The Effects of General Education Completion on Transfer Student Success:

A Transcript Study of Tennessee Transfer Students

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Abstract

This study examines the effects of completing the common general education core prior to transferring on transfer student college success. Comparing students who are similar in terms of their background and educational experiences, we find that pre-transfer completion of the general education requirements has a large statistically significant effect on college success. Specifically, completion of the entire core, or its individual components, increases the probability of graduation, reduces time to a bachelor's degree, and increases college GPA. The effects differ by component, with the mathematics and communications clusters having the largest impact on the outcomes. We conclude that the general education core effectively serves the goal of facilitating transfer student success and recommend students' early and full completion of the general education requirements.

Keywords: transfer and articulation, general education, college success, propensity score matching, event history analysis

Executive Summary

This research is an addendum to the 2011 Articulation and Transfer report (THEC, 2011). The Tennessee Higher Education Commission (THEC) is statutorily required to evaluate the progress of articulation and transfer policy implementation and transfer student activity. In 2011, THEC initiated a transcript study of transfers into the Tennessee Board of Regents (TBR) university system and committed to publish its results in conjunction with the Articulation and Transfer report.

The purpose of this study is to examine the relationships between pre-transfer completion of the common general education requirements and time to degree, college GPA, and the probability of graduation of transfer students at select TBR universities.

In 2004, the TBR introduced a common core of fully transferable general education courses among its institutions. The general education core included 41 hours of instruction in six subject areas (clusters). The purpose of that initiative was to facilitate transfer from community colleges to baccalaureate degree programs in the system's universities. In 2010, the Complete College Tennessee Act (CCTA) called for development of a fully transferrable university parallel track program within the University of Tennessee and TBR systems. In light of this reform, the results of using the general education core at TBR universities are critical for CCTA implementation.

The study examines whether pre-transfer completion of the general education requirements improves college success of transfer students as measured by the probability of graduation, time to degree, and GPA. This investigation was prompted by an earlier observation that transfer students in Tennessee institutions show lower degree efficiency than non-transfer students. Five universities volunteered to provide data for the study.

PARAMETERS OF THE STUDY:

- The sample of 18,527 new (non-returning) transfer students at five TBR universities;
- Three cohorts of transfer students, which are defined by the academic year of transfer: academic year 2006-07, 2007-08, and 2008-09;
- The observation period (differs by university and cohort): Fall 2006 – Spring 2011;
- The outcomes: the probability of graduation, hazard rate for graduation, and GPA;
- The treatment variables: completion of the general education core and completion of individual subject areas (clusters) of the general education core.

KEY FINDINGS OF THE STUDY:

- Pre-transfer completion of the entire general education core, or its individual components, increases the probability of graduation, reduces time to degree, and is associated with a higher GPA at the transfer institution.
- The effects differ by component, with the mathematics and communications clusters having the largest impact on the outcomes of interest.
- Conducting the same analysis on a sample of students who had been "matched" with peers who are similar in many respects attenuates the effects on graduation and time to degree in most models, with larger effects occasionally observed in the matched samples. In all specifications, effects remain positive and statistically significant. The differences between the full and matched samples attest to selection bias in the full sample.
- In the matched sample, the probability of graduation is approximately 25 percentage points higher among students who completed the general education core.

The effects of general education completion on transfer student success: Transcript study of Tennessee transfer students

Increasing the number of college graduates is a nationwide priority and is vital to the economic health of the country. Researchers and policy makers refer to the current situation with college completion as a retention-graduation crisis and call for immediate actions to improve it (Bowen, Chingos & McPherson, 2009; CCA, 2011; Johnson et al., 2009; Seidman, 2012). Despite increasing college participation and rising labor market rewards to a higher education degree, college attainment is growing slowly (about 30 percent of the adult population in the United States hold at least a bachelor's degree), and students are taking longer to graduate than in the past (Bound, Lovenheim & Turner, 2009, 2010; Turner, 2004; U.S. Census Bureau, 2011).

College degree completion is an ultimate goal of college attendance for most students and an indicator of expected level of knowledge and skills for employers. It is also a readily available measure of overall student success. To illustrate, graduation rate—that is, the percentage of a student cohort that graduates within a specific period—is one of the most commonly used measures of institutional and system productivity. At the state level, metrics like six-year graduation rates allow assessing and comparing effectiveness of state higher education systems.

In Tennessee, over the past 15 years, the six-year graduation rate has increased by about 11 percentage points at public universities and over 6.5 percentage points at community colleges (THEC, 2012b). However, despite these gains, Tennessee continues to trail the national average and other states in the number of college graduates produced annually (SREB, 2010; CCA, 2011). To reach the national average, the state set an ambitious goal of increasing its degree productivity by four percent every year until 2025. The state focuses on identifying factors that affect timely graduation and policy solutions that can provide for successful degree completion.

One such policy solution has been the introduction of the common general education core fully transferrable to Tennessee public institutions as a block. This policy—first introduced at the Tennessee Board of Regents (TBR) system and later adopted by all public institutions in the state—aims to facilitate articulation and student transfer among institutions. It intends to raise graduation rates of transfer students by decreasing time and credits to a bachelor's degree. The study focuses exclusively on the TBR experience during the period from 2006 and through spring 2011 and examines whether meeting the requirements of the TBR-approved general education core prior to transferring improves college success of transfer students as measured by the probability of graduation, time to degree, and college GPA.

Background

In fall 2004, the TBR implemented a reform to streamline articulation and ensure seamless transfer of courses among its institutions. The system implemented a common 41-hour general education core and identified associate's degrees designed for transfer to a university. The idea is that transfer students who completed these associate's degrees have fulfilled all general education requirements and will not have to repeat them at a university. Students can also transfer clusters of general education courses that are completed in particular subject areas. The same principle holds true for blocks of subjects within the general education core: completing specific clusters means fulfilling the general education requirements in the respective subject area. The 41 semester-hour general education core includes the following six clusters: communications (9 semester hours), humanities and/or fine arts (9 hours), natural sciences (8 hours), social and behavioral sciences (6 hours), history (6 hours), and mathematics (3 hours).

The Complete College Tennessee Act (CCTA) of 2010 called for expanding the TBR approach to all public institutions in the state. The CCTA requires the development of a fully

transferrable university parallel transfer track, which satisfies the general education common core requirements of all Tennessee public universities and community colleges. The university parallel transfer track consists of 60 hours of instruction that could be transferred and applied toward requirements for a bachelor's degree. The 60 hours comprise a 41-hour general education common core and a 19-hour pre-baccalaureate major; both components are transferable as blocks rather than course by course. The university parallel transfer track was fully implemented in fall 2010, with 49 transfer pathways providing seamless transfer from community colleges to any public university in Tennessee across 28 fields of study.

In this regard, it is critical to understand whether completing the general education core—entirely or by specific cluster—prior to transferring to a university increases the probability of graduation and academic performance of transfer students. The experience of the TBR universities offers a unique opportunity to examine this research question; transcript-level data on TBR transfer students serve as a basis for this investigation.

This investigation was conducted under the auspices of the Advisory Committee for the study, which was made up of representatives of TBR universities, systems of public higher education in Tennessee, and research and academic staff of the Tennessee Higher Education Commission. Appendix I lists the members of the Advisory Committee. The Advisory Committee held two meetings, in July and August 2011; Middle Tennessee State University also hosted an on-site meeting of data analysts to discuss the technicalities of transcript data analysis. Five of the six TBR universities volunteered to provide data on students who transferred into their institution during the time period of interest: East Tennessee State University, Middle Tennessee State University, Tennessee Technological University, the University of Memphis, and Tennessee State University.

Purpose of the Study

This study examines the relationship between completing the general education requirements prior to transferring and college success of transfer students. Tennessee transfer students, on average, are less efficient in degree completion than non-transfer students: they accumulate many extra credit hours at transfer without earning a degree and take longer to graduate (THEC, 2010, 2011, 2012a). One potential explanation for this observation is failing to complete the general education requirements prior to transferring. In contrast, one may expect that pre-transfer completion of the general education courses provides for better college performance and more efficient graduation. In other words, completing more general education requirements prior to transferring is expected to enhance the college success of transfer students.

We hypothesize that pre-transfer completion of the general education core, in whole or in part, will increase the probability of graduation, decrease time and credits to degree, and improve academic performance of transfer students. We investigate whether completing the general education core prior to transferring provides for better college performance and more efficient graduation, while accounting for other factors that influence the outcomes of interest.

The research question of the study is: Does completion of the general education core, or any of its components, prior to transferring into a university increase the probability of graduation, decrease time and credits to a bachelor's degree, and improve college GPA?

Literature Review

This section reviews prior research on college degree completion and transfer students success. Its main focus is on the factors that determine student graduation and time to degree. However, it does not address theoretical explanations of student retention or attrition. The review of the research literature is guided by the following general questions: What do we know about

the determinants of successful and timely graduation from college? Specifically, what determines college success of transfer students? What is the situation in Tennessee in regard to graduation rates and transfer students success?

Degree attainment and time to graduation are the ultimate measures of student success and institutional productivity. Multiple influences affect these critical outcomes (Kuh et al., 2006; Moore & Shulock, 2009). The factors commonly identified as affecting the probability of college graduation and time to degree include the following broad groups of influences: 1) demographic, socio-economic, and other background characteristics of students; 2) pre-college academic preparation and social conditioning; 3) academic performance, attendance patterns, and social integration in college; 4) institutional characteristics; and 5) other environmental factors.

First, demographic, socio-economic, and background characteristics of students comprise a number of different factors: gender, age, race/ethnicity, socio-economic status (SES), parental education, environment supportive of college aspirations, and others. Previous research has convincingly demonstrated that certain demographic and socio-economic characteristics of students affect the probability of graduation and time to degree (Adelman, 2004, 2006; Astin, 2001; Astin & Oseguera, 2005; Astin, Tsui & Avalos, 1996; Baum & Payea, 2004; Berkner, He & Cataldi, 2002; Bound, Lovenheim & Turner, 2009, 2010; DesJardins et al., 2002; Horn, 2006; Seidman, 2012; Tinto, 1993; Turner, 2004).

For gender effects, various studies have shown that females have higher graduation rates than male students and that postsecondary participation and the probability of degree completion of female students increase over time (Astin, Tsui & Avalos, 1996; Bound, Lovenheim & Turner, 2009; Horn, 2006; Knapp, Kelly-Reid & Ginder, 2010; Mortenson, 2003; Peter & Horn, 2005; Turner, 2004). The only exception to this rule, at least for certain cohorts of students, is

private for-profit institutions, in which men are more likely to obtain a degree (Knapp et al., 2010). The probability of degree completion for women differs by racial and ethnic group and socio-economic status (Astin, Tsui & Avalos, 1996; King, 2000; Peter and Horn, 2005).

There are also distinct differences in degree completion by race/ethnicity. The most common findings are that Caucasian and Asian students graduate at higher rates than African-American and Hispanic students; belonging to minority groups decreases the probability of graduation; and college-completion gap between ethnic groups is increasing over time (Adelman, 2004; Astin, Tsui & Avalos, 1996; Cabrera, Burkum & LaNasa, 2005; DesJardins, 2002; Horn, 2006; KewalRamani et al., 2007; Tinto, 1993; Titus, 2006a, 2006b). In contrast, Adelman (2006) finds no race/ethnicity effects on graduation when other factors are controlled for.

Researchers concur that SES is a critical determining factor of degree completion. Studies have consistently shown that higher SES increases the probability of graduation even when other factors are taken into account and that individual factors used to construct SES also exert their specific effects on the likelihood of degree completion (Adelman, 1999, 2006; Astin, 2001; Astin & Oseguera, 2005; Astin, Tsui & Avalos, 1996; Berkner, He & Cataldi, 2002; Cabrera, Burkum & LaNasa, 2005; Kim, 2007; Tinto, 1993; Titus, 2006a, 2006b; Turner, 2004).

In some studies and for some student populations, the age of students has a statistically significant negative effect on the likelihood of retention and degree completion (Astin, 2001; Calcagno et al., 2006; Hagedorn, Maxwell & Hampton, 2007).

Regarding students' background, parental education is found to affect degree completion (Adelman, 2006; Astin, 2001; Baum & Payea, 2004; Turner, 2004). Students who, while in high school, received parents and peers' support and encouragement to pursue a postsecondary degree

are more likely to graduate from college (Bank, Slavings & Biddle, 1990; Cabrera, Burkum & LaNasa, 2005).

These differences in degree attainment by demographic group are observed in Tennessee public higher education, the focal point of this analysis. From a descriptive standpoint, at Tennessee's public universities and community colleges, Caucasian students demonstrate higher than average six-year graduation rates, while graduation rates for African-American students have been consistently below average; females show better performance than males across all institutional types; and the graduation rate of Pell-eligible students is quite low (THEC, 2012b).

Second, regarding pre-college academic preparation, studies show that high school GPA and performance on standardized tests (ACT or SAT) explain at least half of the variation in degree attainment rates and thus are strong predictors of degree attainment (Astin, 1996; Astin, Tsui & Avalos, 1996). Also, quality of high school curricula, completion of certain coursework in high school, and other academic resources are positively related to chances of college degree completion (Adelman, 1999, 2006; Cabrera, Burkum & LaNasa, 2005; DesJardins, Kim & Rzonca, 2003; Warburton, Bugarin & Nuñez, 2001). It is important that access to pre-college academic resources often differs by racial/ethnic and SES group, and this difference in resource availability may determine college outcomes (Kuh et al., 2006; Swail et al., 2005).

Third, performance in college embraces such important factors as academic performance, attendance patterns, and social integration. Student performance is directly related to chances of timely graduation. College GPA is the single best predictor of student success in higher education and the probability of obtaining a degree (Cabrera, Burkum & LaNasa, 2005; DesJardins, Kim & Rzonca, 2003; Huesman et al., 2007; Kim, 2007; Pascarella & Terenzini,

2005; Titus, 2006a, 2006b). Importantly, college GPA positively affects the probability of graduation across ethnic and SES groups (Cabrera, Burkum & LaNasa, 2005).

