
MODELING ENROLLMENT AND DEGREES

This appendix describes the details of the enrollment model used to generate the results given in Chapters 2 and 3. Our model builds on the “participation rate” methodology used by Michael Shires (1996), which is based on the demographics of California’s general population. Like Shires, we draw upon this population to model the number of first-time freshmen in UC, CSU, and the CCs broken down into ethnic, age, and gender cohorts. Then, we model the flow of each cohort of admitted students between systems and classes (freshman, sophomore, junior, and senior), as shown in Figure A.1. Unlike Shires, we also consider the effect of students who repeat classes and drop out; we also estimate the number of bachelor’s degrees granted from the number of seniors in UC and CSU, including those students who have transferred from the CCs.

CALCULATION OF FRESHMAN ENROLLMENT

We model the number of first-time freshmen (FTF) of a given ethnicity, gender, and age as

$$\begin{aligned}
 &FTF(system, ethnicity, gender, age, xt, year) \\
 &= Demog(ethnicity, gender, age, year) \\
 &\quad * cPRT(system, ethnicity, gender, age, xt, year)
 \end{aligned}
 \tag{A1}$$

where $Demog(ethnicity, gender, age, year)$ is the projected population in California of a given ethnicity, gender, and age cohort in a given

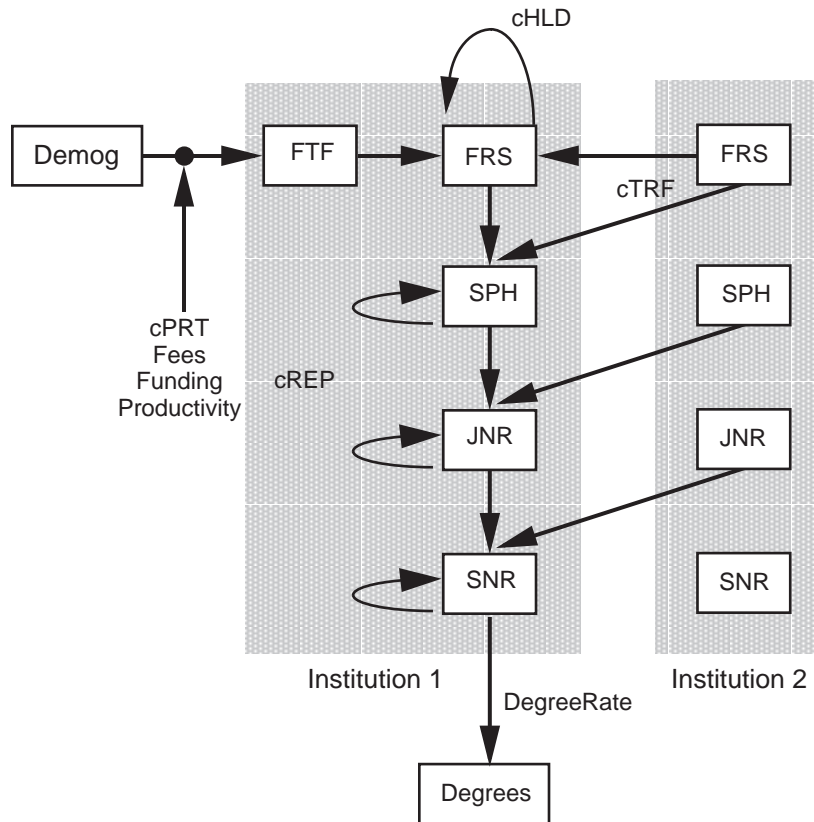


Figure A.1—Student Admissions and Flows

year;¹ the participation rate $cPRT(system, ethnicity, gender, age, xt, year)$ represents the fraction of each population cohort that becomes freshmen in each system each year; and xt indexes full-time vs. part-time status. In the unconstrained admissions case (see Chapter 2), the full number of FTF calculated above is assumed to be admitted into the various systems. In the constrained admissions case,

¹Other groups have used projected high school graduates as the baseline input. Except for factoring an assumed coefficient for high school graduation rate, these two methods should be equivalent.

only a subset of this calculated number is assumed to be admitted. This process is described in detail in Appendix B.

We take $Demog(ethnicity,gender,age,year)$ from population projections for each of 100 cohorts² provided by the California State Demographic Research Unit (1995). We estimate participation rates from California Postsecondary Education Commission (CPEC, 1995b) data on the number of FTF from 1993 to 1995 in the UC, CSU, and CC systems.³ We parse these data to generate historical populations of FTF broken down into the cohorts listed above.⁴ We then use demographic data for each cohort from 1993 to 1995 to find the average participation rate:

$$cPRT(system,ethnicity,gender,age,xt) = \frac{1}{3} \sum_{year=1993}^{1995} \frac{FTF(system,ethnicity,gender,age,xt,year)}{Demog(ethnicity,gender,age,year)} \quad (A2)$$

Following Shires, we use the value for the FTF (from Eq. A1) to calculate the total number of enrolled freshmen as

$$FRS(sys,year) = FTF(sys,year) + cHLD_1(sys) * FRS(sys,year-1) + TRF_1(sys) \quad (A3)$$

where $cHLD_1(sys)$ is the percentage of freshmen in each system who repeat their freshman year and $cTRF_1(sys)$ is the number of students from other systems who transfer in as freshmen. We assume these coefficients remain constant over time and estimate them using CPEC data on (1) the enrollment for each system by class, ethnicity, gender, full-/part-time status, and year; (2) the number of transfers

²In our model, the state's population is broken down into 100 cohorts of ethnicity (Asian, black, Hispanic, white, and other), gender (male and female), and age group (10 categories ranging from 0 to 99+ years old).

