A comparison of enrollment projection models
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Summary
Accurately forecasting student enrollment is important for institutional planning and development. We investigated the fit of an integrated enrollment forecast model (ARIMA) and a mixed forecast model to 22 and 12 years of student enrollment data, respectively, from records at Utah Valley University.

• The ARIMA models had excellent fit but results were confounded by highly correlated independent variables.
• The mixed forecast models, based on the historic linear or geometric averages for 6 student body registration categories, show that improvements in persistence of continuing students represented the greatest portion of both prior and projected growth.
• Linear regression results of several local demographic and economic climate variables included in the ARIMA model show that the unemployment rate (t=8.23, p<0.001) and the number of Utah high school graduates (t=4.85, p<0.001) have the most influence on UVU enrollment.

Utah Valley University
This is a single institution study at a large, public, open-enrollment university in Orem, Utah (circled on map), about 35 miles south of Salt Lake City.

UVU began as a vocational school in 1941, became a community college in 1987, a state college in 1993, and received University status in 2008.

ARIMA model methods
We compared the fit of an autoregressive integrated moving average (ARIMA) model for full-time equivalent (FTE) and head count using 22 years of enrollment data (1985-2007) compiled from University records. ARIMA models are capable of incorporating independent variables – such as demographic and economic indicators – to attempt to increase explanatory power. We included annual data for the following independent variables (IVs) over the same period:

• Utah unemployment rate
• Utah per capita income
• Utah high school graduates
• U.S. consumer price index (CPI)
• State appropriations for Utah Higher Education
• Gross national product (GNP)

Following Chen (2008), we lagged these variables by one-year to make the forecast models more logical. Data analyses were conducted using SPSS (ARIMA module of SPSS Trends, v. 14) statistical software. We allowed the automated process in Expert Modeler in SPSS trends to determine the best model.

Mixed model methods
Mixed FTE and head count forecast models were constructed for the Utah System of Higher Education separating students into distinct registration categories. Annual enrollment projections for these groups of students were calculated using the following average growth rates from 1998-2010:

• Continuing students – 1.26% geometric mean
• High school concurrent enrollment: – 2.87% geometric mean
• Returning students – 1.62% geometric mean
• Transfer students – 1.78% linear mean
• First-time freshman <1 yr since HS – 1.78% linear mean
• First-time freshman <1 year of HS – 5.19% geometric mean

Fall FTE projections followed the same methodology as headcount, except the continuing student category was capped at 77% of overall FTE. Analyses were conducted using Excel.

Results
ARIMA models
• Both ARIMA models have an identical fitting R-squared statistic value of 0.991, which is exceptionally high.
• Linear regression results indicate that four of the IVs: CPI, per capita income, GNP and state appropriations all correlate strongly (over 0.9), while annual HS graduates and Utah unemployment only correlate moderately with these.
• The Ljung-Box chi-square test indicates that both models are appropriate because the values fail to reject the null hypothesis that the ARIMA model tested is appropriate.
• No outliers occur in either model.
• The FTE model has better forecasting accuracy with a smaller MAE value (346.001 vs 501.164).

Mixed models
• Improved retention of continuing students accounts for the bulk of past and future enrollment growth.
• First-time students who enroll within 1 year after high school represent the 2nd largest portion of future growth.
• Returning, transfer and first-time students who have been out of high school more than 1 year, are a stable portion of prior and future enrollment.
• While high school concurrent enrollment has increased significantly in the past, we project this category will plateau due to supply restrictions and demand saturation.

References

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