Student attendance patterns make a difference in terms of the probability of degree completion. Full-time students are more likely to graduate than their part-time counterparts (Adelman, 2006; Kim, 2007). Continuous enrollment increases, while interrupted enrollment decreases, chances of degree completion (Adelman, 2006; Cabrera, Burkum, & LaNasa, 2005; DesJardins, Ahlburg & McCall, 2006; Pascarella, 1985). Repeating classes for different reasons has a negative effect of the likelihood of completing a degree (Adelman, 2006; Cabrera, Burkum & LaNasa, 2005). Majors and taking remedial courses also affect the probability of graduation (Astin, 2001; Astin, Tsui & Avalos, 1996; Cabrera, Burkum & LaNasa, 2005; Calcagno et al., 2006; DesJardins, Kim & Rzonca, 2003; Huesman et al., 2007; Pascarella & Terenzini, 2005).

There is some consistent evidence that factors of social integration, including living on campus, extracurricular activities, quality of instruction, and working on campus, are positively related to chances of graduation (Astin, 2001; Cabrera, Burkum & LaNasa, 2005; Pascarella & Terenzini, 2005; Tinto, 1975).

Fourth, institutional characteristics are critical for student success and are largely outside students' control (Doyle, 2006; Kuh et al., 2006). The existing literature on the topic shows that various institutional characteristics bear on the likelihood of degree attainment (Astin & Oseguera, 2005; Astin, 2001; Astin, Tsui & Avalos, 1996; Bound, Lovenheim & Turner, 2010; Pascarella & Terenzini, 2005). The following institutional characteristics affect the probability of graduation, with varying effects for different gender and ethnic groups of students: institutional size, selectivity, type of control, campus climate, tuition revenue, institutional grants, and the freshman class average SES (Astin, Tsui & Avalos, 1996; Bound, Lovenheim & Turner, 2009;

Gansemer-Topf & Schuh, 2005; Horn, 2006; Kim, 2007; Titus, 2006a). Campus climate, or rather student satisfaction with it, predicts student retention, which in turn is related to students' probability of graduating (Astin, 2001; Braxton, Hirschy & McClendon, 2004; Schreiner, 2009).

The type of institutions students transfer from is a critical factor that may affect the likelihood of graduation and time to degree. For example, prior literature has shown that students who transfer from two-year institutions to universities are less likely to graduate and take longer to obtain a degree (Berkner, He & Cataldi, 2002; Doyle, 2006, 2009; Lorentz & Benedict, 1996; Peter & Cataldi, 2005, Rouse, 1995, 1998). The transfer college quality also affects student performance in the receiving school (Dills & Hernández-Julián, 2006), which may have a bearing on the probability of graduating.

Finally, other environmental factors include the influences that are largely outside students' control, such as state-level policies, receipt and amount of financial aid, having to work during studies, and proximity of college to a student's home.

Receipt and amount of financial aid is positively related to chances of completing a degree (DesJardins et al., 2002; Kim, 2007; Titus, 2006a, 2006b). Titus (2006a) finds that the amount of state need-based aid per student increases the probability of degree completion. At the same time, having to work more than 10 hours per week decreases one's chances of degree completion (DesJardins et al., 2002; Titus, 2006a, 2006b).

The distance to an institution is an important factor because it affects the probability of attending college (especially for low-income students), enrollment patterns, and the probability of a student-college match (Frenette, 2002, 2003; Rouse, 1995, 1998; Smith, Spinelli & Zhou, 2002). Moving away from home entails considerable financial and other costs and thus may affect the chances of timely graduation.

As a group, transfer students are unique in many ways, and their college graduation rates and performance may differ from the ones of both non-transfer students and first-time freshmen. The literature on transfer student success is large but often inconclusive.

The population of postsecondary transfer students is vast and diverse. Nationwide, 17 percent of beginning postsecondary students transfer to a different institution within the first three years; about 20 percent of first-time enrollees at four-year institutions are transfer students (Berkner & Choy, 2008). Approximately 40 percent of college entrants attend more than one institution in the following six years; nearly 60 percent of college graduates have attended two or more institutions (GAO, 2005; Peter & Cataldi, 2005). Despite voluminous literature on transfer students, the knowledge about what determines their college success is still inadequate.

Tennessee's student population is very mobile: Almost eight percent of all undergraduate enrollees are new transfers, over 20 percent of all public-sector freshmen transfer at least once during the following six years, and more than half of all public baccalaureate graduates change schools at least once during their academic career (THEC, 2010, 2011, 2012a). An important finding from annual reports on the status of transfer activity in Tennessee is that public transfer students accumulate many extra credit hours at transfer without earning a degree and take longer to graduate (THEC, 2010, 2011, 2012). This observation has been one of the primary motivations for the current study.

Transfer students are different from first-time freshmen and native students in several ways: demographics, academic background, college expectations and aspirations, academic performance, campus engagement, and graduation rates (Belcheir, 1999, 2001; Eimers & Mullen, 1997; Jacobs, Busby, & Leath, 1992; Miville & Sedlacek, 1995; NSSE, 2009; Owen, 1991; Piland, 1995; Townsend, 1995). While in some contexts transfer students out-perform

first-time freshmen on these indicators (Belcheir, 1999, 2001; Lorentz & Benedict, 1996), in other investigations transfer students demonstrate lower GPA and graduation rates than freshmen or native students (Best & Gehring, 1993; Eimers & Mullen, 1997; Owen, 1991). Researchers have consistently found that students transferring from community colleges have lower probability of completing a bachelor's degree and lower educational attainment than similar students who begin at four-year colleges (Doyle, 2009; Leigh & Gill, 2003; Rouse, 1995, 1998). Another critical finding is that transfer students take longer to graduate (Lorentz & Benedict, 1996; Peter & Cataldi, 2005).

The review of the previous research on the topic of degree completion allows identifying critical factors that must be accounted for in studies of academic performance and graduation rates of transfer students. The Variables and Measures section outlines the variables that are used in the current investigation.

Research Design

Identification problems

The purpose of this study is to examine the impact of the general education core completion on the probability of graduation, time to degree, and college GPA. This research question poses a number of estimation problems. First, selection bias could be massive: students who complete the general education requirements by the time of transfer are likely to be systematically different from those who do not. To wit, such students are expected to be more methodical in college planning, pay more attention to what they are supposed to do, and be more willing and able to follow through with the plan. In addition, such students may predominantly come from a certain demographic, socio-economic, or academic background; from a specific type of institution; or from a category of financial aid recipients. In other words, general

education completers and noncompleters are likely to be different on a host of observable and non-observable characteristics.

Second, the data under examination have a time-varying nature. To wit, the probability of graduation changes over time, the units of analysis provide data for different durations, and much data are censored. It is not reasonable to assume that the probability of graduation remains constant, and we must account for its changes over time. Depending on the cohort and university, students remain in the study for different durations. In addition, not all transfer students graduate or drop out during the observation period. In other words, we do not know whether a particular student who is still enrolled at the end of observation will complete degree requirements in the future. Also, many transfer students leave the study during the observation period: they may stop out or drop out, they may transfer out of the TBR system, or their data may not be available any more. As a result, the data for such students are right-censored.

Finally, multiple students graduate during the same semester. Since graduation happens in the same period, it is impossible to estimate individual durations of time and determine the order of event occurrence precisely. This problem is known as tied events.

The research question of the study demanded the use of several techniques. We developed a data set that includes student-level data across participating institutions and over time. To address selection bias, we used the propensity score matching. To deal with the estimation issues and account for different outcomes of interest, we used the following methods: logistic regression, Event History Analysis, and Ordinary Least Squares.

Description of the dataset

This study employs two major data sources: transcript data from the TBR universities that volunteered to participate in the investigation and student-level data from THEC's Student

Information System (SIS). Five of the six TBR universities provided data on students who transferred into their institution during this period: East Tennessee State University, Middle Tennessee State University, Tennessee Technological University, the University of Memphis, and Tennessee State University. The universities' data were matched with the THEC's Student Information System to allow for longitudinal analyses of outcomes.

The population of interest includes students who transferred into the TBR universities after the common general education core became operational. We assume that all these students are bachelor's degree-seeking. In this study, students are considered transfers if they meet the following criteria: they received credit from another institution and were enrolling at the receiving institution for the first time. The study examines students who transferred into the TBR universities from the state's community colleges, other TBR universities, Tennessee private institutions, and out-of-state colleges. The last two groups of institutions do not have the same general education requirements as the TBR universities but they offer general education courses that can be transferred as equivalents.

The observation period for the study covers fall 2006 through spring 2011. The investigation examines three cohorts of transfer students (from academic years 2006-07, 2007-08, and 2008-09) and analyzes their outcomes as of spring 2011. It is important that based on data availability, universities provided data for various cohorts of students; thus the actual observation period differs by institution and cohort.

The potential outcomes for transfer students include two main scenarios: graduating during the observation period and being censored. Censoring takes place if a student is still enrolled at the end of observation, transfers out of the TBR system, drops out or stops out, or

lacks requisite data. The descriptive statistics below include only transfer students who remained in the study after the data validation and cleaning process.

The total number of transfer students in the study is 18,527. Out of this number, 4,689 students (25 percent) transferred to a participating TBR university in academic year 2006-07; 6,663 students (36 percent) transferred in 2007-08; and 7,175 students (39 percent) transferred in 2008-09. Thus, we identify three cohorts of transfer students that participated in the study: 2006, 2007, and 2008 cohorts.

Three universities provided data for all three cohorts: East Tennessee State University (3,507 students), Middle Tennessee State University (8,057 students), and Tennessee Technological University (2,756 students). University of Memphis provided data for 2007 and 2008 (3,789 students), while Tennessee State University submitted data on 418 students from the 2008 cohort. Therefore, the entry into the study is determined by the time of transfer into a university and differs by institution and cohort.

Methods

The study examines whether pre-transfer completion of the general education requirements has an effect on the probability of graduation, time to degree, and college GPA. Completion of the general education core—in whole or in part—is the treatment variable in various models in this study. We estimate the impact of general education completion on students who actually completed the core or its individual clusters. This is known as the effect of the "treatment on the treated" (Heckman & Robb, 1985; Smith & Todd, 2001).

The identification issues outlined above necessitated the use of the following primary techniques: Propensity Score Matching and Event History Analysis. This section briefly discusses both approaches and the rationale for their use.

Propensity Score Matching

We use propensity score matching to mitigate the problem of selection bias in the estimation of the treatment effect (Morgan & Harding, 2006). This technique allows us to achieve the following necessary condition for making causal inferences based on observational data: Distribution of the observed variables is exactly the same for the treatment and comparison groups (Heckman, Ichimura & Todd, 1997). At the same time, it does not guarantee that the other condition—the same distribution of unobserved attributes—is met. However, according to these authors, meeting the first condition is far more important and "[s]election bias, rigorously defined, is a *relatively* small part of bias as conventionally measured" (Ibid—emphasis in the original). In sum, propensity score matching allows reducing bias in estimations. It makes it more causally suggestive that the treatment is having an effect if we are comparing students with very similar characteristics and very similar likelihood of getting a treatment.

Our matching analysis considers completion of a general education course sequence as a treatment, similar in many ways to being assigned to a treatment or control condition in an experiment. Individuals who complete the general education core or any of the individual clusters prior to transferring are likely to be systematically different from those who do not complete these sequences of courses. General education completers are likely to be different both in terms of their observable characteristics such as race and age, and in terms of their unobservable characteristics such as motivation or drive.

To make the analysis in this report closer to an analysis from which we could derive a causal inference, we limit comparisons to a matched sample of individuals who are similar in terms of a host of observable characteristics, some of whom completed a cluster of courses and others did not. The result of this procedure is that the only observable difference between the two

groups is completion of a cluster—thus indicating that completion of the cluster is the most likely reason for any differences in outcomes between the two groups. The propensity score is estimated via logistic regression, with 16 student characteristics used to predict treatment status.

Our matching procedure works as follows. For each year and for each treatment condition, we match students who had received the treatment with a similar group of students who had not received the treatment. To match students, we predict the probability of treatment for each individual student. We use as predictors 16 different characteristics of students, including race/ethnicity, gender, age, academic performance indicators, type of transfer-from institution, receipt of financial aid, and income category. The Variables and Measures section and Table 1 describe the variables used in the study.

Once the probability of treatment is predicted, we select one individual who had not received the treatment whose probability of treatment was most similar to an individual who had received the treatment. If no suitable matches can be found within a certain range of probability (we use the caliper equal to 0.15 standard deviations of the propensity score), the individual is dropped from the analysis. We repeat this procedure until every individual in the treatment group has been matched with an individual in the control group. In the parlance of propensity score matching, it is known as one-to-one propensity score matching with calipers.

Event History Analysis

Event History Analysis (EHA) is a primary analytic technique for this study because this method is superior to alternative ways of estimation in investigation of one of our research questions.

EHA offers a number of critical advantages over the traditional regression estimators (such as ordinary logistic regression or time-series methods), which determined our choice of

this method. First, it accounts both for occurrence and timing of events, thus, allowing researchers to investigate issues that could not be adequately addressed with other techniques. EHA is well suited for studying qualitative changes (events) over time because it models both the event occurrence and the duration of time elapsed before the event. To paraphrase, EHA analyzes not only whether an event occurs (the outcome) but also when it occurs (the timing of an event) (Allison, 1984; Yamaguchi, 1991; Box-Steffensmeier & Jones, 1997, 2004; DesJardins, 2003).

