University of Nebraska at Omaha
DigitalCommons@UNO

Theses/Capstones/Creative Projects | University Honors Program

12-2018

Regression and Progression: Using Econometrics to Analyze Shifts in UNO's Enrollment Over Time

Alexander Swenson
aswenson@unomaha.edu

Follow this and additional works at: https://digitalcommons.unomaha.edu/university_honors_program
Please take our feedback survey at: https://unomaha.az1.qualtrics.com/jfe/form/SV_8cchtFmpDyGfBLE

Recommended Citation

Swenson, Alexander, "Regression and Progression: Using Econometrics to Analyze Shifts in UNO's Enrollment Over Time" (2018). *Theses/Capstones/Creative Projects*. 31.
https://digitalcommons.unomaha.edu/university_honors_program/31

This Dissertation/Thesis is brought to you for free and open access by the University Honors Program at DigitalCommons@UNO. It has been accepted for inclusion in Theses/Capstones/Creative Projects by an authorized administrator of DigitalCommons@UNO. For more information, please contact unodigitalcommons@unomaha.edu.

Regression and Progression:
Using Econometrics to Analyze Shifts in UNO's Enrollment Over Time

University Honors Program Senior Thesis

University of Nebraska at Omaha

Submitted by

Alex Swenson

December 2018

Christopher Decker, Advisor

ACCEPTANCE PAGE

SENIOR HONORS THESIS/PROJECT/CREATIVE ACTIVITY ACCEPTANCE

This thesis has been accepted for the faculty of the College of _____ in partial fulfillment of the requirements for completion of the University Honors Program of the University of Nebraska at Omaha.

_____
Thesis Advisor

_____
Date

_____
College Honors Coordinator

_____
Date

_____
Student

Table of Contents

UNIVERSITY OF NEBRASKA AT OMAHA

HONORS THESIS/PROJECT/CREATIVE ACTIVITY ABSTRACT

PROGRAM: UNIVERSITY HONORS PROGRAM

DIRECTOR: LUCY MORRISON

ADDRESS: KH 208

UNIVERSITY OF NEBRASKA AT OMAHA

OMAHA, NE 68182

TELEPHONE: (402) 554-2696

UNIVERSITY: YES

STATE: YES

PROGRAM SIZE: 600+

THESIS: REQUIRED

THESIS ISSUED: PROGRAM

Abstract of Thesis:

From the construction of innovative academic buildings to the addition of new athletic teams, the University of Nebraska at Omaha (UNO) has experienced abundant changes over the past 25 years. Of particular interest, fluctuations in enrollment as well as changes in the average profile of UNO have occurred. What relationships, if any, exist between these shifts and the notable events in UNO's past? An answer to this question would be

significant for UNO and affect its future decisions. In general, understanding what has affected UNO's enrollment would be important for all mid-size, metropolitan universities as they make decisions to maximize enrollment. This project investigates how UNO has changed over time and uses econometrics to analyze enrollment data. An initial analysis of the data included plotting the data to recognize trends. Furthermore, in order to uncover relationships amongst the variables, models were constructed using stepwise regression techniques. By taking this approach, it is apparent that enrollment has a connection to the population of Omaha. Moreover, the creation of on-campus housing and hockey have had major impacts on the average age of the undergraduate population. It does not appear that an endeavor similar to this has focused on UNO and its enrollment data. Overall, this project describes any relationships that may exist between enrollment at UNO and a variety of factors at UNO or in the Omaha MSA.

Background & Motivation

The University of Nebraska at Omaha (UNO) is an institution of higher education located in Omaha, NE. It is part of the larger University of Nebraska system. Currently, just over 16,000 students are enrolled at the university which represents a notable increase in attendance over the past couple decades. In general, UNO has made great strides in recent years and has taken steps to be a more traditional public research university. Starting in 2011, UNO's athletics transitioned from membership in Division II of the NCAA to competition in Division I athletics (Remembering the History, 2017). This has increased the exposure of the university. In addition to changing divisions, sports have been added to increase the offerings of the athletic department. The most notable additions have been hockey in 1998 and men's soccer in 2011. More relevant to the general student body has been the addition of numerous on-campus housing complexes. UNO's profile as an institution has started shifting away from a commuter school and more towards being a more traditional undergraduate four-year institution. The addition of housing has been a key factor in this change. In the past 10 years, a variety of renovations have been carried out and even the construction of new academic buildings. Notable renovations or constructions include the improvement of the campus recreation center, H&K, and the construction of Mammel Hall, the new home for the College of Business.

Like UNO, the city it calls home, Omaha, has experienced steady growth in recent years. Omaha is the largest city in Nebraska and a central part of the state's economy. Many students at UNO come from the Omaha metro area which mainly consists of Douglas and Sarpy counties in Nebraska. It is not always the case that a high proportion of a university's students come from so close to campus. Thus, this characteristic is something notable about UNO. It is also worth

noting that Offutt Air Force Base is located south of Omaha in Sarpy County. Omaha is home to Creighton University, another nationally relevant institution and member of Division I athletics.

UNO is an incredibly unique university which means there are numerous motivations for undertaking this project. It is apparent that the student body has undergone a transformation in recent years and that the university has taken steps to encourage this transformation. Like any college or university, UNO wants to increase enrollment and has surely taken steps to try and achieve this goal. With so many changes occurring at UNO in recent years, it is worth wondering which, if any, of these changes really is responsible for the increasing enrollment and changing dynamic of the student population. One key motivation for the research is the switch to Division I. The decision to change the level of NCAA competition was not without controversy. In order to move from Division II, both the football and wrestling programs had to be cut. This was a very contentious decision because these two programs were some of the university's most successful and popular sports. Ultimately, administrators must have believed that moving up a division would increase UNO's market and exposure, even if it meant sacrificing such traditional sports at the university. Now that several years have passed since the transition, we can look back and analyze whether there is evidence that the switch has had the desired impact. Another motivation for the research is to see whether the millions of dollars in renovation and construction costs can be rationalized. With recent budgets cuts, UNO is under increasing pressure to make sure it is getting the most out of every penny. This project can serve two purposes. First, it can help us understand whether previous expenditures for the university have been money well-spent or ultimately irrelevant in the pursuit of higher enrollments. Second, we can glean what changes are effective at increasing enrollment and then use that information to guide future policy and investment decisions by the university. It does not appear a similar

project has ever been done to analyze enrollment at UNO. Thus, this project has great potential to provide valuable insight into the university.

Literature Review

While the research done in this project will generate new and important findings for UNO, the broad topic of influences on enrollment has been studied previously on multiple occasions. Several key studies have been conducted by other organizations which can be considered to help guide the project. In *The Effects of Tuition and State Financial Aid on Public College Enrollment*, the author, Donald Heller, describes how tuition prices have increased over time although sometimes not as fast as inflation (Heller, 1999). He also notes how previous studies have found that there is an inverse relationship between tuition prices and enrollment, ceteris paribus. These observations guide Heller towards two main questions which he aims to answer with this study. First, the author plans to examine if there is a relationship between tuition or financial aid levels and public undergraduate enrollment rate in individual states. Second, Heller hopes to discover if the relationship is different for students of different races and backgrounds. The data for the project largely comes from surveys such as the Integrated Postsecondary Education Data System (IPEDS) survey. The information is focused on enrollment and tuition price data. The data falls under the category of panel data which influences the approach to analysis. Heller opts to use a fixed-effects model based on the characteristics of the IPEDS data. The results of the model are similar to previous studies. Heller finds that tuition increases are associated with decreased public enrollment, ceteris paribus, especially at community colleges. Additionally, state grant spending decreases appear to have the same effect. Finally, enrollment of minority students across the board is more responsive to these decreases than enrollment for white students.

In *Analysis of Factors Affecting Declining CIS Enrollment*, the authors, Lissa Pollacia and William L. Lomerson aimed to explain why there has been decreased enrollment in computer-related majors and fields (Pollacia & Lomerson, 2006). They also hoped to uncover what actions Computer Information Systems (CIS) programs can take to increase the number of students that pursue a computer-related major. The method that Pollacia and Lomerson used to conduct the study was a survey. The survey was given to students in starting computer classes and collected information regarding how the student chose a college and a major. This information hopefully would uncover data from the student's perspective. The survey also included questions concerning suggested causes of disinterest with CIS majors. Before giving the questionnaire, a pilot study was done to ensure the questions were phrased correctly and addressed all necessary points. When appropriate, the authors used Likert scales in the survey. One interesting result from the study was that approximately a quarter of respondents reported that they were not majoring in CIS but had considered it. The authors suggest this means there may be a body of students that would be receptive to further CIS recruitment. In an additional section of the survey, the authors found that self-collected inputs are the leading factor in how people decide on a major. A final important finding from the survey is that the majority of respondents expressed some level of dissatisfaction with their high school counseling experience. Many did not feel that their counselors gave them good advice on college majors or information about careers. The implication of this finding is that many high school students are uneducated or given inaccurate information when it comes to choosing a major. This lack of knowledge could lead to students never even considering the field when they actually would flourish in a CIS career.

