leads students to attend a substantially higher quality university than they would have otherwise. We leave these questions to future research, as well as the broader question of the welfare effects of broad-based, simplified financial aid versus targeted aid that is conditioned on economic disadvantage.

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Tables

Table 1: Descriptive Statistics

	Flagship eligible	Flagship ineligible	Flagship eligible from low college-going schools	Flagship ineligible from low college-going schools	Flagship ineligible from similar schools
	(1)	(2)	(3)	(4)	(5)
Panel A: High School Graduates					
Enrolled in any public college	0.48	0.59	0.45	0.49	0.55
Enrolled in UTK	0.03	0.06	0.02	0.03	0.03
Enrolled in a 2-year public college	0.21	0.27	0.21	0.26	0.26
Enrolled in a 4-year public college	0.29	0.36	0.27	0.26	0.32
In-state bachelor's degree by 2020	0.14	0.26	0.12	0.19	0.21
UTK bachelor's degree by 2020	0.02	0.06	0.01	0.03	0.03
Female	0.55	0.51	0.54	0.50	0.52
Asian	0.01	0.02	0.01	0.01	0.02
Black	0.84	0.16	0.82	0.14	0.39
Hispanic	0.03	0.02	0.04	0.02	0.03
White	0.11	0.80	0.13	0.82	0.56
Regular high school diploma	0.96	0.98	0.95	0.98	0.98
HOPE eligible	0.25	0.55	0.24	0.48	0.43
Observations	23,617	202,204	17,937	72,725	46,117
Panel B: College Enrollees					
Student Characteristics					
Female	0.61	0.54	0.60	0.56	0.56
Asian	0.02	0.02	0.02	0.01	0.02
Black	0.86	0.15	0.83	0.14	0.39
Hispanic	0.01	0.02	0.02	0.01	0.02
White	0.11	0.81	0.13	0.83	0.57
Regular high school diploma	>0.99	>0.99	0.99	>0.99	>0.99
HOPE eligible	0.37	0.66	0.36	0.62	0.55
College Characteristics					
Per-student expenditures (thousands)	13.98	15.20	13.62	13.29	13.78
Admission rate (% if non-missing)	0.67	0.81	0.68	0.82	0.76
Missing admission rate (%)	0.30	0.11	0.29	0.12	0.15
Graduation rate (%)	0.30	0.39	0.29	0.37	0.36
10th-year earnings (thousands)	34.27	35.48	33.85	33.87	34.87
Observations	11,282	118,875	8,050	35,994	25,143

Notes: Column (1) sample includes students from all Flagship eligible high schools; column (2) sample includes students from all Flagship non-eligible high schools; columns (3) and (4) restrict the sample to students who graduated from high schools with below-median college enrollment rates, for Flagship eligible and non-eligible schools, respectively; and column (5) include students from non-Flagship schools with top 25% Flagship propensity. Panel A describes high school graduates for the school year 2005-2006 to 2008-2009. Panel B describes students who enrolled in college immediately after high school. College enrollment outcomes are for the year immediately after high school graduation. Bachelor's degree completion is only observed for students who graduated from in-state public universities. College spending, admission, and graduation data are from 2007-2008. "10th-year earnings," from College Scorecard, represents median earnings of all students who enrolled in an institution between 2007 and 2009 (not limited to Tennessee students or linked to individuals in these data) and who borrowed for college, 10 years after initial enrollment.

Table 2: Estimated Effects of Flagship Eligibility

	All High School Graduates (1)	Students from HS with Below-Median College Enrollment (2)	Students from Flagship or Comparable HS (3)
Panel A: High School Graduates			
Enroll in UTK	0.016	0.013	0.017
	(0.004)***	(0.004)***	(0.004)***
Enroll in 2-year College	-2.2e-4	0.009	-0.004
	(0.010)	(0.010)	(0.011)
Enroll in 4-year College	0.007	-0.012	0.007
	(0.011)	(0.013)	(0.013)
Enroll in Any College	0.011	0.002	0.006
	(0.013)	(0.013)	(0.015)
In-State Bachelor's Degree	-0.001	-0.001	-1.8e-4
	(0.008)	(0.009)	(0.009)
UTK Bachelor's Degree	0.009	0.006	0.006
	(0.003)**	(0.003)	(0.004)
Observations	225,821	90,662	69,734
Panel B: College Enrollees			
Per-student expenditure (thousands)	0.289	0.433	0.378
	(0.335)	(0.296)	(0.351)
Admission rates (%)	-3.439	-2.578	-2.284
	(0.688)***	(0.830)**	(0.867)**
Graduation rates (%)	1.027	-0.011	0.851
	(0.617)	(0.781)	(0.751)
10^{th}-year median earnings (thousands)	0.307	0.053	0.349
	(0.213)	(0.246)	(0.249)
Observations	129,790	43,947	36,275