Second, EHA uses information very efficiently and can handle the issues of censoring and time-varying covariates. The use of standard multiple regressions in such cases would lead to a loss of information and biased estimations. In contrast, EHA uses information provided by censored cases to produce unbiased estimates and allows for time-related changes in values of the independent variables. Finally, EHA works well when there is little variation in the dependent variable; such condition is typical when the dependent variable is determined by a binary outcome (graduation or not) and a limited number of time measurement units (for example, time measured in semesters of study) (Allison, 1984; Bennett, 1999; Berry & Berry, 2007; Box-Steffensmeier & Jones, 2004).

Specifically, we use a Cox proportional hazards model, which has several advantages over alternative EHA models (Box-Steffensmeier & Jones, 2004; Jones & Branton, 2005; Yamaguchi, 1991). Unlike parametric models, it does not require specifying the baseline hazard function, or the functional form of the duration dependence. The Cox model makes no assumptions about the shape of the baseline hazard rate; the latter is not estimated and is assumed to be common to all observations (Box-Steffensmeier & Jones, 2004). This advantage helps to avoid incorrect estimations if the time dependence parameter is specified inaccurately

(Jones & Branton, 2005). Therefore, the hazard rate can assume any form suggested by the data. Although the baseline hazard is not estimated from the data and its form is unspecified, it is parameterized as a function of covariates (Cox, 1972; Box-Steffensmeier & Jones, 2004; Jones & Branton, 2005).

The Cox model can also be adapted to address the issue of ties, or multiple events occurring in the same period (Box-Steffensmeier & Jones, 2004). This advantage is critical for our study, which deals with graduation of thousands of students in the same semester.

The fundamental dependent variable in EHA is a hazard rate (Allison, 1984). The hazard rate is defined as the instantaneous probability of event occurrence, given that the event did not occur prior to a particular time (Yamaguchi, 1991). It measures the duration of time that a unit of analysis spends in a given state before it experiences the event. The analysts are primarily interested in the relationships between the observed duration before the event and key independent variables (Box-Steffensmeier & Jones, 2004).

In this study, the hazard rate is the probability of graduation. The EHA models time to graduation by examining whether students graduated and, if they did, how long it took them to graduate. It estimates the impact of the treatment variable on both the probability of the event and the duration of time that elapsed in the prior condition before the event.

Variables and Measures

The data for the study come from two main sources: five participating TBR universities and the Student Information System (SIS) operated by the THEC.

After data capacity assessment, the universities provided data on those cohorts of transfer students that met the quality requirements. This approach resulted in universities providing data for different cohorts. The reported data elements included completion of the general education

core and its individual clusters, number of hours completed in each cluster and the whole core, the semester and year of transfer, permanent address at the time of transfer, and student identification number (ID). These variables were then matched on a student ID to the SIS data. The matched data were checked for accuracy and consistency before compiling a final data set for analysis. Several variables were computed from the raw data, and some variables were recoded for the purposes of estimation.

Depending on the model, this study employs three dependent variables. In logistic regression, the outcome variable is a binary variable for graduation, which is coded to 1 if a transfer student graduated during the observation period and coded to 0 otherwise. In OLS models, the dependent variable is college GPA in the final semester of observation for a given student. In the EHA models, the dependent variable is the hazard rate for graduation. The hazard rate is an instantaneous probability of change (event occurrence), given that a student has lasted until this time without graduating.

The hazard rate cannot be observed directly; it reflects the amount of time elapsed since transfer until a student's graduation. We use two types of data to estimate hazard rates: a marker for graduation and measures of time before graduation. First, we employ a binary variable to mark the event of graduation; it equals one for the semester when a student graduated and equals zero in all preceding terms. Second, we use variables that measure time from the moment of transfer into a TBR university and until graduation or censoring. For the latter indicator, depending on the model, we rely either on the semester count (*Calendar Time*) or on the count of attempted credit hours (*Seat Time*). Table 1 offers variables description, data sources, and basic descriptive statistics.

The key predictors of interest are binary variables for completion of individual clusters and a binary variable for completion of the whole general education core. They are coded to 1 if a student completed the core or a respective cluster and coded to 0 otherwise. These variables are drawn from the data provided by the participating universities.

Seven covariates were used as control variables: age in years at the time of transfer, dummy variables for ethnic groups and gender, high school GPA, and ACT score. The 16 variables that were used for student matching include the following: age at the time of transfer, gender, binary variables for ethnic groups and non-traditional age students, high school GPA, ACT score, dummy variables for the type of the previous institution and receipt of state financial aid grants, and income category. For income, we use the gross family income for dependent students and individual income for independent students. These data come from the THEC SIS.

Descriptive Analysis

The final data set for analysis includes data on 18,527 transfer students moving into the participating TBR universities for every semester of enrollment since the time of transfer. This section describes the students who took part in the study.

Demographic and Academic Characteristics of Transfer Students

Table 2 presents the characteristics of transfer students from the 2006, 2007, and 2008 cohorts. Overall enrollment characteristics of transfer students are reflective of the entire student population over the same period. Regarding demographic characteristics, almost 57 percent of transfer students are females; at the time of transfer, over 72 percent are traditional-age students; and the average age at transfer is 21 years. Almost 10 percent (1,826 students) are 35 years of age or older. The majority of students is Caucasian (over 75 percent), followed by African-

Americans (almost 17 percent); the share of other minority groups among transfer students reaches 7.3 percent total. Eighty-seven percent of transfers are from in-state institutions.

Most transfer students are either walking commuters (11.5 percent) or driving commuters (48 percent). In other words, almost 60 percent of transfer students commute to campus fewer than 50 miles. Less than 30 percent of students have to travel more than 50 miles to their new institution. Over 58 percent of students transfer early in their academic careers, in their freshmen and sophomore years; almost 31 and 11 percent transfer in their junior and senior years respectively. Most students transfer from community colleges (over 47 percent), followed by out-of-state institutions (almost 27 percent) and other in-state public universities (14.5 percent).

Time to Degree by Student Group

During the period of observation, 7,621 transfer students graduated with a bachelor's degree; this number constitutes 41 percent of all participating students. The share of graduates differs by transfer cohort: 55.9 percent of students (2,623 students) graduated from the 2006 cohort, 44.1 percent (2,941 students) from the 2007 cohort, and only 28.7 percent (2,057 students) from the 2008 cohort. This variance in the proportion of graduates is explained by the different amount of time that students from each cohort spend in the study: the later the students enter the study, the more likely they are to be censored, that is, to graduate or drop out after the end of the observation.

Transfer students differ by how long it takes them to complete a bachelor's degree. The time to graduation can be measured in semesters or in attempted credit hours. Table 3 and Figures 1a and 1b present the average time to degree for various groups of students.

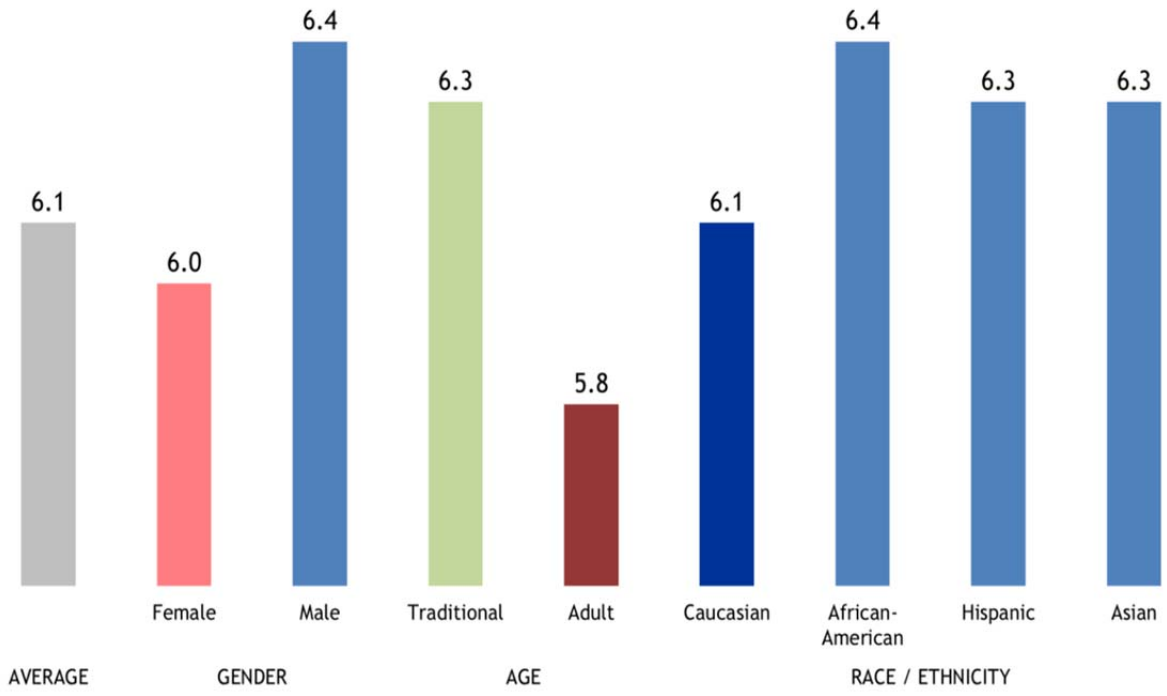

Figure 1a: Time to Graduation in Semesters by Gender, Age, and Race/Ethnicity

For all graduates, the average time to graduation is 6 semesters and 78 attempted credit hours. However, these general figures mask certain differences among various groups of transfer students. As Table 3 and Figure 1a show, after transferring into a university, female students graduate faster and with fewer credit hours accumulated than male students, although the difference is less than half a semester and six credits. Adult students also demonstrate slightly more efficient graduation patterns than traditional-age students. For the ethnic groups, Caucasian students graduate faster and more efficiently than the other groups. Asian students attempt more credit hours than students from other ethnic categories, while still managing, on average, to graduate within a similar timeframe.

Figure 1b shows that students from the least and most affluent backgrounds show the least efficient graduation patterns: it takes them the longest to get a bachelor's degree (6.3

semesters) with more attempted credits in comparison with the students from the other income categories. Students from the income category “25-50 thousand dollars a year” graduate slightly faster and with fewer credits than students from the other income groups. For this group of students, the cost of higher education is certainly an important factor; aiming to cut costs, they probably start at two-year public institutions and complete many courses at a lower cost before transferring to a university. If true, this strategy allows these students to graduate more efficiently in terms of time and credits in comparison with the more affluent students. The descriptive analysis shows that the majority of these students (57 percent) transfers into TBR universities from Tennessee community colleges.

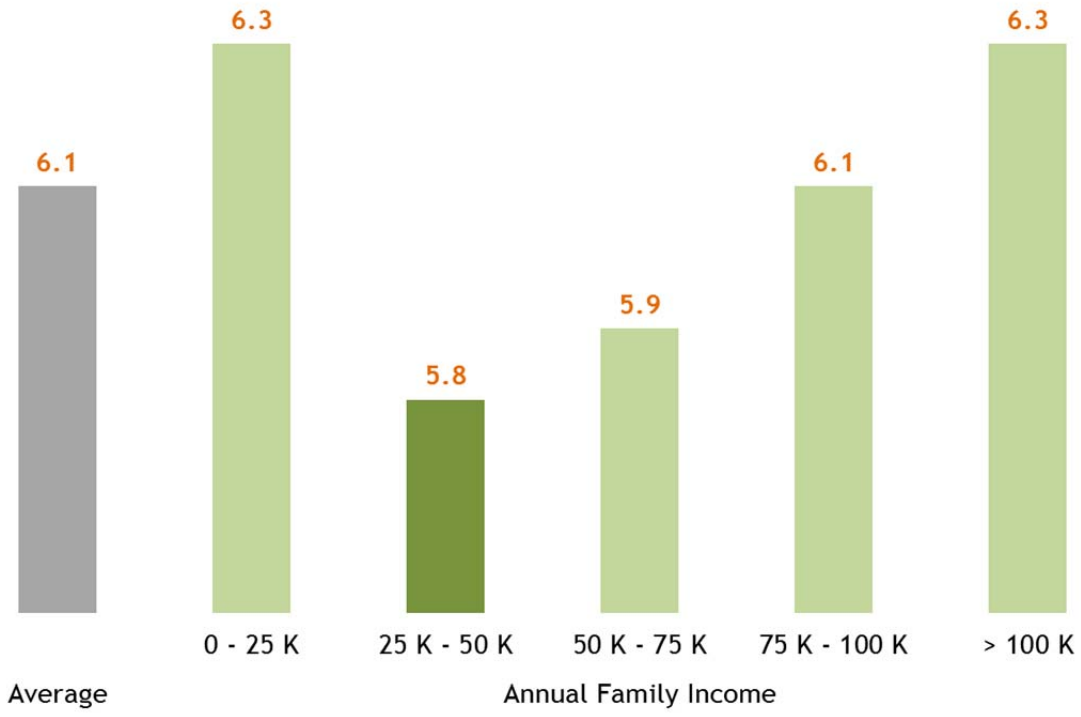

Figure 1b: Time to Graduation in Semesters by Income Group

Completion of General Education Requirements by Time of Transfer

Transfer students arrive at TBR universities with various degrees of completion of the general education requirements. The entire general education core consists of 6 individual clusters and 41 total credit hours; the required number of hours differs by cluster. Thus, meeting general education requirements can be presented in terms of the number of clusters and number of hours completed by the time of transfer.

Table 4 and Figures 2a, 2b, 2c, and 2d present a distribution of transfer students by the extent to which they had met the general education requirements prior to transferring. As Table 4 and Figure 2a demonstrate, 10.7 percent of students transfer into TBR universities with the entire general education core completed by the time of transfer. Completion of the core means that they have completed all six clusters of the core and have at least 41 general education hours.