Another notable previous work to consider is *Logit Estimation of a Gravity Model of the College Enrollment Decision* by Karen Leppel. The author's goal in this study was to uncover what factors played a part in each student's decision to attend a particular school (Leppel, 1993). The subjects that were examined were students accepted to that school so not every respondent ultimately enrolled. The author notes that this study is different from previous ones because the school in question is a private institution rather than a public one. Leppel utilizes a gravity model and logit analysis for the study. The data used is from the financial aid office at this institution. Thus, the subjects in the data set are those students that applied for financial aid. The study reached several conclusions. First, distance and academic record, particularly the SAT score, are the two main factors that influence a student's decision to choose this private institution. Additionally, family income, age, gender, etc. may play a part in the early stages of the decision-making process but they have an inconsequential impact in the later stages of it. These findings are important because they can help guide university policy in the future. Understanding that distance plays a major part in the decision is particularly noteworthy. Students who are farther away from the school often hear less about it and receive less information. Greater publicity is necessary to make up for distance.

The previous project described focused on general factors that affect students' enrollment decisions and the next notable study described takes a very similar approach. In *An Exploratory Study of Factors Influencing the College Choice Decision of Undergraduate Students in Malaysia*, the authors, Samsinar Sidin, Siti Rahayu Hussin, and Tan Ho Soon, aim to understand what factors influence Malaysian students' college choice. Additionally, the authors hoped to rank the explanatory variables based on how important they are for college choice (Sidin, Hussin, & Soon, 2003). Lastly, the authors aimed to address what external sources, if any,

affected students' decisions. In particular, they sought to determine if demographic factors played a part. To conduct the study, the authors surveyed 210 first-year undergraduates from eight institutions of higher education. Four of the eight were public universities and the other four were private. Before analyzing the data, the authors created four hypotheses to test. These addressed variables such as gender, ethnicity, family income, university academic qualification, and more. The study found that students' qualification influenced what type of institution they enrolled in. A majority of the variance could be attributed to five factors. Among these were academic quality, financial aid, campus, and facilities. Three of the four hypotheses were supported by the findings. A final important finding was that there is support for the idea that income has an affect on whether students choose public of private institutions.

Sports are certainly a major part of American culture and are also a key focus in *INTERCOLLEGIATE ATHLETICS AND STUDENT COLLEGE CHOICE: Exploring the Impact of Championship Seasons on Undergraduate Applications* by J. Douglas Toma and Michael E. Cross. The authors' goal for this project was to find support for the notion that a championship season in football or men's basketball leads to increases in undergraduate admission applications in the following years at that institution (Toma & Cross, 1998). More specifically, the authors sought to quantify the increases in applications and determine if they were consistent with changes at other universities. Additionally, the study addresses whether an increase is temporary or starts a trend for that institution. For the study, the authors collected data for any institution that won a football or men's basketball championship between 1979 and 1992. They also consulted with the institutions to determine peer institutions which their enrollment data should be compared with. The enrollment numbers for football focused for the following fall semester after the championship and were lagged a year for basketball since its championship does not

take place until April. Generally, the analysis can be described as comparing yearly and multi-year application number changes for winning institutions with the application data from peer institutions. This isolates athletic success as a variable. If athletic success is significant, we should see relative gains for the winning institutions compared to their peers. The study uncovered several important findings. First, there were noticeable increases in applications following championship seasons at the institutions. This increase was not only in absolute terms but also in relative terms. The fact that the increases were generally relative is an important note. In a couple cases, there wasn't an increase in applications. However, the majority of cases did show increases. Another finding from the study is that football championships have a bigger impact than basketball. The authors suspect that this can be attributed to the timing of the sports seasons as well as simply the general popularity of football. The study also leads the authors to reason that college sports may make individuals more aware of higher education at a young age although the data lacks direct evidence for this conclusion. Finally, the analysis suggests that the increases are more than temporary and can span multiple years. Overall, the study is important since it shows success in collegiate athletics and the positive attention associated with that success do influence where prospective students apply.

Another notable previous work, *A Study of Demand for Higher Education at Private Institutions in the US: A Dynamic and General Specification* by Hui S. Chang and Yu Hsing, is valuable because it addresses differences between public and private institutions. The goal of the project was to create a model which would help the authors understand the demand for higher education at private institutions in the US compared to the demand for public ones (Chang & Hsing, 1996). The introduction discusses how greater increases in cost of attendance at private institutions compared to public ones have led some people to worry about enrollment numbers at

private universities. Another goal of the project is to use the model to help understand the effects of various factors, particularly tuition, on enrollment figures. To perform the study, annual (time-series) data was used. The authors used a general functional form for the model with a Box-Cox transformation. It is important to note that the authors' lit review revealed that a static specification would not be appropriate for an enrollment demand function. Thus, a dynamic specification was used for the model in this study. The authors were able to conclude several things from their study. First, decreases in private enrollment compared to public enrollment can mostly be attributed to the greater increases in cost of attendance at private institutions as well as increases in the real wage rate. Additionally, enrollment is relatively inelastic in the short run but elastic in the long run. A final conclusion which follows from the previous point is that actual enrollment figures usually change slowly compared to desired enrollment changes.

A notable work that gained some very important insights from students in Chile is *The Effects of Earnings Disclosure on College Enrollment Decisions* by Justine Hastings, Christopher A. Neilson, and Seth D. Zimmerman. The project had several goals. The first was to help the Chilean government understand students' enrollment decisions (Hastings, Neilson, & Zimmerman, 2015). Second, the authors sought to uncover whether more information regarding colleges and majors can help students make better educational investments. To conduct the study, a randomized controlled trial was given to students through the Chilean federal student loan application process. The survey asked students about their enrollment plans, beliefs about earnings, and beliefs about costs. The authors also collected data for the earnings of previous cohorts of Chilean students. The project found three important insights. First, students who choose degree programs with low earning potential vastly overestimate the earnings of past graduates from that program. Conversely, students in programs with high earning potential tend

to underestimate how much previous program graduates earn. The second finding is that disclosing degree-specific earnings decreased demand for programs with low earning potential. This decrease in demand was particularly noticeable for students coming from low socioeconomic statuses. Interestingly, the low socioeconomic students adjust their degree choices when provided the earnings disclosures and stay in school longer to finish the programs with high earning potential. The third finding is that degree-specific disclosure policies should be utilized more in higher education policy. Overall, the authors note that the effects are relatively small but still undoubtedly outweigh the cost of disclosure policies.

In, *An Analysis of Student Enrollment Demand*, the authors, James Wetzel, Dennis O'Toole, and Steven Peterson, aimed to explore how different groups responded to changes in the cost of attendance at an urban, public university. This goal was partially motivated by the predominant thinking behind programs such as the Pell Grant (Wetzel, O'Toole, & Peterson, 1998). This thinking says that low-income and minority students are more sensitive to changes in tuition. In general, the authors sought to discover if there is empirical evidence for this idea of different sensitivities to cost of attendance between different groups. To conduct the study, the six years from 1988 through 1993 were analyzed with a simple panel data model. The estimated results were obtained by GLS random effects. Also, the estimation controlled for appropriate qualitative variables such as academic record. One conclusion from the study is that minority student enrollment figures are indeed more sensitive to cost of attendance increases than white student enrollment figures. This is an important finding since it supports the logic behind government programs such as Pell grants.

A unique approach is taken to studying enrollment influences in *What Is in a Name? The Impact of Strategic Name Change on Student Enrollment in Colleges and Universities* by Paul

Sergius Koku. This study sought to explore how universities market themselves and what effect that has on enrollment figures (Koku, 1997). Specifically, Koku investigates how the marketing strategy of changing an institution's name impacts its enrollment. The author notes that the *a priori* expectation is that an effective name change will be associated with increased enrollment. To conduct the study, a time-series quasi design approach was used. Changes in enrollment in the five years before and after the name-change event were analyzed at 140 colleges and universities. Interestingly, the results of Koku's work differ from the *a priori* expectation outlined above. From the analysis, he concluded that a strategic name change does not have a significant impact on enrollment figures. This is a general conclusion based on considering all of the sample schools. Some institutions did see incremental changes that could potentially be significant. But, this group of schools represented a very small proportion of the sample. Overall, the author's findings suggest that administrators should not rely on this marketing strategy to increase their enrollment figures.