Notes: */**/*** denotes significance at the 10/5/1 percent level. Standard errors reported in parentheses are clustered at the high school level. Column (1) reports Equation 1 results for the sample of all high school graduates. Column (2) reports Equation 1 results for the sample of high school graduates from schools with below-median college enrollment. Column (3) reports Equation 1 results for the sample of Flagship schools plus 25% of other schools that were most similar to Flagship schools in terms of graduation rates, attendance rates, racial composition, and the percent of students who scored "proficient" on Algebra I and English II end-of-course exams (estimated by logit).

Table 3: Event Study Estimates of the Effects of Flagship Eligibility

	UTK	2-Year College	4-Year College	Any College	Any In-State Bachelor's	UTK Bachelor's
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All HS Graduates						
Period 2: 2007	0.014	-0.005	0.011	0.006	-0.003	0.005
	(0.006)*	(0.011)	(0.017)	(0.016)	(0.009)	(0.004)
Period 3: 2008	0.013	-6.1e-4	6.3e-4	0.007	-0.002	0.009
	(0.004)**	(0.009)	(0.010)	(0.013)	(0.009)	(0.003)**
Period 4: 2009	0.020	0.004	0.009	0.019	3.6e-4	0.014
	(0.004)***	(0.013)	(0.011)	(0.014)	(0.009)	(0.003)***
Observations	225,821	225,821	225,821	225,821	225,821	225,821
Panel B: From Below-Median College-Going HS						
Period 1: 2007	0.012	0.003	-0.014	-0.009	0.002	0.002
	(0.006)	(0.012)	(0.019)	(0.017)	(0.010)	(0.005)
Period 2: 2008	0.012	0.004	-0.009	0.003	6.4e-4	0.005
	(0.004)**	(0.010)	(0.012)	(0.014)	(0.010)	(0.003)
Period 3: 2009	0.017	0.018	-0.012	0.011	-0.005	0.010
	(0.005)***	(0.012)	(0.014)	(0.015)	(0.011)	(0.004)**
Observations	90,662	90,662	90,662	90,662	90,662	90,662
Panel C: From Flagship-Comparable HS						
Period 1: 2007	0.015	-0.006	0.006	-5.8e-4	-3e-5	0.003
	(0.006)*	(0.012)	(0.018)	(0.018)	(0.011)	(0.005)
Period 2: 2008	0.015	-0.004	6.8e-4	0.003	-0.005	0.006
	(0.005)**	(0.011)	(0.013)	(0.016)	(0.010)	(0.004)
Period 3: 2009	0.020	-0.001	0.013	0.014	0.005	0.009
	(0.005)***	(0.014)	(0.014)	(0.016)	(0.010)	(0.005)
Observations	69,734	69,734	69,734	69,734	69,734	69,734

Notes: */**/*** denotes significance at the 10/5/1 percent level. Standard errors reported in parentheses are clustered at the high school level. Panel A reports Equation 2 results for the statewide sample of high school graduates. Panel B reports Equation 2 results for the sample of high school graduates from schools with below-median college enrollment. Panel C reports Equation 2 results for the sample of Flagship schools plus 25% of other schools that were most similar to Flagship schools in terms of graduation rates, attendance rates, racial composition, and the percent of students who scored "proficient" on Algebra I and English II end-of-course exams (estimated by logit).