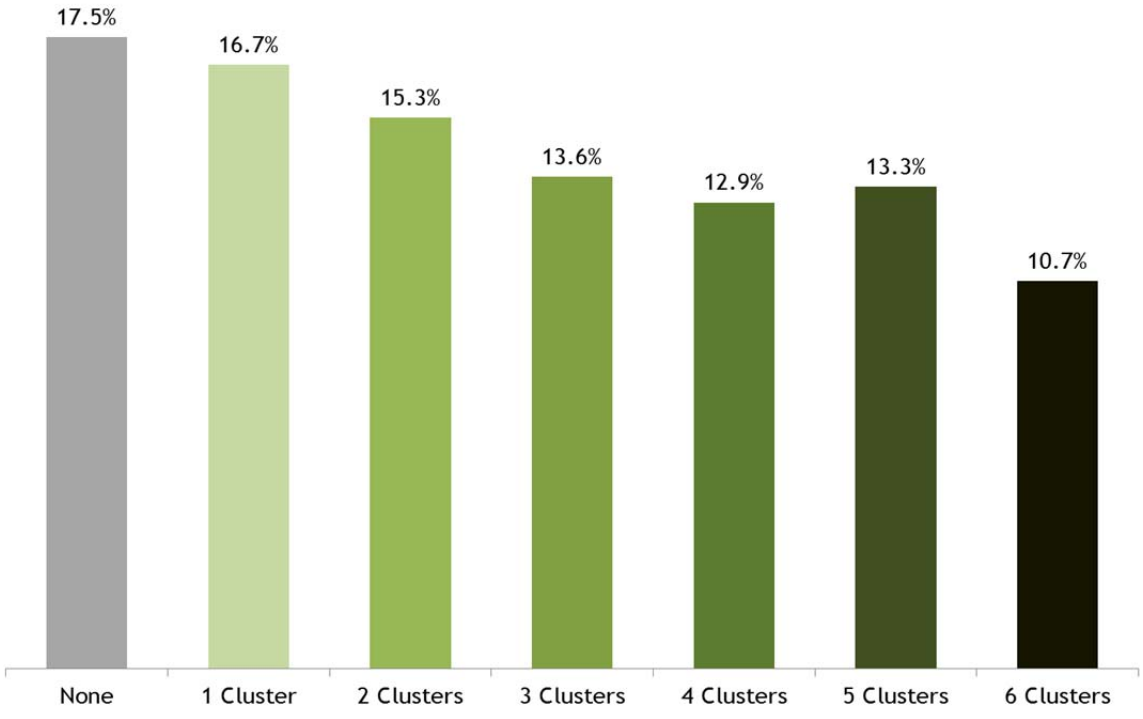

Figure 2a: Number of Clusters Completed by the Time of Transfer

The overall 10.7 percent is an average percentage of transfer students from all three cohorts in the study. The percentage of core completion by cohort varies from 10.2 percent in the academic year 2006-07 to 11.3 percent in the academic year 2007-08.

More than 17 percent of all transfer students arrive without any general education clusters completed. About 45 percent of students transferred between one and three general education clusters; however, almost 37 percent of students came in with four or more clusters completed by the time of transfer

The number of general education clusters completed by the time of transfer differs by age, gender, and ethnicity. Figures 2b, 2c, and 2d illustrate these distinct patterns.

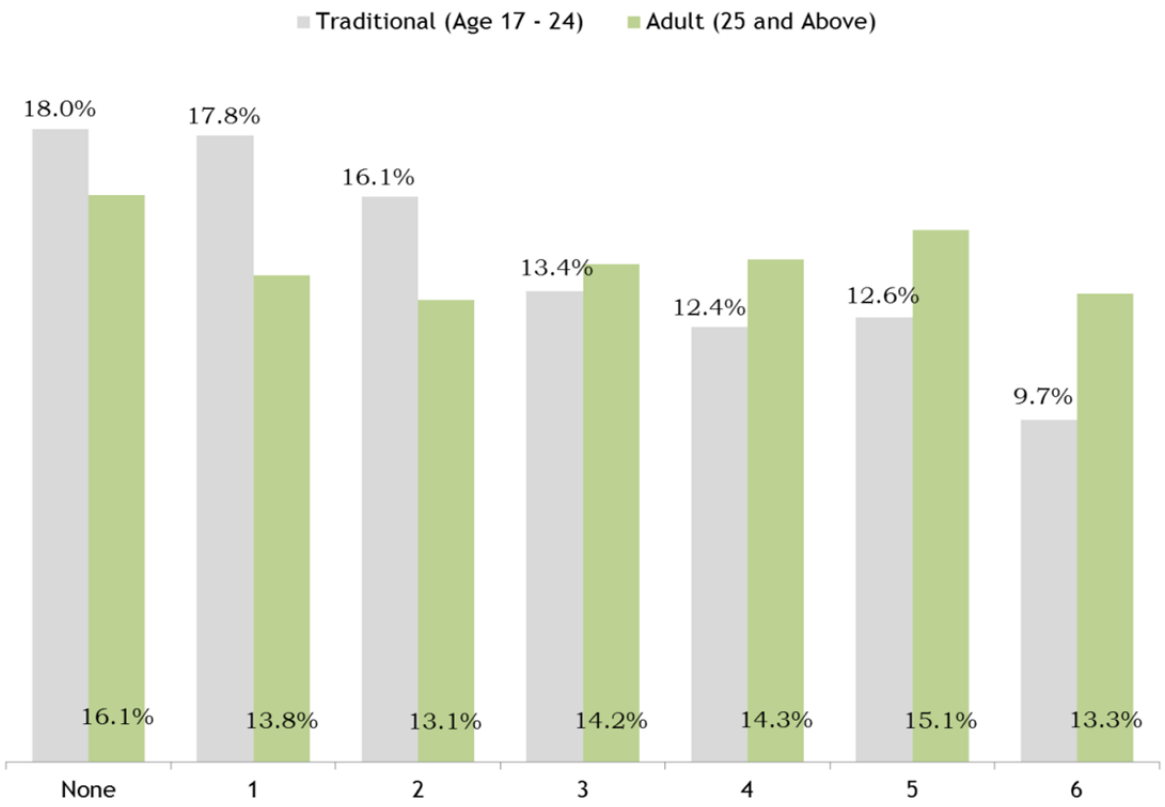

Figure 2b: Number of Clusters Completed by the Time of Transfer by Age

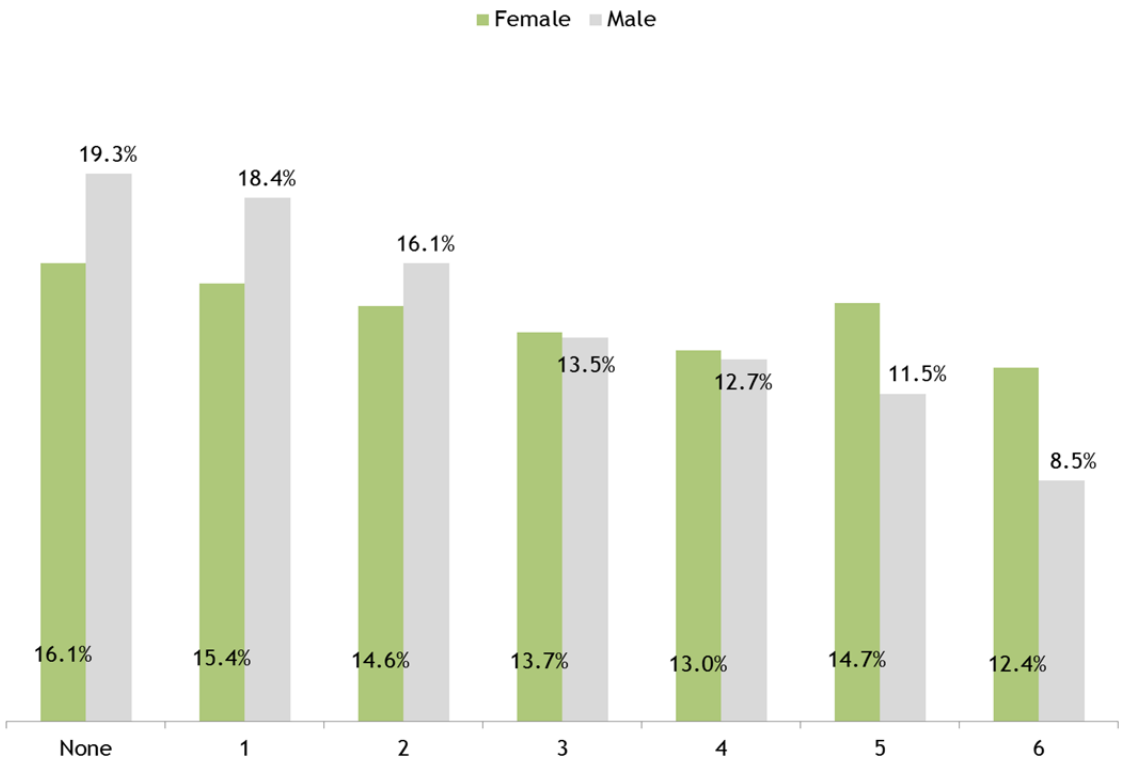

Figure 2c: Number of Clusters Completed by the Time of Transfer by Gender

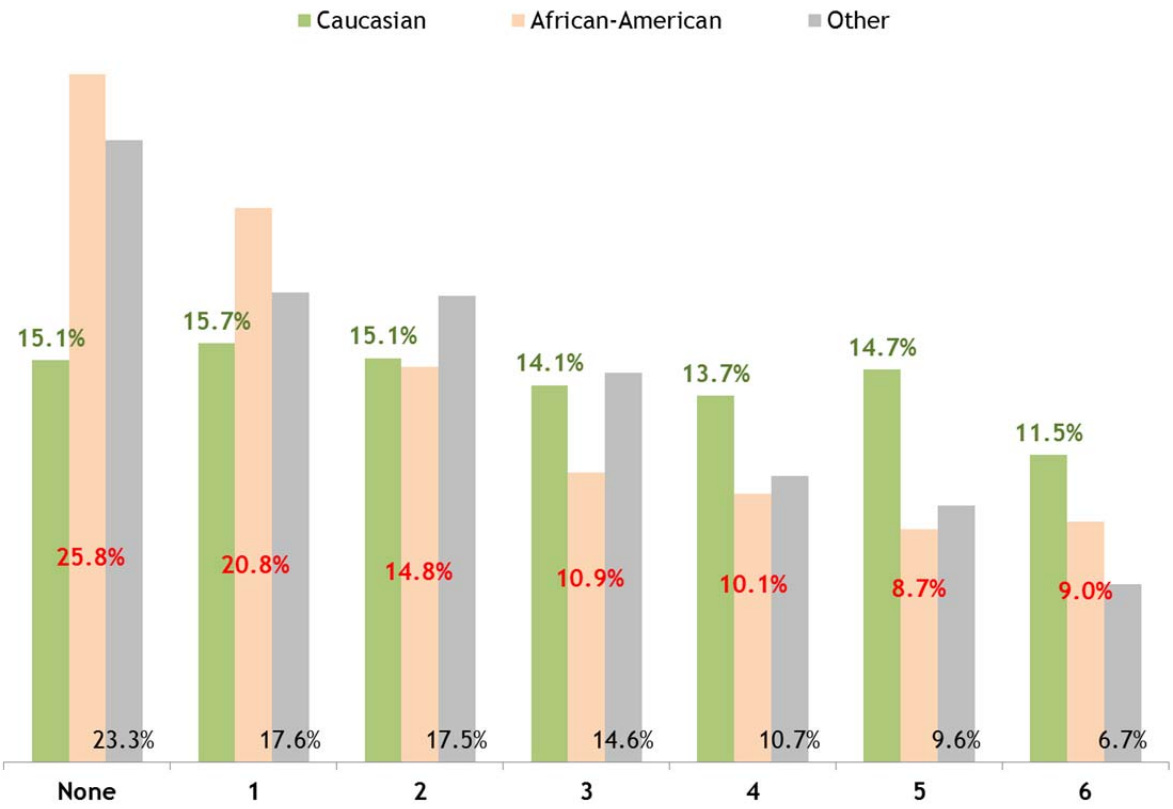

Figure 2d: Number of Clusters by Race/Ethnicity

With an increase in the number of clusters completed before transfer, adult students start to perform better than the traditional-age students, and the gap between these groups grows with every additional cluster. The same pattern holds true for female versus male students. Minority students lag behind Caucasian students when the number of completed clusters increases.

The most popular subject areas completed prior to transferring are mathematics (almost 63 percent of all students) and social sciences (almost 53 percent). The least popular blocks are humanities (24 percent) and history (38 percent). It is important to remember, though, that the mathematics cluster includes just three credit hours and is the easiest one to complete, while the humanities cluster consists of nine hours and takes appreciably longer. At the same time, popularity of clusters is not a direct function of their size in terms of credits. For instance, both social sciences and history require completion of six credit hours but enjoy different popularity with transfer students. The communications cluster holds the third position despite nine required credits. Figure 3 presents this information in the descending order of cluster completion.