The effect of sports is of interest to UNO based on the recent switch to Division I NCAA athletics. This led to the review of another sports-based article, *Does Intercollegiate Athletics Draw Local Students to a University* by Stephen J. Perez. The goal of this study was to explore what impact intercollegiate football or basketball had on NCAA Division I California State Universities' enrollment figures (Perez, 2012). The author notes how other researchers have explored the effect of sports on enrollment but opts to differentiate himself by focusing on the California schools. Overall, Perez aimed to understand if successful athletics can make an institution more appealing to prospective college students. To conduct the analysis, the author looked at enrollment data for the eight relevant schools. Specifically, Perez looked at data concerning the percentage of high school graduates that enroll at the campus of their relevant

California State University. Various potential variables such as cost of attendance and unemployment were included in the model. Athletic result data was also included in the model. Overall, Perez estimated the relationships by performing a general panel regression. The percentage of high school graduates was the dependent variable. The main finding from the study is that football and basketball success are associated with increased enrollment of local students at the California State Universities. The author notes that this result was reached for only California institutions of higher educations but also says nothing in the data suggests the results couldn't be generalized for other public universities. There is not evidence that students in California are more receptive to athletic success than students in other states. Another finding from the study is that basketball success has a quicker effect on enrollment figures than football success.

A final article that was considered focuses on public four-year institutions of education and even addresses other previous studies. In, *Rethinking Tuition Effects on Enrollment in Public Four-year Colleges and Universities*, the authors, Jung-cheol Shin and Sande Milton, examine tuition effects regarding enrollment figures for academic years in the period 1998 to 2002. Their research was motivated by the fact that several other studies had been conducted to understand tuition's relationship with enrollment and very mixed results had been obtained (Shin & Milton, 2006). The authors believe that the different results of previous studies might be the result of missed historical and market contexts. So, the authors' secondary goal is to understand what other factors may enhance or mitigate tuition effects on enrollment levels. The study was done using time-series data from public colleges and universities for the years mentioned previously. It is worth noting that the study only focused on in-state first year student enrollment. This is understandable since out-of-state tuition levels and the characteristics of out-of-state students are

almost always different compared to their in-state counterparts. A causal model was used to estimate relationships. More specifically, a hierarchical linear growth model was used. Independent variables included competitors' tuition, financial aid, and more while college enrollment (of in-state first year students) was the dependent variable. The authors created three hypotheses to test as well. These focused on whether tuition influences enrollment, whether competitors' tuition has an effect, and whether the wage premium of a college education has an effect. The first finding that the authors were able to glean from the analysis was that tuition changes are not significant when explaining enrollment growth. Next, the authors found that competitors' tuition levels as well as the wage premium to college graduates were significant when explaining enrollment growth. An additional finding is that financial aid and the unemployment rate were not significant in explaining the growth in enrollment during the relevant period. These findings are interesting and should be considered by administrators and policymakers.

As was mentioned earlier, a project like this hasn't been undertaken at UNO before. Reviewing academic sources was valuable because it uncovered informative resources which helped focus the approach to this project. It is apparent that studying influences of enrollment trends is an important and popular idea. However, the review did not yield any sources which conducted a study that was extremely similar to this project. Thus, this project is unique and is a valuable resource for the UNO community. There are a couple factors that differentiate this project from those discussed previously in this section. The first and main factor is the explanatory variables that this study investigates. The prime focus of many papers that analyze enrollment is tuition. Most researchers are investigating how changes in tuition may be related to changes in enrollment. So, while studies on enrollment levels are somewhat prevalent, those

which look much further beyond tuition prices are few and far between. The literature review did not uncover research that addressed the effect of renovations on enrollment for example. The second factor that differentiates this study is the location of UNO. Several of the papers that were reviewed did not come from the United States. While these studies are certainly good sources which can help guide the research and model in this project, it is ultimately uncertain what the results would have been in the United States. It is not a guarantee that students will behave uniformly worldwide. Finally, several of the studies reviewed above were not concerned with public institutions like UNO. Rather, they focused on private institutions. These studies made it clear that their results may not be applicable to public colleges and universities. Reviewing these pieces of literature can help guide the process for our project and they do not decrease the value of conducting this research focusing on UNO.

Expectations

The two main dependent variables in the data are enrollment and average age of the undergraduate population. First, we will address enrollment. It is expected that the population of Omaha will have a positive impact on enrollment since a higher population would represent a larger base for UNO's students to come from. It generally accepted that enrollment increases as the economy worsens so it is expected that enrollment will have an inverse relationship with Omaha's real income per capita and employment. We expect the switch to the higher NCAA division to have a positive impact on enrollment since the added level of prestige and exposure associated with Division I athletics will attract more students. Similarly, a positive relationship is expected with the addition of the hockey program since it represents an additional form of entertainment for the students. The expectations outlined above that pertain to sports are partially guided by the literature review. Articles were reviewed which investigated what role sports can

have in explaining enrollment. It is worth noting that there is a distinction between the resources that were reviewed and this project itself regarding sports. In the reviewed sources, the researchers focused on the effect that successful sports can have. In this study, we simply are researching what effect the addition of a sports program can have. This study investigates the mere existence of a sport at an institution rather than the level of success on the field. Despite this distinction, we believe we can still learn from the previous studies. The results obtained by those researchers suggest that success on the field does positively impact enrollment. This implies that students care about collegiate athletics and leads us to expect a positive relationship between the hockey program and enrollment. Our expectation regarding the switch to Division I athletics follows similar reasoning. We expect there to be a positive relationship between the creation of housing complexes and enrollment since the housing complexes will attract more traditional undergraduate students while simultaneously not affecting commuter student enrollment. It is expected that there will be a positive relationship between enrollment and the various renovations and constructions of new buildings since these actions represent an improvement in facilities which will encourage more students to attend the institution. This expectation as well as the one pertaining to the creation of housing complexes are partially guided by the literature review. In the fourth article reviewed, a key conclusion was that students in Malaysia valued the condition of a campus and its facilities when choosing an institution of higher education. This study will ultimately tell us if these findings are applicable at UNO. Currently we expect UNO students to similarly value a campus' condition. Enrollment is expected to be negatively impacted by the introduction of primarily online forms of higher education such as Kaplan or Ashford since those are entities competing for the same non-traditional students as UNO.

Next, the expectations for average age of the undergraduate students are outlined. It is expected that there will be a negative relationship between average age and high school enrollments from Douglas and Sarpy counties since more traditional undergraduate students effectively represent the youngest possible attendees at UNO. We also expect there to be a negative correlation between average age and the introduction of hockey as well as the switch to Division I since traditional undergraduate students will be attracted by those changes. Similarly, the introduction of on-campus housing complexes will have a negative correlation with average age since those complexes will appeal mostly to traditional undergraduate students. Finally, the introduction of universities like Kaplan or Ashford will have a negative correlation with average age since those colleges are more likely to lure away the older students.

Data

The data utilized in this project was collected from several different sources and assembled in one CSV file. The programming language R was used to analyze the data in this file. The time frame covers the period between 1982 and 2017 for the majority of the variables (we were unable to find reliable figures dating back to 1982 for a couple of the variables such as high school enrollment for Douglas and Sarpy Counties). Definitions for the variables in the CSV file are located in Table 1. of the Appendix. Much of the information in the CSV file was pulled from UNO Factbooks and the Common Data Set. Both resources are publicly available on UNO's website. The Factbooks are reports generated each year that detail many aspects of the university such as enrollment and where the current students at the university originate from. The Common Data Set was very useful for the project because it provided average age information for students throughout the years. Overall, we were able to create columns for total enrollment, average age of undergrads, undergraduate enrollment, and graduate enrollment from these