Table 4: Estimated Effects of Flagship Scholarship on Flagship HS Cohort Composition

	Cohort Size (1)	Female (2)	Male (3)	Asian (4)	Black (5)	Hispanic (6)	White (7)	Regular Diploma (8)	HOPE eligible (9)
Panel A: All HS Graduates									
	16.508	-0.009	0.009	-0.002	0.002	-0.002	0.003	-0.025	-0.004
	(5.421)**	(0.010)	(0.010)	(0.002)	(0.008)	(0.002)	(0.007)	(0.007)***	(0.013)
Observations	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,270
Pre-treatment mean	150.60	0.559	0.441	0.012	0.853	0.022	0.112	>0.99	0.212
Panel B: From Below-Median College-Going HS									
	10.924	-0.018	0.018	-1.2e-4	0.004	-0.001	-0.002	-0.018	-0.013
	(6.029)	(0.014)	(0.014)	(0.002)	(0.008)	(0.003)	(0.008)	(0.011)	(0.016)
Observations	598	598	598	598	598	598	598	598	598
Pre-treatment mean	146.77	0.560	0.440	0.010	0.839	0.025	0.125	>0.99	0.203
Panel C: From Flagship-Comparable HS									
	16.74	0.005	-0.005	-0.001	-0.014	-0.004	0.021	-0.030	-0.003
	(6.515)*	(0.014)	(0.014)	(0.002)	(0.010)	(0.003)	(0.009)*	(0.007)***	(0.015)
Observations	417	417	417	417	417	417	417	417	417
Pre-treatment mean	150.61	0.559	0.441	0.012	0.853	0.022	0.112	>0.99	0.212

Notes: */**/*** denotes significance at the 10/5/1 percent level. The table reports Equation 1 estimates applied to HS cohort size and composition. The dependent variable in column (1) is the total number of students in each high school's graduating cohort. The dependent variables in columns (2) to (9) represent the percentage of students in each group at the school level. Pre-treatment means represent average values for Flagship high schools before the implementation of the scholarship program. Standard errors are reported in parentheses and clustered at the high school level.

Table 5: Estimated Effects of Flagship Eligibility, by Student Subgroup

	Female	Male	White	Black
	(1)	(2)	(3)	(4)
Panel A: All High School Graduates				
Enroll in UTK	0.020	0.012	0.021	0.017
	(0.005)***	(0.004)**	(0.011)	(0.005)***
Enroll in 2-year College	0.005	-0.008	0.025	-0.007
	(0.013)	(0.012)	(0.017)	(0.013)
Enroll in 4-year College	0.012	0.001	0.052	-0.001
	(0.014)	(0.013)	(0.027)	(0.015)
Enroll in Any College	0.023	-0.004	0.075	-0.007
	(0.015)	(0.016)	(0.028)**	(0.015)
In-State Bachelor's Degree	-0.008	0.006	0.006	-0.010
	(0.010)	(0.009)	(0.027)	(0.010)
UTK Bachelor's Degree	0.010	0.009	0.003	0.009
	(0.004)*	(0.004)*	(0.009)	(0.004)**
Observations	115,053	110,755	164,524	51,761
Panel B: College Enrollees				
Per-student expenditure (thousands)	0.563	-0.134	0.383	0.412
	(0.357)	(0.450)	(0.711)	(0.381)
Admission rates (%)	-3.412	-3.617	-2.433	-1.429
	(0.947)***	(1.009)***	(1.492)	(0.709)*
Graduation rates (%)	1.487	0.364	2.797	0.540
	(0.772)	(0.773)	(1.447)	(0.774)
10^{th}-year median earnings	0.345	0.264	0.513	0.273
	(0.266)	(0.260)	(0.473)	(0.282)
Observations	71,048	58,728	97,764	27,458

Notes: */**/*** denotes significance at the 10/5/1 percent level. Standard errors reported in parentheses are clustered at the high school level. The table reports Equation 1 estimates for gender and race subgroups of the statewide sample of high school graduates.

