The Tennessee Student Flow Model:
A Tool to Build a Statewide Strategic Plan to Increase Degree Productivity

Introduction

Tennessee lags regional and national averages in the educational attainment level of its working-age population. Currently, only 29.9 percent of Tennessee's adults aged 25-64 hold an associate's degree or higher, compared to an average of 34.3 percent for Southern Regional Education Board states and 37.2 percent for the nation. To meet the current Southern states' average, Tennessee needs an additional 140,000 citizens with associate's degrees or higher, more than double the current annual degree production of the state's public and private institutions. The need to increase attainment, coupled with a recent downturn in state revenues, led the Tennessee Higher Education Commission (THEC) to seek and receive planning funds for Making Opportunity Affordable (MOA), a national grant initiative designed to focus policy conversation around a productivity agenda for state higher education systems.

To support goal development for the state's efforts relative to MOA, the THEC staff developed the Student Enrollment and Completion Simulation Tool. Essentially, this tool derives annual and accumulated numbers of students enrolling in and graduating from the state's higher education system from 2008 to 2015. The tool allows users to simulate how enrollment and degree production levels will be influenced by altering up to 15 variables such as the high school graduation rate, college-going rate, percent of freshmen bringing in dual enrollment credit or needing remedial or developmental work, postsecondary enrollment share of out-of-state and private institutions, adult enrollment rate, and undergraduate retention rates. The tool is intended to build consensus around a goal for increased degree production, to chart the points along the P-16 educational pipeline that would lead to goal success, and to allocate responsibility for goal attainment among the state's various postsecondary providers.

Conceptual Framework

While several methodologies exist for projecting enrollments, the Cohort Survival Ratio (CSR) technique was chosen for the present purpose because the average accuracy rate of CSR (defined as (Forecasted-Observed)/Observed)was highest among the various methods discussed by Guo (2002). The CSR technique serves our purpose because we also intend to predict degree production, which is a function of enrollment. To predict degree completion as precisely as possible, it is important to estimate enrollment accurately.

Data

The Higher Education Commission has collected student-level data from all public institutions in the state since 1994 in its Student Information System (SIS). From the SIS, the researchers retrieved the following data elements for all undergraduate students who enrolled in any Tennessee public institutions from 1997 to 2007: student identification number, year and term enrolled, institution and system enrolled, residency status, age, number of credit hours taken, remedial and developmental coursework, registration status (e.g., first-time freshman, transfer, readmitted student, etc.), and the term in which a degree was conferred.

Methodology

Because cohort survival is determined largely by students' demographic and academic backgrounds, the model generates enrollment and graduation projections for different student groups separately. First, students were divided into freshman and non-freshman cohorts. Then, these two basic cohorts were broken out further. The Freshman Cohort was sub-divided into six groups, including four distinct cohorts of recent high school graduates enrolled as first-time freshmen: those with dual enrollment credit, those requiring remedial or developmental education, non-residents, and other. Freshman cohorts were also developed for freshmen aged 20-24 and 25 and up. Sub-groups in the Non-Freshman Cohort included returning students, readmitted students, non-degree-seeking students, community college transfers, and transfers from other institutions.

The progression of each cohort was tracked from the fall 1997 term through spring 2007. For each term during this time period, we calculated retention and graduation rates for every cohort. For projections of enrollment and completion beyond spring 2007, we employed an exponential smoothing method, meaning the previous two years' retention and graduation rates were used to estimate both retention and completion rates for each future term. In calculating these estimates for each term in the out-years, we assigned 90 percent of the entire weight to the most recent year and ten percent to the other year. (For instance, if second term retention rates of Fall 2006 and Fall 2007 adult student cohort at the University of Tennessee System were 70 and 80 percent, respectively, the model would return 79% as the projected second term retention rate of the Fall 2008 cohort.)

To evaluate the reliability of this method, we compared predicted values to actual figures. Beginning with actual student progression data from 1997 and 1998, we applied the exponential smoothing method described above to develop projections for all terms from 1999 through 2007. We then divided the projected value by the actual value at each term to get an error rate. Differences between simulated and actual data from 1999-2007 were within plus or minus three percent for both enrollment and completion for all systems in all terms. This result implies our model can predict student progress with reasonable accuracy as long as first-term enrollment is correct.

Implications

Tennessee is in the process of developing its higher education master plan for 2010-15. One of the important goals of the plan, supported by MOA expertise and funding, will be how to improve institutional and system degree productivity given the unlikely prospect of greatly increased state funding levels. The premise of the simulation tool is that it is possible to increase productivity substantially by targeting policy interventions at various points along the P-16 education pipeline. The tool is intended to help policymakers understand where intervention is most critical and what the results are likely to be.