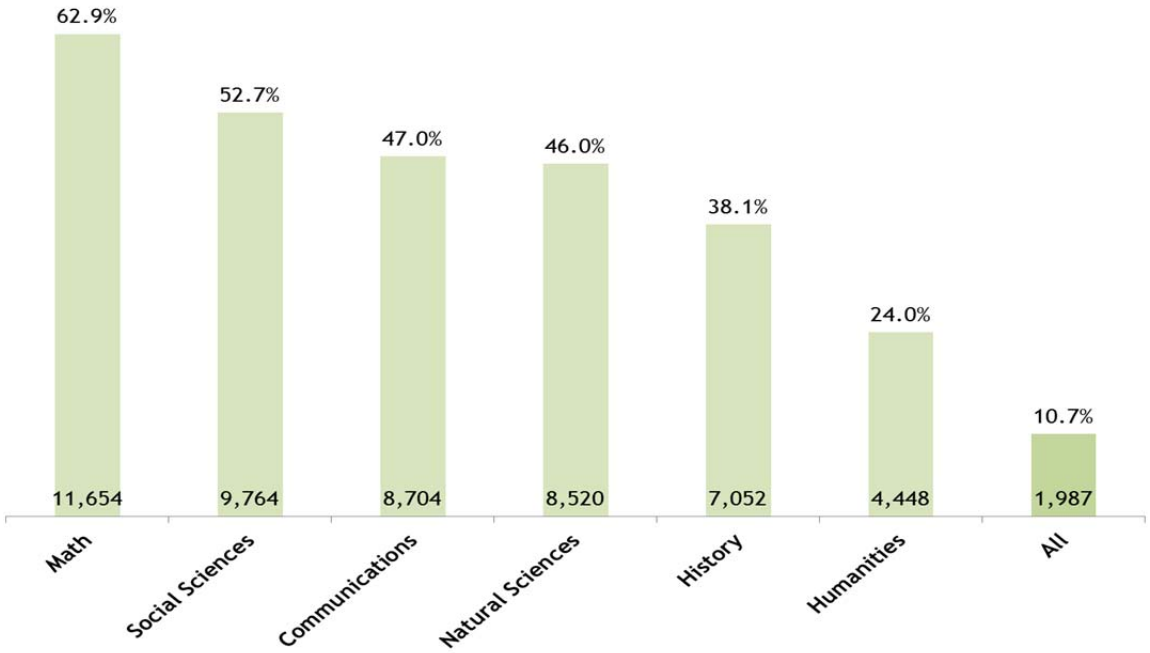

Figure 3: General Education Clusters Completed Prior to Transferring: All Students

Figure 4 presents data on the general education clusters completion just for graduates. The percentage is of the total number of graduates. The general order of cluster completion before transfer is the same as in Figure 3 with noticeable changes in percentages. As expected, for graduates, the share of general education clusters completed prior to transferring is appreciably higher than for the overall population of transfer students. This observation serves as an indirect support for the importance of meeting the general education requirements by the time students transfer to universities.

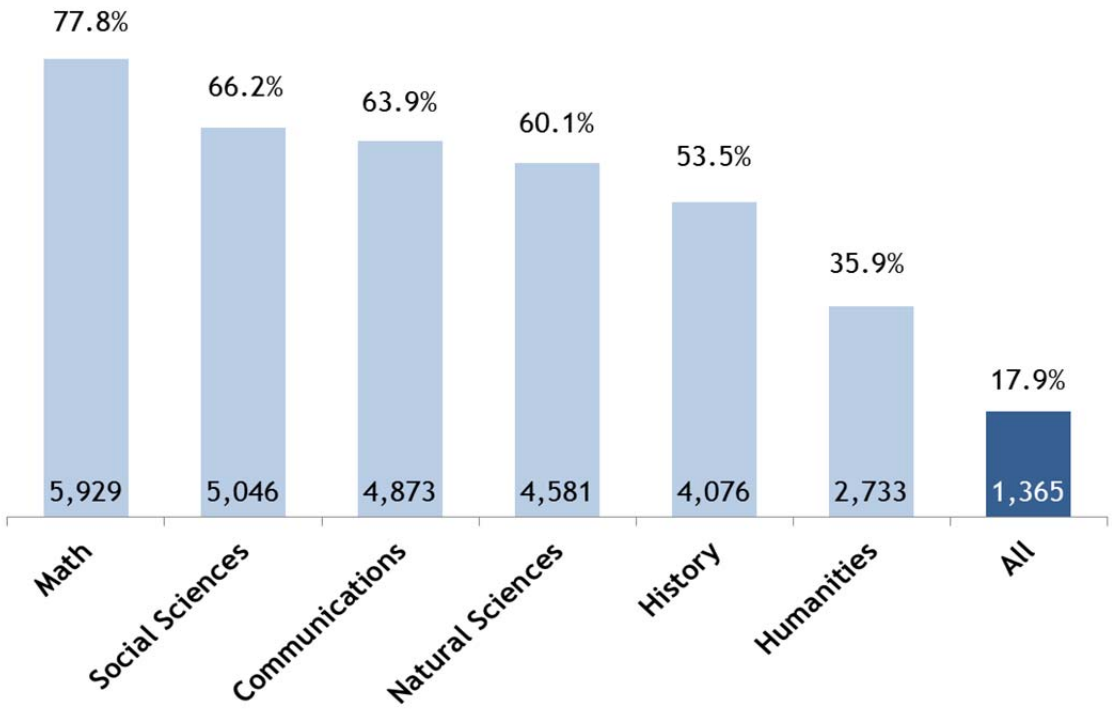

Figure 4: General Education Clusters Completed Prior to Transferring: Graduates Only

Figure 5 presents completion of general education clusters by transfer cohort of graduates. Each cluster is represented by three columns, one for each cohort of graduates. The

columns represent a share of that cluster completion of the total number of graduates from the given transfer cohort (2006, 2007, or 2008). For each general education cluster, as well as for the entire core, the percent of graduates who completed that cluster appreciably grows over time. Completion of the entire general education core has increased from 14.4 percent for the 2006 cohort' graduates to as high as 22 percent for the graduates from the transfer cohort of 2008. Therefore, pre-transfer general education completion becomes more common among transfer students who eventually graduate.

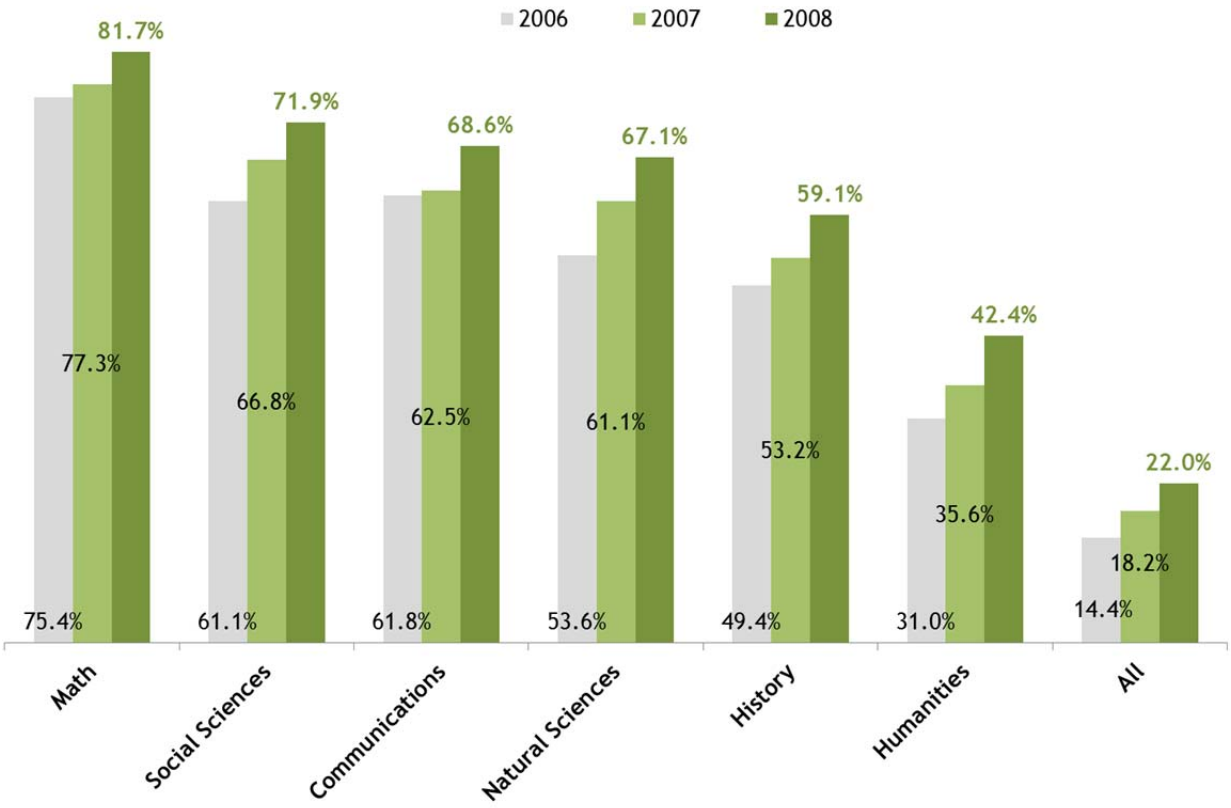

Figure 5: General Education Clusters Completed: By Transfer Cohort of Graduates

Regarding the extent to which the general education requirements are met prior to transferring, an average transfer student arrives with 22 general education credit hours (Table 4).

This number constitutes slightly over a half of the minimum for the whole general education core.

Table 4 also presents the average number of general education hours completed by subject area together with the required number of hours in each cluster. The averages for the mathematics, social sciences, and communications clusters are the closest to the required number of hours in each subject area. Transfer students usually arrive with fewer hours completed in relation to the required minimum in the other three subject areas—humanities, history, and natural sciences.

Table 5 presents the number of students in full and matched samples by respective cohort and general education course sequence.

The number of transfer students who moved into the five TBR universities during the observation period is 18,527. Participating universities provided data for the study for various cohorts. As a result, the full sample sizes for the respective cohorts are as follows: 4,689 students for 2006, 6,663 students for 2007, and 7,175 students for the 2008 cohort.

In full (unmatched) samples, the number of students who completed or did not complete various general education course sequences differs appreciably. The first three columns of Table 5 report the number of general education completers and noncompleters as well as the total number of transfer students in each cohort.

The employed one-to-one matching technique has reduced the number of students in the matched samples in comparison with the full samples. In the resultant matched samples, the number of completers and noncompleters of particular general education clusters is identical. The last three columns of Table 5 report the sample sizes of the matched samples by completers and noncompleters together with the total sample size.

Table 6 presents t-statistics for the difference in means between the treatment and control group in full and matched samples for 2006. Very high t-statistics for covariates in full samples attest to large differences between general education completers and noncompleters. In contrast, comparing means between the treatment and control group for matched samples reveals either no significant differences in means on the matching variables or its appreciable reduction. This indicates that the distribution of observable characteristics is likely to be similar in the treatment and control group, which is the goal of propensity score matching. The results for the 2007 and 2008 cohorts are similar.

Results

In this section, we provide several sets of estimates. Their presentation is separated by the outcome variable, type of the sample, and the use of control variables. We report results for each outcome of interest in the following order: the probability of graduation, time to graduation (expressed as hazard ratios for graduation), and college GPA. For the second outcome (time to degree), we employ two timing variables—number of semesters completed since the time of transfer and number of attempted credits—and provide separate estimates for both cases.

For each of the outcomes, in turn, we report two sets of estimates. We first provide estimates from a standard regression-based technique (logistic regression, Cox proportional hazards models, or ordinary least squares, depending on the outcome variable) for the entire general education core and for each of the individual clusters. We then report the same estimates from a matched sample. The results from the full and matched samples for each outcome are presented in adjacent tables.

The results tables have an identical structure. For every cohort year, we provide two estimates for each of the various course sequences. The first estimate is from a model predicting

the outcome of interest using only completion of that course sequence as a predictor. The second estimate is from a model predicting graduation using completion of that course sequence and a set of control variables including race, age, gender, high school GPA, and ACT scores. In the tables, the second estimate is identified with a note 'with controls' in parentheses. Each transfer cohort (the academic year of transfer: 2006, 2007, or 2008) is reported in a separate column of each table. Standard errors are reported in parentheses; confidence intervals for Cox models are reported in brackets.

The comparison groups for each of the reported estimates are different. For the general education core, the comparison group includes students who had not completed the entire core. For each individual cluster, the comparison group includes individuals who had not completed that cluster, excluding those who had completed the entire general education core. This limits the comparison to those who had completed the particular cluster with those who had not completed either that cluster or the entire core.

Results for Probability of Graduation: Logistic regression

We begin by reporting results for the impact of the general education clusters on the probability of graduation. As graduation is a binary variable, we model this outcome using logistic regression. Table 7 includes estimates from a logistic regression predicting graduation as a function of completion of the various course sequences.

The first row of Table 7 shows the predicted impact of completing the general education core in terms of the increase in probability of graduation. As the first column in the table shows, the probability of graduation is predicted to increase by 29 percentage points after completion of the general education core. This effect is robust to alternative specification—even after additional controls are included, the predicted effect is still 27 percentage points, and is highly

statistically significant. The analysis repeated in 2007 and 2008 shows very similar results: the impact of completion of the general education core appears to have large and statistically significant impacts on the probability of graduation, even after controlling for relevant variables.

The remaining rows of Table 7 include estimates for the impact of completion of the other general education clusters. As the table shows, completion of each of the clusters is predicted to increase the probability of graduation, and is statistically significant for every type of sequence. The predicted increase in the probability of graduation ranges from 12 percentage points (social sciences) to 23 percentage points (mathematics).

In Table 8, we report results from the same logistic regression, this time using matched datasets. As the table shows, once we limit the comparison to individuals who are similar to the treatment group on a host of observable characteristics, the predicted impact of completing various sequences decreases considerably. The predicted impact of completing the general education core for 2006 goes from 29 percentage points in the full sample down to 18 percentage points in the matched sample. The impact of completing the general education core is still statistically significant and positive in every year, but ranges from 18 to 26 percentage points.

We find similar results for the completion of other sequences. Using a matched sample attenuates the predicted impact of completing these sequences on graduation. The highest estimated impact in the matched sample is an increase in the predicted probability of graduation of 25 percentage points (mathematics cluster); the lowest effect is an increase in the probability of graduation of 7 percentage points (humanities cluster).

