Geographic Modeling of College Student Migration in Oklahoma

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Countywide Models

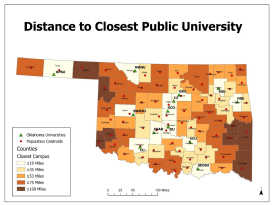

Figure 1

This map shows the distance from the county population centroid to the closest public 4-year campus

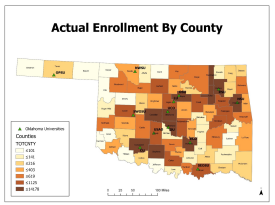

Figure 2

This map shows the combined actual enrollment at all public 4-year campuses from each county

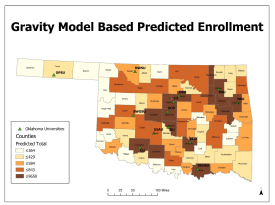

Figure 3

This map shows the combined predicted enrollment at public 4-year campuses from each county

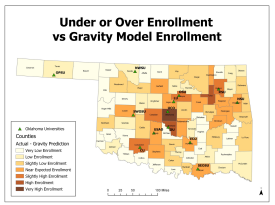

Figure 4

Under or Over Enrollment by County vs Combined Predictions from the Gravity Model

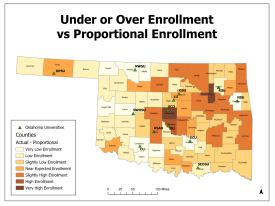

Figure 5

Under or Over Enrollment by County vs Proportional Enrollment Predictions based on Overall County Population

Discussion

Introduction: This project is a preliminary analysis of enrollment migration patterns at public universities in Oklahoma. The purpose of the study is to investigate enrollment patterns by county and individual campuses, Additionally, we analyze the state university system as a whole in order to determine which areas of the state are being well served and which are being under served. The analysis of the actual enrollment data has been compared to a "draft" gravity model developed to predict enrollment at each campus from each county and to a strictly proportional model of students attending the system as a whole. The gravity model estimates by county are also compiled into system wide estimates for analysis.

The impetus of this study is based on an earlier and more comprehensive study undertaken in the early 1990s of similar enrollment patterns for the Tennessee Higher Education Commission analyzing patterns based on data taken from the entire decade of the 1980s. That analysis showed a very high level of accuracy between the gravity model and actual enrollments, and this basic study was undertaken to determine if a similar long term study of Oklahoma (and/or other states) would be justified.

Data Discussion: The primary dataset used for this study was provided by the Office of Student Performance Data for the Oklahoma Regents for Higher Education (ORHSE). The dataset consisted of county by county enrollment for each two and four year campus in the public higher education system as well as all private institutions in Oklahoma. For this analysis only public four year campuses were analyzed. Based on results from the Tennessee study the accuracy of estimates from the gravity model for two year campuses by county is far less accurate, and it is believed that this will hold true in Oklahoma as well. This is due to the highly "local" nature of the student body at most two year public campuses.

One other issue must be discussed regarding the data. Only aggregate data for Oklahoma Panhandle State (OPSU) were available – no county by county enrollment figures were provided. The impact of this on the overall accuracy of the gravity model should be limited. Only 629 out of 1,138 undergraduate students at OPSU are in-state students (within a statewide total of over 65,000 students), and from a brief discussion with representatives from the ORHSE and OPSU the vast majority of these students are from five counties in northwest Oklahoma and the Panhandle region.

Gravity Model: The gravity model developed for this study can be shown as follows:

$$ENR_{ij} = (\ln(TotEnr_i) * \ln(CntyPop_j) / (Distance_{ij})^2) * CntyPop_j$$

ENR = Enrollment Projection for County/Campus Pair
TotEnr = Total Instate Undergraduate Enrollment for Campus i
CntyPop = Total Population for County j
Distance = Travel distance between County and Campus
i – Subscript for Campus
j – Subscript for County