sources. Additionally, data for enrollment from Douglas County, percentage of UNO enrollment from Douglas County, enrollment from Sarpy County, percentage of UNO enrollment from Sarpy County, out of state enrollment, total enrollment from Nebraska, and international enrollment was able to be included. However, this data could only be found going back to 1998. A point of interest was how local high school enrollment numbers impacted UNO's enrollment. Fortunately, we were able to obtain 12th grade enrollment for Douglas County as well as Sarpy County from the Nebraska Department of Education. This data was added to the file although it only dates back to 1999. It should be noted that the data related to high school enrollment was led by one year so it corresponded to the correct year when those high schoolers would become freshmen in college. In addition to educational enrollment data, we felt it was also important to uncover information regarding the general population of the Omaha Metropolitan Statistical Area (MSA). This data was available through the Bureau of Economic Analysis (BEA). Thus, columns for Omaha's population, income, and employment were added to the data set. Additionally, by working with the data and using CPI figures from the US Inflation Calculator, columns for enrollment per capita, income per capita, CPI, real income, real income per capita, real income per capita percent change, and employment percent change were added to the CSV file. The remaining columns in the file represent notable events of interest in UNO's history and other educational entities. These columns are simple dummy variables. In other words, the columns contain zeros unless the particular event they are concerned with has occurred in the year in question. At that point, the value for that year becomes a one. An example is UNO's switch from Division II athletics to Division I in 2011. In the data, this column contains zeros until the row denoting the year 2011 is reached. At that point and beyond, the column contains one's. Quick insights can be gained from dummy variables. For example, the mean value for a

dummy variable represents the percent of values in that column that are ones. This concept can be applied to our data. The mean value for the column of data for the creation of the Durham Science Center is 0.86 (Table 2). So, the interpretation of this is that the Durham Science Center has existed for 86 percent of the years in our data set. Descriptive statistics, including the mean, for all the variables can be found in Table 2. in the Appendix. Other events that are represented in the data set include the addition of hockey as a sport at UNO, the creation of individual housing complexes on campus, the creation or renovation of key academic buildings, and the formation of five traditionally online higher education entities.

UNO's enrollment has increased over the past two decades although it isn't currently at unprecedented levels (Figure 1). Rather, enrollment has rebounded in recent times after undergoing a sharp decline in the 1990's. By separating undergraduate and graduate enrollment, we can see that most of the fluctuation in enrollment has been a product of the undergraduate population (Figure 2). The graduate enrollment has steadily increased over time (Figure 3). Additionally, we can see the average age of the undergraduate population started to decline in the 1990's and is three years lower than at its peak (Figure 4). Although it is more relevant for the city than UNO, another plot of note is the real income per capita over time for Omaha. This plot shows a steady increase over time which speaks to the economic health of Omaha and the increased standard of living for its residents (Figure 5). A final route to explore with the data is the proportion of undergraduate enrollment to total enrollment at the university. This is easily calculated by dividing the undergraduate enrollment column in the data by the total enrollment column. By plotting this over time, we can see that the percentage of enrollment made up by undergraduates at UNO has decreased several percentage points over time (Figure 7).

Models

The main goal of this project is to explore what factors are impacting changes in enrollment at UNO. To accomplish this, three models were constructed with different dependent variables. The first model differentiates itself from the other models by having average undergraduate age as the regressand. Average undergraduate age was selected to be the dependent variable because UNO has undergone a transformation in recent years. Examining the average age of the undergraduate population can illustrate how much UNO has shifted from a commuter school to a more traditional, research institution and what has led to the shift. The second looks at enrollment per capita as the dependent variable. This is helpful because it addresses what factors are influencing enrollment while also accounting for the ever-increasing population of the city. The final model considers undergraduate enrollment divided by total enrollment as the regressand. This approach was taken because it provides insights on characteristics of the student body and enrollment patterns.

Although this project uses numerous models to analyze various aspects of enrollment, all of them are of the linear form and use multiple regressors. Stepwise regression was used to select the regressors and generate the models overall. Specifically, forward stepwise was the approach taken so we started with the dependent variable but nothing else. Each potential regressor is added to an individual model with only the regressand to be examined. The statistically significant variable associated with the model with the highest F statistic is selected and added to the true model. Then, all the potential variables are added to new base models that consist of the regressand and the previously chosen regressor. The same criteria are used as before to choose the next regressor to add to the true model. This process is repeated until the addition of none of the remaining potential explanatory variables is statistically significant. For the model with

average undergraduate age as the dependent variable, five statistically significant regressors were identified. Interestingly, all five of these are dummy variables. Specifically, the regressors for the average age model are the indicator variables for the construction of University Village, the addition of the hockey program, the construction of Scott Village, the construction of Durham Science Center, and the introduction of Walden University. For the model with enrollment per capita as the dependent variable, it only required four cycles to fail to identify a new statistically significant variable. Thus, three statistically significant regressors were identified. These were the dummy variable associated with the creation of Walden University, real income per capita in Omaha, and the dummy variable associated with the creation of the Durham Science Center. For the model with undergraduate percentage of enrollment as the dependent variable, the fifth cycle is when none of the independent variables were statistically significant when added. Thus, four statistically significant variables were identified. These were the dummy variable associated with the creation of Walden University, the dummy variable associated with the addition of the Weber Fine Arts Building, the dummy variable representing the renovation of the campus recreation center (known at the time as HPER), and employment in the Omaha MSA.

Several statistical tests were conducted to check the quality of the models. First, the necessity of transformations for the any of the regressors was explored. This was done by looking at individual scatter plots of the regressors and regressand. Ultimately, it was determined that no transformations of regressors would improve the models. For all the models, the residuals versus fitted values plot, the Normal Q-Q plot, the Cook's distance plot, the Shapiro-Wilk Normality test, the Breusch-Pagan test, and the Durbin-Watson test were interpreted. For the average age model, it did not appear that there was a pattern in the fitted values versus residuals plot which supports the idea of constant variance (Figure 7). It does appear that the error terms

are not normally distributed based on the major deviations from the line in the Normal Q-Q plot (Figure 8). Fortunately, the Cook's distance plot shows there are not any problematic outliers in the data since none of the Cook's distances are close to a value of one (Figure 9). The results of some formal hypothesis tests are a bit unexpected based on the graphical analysis described previously. For each test, the level of significance was 0.05. The average age model fails the Breusch-Pagan test which suggests the error terms have a non-constant variance (Table 4). Additionally, the model does not pass the Durbin-Watson test which leads us to conclude the error terms are not independent. Lastly, the model does not pass the Shapiro-Wilk normality tests which tells us the error terms are not normally distributed. This was expected based on the analysis of the Normal Q-Q plot. A final model checking technique performed on the average age model was considering the variance inflation factors (VIFs). This approach did suggest some multicollinearity issues between the University Housing and Hockey dummy variables (Table 5). This was ultimately expected however based on the relatively close time period that those two events occurred at UNO.

For the model concerning enrollment per capita, the fitted values versus residuals plot did not raise any red flags (Figure 10). Additionally, the residuals follow the line well in the Normal Q-Q plot for this model (Figure 11). So, it appears the error terms follow a normal distribution. The Cook's distance plot does not show any evidence of problematic outliers (Figure 12). As was the case with the previous model, all hypothesis tests are conducted at an alpha level of 0.05. This model also fails the Breusch-Pagan test, so the residuals may indeed have non-constant variance (Table 7). Next, the model does not pass the Durbin-Watson test which leads us to conclude the error terms are not independent. However, the model does pass the Shapiro-Wilk normality test which supports the observations from the Normal Q-Q plot. Another positive

result from the model checking procedures is that none of the VIFs indicate multicollinearity issues (Table 8).

For the third model, there does not appear to be a pattern in the fitted values versus residuals plot which suggests that the error terms have constant variance (Figure 13). Analysis of the Normal Q-Q plot shows that the error terms likely follow a normal distribution since they follow the line in the plot well (Figure 14). As was observed with the previous models, the Cook's distance plot does not raise any red flags since none of the distances are close to one (Figure 15). The following hypothesis tests were conducted at an alpha level of 0.05. The undergraduate percentage model passes the Breusch-Pagan test which aligns with the observations from the fitted versus residuals plot (Table 12). This model does fail the Durbin-Watson test however. This suggests a lack of independence amongst the error terms. This model passes the Shapiro-Wilk normality test which supports the observations from the Normal Q-Q plot. In regard to the VIFs, the value associated with the Omaha employment variable indicates that there may be multicollinearity issues between it and the other variables, but it is not a major red flag (Table 13). It should be noted that the successive failures of the Durbin-Watson test for each model are not surprising because the data is time-series. Thus, the observations aren't independent. Overall, the models do not pass as many of the model checking tests as we desire but, considering the relatively limited size of the data, the models are sufficient for moving forward with the project.