Figure 6 summarizes these results, showing the predicted impact of cluster completion using the matched samples for all years. As the figure shows, the highest predicted effects on graduation are from completing the general education core, while the lowest impacts come from

completion of the humanities cluster. Among individual clusters, communications and history exert the largest effects on the predicted probability of graduation. We also see a large effect for mathematics; however, this big impact is observed only for one cohort (2006), while the effects for the other cohorts of transfer students are smaller.

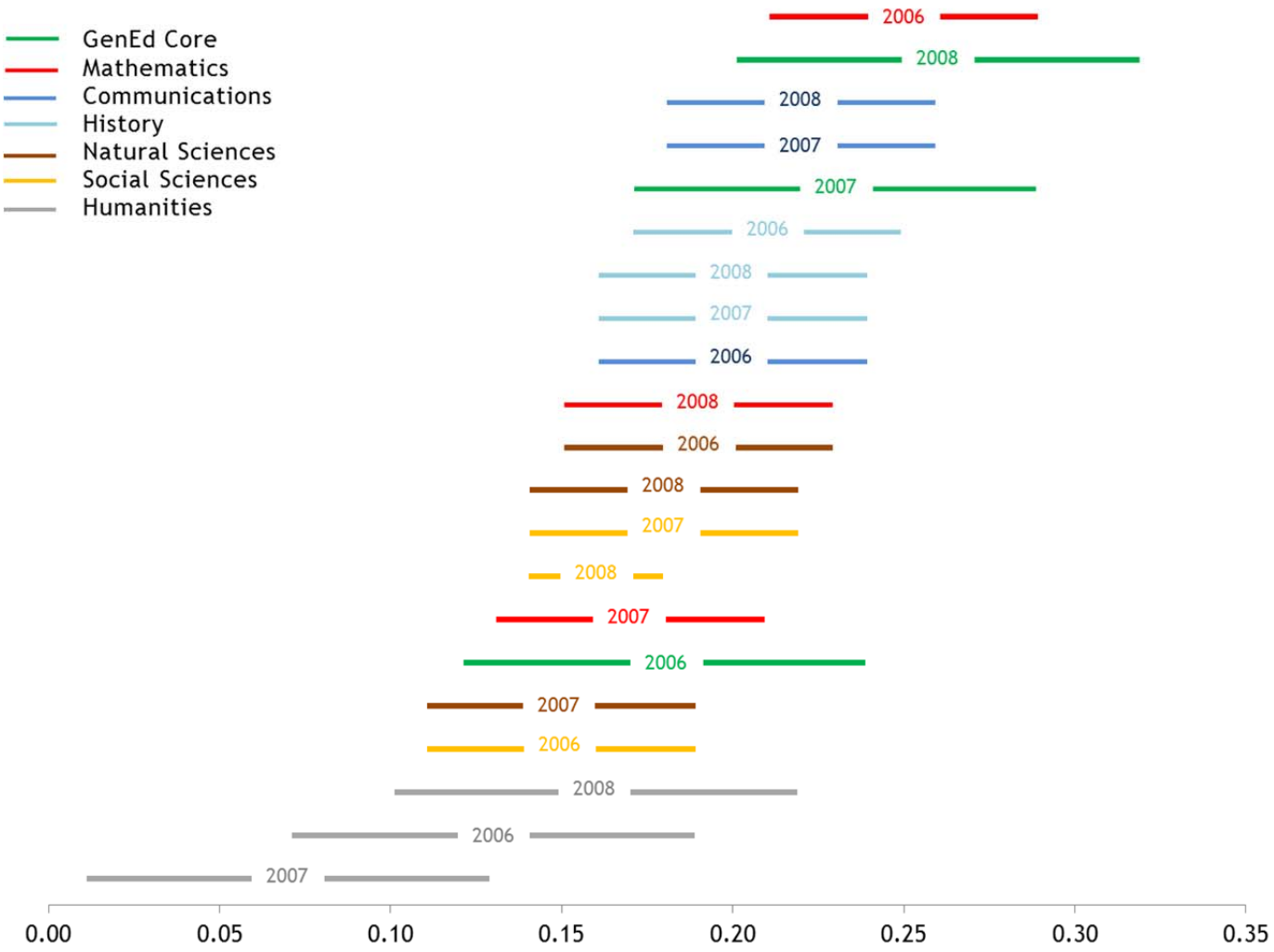

Figure 6: Predicted Increase in Probability of Graduation

Results for Time to Graduation: Event History Analysis

In the EHA models, we estimate the hazard rate for graduation. This outcome variable is estimated based on two components: whether the event of graduation took place and, if it did, how long it took a transfer student to graduate.

We provide two sets of estimates for the impact of the various course clusters on time to graduation. In the first set, we use number of semesters completed since the time of transfer as the timing variable. In the second set, we use number of attempted credits as the timing variable. Table 9 includes estimates from a model using number of semesters as the timing variable for the full sample. As the table shows, completing each of the course sequences is predicted to have a large and statistically significant effect on time to degree, as measured in semesters. For instance, for the 2008 cohort, we estimate that completing the general education core will increase the likelihood of completion by 2.5 times over the baseline rate of graduation. This estimate is robust to alternative specification. We find similar results for the completion of individual general education clusters—all have a large and statistically significant impact on the likelihood of graduation.

These estimates are again attenuated when we use the matched sample (Table 10). In the matched sample, the likelihood of completing a bachelor's degree increases by between 1.6 and 1.9 times among those who complete the general education core. Similar effects are found for all clusters: completing the cluster decreases the number of semesters required to complete a degree by a statistically significant margin. Figure 7 plots the survival curve for students who completed and did not complete each of the clusters using estimates from both the matched and the unmatched samples. The figure shows that students who complete the clusters are more likely to have graduated in any given year than students who have not, even when comparing very similar

groups of students. For instance, in 2008, 70 percent of students who had completed the general education core are predicted to have graduated within six semesters, while only 40 percent of students who had not completed the general education core are predicted to have graduated in the same time period.

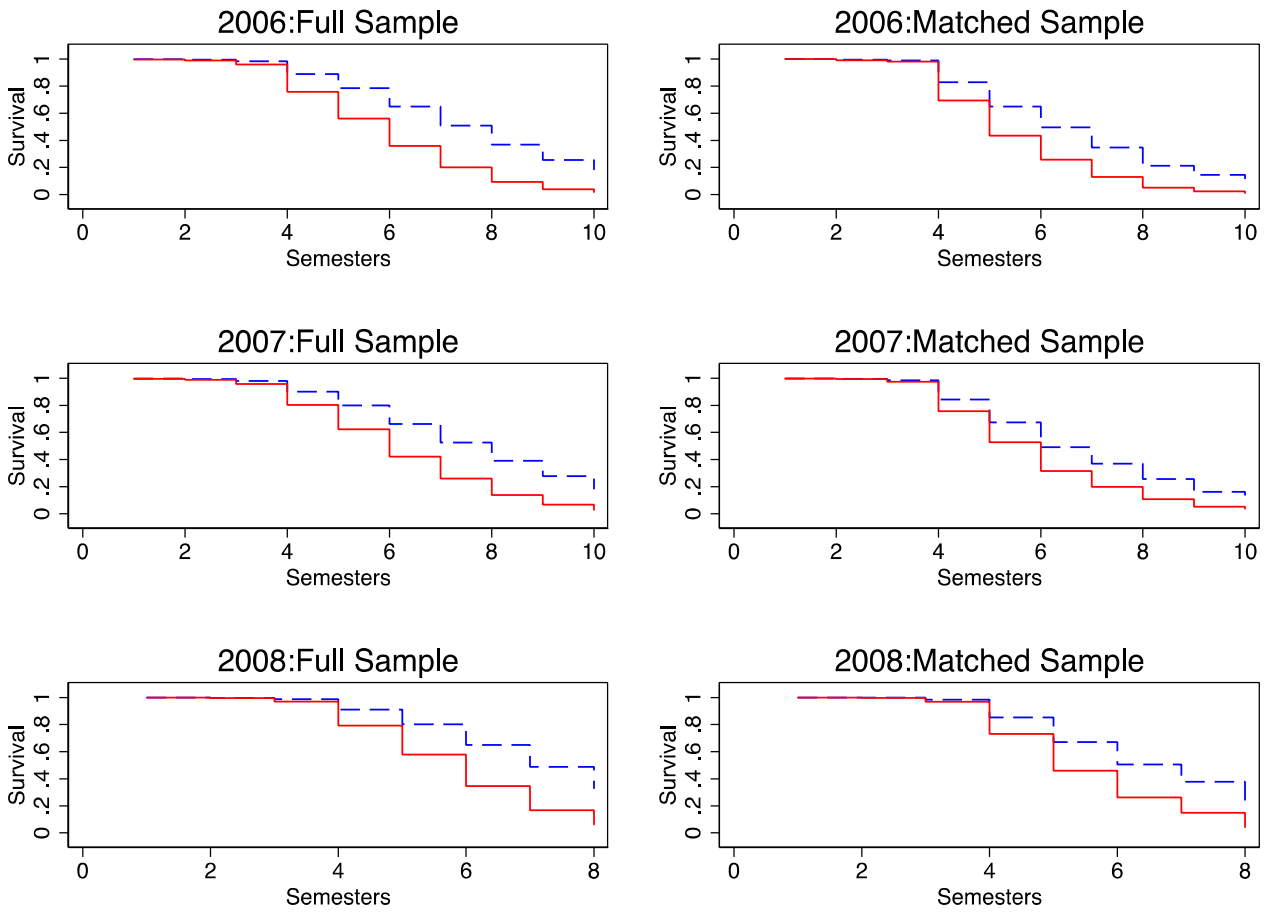

Figure 7: Estimated survival curves for students who had completed the general education core (in red) and students who had not

We find precisely the same pattern of results when we use attempted credits as opposed to semesters as the timing variable. As Table 11 shows, while all of the clusters are predicted to increase the likelihood of graduation, this effect is strongly attenuated in the matched sample (Table 12).

Results for GPA: Ordinary Least Squares

Estimates for the impact of completion of various course sequences on college GPA are reported in Table 13. As the table shows, GPAs are much higher among those who completed each of the clusters. For those who completed the general education core, GPAs are about 0.3 points higher than their peers, even after controlling for other characteristics. This difference remains after matching students with peers with similar characteristics (Table 14). In the matched sample, students who had completed the general education core have GPAs that are 0.33 to 0.25 points higher than their peers.

Discussion

This study examined the impact of pre-transfer general education completion on three main academic outcomes of university transfer students: the probability of graduation, time to degree, and college GPA. We hypothesized that completing general education requirements prior to transferring into a university would increase the probability of graduation, decrease time and credits to a bachelor's degree, and improve academic performance of transfer students. The results of the study confirmed our hypotheses.

The key findings of the study, and their main implications for Tennessee public higher education and individual institutions, are as follows. First, in line with our hypothesis, completion of the general education core, or its individual components, prior to transferring to a TBR university has a large and positively significant effect on the probability of graduation and decreases time to a bachelor's degree. These results demonstrate that the policy under investigation serves its purpose very effectively: The TBR-approved general education core allows transfer students to graduate with greater efficiency. In other words, meeting the requirements of the core by the time of transfer significantly increases the likelihood of degree

attainment and decreases time and credits to graduation. Therefore, to raise the likelihood of graduation, students should be encouraged to complete the general education requirements early in their academic careers.

Second, individual clusters making up the general education core affect the likelihood of graduation to varying extents. Completion of the mathematics cluster has an especially large effect in comparison with the other clusters. Completion of any individual cluster without completing the overall general education cluster increases the probability of graduation by between .07 and .25 percentage points. Completion of the humanities cluster has the lowest impact on the probability of graduation, while completion of the mathematics and communications clusters has the highest impact on students' probability of graduation. Therefore, students should be also encouraged to complete the clusters with the largest effect on college success as early as possible.

Third, we find that students who complete either the overall general education core or the specific clusters tend to have higher GPAs post-transfer than their peers who did not complete these clusters. The causal direction of this finding cannot be verified, but it suggests at the very least that students who complete the general education requirements prior to transferring tend to go on to be successful at the transfer institution.

Finally, this study may have implications for institutions as well as students. In 2010, Tennessee adopted a new public higher education funding formula that allocates state operating appropriations entirely on the basis of institutional and student outcomes. Performance metrics common to all public universities (or community colleges) are assigned unique weights reflective of institutional mission. Unique among the formula's outcome measures is an academic progress metric that counts students as successful when they accumulate 24, 48, or 72 credit hours. The

formula development committee thought it important to reward institutions for the progress their students make prior to the final outcome. The current study arms finance policymakers in Tennessee with data that may enable them to focus on credit accumulation benchmarks that are truly indicative of degree momentum and later academic success.