³Unless otherwise stated, all historical student data for the state were obtained from CPEC data files. Although CPEC has data going further back than 1993, it is sufficient here to average over only the last three years of data.

⁴Actually, the original data have FTF broken into cohorts of ethnicity, gender, full-/part-time status, and year. To assign an age distribution, we used the age distribution of the entire freshman class (which includes transfers and holdovers from previous years, thus slightly skewing the age higher).

between systems by source system, destination system, class, ethnicity, gender, full-/part-time status, and year; and (3) the number of FTF.

CALCULATION OF SOPHOMORE, JUNIOR, AND SENIOR ENROLLMENT

Analogously to what we did for the freshman class, we write the number of students enrolled as sophomores, juniors, and seniors in each system as

$$SPH(sys, year) = cADV_2(sys) * FRS(sys, year - 1) \\ + cHLD_2(sys) * SPH(sys, year - 1) + cTRF_2(sys)$$

$$JNR(sys, year) = cADV_3(sys) * SPH(sys, year - 1) \\ + cHLD_3(sys) * JNR(sys, year - 1) + cTRF_3(sys) \quad (A4)$$

$$SNR(sys, year) = cADV_4(sys) * JNR(sys, year - 1) \\ + cHLD_4(sys) * SNR(sys, year - 1) + cTRF_4(sys)$$

where the first term on the right side of each equation is the number of students that advanced into that class from a lower class, the second term is the number that remained in the same class from the previous year, and the third term is the number that transferred into that class from another system. Unfortunately, we cannot calculate the advancement and holdover rate coefficients directly, because the existing data do not distinguish members of a class who advanced from the previous class (e.g., sophomores who were previously freshmen) from members of that class held over from the previous year (e.g., students who repeat their sophomore year)—there are no data on “first-time” sophomores. We can, however, estimate these coefficients indirectly, as described next.

Shires writes the number of enrolled sophomores, juniors, and seniors as

$$\begin{aligned}
SPH(sys, year) &= cADV_2'(sys) * FRS(sys, year - 1) + cTRF_2(sys) \\
JNR(sys, year) &= cADV_3'(sys) * SPH(sys, year - 1) + cTRF_3(sys) \\
SNR(sys, year) &= cADV_4'(sys) * JNR(sys, year - 1) + cTRF_4(sys)
\end{aligned} \tag{A5}$$

Shires estimates his effective advancement rates, $cADV'(sys)$, for years with available data, as the ratio between two adjacent classes. Using this general method, we find, for instance,

$$cADV_2'(sys) = \frac{1}{3} \sum_{year=1993}^{1995} \frac{SPH(sys, year) - cTRF_2(sys)}{FRS(sys, year - 1)} \tag{A6}$$

where the summation is used to average over three years. Similar ratios give $cADV_3'(sys)$ and $cADV_4'(sys)$. Historically, these ratios are relatively stable over time.

We can now combine Eqs. A4 and A5 to relate $cADV'$ to $cADV$ and $cHLD$. The equations for the sophomore class give

$$\begin{aligned}
cADV_2(sys) * FRS(sys, year - 1) + cHLD_2(sys) * SPH(sys, year - 1) \\
= cADV_2'(sys) * FRS(sys, year - 1)
\end{aligned} \tag{A7}$$

and similarly for the junior and senior classes.

We can get a second equation for $cADV_n(sys)$ and $cHLD_n(sys)$ by noting that in any given cohort of any given class, the students must either (1) remain in the same class, (2) advance to the next class, or (3) drop out or transfer to another system. Thus

$$cADV_n(sys) + cHLD_n(sys) + cDRP_n(sys) = 1 \tag{A8}$$

where $cDRP_n(sys)$ refers to students leaving by dropping out or transferring.

We can now solve for $cADV_n(sys)$ and $cHLD_n(sys)$ using Eqs. A7 and A8. We can use dropout and transfer-out data for the UC and CSU systems available in the form of life-tables that track cohorts of students on a year-by-year basis (rather than grade by grade). While these data are not necessarily equivalent in character to the enroll-

ment data (which track students by grades), the fact that we are primarily focusing on those students who stay within the systems rather than those who leave makes this analysis fairly insensitive to the details of the dropout rate. Not surprisingly, the enrollment predictions obtained using this method agree fairly closely with the results obtained by Shires.

For the CCs, we calculate enrollments using Shires's Eqs. A5 because the data available to reliably calculate the coefficients for Eqs. A4 are insufficient. Furthermore, we set the advancement and transfer rates for the junior and senior classes to zero since these classes do not exist in the CCs. We treat transfers from the CCs to the freshman, sophomore, and junior classes at UC and CSU in the same way we treat transfers between the four-year systems. However, we assume CC transfers going into the UC and CSU senior class come from the CC sophomore class, rather than from a nonexistent junior class. Transfers from the CCs are treated as a distinct cohort as they progress through the UC and CSU systems.

CALCULATION OF DEGREES AWARDED

We calculate the number of bachelor's degrees awarded each year by UC and CSU as

$$\text{Degrees}(\text{sys}, \text{year}) = cGRAD(\text{sys}) * SNR(\text{sys}, \text{year} - 1) \quad (\text{A9})$$

where $cGRAD(\text{sys})$ is the graduation rate for each system, broken down into the various student cohorts enumerated above. We use 1993 to 1995 data for the ratios of the number of degrees awarded to the number of seniors in order to calculate $cGRAD(\text{sys})$.⁵ The available data also specify the number of degrees awarded to students who transferred from the CCs.⁶ Because we track those transfer students separately, we can also project the number of bachelor's degrees awarded to CC students who eventually transfer into UC or CSU.

⁵These data may be obtained at the CPEC Website.

⁶From 1993 to 1995, nearly a quarter of all degrees awarded by UC went to such transfers, with nearly one half for CSU.