Table 6: Estimated Effects of Flagship Eligibility among Below-Median College-Going High Schools, by Student Subgroup

	Female (1)	Male (2)	White (3)	Black (4)
Panel A: High School Graduates				
Enroll in UTK	0.016	0.010	0.016	0.018
	(0.006)**	(0.005)*	(0.011)	(0.005)***
Enroll in 2-year College	0.018	-0.005	0.018	0.010
	(0.015)	(0.011)	(0.018)	(0.015)
Enroll in 4-year College	-0.008	-0.016	0.022	-0.014
	(0.016)	(0.015)	(0.028)	(0.019)
Enroll in Any College	0.017	-0.016	0.041	-0.003
	(0.015)	(0.017)	(0.029)	(0.020)
In-State Bachelor's Degree	0.005	0.007	-0.001	0.011
	(0.004)	(0.004)	(0.009)	(0.004)*
UTK Bachelor's Degree	0.005	0.007	-0.001	0.011
	(0.004)	(0.004)	(0.009)	(0.004)*
Observations	46,141	44,518	62,017	25,074
Panel B: College Enrollees				
Per-student expenditure (thousands)	0.643	0.104	0.343	0.887
	(0.367)	(0.467)	(0.676)	(0.475)
Admission rates (%)	-2.827	-2.288	-1.495	-1.549
	(1.218)*	(1.208)	(1.517)	(0.938)
Graduation rates (%)	0.159	-0.356	2.147	0.124
	(1.051)	(0.954)	(1.602)	(1.141)
10^{th}-year median earnings	0.090	7.7e-4	0.264	0.011
	(0.332)	(0.301)	(0.524)	(0.375)
Observations	24,809	19,135	31,010	11,649

Notes: */**/*** denotes significance at the 10/5/1 percent level. Standard errors reported in parentheses are clustered at the high school level. The table reports Equation 1 estimates for gender and race subgroups of the sample of high school graduates from schools with below-median college enrollment.

Table 7: Estimated Effects of Flagship Eligibility among Comparable High Schools, by Student Subgroup

	Female (1)	Male (2)	White (3)	Black (4)
Panel A: High School Graduates				
Enroll in UTK	0.020	0.012	0.025	0.014
	(0.006)***	(0.006)	(0.012)*	(0.005)**
Enroll in 2-year College	0.003	-0.013	0.021	-0.005
	(0.014)	(0.014)	(0.018)	(0.014)
Enroll in 4-year College	0.004	0.011	0.060	-0.018
	(0.016)	(0.016)	(0.029)*	(0.016)
Enroll in Any College	0.015	-0.007	0.078	-0.021
	(0.016)	(0.019)	(0.030)**	(0.016)
Bachelor's Degree	-0.004	0.004	0.011	-0.014
	(0.012)	(0.010)	(0.028)	(0.012)
UTK Bachelor's Degree	0.006	0.006	0.002	0.005
	(0.005)	(0.006)	(0.010)	(0.004)
Observations	36,777	32,954	28,607	37,807
Panel B: College Enrollees				
Per-student expenditure (thousands)	0.532	0.118	0.443	0.417
	(0.378)	(0.494)	(0.732)	(0.418)
Admission rates (%)	-2.163	-2.524	-1.655	-1.264
	(1.058)*	(1.247)*	(1.698)	(0.815)
Graduation rates (%)	1.082	0.472	2.558	0.289
	(0.931)	(0.938)	(1.580)	(0.822)
10^{th}-year median earnings	0.350	0.361	0.499	0.243
	(0.314)	(0.297)	(0.485)	(0.317)
Observations	20,910	15,363	15,486	19,487

Notes: */**/*** denotes significance at the 10/5/1 percent level. Standard errors reported in parentheses are clustered at the high school level. The table reports Equation 1 estimates for gender and race subgroups of the sample of high school graduates from Flagship-comparable schools, in terms of graduation rates, attendance rates, racial composition, and the percent of students who scored "proficient" on Algebra I and English II end-of-course exams.