Table 1. Variable Description and Sources

Variable	Source	Total	Mean	Std. Dev.	Min	Max
graduated with a bachelor's degree	THEC SIS data	7,621	_	_	_	_
survival time in semesters	computed		3.7	2.2	1	14
survival time in attempted credits	computed		44.7	27.9	1	189
entire GenEd core completed (binary)	university data		0.1	0.3	0	1
number of GenEd clusters completed	university data		2.7	2.0	0	6
communications cluster completed (binary)	university data		0.5	0.5	0	1
history cluster completed (binary)	university data		0.4	0.5	0	1
humanities cluster completed (binary)	university data		0.2	0.4	0	1
math cluster completed (binary)	university data		0.6	0.5	0	1
natural sciences cluster completed (binary)	university data		0.5	0.5	0	1
social sciences cluster completed (binary)	university data		0.5	0.5	0	1
number of GenEd hours satisfied	university data		21.6	14.3	0	84
number of communications hours satisfied	university data		5.4	3.9	0	15
number of history hours satisfied	university data		2.6	2.8	0	9
number of humanities hours satisfied	university data		3.6	4.0	0	18
number of math hours satisfied	university data		2.1	1.9	0	17
number of natural sciences hours satisfied	university data		4.1	4.2	0	36
number of social sciences hours satisfied	university data		3.7	2.8	0	18
race/ethnicity: Caucasian (binary)	THEC SIS data	14,044	–	–	–	–
race/ethnicity: African-American (binary)	THEC SIS data	3,132	–	–	–	–
race/ethnicity: Asian (binary)	THEC SIS data	419	–	–	–	–
race/ethnicity: Hispanic (binary)	THEC SIS data	363	–	–	–	–
race/ethnicity: other race (binary)	THEC SIS data	569	–	–	–	–

Table 1, continued

Variable	Source	Total	Mean	Std. Dev.	Min	Max
gender: female (binary)	THEC SIS data		0.6	0.5	0	1
adult students: 25 and older (binary)	computed		0.3	0.4	0	1
in-state resident (binary)	THEC SIS data		0.9	0.3	0	1
college GPA at transfer	THEC SIS data		2.8	1.0	0	4
number of major changes	computed		0.5	0.7	0	5
number of transfer credits	THEC SIS data		52	29	0	389
transferred from public university (binary)	THEC SIS data		0.2	0.4	0	1
transferred from community college (binary)	THEC SIS data		0.5	0.5	0	1
transferred from private institution (binary)	THEC SIS data		0.1	0.3	0	1
transferred from specialized institution (binary)	THEC SIS data		0.0	0.1	0	1
transferred from out-of-state institution (binary)	THEC SIS data		0.3	0.4	0	1
distance from home to institution	computed		73	160	0	4,604
gross family income	THEC SIS data		54,469	59,370	0	952,457
received TSAA (state grant) (binary)	THEC SIS data		0.1	0.3	0	1
received HOPE (lottery grant) (binary)	THEC SIS data		0.3	0.4	0	1
student level at transfer	THEC SIS data	4	–	–	–	–

Table 2. Enrollment Characteristics of Transfer Students

	Number	Percent
Gender		
Female	10,517	56.8
Male	8,010	43.2
Age		
Traditional age	13,380	72.2
Adult (25 and above)	5,147	27.8
Race/Ethnicity		
Caucasian	14,044	75.8
African-American	3,132	16.9
Hispanic	363	2.0
Asian	419	2.3
Other	569	3.0
Residence status		
In-state	16,128	87.0
Out-of-state	2,399	13.0
Proximity to college		
1 - 5 miles	2,133	11.5
6 - 50 miles	8,891	48.0
51 - 100 miles	2,758	14.9
101 - 500 miles	2,308	12.5
Over 500 miles	413	2.2
Unknown distance	2,024	10.9
Student level at transfer		
Freshmen	5,383	29.1
Sophomore	5,393	29.1
Junior	5,741	31.0
Senior	1,989	10.7
Special undergraduate student	21	0.1
Direction of transfer		
From public universities	2,691	14.5
From community colleges	8,786	47.4
From private institutions	1,401	7.6
From out-of-state institutions	4,981	26.9
From specialized institutions	118	0.6
Unknown	550	3.0

Table 3. Average Time to Degree

	Semesters	Attempted credits
All transfer students who graduated (7,621)	6.1	78.3
General Education Core Completion		
Entire General Education core	5.3	66.5
Communications cluster	5.8	73.2
History cluster	5.7	71.8
Humanities cluster	5.5	69.2
Mathematics cluster	5.9	75.2
Natural Science cluster	5.8	72.1
Social Sciences cluster	5.8	73.4
Gender		
Female	6.0	75.9
Male	6.4	81.8
Age		
Traditional age	6.3	82.1
Adult (25 and above)	5.8	67.4
Race/Ethnicity		
Caucasian	6.1	77.9
African-American	6.4	80.0
Hispanic	6.3	78.6
Asian	6.3	84.6
Income		
0 – 25,000	6.3	80.3
25,000 – 50,000	5.8	74.2
50,000 – 75,000	5.9	76.2
75,000 – 100,000	6.1	80.1
Over 100,000	6.3	84.6

Table 4. Completion of General Education Requirements by Transfer

	Number of students	Percent of total
Completed the entire General Education core	1,987	10.7
in academic year 2006-07	478	10.2
in academic year 2007-08	751	11.3
in academic year 2008-09	758	10.6
Number of General Education clusters completed		
0 clusters	3,238	17.5
1 cluster	3,095	16.7
2 clusters	2,826	15.3
3 clusters	2,521	13.6
4 clusters	2,390	12.9
5 clusters	2,470	13.3
6 clusters	1,987	10.7
Type of a General Education cluster completed		
Communications cluster	8,704	47.0
History cluster	7,052	38.1
Humanities cluster	4,448	24.0
Mathematics cluster	11,654	62.9
Natural sciences cluster	8,520	46.0
Social sciences cluster	9,764	52.7
	Number of hours	Maximum number
Average number of General Education hours	22	41
Average number of General Education hours by cluster		
Communications cluster	5.4	9
History cluster	2.6	6
Humanities cluster	3.6	9
Mathematics cluster	2.1	3
Natural sciences cluster	4.1	8
Social sciences cluster	3.7	6

Table 5. Number of Students in Full and Matched Samples by Cohort and General Education Course Sequence

	Full sample			Matched sample		
	Completed	Did not complete	Total	Completed	Did not complete	Total
			2006 cohort			
Entire core	478	4,211	4,689	289	289	578
Communications	2,378	2,311	4,689	784	784	1,568
History	2,839	1,850	4,689	731	731	1,462
Humanities	3,564	1,125	4,689	595	595	1,190
Natural sciences	2,683	2,006	4,689	981	981	1,962
Social sciences	2,182	2,507	4,689	1,062	1,062	2,124
Mathematics	1,713	2,976	4,689	692	692	1,384
			2007 cohort			
Entire core	751	5,912	6,663	400	400	800
Communications	3,550	3,113	6,663	1,000	1,000	2,000
History	4,063	2,600	6,663	1,054	1,054	2,108
Humanities	5,011	1,652	6,663	776	776	1,552
Natural sciences	3,500	3,163	6,663	1,418	1,418	2,836
Social sciences	3,111	3,552	6,663	1,382	1,382	2,764
Mathematics	2,415	4,248	6,663	1,024	1,024	2,048
			2008 cohort			
Entire core	758	6,417	7,175	394	394	788
Communications	3,962	3,213	7,175	1,281	1,281	2,562
History	4,573	2,602	7,175	1,227	1,227	2,454
Humanities	5,504	1,671	7,175	801	801	1,602
Natural sciences	3,824	3,351	7,175	1,523	1,523	3,046
Social sciences	3,470	3,705	7,175	1,624	1,624	3,248
Mathematics	2,745	4,430	7,175	1,119	1,119	2,238

Table 6. T-statistics for Differences in Means between General Education Completers and Noncompleters by Matching Variable and Cluster, 2006

Matching variables	Communications		History		Humanities		Natural sciences		Social sciences		Mathematics		Entire core	
	Full	Matched	Full	Matched	Full	Matched	Full	Matched	Full	Matched	Full	Matched	Full	Matched
Ethnicity: African-American	-10.58	-0.42	-12.51	-1.9	-8.92	-0.11	-16.54	-1.29	-7.88	-1.43	-13.36	-5.52	-3.29	-0.29
Ethnicity: Asian	-4.38	-1.23	-8.66	0.3	-6.91	0	0.18	-1.64	-1.44	-1.13	1.73	-0.4	-5.97	0
Ethnicity: Hispanic	-0.4	0.5	1.6	-0.26	-3.57	0.82	-5.37	-0.9	-1.23	-0.86	-0.71	-0.45	-1.89	-0.58
Gender: Female	13.54	2.31	7.12	1.96	10.12	0.6	11.55	1.42	11.96	4.05	5.29	1.9	12.21	-0.09
Adult students	9.59	4.09	11.32	3.4	13.21	2.15	13.53	3.64	13.29	3.83	-4.81	1.88	9.16	0.12
Age	14.02	8.54	14.51	7.31	16.8	2.25	17.7	8.03	21.11	10.1	-1.6	6.86	13.51	0.55
Transfer: community college	54.66	5.43	73.46	3.3	40.37	-1.4	45.29	8.22	26.27	10.03	37.77	9.02	45.85	-0.15
Transfer: private institution	-15.29	-2.34	-22.56	0.93	-11.03	0.14	-12.5	-3.86	-23.19	-6.32	-5.69	-4.97	-13.06	0.58
TSAA (state grant) receipt	2.65	-0.09	6.93	1	5.33	0.91	2.28	1.15	1.1	0	-1.02	-0.09	5.7	1.03
HOPE (lottery grant) receipt	3.2	-3.1	3.17	0.43	-0.81	0.78	5.76	-0.27	-6.29	-2.66	16.21	5.38	5.05	0.08
ACT score	-14.74	-3.28	-17.3	-2.6	-9.73	0.39	0.29	-1.93	-9.35	-2.63	9.39	3.94	-14.1	-0.83
High school GPA	7.65	0.17	4.05	1.12	4.62	-0.06	16.42	1.8	2.75	0.34	14.42	6.13	2.04	-1.32
Income category: 0-25K	3.4	1.96	5.41	2	6.99	0.72	1.79	1.41	-1.69	0.35	-3.75	-0.86	3.11	-0.37
Income category: 25-50K	8.26	1.21	8.22	0.81	7.55	-0.87	2.48	0.49	2.79	1.52	6.98	2.01	7.58	0.19
Income category: 50-75K	5.64	-0.26	7.03	-0.68	2.04	-0.36	5.88	1.03	0.51	0	8.07	-0.56	1.82	-0.62
Income category: 75-100K	1.04	-1.01	2.26	0.2	-0.18	-0.69	1.56	-1.35	-1.17	0.53	5.72	1.59	1.77	-0.23

Table 7. Predicted Increase in Probability of Graduation as a Result of Completing Various Sequences, Full Sample

	2006	2007	2008
General Education	0.29 *	0.30 *	0.29 *
	(0.03)	(0.02)	(0.01)
General Education (with controls)	0.27 *	0.28 *	0.27 *
	(0.03)	(0.02)	(0.02)
Communications	0.21 *	0.23 *	0.21 *
	(0.01)	(0.01)	(0.01)
Communications (with controls)	0.18 *	0.22 *	0.21 *
	(0.02)	(0.01)	(0.01)
History	0.20 *	0.21 *	0.20 *
	(0.02)	(0.01)	(0.01)
History (with controls)	0.18 *	0.21 *	0.19 *
	(0.02)	(0.02)	(0.01)
Humanities	0.17 *	0.18 *	0.21 *
	(0.02)	(0.02)	(0.01)
Humanities (with controls)	0.17 *	0.14 *	0.20 *
	(0.03)	(0.02)	(0.02)
Natural Sciences	0.21 *	0.19 *	0.17 *
	(0.01)	(0.01)	(0.01)
Natural Sciences (with controls)	0.17 *	0.16 *	0.17 *
	(0.02)	(0.02)	(0.01)
Social Sciences	0.13 *	0.19 *	0.18 *
	(0.01)	(0.01)	(0.01)
Social Sciences (with controls)	0.12 *	0.19 *	0.16 *
	(0.02)	(0.01)	(0.01)
Mathematics	0.25 *	0.22 *	0.20 *
	(0.01)	(0.01)	(0.01)
Mathematics (with controls)	0.23 *	0.18 *	0.21 *
	(0.02)	(0.02)	(0.01)

Note. Standard errors in parentheses. Controls: ethnicity, gender, age, high school GPA, and ACT score.

* Indicates statistically significant result ($p < 0.05$)

Table 8. Predicted Increase in Probability of Graduation as a Result of Completing Various Sequences, Matched Sample

	2006	2007	2008
General Education	0.18 *	0.23 *	0.27 *
	(0.03)	(0.03)	(0.03)
General Education (with controls)	0.18 *	0.23 *	0.26 *
	(0.03)	(0.03)	(0.03)
Communications	0.20 *	0.24 *	0.23 *
	(0.02)	(0.02)	(0.02)
Communications (with controls)	0.20 *	0.22 *	0.22 *
	(0.02)	(0.02)	(0.02)
History	0.22 *	0.23 *	0.23 *
	(0.02)	(0.02)	(0.02)
History (with controls)	0.21 *	0.20 *	0.20 *
	(0.02)	(0.02)	(0.02)
Humanities	0.13 *	0.07 *	0.16 *
	(0.03)	(0.03)	(0.03)
Humanities (with controls)	0.13 *	0.07 *	0.16 *
	(0.03)	(0.03)	(0.03)
Natural Sciences	0.19 *	0.19 *	0.20 *
	(0.02)	(0.02)	(0.02)
Natural Sciences (with controls)	0.19 *	0.15 *	0.18 *
	(0.02)	(0.02)	(0.02)
Social Sciences	0.16 *	0.20 *	0.19 *
	(0.02)	(0.02)	(0.02)
Social Sciences (with controls)	0.15 *	0.18 *	0.16 *
	(0.02)	(0.02)	(0.01)
Mathematics	0.28 *	0.24 *	0.24 *
	(0.02)	(0.02)	(0.02)
Mathematics (with controls)	0.25 *	0.17 *	0.19 *
	(0.02)	(0.02)	(0.02)

Note. Standard errors in parentheses. Controls: ethnicity, gender, age, high school GPA, and ACT score.