Results

The regression results for the three models yielded numerous insights into the enrollment patterns at UNO and what has influenced them. UNO has transformed in many ways over recent years so, in addition to exploring enrollment figures, it is desirable to understand the

characteristics of the student body. This provides the motivation for the first model constructed for the project. In this model, average age for the undergraduate population is the dependent variable. The adjusted R-squared of 0.98 indicates that 98 percent of the variation in the average age of the undergraduate students is explained by the variation in the regressors in this model (Table 3). Additionally, a very small p-value indicates that the overall model does have explanatory power. Focusing on the regressors, the addition of University Village housing is associated with a decrease of 0.82 years for the average undergraduate age. The idea of ceteris paribus should be applied to the above statement as well as all interpretations of coefficients below. The addition of Scott Village housing is associated with a 0.66-year decrease in the average age of undergraduates at UNO. Furthermore, the addition of the hockey program at UNO is associated with a decrease of one year in the average undergraduate age. Additionally, the construction of the Durham Science Center is associated with an increase of 0.39 years in the average age of undergraduate students. Lastly, the addition of Walden University is associated with a 0.42-year decrease in the average age of undergraduate students at UNO.

Analyzing nominal enrollment is a useful tool although it fails to consider how the population around an institution has changed. If enrollment is growing proportionately to the population in the surrounding areas, it is possible that none of the efforts of the university to increase enrollment have actually influenced any noticeable changes. This provides the motivation to create a model related to enrollment. The next model in the project uses enrollment per capita as the dependent variable. The adjusted R-squared of 0.9548 for this model indicates that 95.48 percent of the variation in enrollment per capita is explained by the variation in the regressors (Table 6). Similar to the first model, this model has explanatory power overall as indicated by the p-value of less than 2e-16. Focusing on the estimated coefficients of the

regressors, the introduction of Walden University is associated with a decrease of 0.002784 students enrolled per capita. Additionally, a one dollar increase in the real Omaha income per capita is associated with a decrease of 0.0000005 students enrolled per capita. Lastly, the addition of the Durham Science Center is associated with an increase of 0.000883 students enrolled per capita.

The final model constructed for the project connects the ideas of a transforming student body and increasing enrollment by utilizing undergraduate enrollment as a percentage of total enrollment as the dependent variable. Overall, the regression results indicate that this model has explanatory power (Table 11). This can be seen from the miniscule p-value given for the model as a whole. The adjusted R-squared of 0.923 indicates that 92.3 percent of the variation in undergraduate enrollment can be explained by the regressors. Focusing on the estimated coefficients for the regressors, the introduction of Walden University is associated with a decrease of 0.017360 percentage points in the undergrad percentage at UNO. The addition of the Weber Fine Arts Building is associated with a decrease of 0.009855 percentage points in the undergrad percentage. Additionally, the renovation of H&K (formerly known as HPER) is associated with an increase of 0.01219 percentage points in the undergrad percentage at UNO. Lastly, an increase of one individual in the employment in the Omaha MSA is associated with a decrease of 0.0000001 percentage points in the undergrad percentage.

These results are valuable for understanding what has affected previous trends as well as giving direction to future efforts. They can provide insights that can help administrators make the optimal decisions to achieve their goals. The first model provides some notable findings related to average age of undergraduates that administrators should be aware of. It is apparent that UNO has made efforts over recent years to attract more traditional students to campus. This inherently

will lower the average age of the undergraduate population. The results from this model strongly support the idea that the construction of on-campus housing attracts traditional undergraduate students and lowers the average age. The regression results also suggest that the addition of more NCAA athletics is desirable to traditional undergraduate students and brings more of them to campus. This in turn will lower the average age of the undergraduate population. Overall, the results help inform administrators how to proceed in the future if making UNO more desirable to traditional undergraduates is their goal. The second model also provides some key observations for policymakers. The presence of the Walden University dummy variable shows that online programs can lure students away from UNO. Marketers from the university should recognize this and direct the necessary energy to not losing these students. Additionally, the second model shows that the construction of a new academic building can increase enrollment. In this situation, it was the addition of the Durham Science Center that attracted more students per capita to campus. The results from the third model have intuitive explanations and lend themselves to some of the existing economic theories. The Walden University variable has a negative coefficient which supports the idea that it and other universities like Kaplan serve as educational alternatives to UNO and are luring prospective students away. This is something that administrators must be aware of. The results also offer evidence that the renovation of the recreation center was a valuable investment since it appears to have increased the share of undergraduate students at the university. This may indicate that efforts to make UNO a more traditional undergraduate university are succeeding. The coefficient for Omaha's employment is negative. This is expected since employment in the city increasing could be a result of less individuals attending institutions of higher education. It also is expected since increased employment is a sign of economic health and people are typically less motivated to pursue

schooling in a strong economy since employment is more readily available. Overall, the results from the third regression contain many interesting findings which can be connected to economic theories and initiatives at the university.

A final set of results that were reached are predictions for the year 2020. These were made by using the models. The first prediction comes from the enrollment per capita model. This prediction was reached by using a fitted value for real Omaha income per capita and adding the year variable to the model. The model predicts an enrollment per capita in 2020 of 0.01305 (Table 9). Furthermore, a prediction of 12,296 for enrollment in 2020 was reached by multiplying the enrollment per capita prediction by a prediction for Omaha's population in 2020 (Table 10). These values would represent a slight decrease from the current enrollment per capita figure and a major reduction in enrollment. This prediction is interesting because it relies a lot on the future strength of the economy. Economic theory tells us that strong economic times give less incentive for individuals to pursue a higher education. If the economy does not experience major changes between the present and 2020, this prediction could be reliable. However, it appears as though the model puts too much weight on the health of the economy. The model believes that the economy will continue to improve which will incentivize vast numbers of prospective students to work instead of enroll in college. Regardless of the strength of the economy, it is hard to imagine such a sharp decrease in UNO's enrollment. If the economy begins to decline, this could affect the prediction and make it less reliable. The other prediction comes from the undergraduate percentage model. This prediction was found by using fitted values for the year 2020 for Omaha's employment. The year variable was also added to the model in order to reach the prediction. This model predicts that the undergraduate percentage of enrollment at UNO in 2020 will be 80.65% (Table 14). This would represent a slight decrease in the percentage

compared to recent years and the present figure. However, it is not a major shift and seems very plausible based on the trend of graduate enrollment increasing. No predictions were made with the average age model because it only consists of categorical variables.

Future Research Opportunities

This project is informative and there are opportunities to continue the research further. UNO is a public, metropolitan university and the results may be representative of trends at other public, metropolitan universities. However, this is not a guarantee. One route to continue the project would be to study a different metropolitan institution of higher education and compare the results with those obtained at UNO. It also is not guaranteed that the relationships found in this study would hold true when applied to a land-grant university. Thus, another option for further work through this project would be to study a land-grant university and compare the results to UNO.

The regression results have provided support for the idea that alternative options to a university like UNO such as online programs do have an impact on enrollment figures. This provides some motivation for a final potential route for continuing research. Rather than comparing studies at different institutions, it would be valuable to further investigate competition between online programs, community colleges, and universities like UNO. The findings from this route could further inform administrators how to approach important decisions in order to maximize enrollment.

Conclusion

Understanding the factors that affect enrollment is of interest to many people such as policymakers and professors which has led to a wide variety of research on the topic. Reviewing several notable existing projects helped to shape the expectations for this endeavor. However, the

literature review did not uncover any projects that focused on UNO or were similar enough to address the goals of this project. Thus, the findings provided by this study are unique and certainly valuable for the UNO community. The importance of this project is enhanced further by the fact that the university has undergone a transition in recent years from a primarily commuter school to a more traditional, research one. Exploring the data helps explain what factors led to this change. UNO has also witnessed numerous renovations and constructions of new academic buildings as well as major changes regarding athletics. A motivation for these events was certainly to make the university more desirable for prospective students and ultimately increase enrollment. Performing this project addresses whether these changes influenced enrollment and to what degree. The data for this project was collected primarily from UNO resources such as the UNO Factbooks. Supporting information was gathered from sources such as the BEA. Once the data was collected, three regression models were constructed using stepwise regression and model-checking procedures. These models focused on the average age of the undergraduate population, the enrollment per capita, and the percent of total enrollment made up by undergraduate students. The results for the first model suggest that new housing complexes as well as the introduction of sports do attract more traditional students. In UNO's case, the creation of the hockey program, University Village housing, and Scott Village housing all are associated with decreases in the average undergraduate age. The first model also suggests that alternatives to UNO such as Walden University have attracted some non-traditional students away from UNO which has in turn lowered the average age. The second model's results further support the idea that educational alternatives have lured students away from UNO since the creation of Walden University is associated with decreased enrollment per capita. The second model also suggests that increased real income in the Omaha MSA is associated with decreased

enrollment per capita. This result aligns with common economic theory. The results for the third model also align with economic theory in this way since Omaha's employment is a significant variable. The third model also provides support for the idea that renovations to academic buildings have attracted more traditional students which leads to a higher undergraduate percentage. This can be gleaned from the positive coefficient for the recreation center variable. In general, the results from the models provide support for many of the initiatives undertaken by the university over the years. The results also show that there is competition between more traditional universities like UNO and educational alternatives. This result and more are thought-provoking and open the door to several different future research opportunities. Overall, the project has accomplished the goal of analyzing the impact of major events at the university. The results suggest that enrollment has been significantly impacted by them which is notable considering the current climate of budget cuts. The initiatives were worth the investment and they affected the student body as intended. Moving forward, this project can serve as a resource for administrators as they make the next important decisions that will shape UNO's future.