Table A1: Heterogeneity Analysis: Asian and Hispanic Students

	All High Schools Sample		Low College-Going HS Sample		Comparable HS Sample	
	Asian	Hispanic	Asian	Hispanic	Asian	Hispanic
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: High School Graduates						
Enroll in UTK	0.043	0.033	0.003	0.012	0.005	0.022
	(0.023)	(0.015)*	(0.031)	(0.011)	(0.024)	(0.014)
Enroll in 2-year College	-0.061	0.029	-0.037	0.033	-0.105	0.029
	(0.078)	(0.038)	(0.095)	(0.039)	(0.087)	(0.042)
Enroll in 4-year College	0.086	0.078	0.089	0.064	0.043	0.088
	(0.083)	(0.026)**	(0.111)	(0.029)*	(0.088)	(0.029)**
Enroll in Any College	-0.014	0.078	-2.7e-4	0.082	-0.109	0.099
	(0.086)	(0.047)	(0.109)	(0.053)	(0.097)	(0.056)
Bachelor's Degree	0.001	0.018	0.024	0.029	-0.022	0.052
	(0.064)	(0.023)	(0.096)	(0.025)	(0.071)	(0.028)
UTK Bachelor's Degree	0.035	0.014	0.021	0.003	-0.004	0.011
	(0.027)	(0.013)	(0.034)	(0.008)	(0.030)	(0.012)
Observations	3,340	5,488	832	2,451	1,011	2,126
Panel B: College Enrollees						
Per-student expenditure (thousands)	2.061	4.011	1.982	1.173	1.912	2.745
	(1.374)	(2.188)	(2.028)	(1.748)	(1.643)	(2.401)
Admission rates (%)	-2.490	10.868	0.219	11.657	-2.043	11.070
	(3.226)	(3.576)**	(4.302)	(3.898)**	(3.730)	(3.884)**
Graduation rates (%)	1.484	9.134	1.378	6.390	2.377	9.950
	(3.175)	(6.935)	(3.658)	(7.447)	(3.805)	(7.518)
10^{th}-year median earnings	1.689	3.481	2.528	2.103	2.818	3.783
	(1.230)	(2.277)	(1.619)	(2.512)	(1.673)	(2.466)
Observations	2,194	1,901	483	630	657	531

Notes: */**/*** denotes significance at the 10/5/1 percent level. Standard errors reported in parentheses are clustered at the high school level. The table reports Equation 1 estimates for Asian and Hispanic subgroups of the statewide sample of high school graduates.

Table A2: Event Study Estimates of the Effect of Flagship Scholarship Eligibility on HS Cohort Composition

	Female (1)	Male (2)	Asian (3)	Black (4)	Hispanic (5)	White (6)	Regular Diploma (7)	HOPE eligible (8)
Period 1: 2007	-0.004	0.004	-0.002	0.005	-0.003	8.2e-4	-0.001	0.029
	(0.009)	(0.009)	(0.003)	(0.007)	(0.003)	(0.006)	(0.001)*	(0.010)**
Period 2: 2008	-0.011	0.011	-0.005	-0.004	-0.007	0.018	-0.052	0.005
	(0.010)	(0.010)	(0.003)	(0.008)	(0.004)	(0.008)*	(0.008)***	(0.011)
Period 3: 2009	-0.001	0.001	-0.002	-0.002	-0.002	0.006	-0.038	0.010
	(0.009)	(0.009)	(0.003)	(0.009)	(0.005)	(0.009)	(0.008)***	(0.009)
Observations	225,821	225,821	225,821	225,821	225,821	225,821	225,821	225,821

Notes: */**/*** denotes significance at the 10/5/1 percent level. The table reports Equation 2 estimates applied to student characteristics. The dependent variables in columns (1) to (8) are binary indicators for demographic, diploma, and HOPE eligibility groups listed in column headings. Standard errors are reported in parentheses and clustered at the high school level.

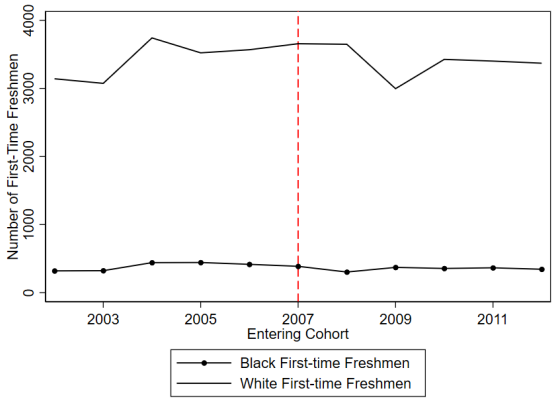
Table A3: Estimated Effects of Flagship Eligibility on UTK Enrollment: Allowing for Positively or Negatively Selected Migration Into Flagship Schools