* Indicates statistically significant result ($p < 0.05$)

Table 9. Estimates from Cox Proportional Hazards Model for Time to Graduation, Measured in Semesters, Full Sample

	2006	2007	2008
General Education	2.39 *	2.10 *	2.48 *
	[2.12, 2.68]	[1.90, 2.31]	[2.25, 2.74]
General Education (with controls)	2.48 *	2.23 *	2.23 *
	[2.17, 2.85]	[1.98, 2.50]	[1.94, 2.55]
Communications	1.93 *	1.88 *	2.25 *
	[1.79, 2.09]	[1.74, 2.03]	[2.04, 2.48]
Communications (with controls)	1.84 *	1.80 *	2.25 *
	[1.67, 2.03]	[1.64, 1.99]	[1.96, 2.58]
History	1.93 *	1.73 *	2.27 *
	[1.79, 2.09]	[1.60, 1.87]	[2.06, 2.50]
History (with controls)	1.84 *	1.80 *	2.16 *
	[1.67, 2.03]	[1.64, 1.99]	[1.92, 2.43]
Humanities	1.79 *	1.70 *	2.14 *
	[1.62, 1.97]	[1.54, 1.87]	[1.90, 2.41]
Humanities (with controls)	1.65 *	1.62 *	2.01 *
	[1.44, 1.89]	[1.44, 1.82]	[1.76, 2.31]
Natural Sciences	1.88 *	1.77 *	1.99 *
	[1.74, 2.03]	[1.63, 1.91]	[1.81, 2.20]
Natural Sciences (with controls)	1.70 *	1.52 *	1.92 *
	[1.54, 1.87]	[1.38, 1.68]	[1.70, 2.15]
Social Sciences	1.67 *	1.80 *	2.01 *
	[1.54, 1.80]	[1.67, 1.95]	[1.83, 2.22]
Social Sciences (with controls)	1.60 *	1.73 *	1.79 *
	[1.45, 1.76]	[1.57, 1.91]	[1.59, 2.01]
Mathematics	2.03 *	1.93 *	2.27 *
	[1.84, 2.24]	[1.75, 2.13]	[2.02, 2.55]
Mathematics (with controls)	1.90 *	1.77 *	2.18 *
	[1.69, 2.13]	[1.57, 1.99]	[1.86, 2.55]

Note. Confidence intervals in brackets. Controls: ethnicity, gender, age, high school GPA, and ACT score.

* Indicates statistically significant result (95% Confidence Interval does not include 1)

Table 10. Estimates from Cox Proportional Hazards Model for Time to Graduation, Measured in Semesters, Matched Sample

	2006	2007	2008
General Education	1.93 *	1.63 *	1.95 *
	[1.59, 2.35]	[1.37, 1.95]	[1.58, 2.42]
General Education (with controls)	2.01 *	1.70 *	1.97 *
	[1.66, 2.45]	[1.42, 2.03]	[1.59, 2.45]
Communications	1.90 *	1.72 *	2.32 *
	[1.65, 2.18]	[1.50, 1.97]	[1.98, 2.71]
Communications (with controls)	1.82 *	1.72 *	2.23 *
	[1.59, 2.09]	[1.50, 1.97]	[1.87, 2.65]
History	2.08 *	1.77 *	2.18 *
	[1.81, 2.38]	[1.54, 2.03]	[1.86, 2.55]
History (with controls)	1.95 *	1.73 *	2.05 *
	[1.70, 2.24]	[1.51, 1.99]	[1.76, 2.40]
Humanities	1.38 *	1.31 *	1.55 *
	[1.15, 1.64]	[1.12, 1.53]	[1.30, 1.85]
Humanities (with controls)	1.38 *	1.35 *	1.58 *
	[1.15, 1.64]	[1.13, 1.61]	[1.30, 1.93]
Natural Sciences	1.79 *	1.58 *	2.12 *
	[1.59, 2.01]	[1.41, 1.78]	[1.81, 2.48]
Natural Sciences (with controls)	1.70 *	1.46 *	1.97 *
	[1.51, 1.91]	[1.30, 1.64]	[1.69, 2.31]
Social Sciences	1.73 *	1.77 *	1.97 *
	[1.54, 1.95]	[1.57, 1.99]	[1.72, 2.26]
Social Sciences (with controls)	1.65 *	1.68 *	1.77 *
	[1.47, 1.85]	[1.50, 1.89]	[1.51, 2.07]
Mathematics	2.16 *	2.03 *	2.77 *
	[1.85, 2.53]	[1.74, 2.38]	[2.28, 3.37]
Mathematics (with controls)	1.99 *	1.80 *	2.27 *
	[1.70, 2.33]	[1.54, 2.11]	[1.87, 2.76]

Note. Confidence intervals in brackets. Controls: ethnicity, gender, age, high school GPA, and ACT score.

* Indicates statistically significant result (95% Confidence Interval does not include 1)

Table 11. Estimates from Cox Proportional Hazards Model for Time to Graduation, Measured in Attempted Credits, Full Sample

	2006	2007	2008
General Education	3.22 *	2.86 *	3.39 *
	[2.86, 3.62]	[2.59, 3.15]	[3.07, 3.74]
General Education (with controls)	3.46 *	2.77 *	2.69 *
	[3.01, 3.96]	[2.47, 3.12]	[2.35, 3.09]
Communications	2.39 *	2.23 *	2.44 *
	[2.21, 2.58]	[2.06, 2.41]	[2.21, 2.69]
Communications (with controls)	2.20 *	2.05 *	2.34 *
	[2.00, 2.43]	[1.86, 2.27]	[2.04, 2.68]
History	2.36 *	1.92 *	2.46 *
	[2.18, 2.56]	[1.77, 2.07]	[2.23, 2.71]
History (with controls)	2.25 *	2.03 *	2.34 *
	[2.04, 2.48]	[1.84, 2.24]	[2.08, 2.63]
Humanities	2.27 *	2.20 *	2.41 *
	[2.06, 2.50]	[2.00, 2.43]	[2.14, 2.71]
Humanities (with controls)	1.90 *	1.99 *	2.12 *
	[1.65, 2.18]	[1.74, 2.29]	[1.85, 2.43]
Natural Sciences	2.25 *	2.01 *	2.20 *
	[2.08, 2.43]	[1.86, 2.18]	[2.00, 2.43]
Natural Sciences (with controls)	2.03 *	1.73 *	2.12 *
	[1.84, 2.24]	[1.57, 1.91]	[1.88, 2.38]
Social Sciences	2.14 *	2.18 *	2.23 *
	[1.98, 2.31]	[2.02, 2.36]	[2.02, 2.45]
Social Sciences (with controls)	1.95 *	1.95 *	1.84 *
	[1.77, 2.16]	[1.77, 2.16]	[1.64, 2.07]
Mathematics	2.12 *	2.18 *	2.20 *
	[1.92, 2.33]	[1.98, 2.41]	[1.96, 2.48]
Mathematics (with controls)	2.05 *	2.08 *	2.32 *
	[1.83, 2.31]	[1.84, 2.33]	[1.98, 2.71]

Note. Confidence intervals in brackets. Controls: ethnicity, gender, age, high school GPA, and ACT score.

* Indicates statistically significant result (95% Confidence Interval does not include 1)

Table12. Estimates from Cox Proportional Hazards Model for Time to Graduation, Measured in Attempted Credits, Matched Sample

	2006	2007	2008
General Education	2.29 *	1.97 *	2.29 *
	[1.89, 2.79]	[1.65, 2.35]	[1.85, 2.85]
General Education (with controls)	2.44 *	2.03 *	2.25 *
	[2.00, 2.96]	[1.71, 2.43]	[1.81, 2.79]
Communications	2.32 *	1.97 *	2.59 *
	[2.02, 2.66]	[1.72, 2.26]	[2.21, 3.02]
Communications (with controls)	2.27 *	1.99 *	2.29 *
	[1.98, 2.60]	[1.74, 2.29]	[1.92, 2.74]
History	2.53 *	1.95 *	2.46 *
	[2.21, 2.91]	[1.70, 2.24]	[2.10, 2.88]
History (with controls)	2.36 *	1.90 *	2.27 *
	[2.02, 2.76]	[1.65, 2.18]	[1.94, 2.66]
Humanities	1.52 *	1.54 *	1.68 *
	[1.28, 1.82]	[1.29, 1.83]	[1.38, 2.05]
Humanities (with controls)	1.51 *	1.57 *	1.67 *
	[1.26, 1.80]	[1.31, 1.87]	[1.37, 2.03]
Natural Sciences	2.08 *	1.75 *	2.29 *
	[1.84, 2.33]	[1.56, 1.97]	[1.96, 2.68]
Natural Sciences (with controls)	1.97 *	1.60 *	2.18 *
	[1.75, 2.22]	[1.42, 1.80]	[1.86, 2.55]
Social Sciences	2.10 *	1.97 *	2.18 *
	[1.86, 2.36]	[1.75, 2.22]	[1.90, 2.50]
Social Sciences (with controls)	1.99 *	1.88 *	1.88 *
	[1.77, 2.24]	[1.67, 2.11]	[1.61, 2.20]
Mathematics	2.29 *	2.32 *	3.00 *
	[1.96, 2.68]	[1.98, 2.71]	[2.47, 3.65]
Mathematics (with controls)	2.14 *	2.23 *	2.64 *
	[1.83, 2.50]	[1.90, 2.60]	[2.13, 3.27]

Note. Confidence intervals in brackets. Controls: ethnicity, gender, age, high school GPA, and ACT score.

* Indicates statistically significant result (95% Confidence Interval does not include 1)

Table 13. OLS Estimates of Impact on GPA, Full Sample

	2006	2007	2008
General Education	0.37 *	0.33 *	0.38 *
	(0.04)	(0.03)	(0.03)
General Education (with controls)	0.35 *	0.30 *	0.31 *
	(0.04)	(0.03)	(0.03)
Communications	0.22 *	0.23 *	0.23 *
	(0.03)	(0.02)	(0.02)
Communications (with controls)	0.20 *	0.19 *	0.20 *
	(0.03)	(0.03)	(0.03)
History	0.13 *	0.18 *	0.23 *
	(0.03)	(0.03)	(0.03)
History (with controls)	0.13 *	0.15 *	0.18 *
	(0.03)	(0.03)	(0.03)
Humanities	0.20 *	0.16 *	0.24 *
	(0.04)	(0.03)	(0.03)
Humanities (with controls)	0.18 *	0.11 *	0.19 *
	(0.04)	(0.04)	(0.04)
Natural Sciences	0.32 *	0.26 *	0.27 *
	(0.03)	(0.02)	(0.02)
Natural Sciences (with controls)	0.23 *	0.14 *	0.15 *
	(0.03)	(0.03)	(0.03)
Social Sciences	0.14 *	0.21 *	0.19 *
	(0.03)	(0.02)	(0.02)
Social Sciences (with controls)	0.09 *	0.13 *	0.11 *
	(0.03)	(0.03)	(0.03)
Mathematics	0.29 *	0.30 *	0.27 *
	(0.03)	(0.02)	(0.02)
Mathematics (with controls)	0.23 *	0.20 *	0.17 *
	(0.03)	(0.03)	(0.03)

Note. Standard errors in parentheses. Controls: ethnicity, gender, age, high school GPA, and ACT score.

* Indicates statistically significant result ($p < 0.05$)

Table14. OLS Estimates of Impact on GPA, Matched Sample

	2006	2007	2008
General Education	0.31 *	0.29 *	0.26 *
	(0.06)	(0.06)	(0.06)
General Education (with controls)	0.33 *	0.30 *	0.25 *
	(0.06)	(0.05)	(0.05)
Communications	0.19 *	0.22 *	0.21 *
	(0.05)	(0.04)	(0.04)
Communications (with controls)	0.16 *	0.18 *	0.16 *
	(0.04)	(0.04)	(0.03)
History	0.20 *	0.23 *	0.25 *
	(0.05)	(0.04)	(0.04)
History (with controls)	0.16 *	0.16 *	0.15 *
	(0.04)	(0.04)	(0.04)
Humanities	0.16 *	0.01	0.09
	(0.06)	(0.05)	(0.05)
Humanities (with controls)	0.13 *	0.02	0.10 *
	(0.05)	(0.05)	(0.05)
Natural Sciences	0.26 *	0.21 *	0.21 *
	(0.04)	(0.04)	(0.04)
Natural Sciences (with controls)	0.22 *	0.11 *	0.12 *
	(0.04)	(0.03)	(0.03)
Social Sciences	0.14 *	0.18 *	0.22 *
	(0.04)	(0.04)	(0.03)
Social Sciences (with controls)	0.09 *	0.12 *	0.13 *
	(0.04)	(0.03)	(0.03)
Mathematics	0.37 *	0.42 *	0.52 *
	(0.05)	(0.04)	(0.04)
Mathematics (with controls)	0.23 *	0.21 *	0.23 *
	(0.05)	(0.04)	(0.04)

Note. Standard errors in parentheses. Controls: ethnicity, gender, age, high school GPA, and ACT score.

* Indicates statistically significant result ($p < 0.05$)

Appendix I

Members of the Advisory Committee for the Study, 2011-2012

Austin Peay State University

Dr. Tristan Denley, Provost and Vice President for Academic Affairs

Melissa Hunter, Director, Institutional Research and Effectiveness

East Tennessee State University

Dr. William Kirkwood, Vice Provost for Undergraduate Education

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Dr. Sheila Otto, Director of General Education

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Dr. Evelyn Nettles, Associate Vice President of Academic Affairs

Dr. Sharon Peters, Director of Off-Campus Programs / EWC

Dr. Cheryl Seay, Director of Distance Education and Multimedia Services

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Dr. Thomas Nenon, Vice Provost for Assessment, Institutional Research, and Reporting

Dr. Gary Donhardt, Director, Office of Institutional Research

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Dr. Kay Clark, Vice Chancellor for Academic Affairs

Dr. Gregory Schutz, Director of Assessment and Institutional Effectiveness

Chris Tingle, Senior Research Analyst

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Dr. Katie High, Interim Vice President for Academic Affairs

Dr. Dennis Hengstler, Director of Institutional Research and Planning

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Dr. Richard Rhoda, Executive Director

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Dr. Thomas Sanford, Director of Research; Policy, Planning, and Research

Dr. Linda Doran, Associate Executive Director, Academic Affairs

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