Appendix

Table 1. Variable Definitions

Variable Name	Variable Type	Definition
YEAR	Discrete	Integer that represents the year
ENROLLMENT	Continuous	Integer that represents the total enrollment at UNO
AVG_AGE_UNDERGRAD	Continuous	Integer that represents the average age of undergraduate students at UNO
ENROLL_UNDERGRAD	Continuous	Integer that represents the undergraduate enrollment at UNO
ENROLL_PER_CAPITA	Continuous	ENROLL_UNDERGRAD/OMAHA_POP
ENROLL_GRAD	Continuous	Integer that represents the graduate enrollment at UNO
ENROLL_DOUGLAS	Continuous	Integer that represents the number of students enrolled at UNO from Douglas County
ENROLL_PERCENT_DOUGLAS	Continuous	(ENROLL_DOUGLAS/ENROLLMENT)
ENROLL_SARPY	Continuous	Integer that represents the number of students enrolled at UNO from Sarpy County
ENROLL_PERCENT_SARPY	Continuous	(ENROLL_SARPY/ENROLLMENT)
ENROLL_NEBRASKA	Continuous	Integer that represents the number of students enrolled at UNO from Nebraska
ENROLL_OUTOFSTATE	Continuous	Integer that represents the number of students enrolled at UNO from states other than Nebraska
ENROLL_INTERNATIONAL	Continuous	Integer that represents the number of students enrolled at UNO that are international students
HSENROLL_DOUGLAS_G12	Continuous	Integer that represents the number of high school seniors in Douglas County
HSENROLL_SARPY_G12	Continuous	Integer that represents the number of high school seniors in Sarpy County
OMAHA_POP	Continuous	Integer that represents the population of the Omaha MSA

OMAHA_INCOME	Continuous	Integer that represents the total income in the Omaha_MSA
OMAHA_INCOME_PER_CAPITA	Continuous	OMAHA_INCOME/OMAHA_POP
CPI	Continuous	Integer representing the CPI, 1982 is the base year
OMAHA_INCOME_REAL	Continuous	Integer representing the total income in the Omaha_MSA measured in real 1982 dollars, OMAHA_INCOME adjusted using CPI
OMAHA_INCOME_PER_ CAPITA_REAL	Continuous	OMAHA_INCOME_REAL/OMAHA_POP
OMAHA_INCOME_PER_ CAPITA_REAL_PERCENT_ CHANGE	Continuous	Integer representing the percent change from the previous year in real income per capita in the Omaha MSA
OMAHA_EMPLOYMENT	Continuous	Integer representing the number of individuals employed in the Omaha MSA
OMAHA_EMPLOYMENT_ PERCENT_CHANGE	Continuous	Integer representing the percent change from the previous year in the number of individuals employed in the Omaha MSA
D1	Dummy	UNO athletics compete in NCAA Division I = 1, UNO athletics do not compete in Division I = 0
HOCKEY	Dummy	UNO has a hockey team = 1, UNO does not have a hockey team = 0
HOCKEY_NCAATOURNAMENT	Dummy	UNO's hockey team makes the NCAA tournament = 1, No NCAA hockey tournament appearance = 0
WRESTLING_ NATIONALCHAMPIONSHIP	Dummy	UNO's wrestling program wins the national championship = 1, No national championship = 0
HOUSING_UV	Dummy	University Village housing exists = 1, University Village does not exist = 0
HOUSING_MV	Dummy	Maverick Village housing exists = 1, Maverick Village does not exist = 0
HOUSING_SHALL	Dummy	Scott Hall housing exists = 1, Scott Hall does not exist = 0
HOUSING_SVILLAGE	Dummy	Scott Village housing exists = 1, Scott Village does not exist = 0

HOUSING_SCOURT	Dummy	Scott Court housing exists = 1, Scott Court does not exist = 0
HPER_REN	Dummy	The recreation center, H&K, has undergone its most recent renovation = 1, No renovation on H&K = 0
DURHAM	Dummy	Durham Science Center is an academic building at UNO = 1, Durham Science Center doesn't exist = 0
MAMMEL	Dummy	Mammel Hall is an academic building at UNO = 1, Mammel Hall does not exist = 0
PKI	Dummy	The Peter Kiewit Institute is an academic building at UNO = 1, The Peter Kiewit Institute does not exist = 0
ROSKENS_REN	Dummy	Roskens Hall has undergone its most recent renovation = 1, Roskens Hall has not undergone the renovation = 0
CEC	Dummy	The Community Engagement Center is an academic building at UNO = 1, The Community Engagement Center does not exist = 0
WEBER	Dummy	The Weber Fine Arts Building is an academic building at UNO = 1, The Weber Fine Arts Building doesn't exist
ASHFORD	Dummy	Ashford University is an available educational alternative to UNO = 1, Ashford University doesn't exist = 0
LIBERTYU	Dummy	Liberty University is an available educational alternative to UNO = 1, Liberty University doesn't exist = 0
WALDEN	Dummy	Walden University is an available educational alternative to UNO = 1, Walden University doesn't exist = 0
CAPELLA	Dummy	Capella University is an available educational alternative to UNO = 1, Capella University doesn't exist = 0
KAPLAN	Dummy	Kaplan University is an available educational alternative to UNO = 1, Kaplan University doesn't exist = 0

Table 2. Variable Descriptive Statistics

Variable Name	Mean	St. Deviation	Min	Max
YEAR	1999	10.25	1982	2016
ENROLLMENT	15,388.00	758.3	13,927	17,045
AVG_AGE_UNDERGRAD	24.37	1.31	22.8	26.1
ENROLL_UNDERGRAD	12,712.00	823	11,345	14,352
ENROLL_PER_CAPITA	0.02	0.003	0.01	0.02
ENROLL_GRAD	2,660.00	307.3	1,994	3,118
ENROLL_DOUGLAS	8,033.00	609.5	7,273	8,946
ENROLL_PERCENT_DOUGLAS	0.53	0.02	0.5	0.57
ENROLL_SARPY	2,276.00	415	1,616	2,815
ENROLL_PERCENT_SARPY	0.15	0.02	0.12	0.18
ENROLL_NEBRASKA	13,064.00	681.9	11,767	13,912
ENROLL_OUTOFSTATE	1,395.00	491.6	831	2,424
ENROLL_INTERNATIONAL	652.3	159.8	461	987
HSENROLL_DOUGLAS_G12	6,832.00	865.3	5,740	8,193
HSENROLL_SARPY_G12	1,868.00	203.5	1,549	2,183
OMAHA_POP	770,609.00	84,566.00	660,724	924,129
OMAHA_INCOME	25,288,811	12,829,914	8,294,491	49,545,167
OMAHA_INCOME_PER_CAPITA	31,452.00	12,853.00	12,554	53,613
CPI	169.4	45.38	96.5	240
OMAHA_INCOME_REAL	13,975,903	3,706,653	8,595,327.00	20,643,217
OMAHA_INCOME_PER_CAPITA_REAL	17,840.00	2,852.00	13,009.00	22,338.00
OMAHA_INCOME_PER_CAPITA_REAL_PERCENT_CHANGE	1.58	2.04	-4.25	5.38
OMAHA_EMPLOYMENT	502,601.00	79,373.00	356,924	623,925
OMAHA_EMPLOYMENT_PERCENT_CHANGE	1.62	1.24	-1.37	3.51
D1	0.17	0.38	0	1
HOCKEY	0.54	0.51	0	1
HOCKEY_NCAATOURNAMENT	0.09	0.28	0	1

WRESTLING_NATIONALCHAMPIONSHIP	0.2	0.41	0	1
HOUSING_UV	0.51	0.51	0	1
HOUSING_MV	0.26	0.44	0	1
HOUSING_SHALL	0.49	0.51	0	1
HOUSING_SVILLAGE	0.4	0.5	0	1
HOUSING_SCOURT	0.17	0.38	0	1
HPER_REN	0.2	0.41	0	1
DURHAM	0.86	0.36	0	1
MAMMEL	0.2	0.41	0	1
PKI	0.6	0.5	0	1
ROSKENS_REN	0.17	0.38	0	1
CEC	0.09	0.28	0	1
WEBER	0.71	0.46	0	1
ASHFORD	0.34	0.48	0	1
LIBERTYU	0.23	0.43	0	1
WALDEN	0.63	0.49	0	1
CAPELLA	0.23	0.43	0	1
KAPLAN	0.37	0.49	0	1

Table 3.