	Lower Bound (1)	Main Results (2)	Upper Bound (3)
Panel A: All HS Graduates			
Enroll in UTK	0.007	0.016	0.022
	(0.002)***	(0.004)***	(0.004)***
Observations (with weighting)	225,329	225,329	225,329
Panel B: From Below-Median College-Going HS			
Enroll in UTK	0.005	0.014	0.018
	(0.002)*	(0.004)**	(0.004)***
Observations (with weighting)	90,650	90,650	90,650
Panel C: From Flagship-Comparable HS			
Enroll in UTK	0.007	0.016	0.022
	(0.004)	(0.005)**	(0.005)***
Observations (with weighting)	69,630	69,630	69,630

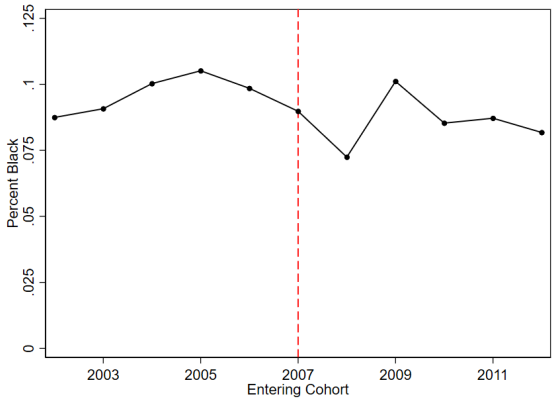
Notes: */**/*** denotes significance at the 10/5/1 percent level. Standard errors reported in parentheses are clustered at the high school level. The table reports Equation 1 estimates for school-by-year UTK enrollment rates, controlling for Flagship treatment status and aggregated variables used in the individual analysis. Estimates are weighted by the number of students in each school and cohort. We measure the dependent variable, i.e., UTK enrollees divided by cohort size, differently across the three models. For the Column (1) specification, we fix the number of UTK enrollees (numerator) at the 2005 figure and let cohort size (denominator) vary as observed. For the Column (2) model, we estimate observed UTK enrollment divided by observed cohort size. Finally, for the Column (3) model, we let the number of UTK enrollees vary as observed but fix cohort size at the 2005 level. Panel A reports Equation 1 results for the statewide sample of high schools. Panel B reports Equation 1 results for the sample of high schools with below-median college enrollment. Panel C reports Equation 1 results for the sample of Flagship schools plus 25% of other schools that were most similar to Flagship schools in terms of graduation rates, attendance rates, racial composition, and the percent of students who scored "proficient" on Algebra I and English II end-of-course exams (estimated by logit).

Figure A1: Trends in UTK First-Time Freshmen Enrollment

(a) Freshmen Headcount, by Cohort and Race

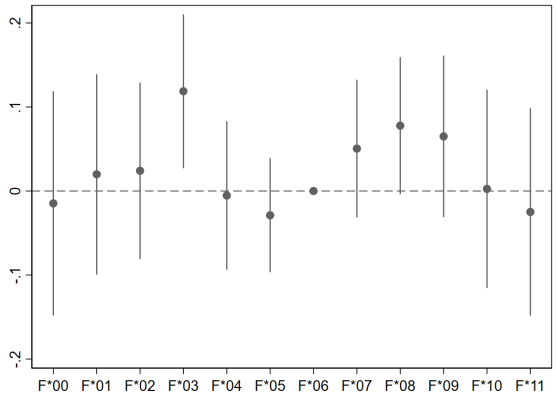


(b) Percent Black, by Cohort



Notes. Authors' calculations using data from UTK Office of Institutional Research and Assessment (various years). First-time freshmen headcount excludes international students. The first Flagship-eligible cohort is marked with a dashed vertical line.

Figure A2: Trends in Flagship-Eligible 12th Grade Enrollment



Notes. Authors' calculations using NCES Elementary and Secondary Information System. The figure plots results from a regression predicting logged 12th grade enrollment in Tennessee high schools. Independent variables include year fixed effects (omitting 2006, the last Flagship-ineligible cohort) and year fixed effects interacted with an indicator for schools designated as Flagship schools in 2007 (omitting the Flagship $\times$ Year-2006 indicator). The figure plots coefficients and 95% confidence intervals for Flagship $\times$ Year indicators.