This basic gravity model provides an estimate of enrollment between county and campus pairings, and these estimates can be aggregated into a campus estimate of statewide enrollment. Figure 6 shows a plot of actual enrollment vs projected enrollment where the regression between these values produces the formula shown:

$$y_{ij} = 23.968 + 0.6603(x_{ij})$$

y_{ij} = predicted enrollment for County/Campus Pair
x_{ij} = enrollment for County/Campus Pair

The main shortcoming of this model is that a minimum enrollment of approximately 24 will always be predicted while there are counties that send zero students to various campuses. The resulting R^2 of 0.6755 is likely influenced by these substantial over predictions. During the Tennessee study, no counties were found to have zero students attending a campus during the 10 year study period. If a longer term dataset can be developed with ORHSE, this problem might be addressable for Oklahoma, thereby improving the viability of models developed in the future.

Despite these shortcomings, an R^2 of 0.6755 between actual enrollment and predicted enrollment for such a preliminary study is noteworthy. Regardless, 67.5% of in-state enrollment can be explained simply by using a model based on county population, campus enrollment, and distance. The model developed here with such basic data would seem to validate the results of the Tennessee study and demonstrate the validity of further exploration into developing a model for Oklahoma (and possibly other states) based on a more comprehensive dataset(s).

Furthermore, there are notable outliers/residual values that need further explanation and analysis, and some basic enrollment patterns can be observed in the figures provided in this poster. One notable item is the over 7,100 students who attend the University of Central Oklahoma from Oklahoma County, a number that is greater than the number of students attending Oklahoma State University (OSU) and The University of Oklahoma (OU) combined from the largest county in the state.

Another factor to be analyzed further is the far larger set of over predicted counties for Oklahoma State compared to Oklahoma. Preliminarily, it appears that OU receives the largest proportion of their students from urban and suburban counties. OSU, likewise, has over enrollments from those counties as well as a number of larger rural counties.

ACKNOWLEDGEMENTS:

We wish to thank Michael Larson and Jon Comer from Oklahoma State University for their advice and assistance. We also wish to thank Jason Debus of the ORHSE and William Scheideler of the University of Central Oklahoma for their assistance in providing the data used in this analysis.

County to School Models

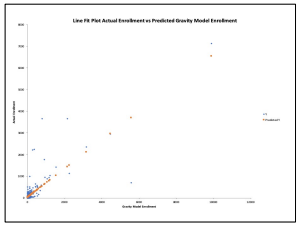

Figure 6

Regression Analysis

Pearson's R	**0.8219**
Multiple R^2	**0.6755**
Adjusted R^2	**0.6751**

Regression between predicted enrollments to actual enrollments

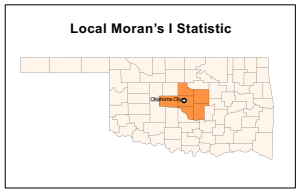

Figure 7

We ran a Local Moran's I clustering analysis, and the overall result was a very low 0.0076, showing virtually no spatial autocorrelation. However, there was a minor high/high cluster surrounding the OKC Metro Area.

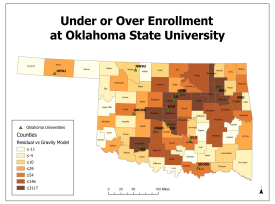

Figure 8

This map shows under and over enrollment at Oklahoma State University by county. Over enrollment is most notable from counties in the urban core of the state in an arc from Tulsa to OKC.

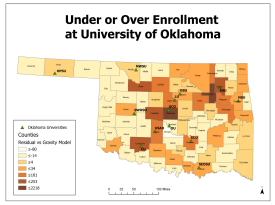

Figure 9

This map shows under and over enrollment at The University of Oklahoma. Over enrollment is most notable from the core counties of the Tulsa and OKC Metro Areas. Rural areas show a much weaker enrollment than OSU.

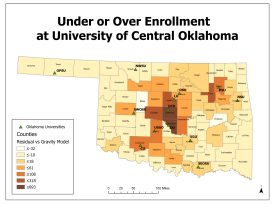

Figure 10

This map shows under and over enrollment at the University of Central Oklahoma. Over enrollment is most notable from the OKC Metro Area and Tulsa County. Rural areas show weaker enrollment than OSU or OU.