Average Undergraduate Age Regression Results

	Dependent variable:
	AVG_AGE_UNDERGRAD
HOUSING_UV	-0.82***
	(0.19)
HOCKEY	-1.00***
	(0.20)
HOUSING_SVILLAGE	-0.66***
	(0.10)
DURHAM	0.39***
	(0.10)
WALDEN	-0.42***
	(0.12)
Constant	25.54***
	(0.08)
Observations	35
R2	0.99
Adjusted R2	0.98
Residual Std. Error	0.17 (df = 29)
F Statistic	393.00*** (df = 5; 29)

Note: *p<0.1; **p<0.05; ***p<0.01

Standard Errors are displayed in parentheses below the regression results

Table 4. Results to Selected Model Checking Hypothesis Tests – Average Age Model

Test	p-value
Studentized Breusch-Pagan	0.04
Durbin-Watson	0.02
Shapiro-Wilk Normality	0.02

Table 5. Variance Inflation Factors – Average Age Model

Variable	VIF
HOUSING_UV	10.929
HOCKEY	11.581
HOUSING_SVILLAGE	2.700
DURHAM	1.393
WALDEN	3.745

Table 6.

Enrollment Per Capita Regression Results

	Dependent variable:
	ENROLL_PER_CAPITA
WALDEN	-0.002784***
	(0.000391)
OMAHA_INCOME_PER_CAPITA_REAL	-0.0000005***
	(0.0000001)
DURHAM	0.000883**
	(0.000323)
Constant	0.026260***
	(0.001003)
Observations	35
R2	0.9588
Adjusted R2	0.9548
Residual Std. Error	0.000537 (df = 31)
F Statistic	240.600000*** (df = 3; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

Standard Errors are displayed in parentheses below the regression results

Table 7. Results to Selected Model-Checking Hypothesis Tests – Enrollment Per Capita Model

Test	p-value
Studentized Breusch-Pagan	0.04
Durbin-Watson	0.01
Shapiro-Wilk Normality	0.10

Table 8. Variance Inflation Factors – Enrollment Per Capita Model

Variable	VIF
WALDEN	4.335
OMAHA_INCOME_PER_CAPITA_REAL	4.827
DURHAM	1.552

Table 9. 95% Prediction Interval for Enrollment Per Capita in 2020

Fitted Value	Lower Bound	Upper Bound
0.01305	0.01178	0.01432

Table 10. 95% Prediction Interval for Enrollment in 2020

Fitted Value	Lower Bound	Upper Bound
12,296	11,099	13,493

Table 11.

Undergraduate Percentage of Enrollment Regression Results

	Dependent variable:
	(ENROLL_UNDERGRAD/ENROLLMENT)
WALDEN	-0.017360***
	(0.004645)
WEBER	-0.009855**
	(0.004146)
HPER_REN	0.012190***
	(0.003302)
OMAHA_EMPLOYMENT	-0.0000001***
	(0.00000004)
Constant	0.901300***
	(0.014390)
Observations	35
R2	0.9321
Adjusted R2	0.9230
Residual Std. Error	0.005616 (df = 30)
F Statistic	102.900000*** (df = 4; 30)

Note: *p<0.1; **p<0.05; ***p<0.01

Standard Errors are displayed in parentheses below the regression results

Table 12. Results to Selected Model-Checking Hypothesis Tests – Undergrad Percentage Model

Test	p-value
Studentized Breusch-Pagan	0.90
Durbin-Watson	0.003
Shapiro-Wilk Normality	0.70

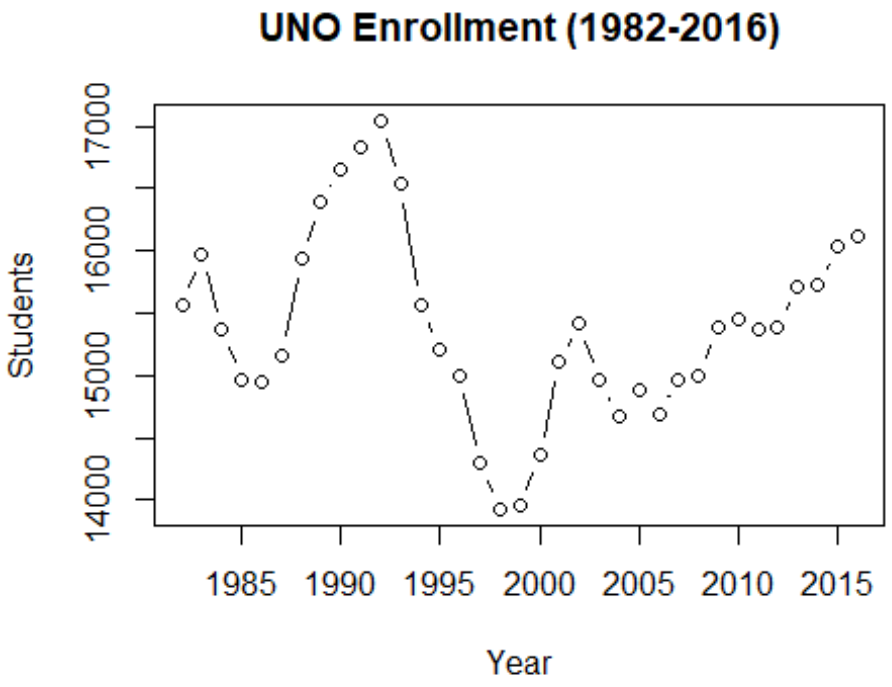
Table 13. Variance Inflation Factors – Undergrad Percentage Model

Variable	VIF
WALDEN	5.589
WEBER	3.892
HPER_REN	1.935
OMAHA_EMPLOYMENT	8.633

Table 14. 95% Prediction Interval for Undergrad Percentage in 2020

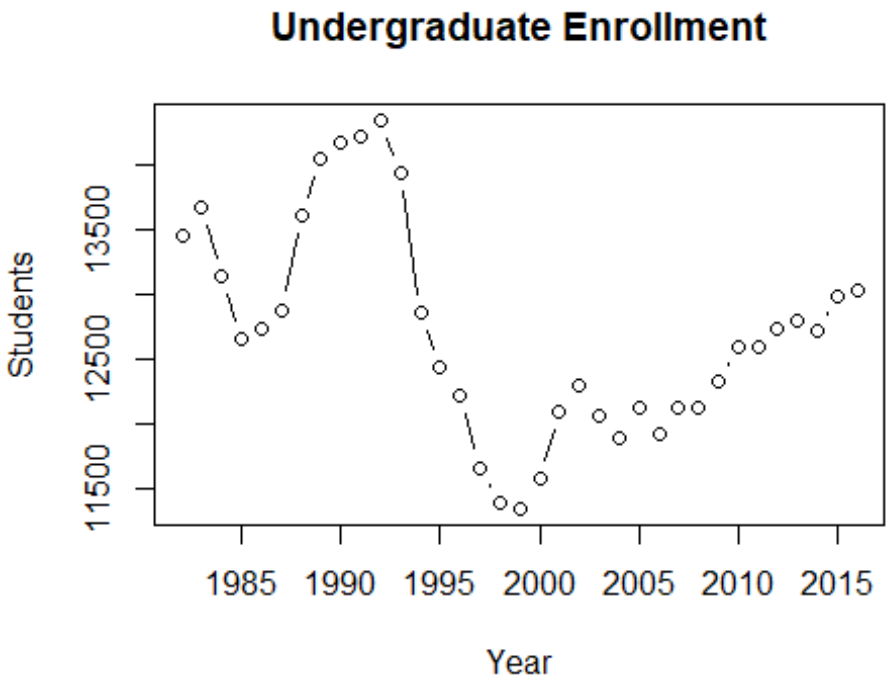
Fitted Value	Lower Bound	Upper Bound
0.8065	0.7928	0.8202

Figure 1.



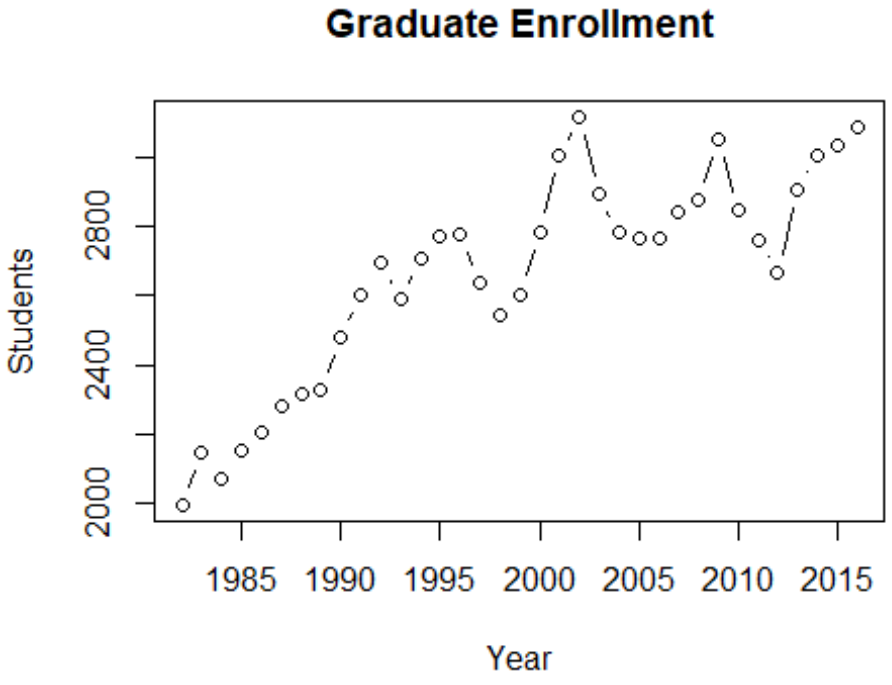
Source: UNO Factbooks, Digital Commons, University of Nebraska at Omaha. Accessed October 20, 2018.

Figure 2.



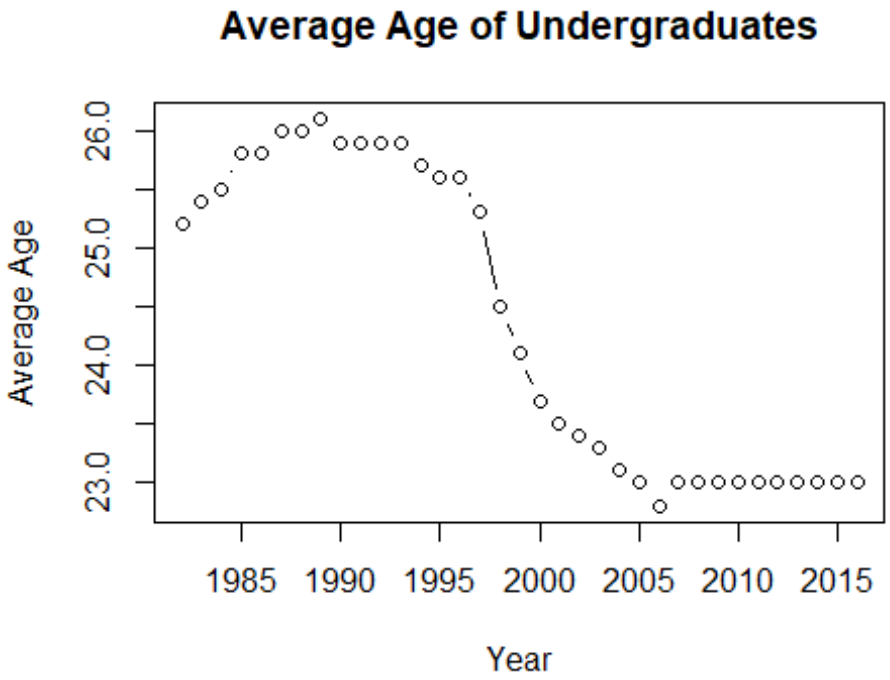
Source: UNO Factbooks, Digital Commons, University of Nebraska at Omaha. Accessed October 20, 2018.

Figure 3.



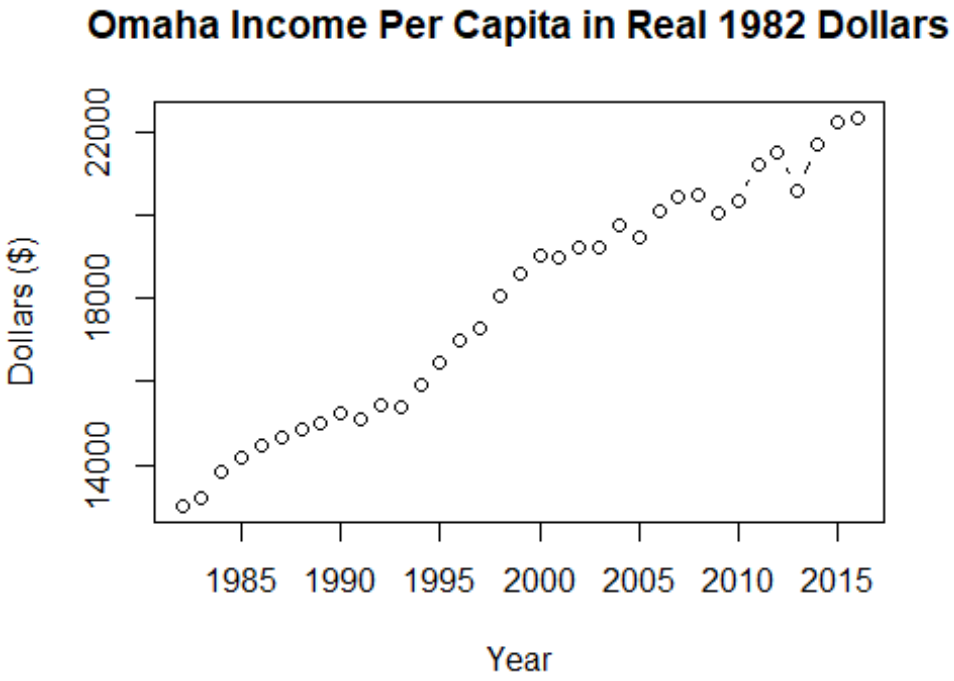
Source: UNO Factbooks, Digital Commons, University of Nebraska at Omaha. Accessed October 20, 2018.

Figure 4.



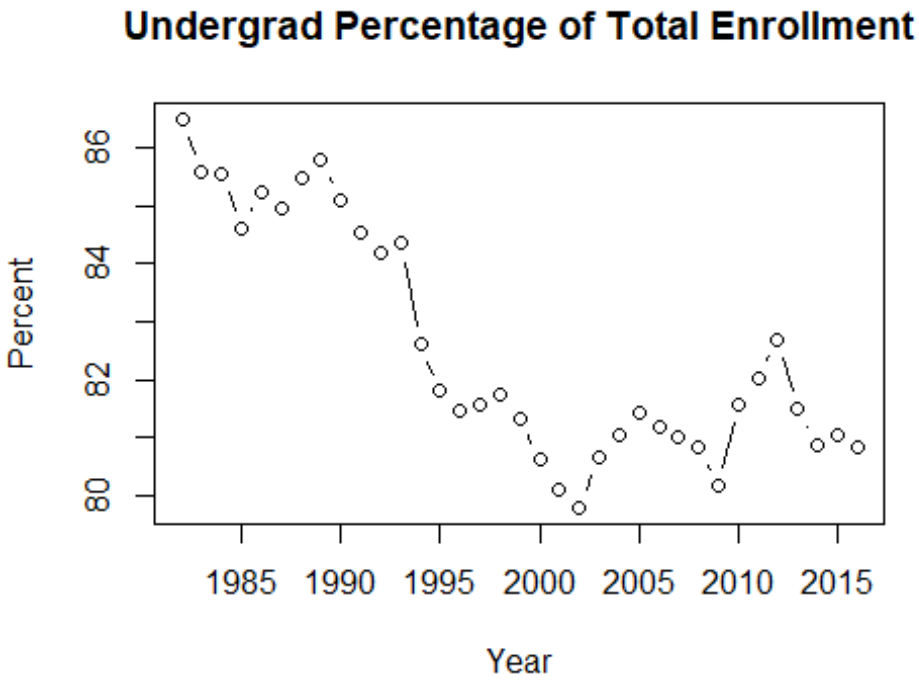
Source: UNO Factbooks & Common Data Set, Digital Commons, University of Nebraska at Omaha. Accessed October 20, 2018.

Figure 5.



Source: BEA Data Tools, Omaha-Council Bluffs MSA, Bureau of Economic Analysis & Consumer Price Index Data from 1913 to 2018, US Inflation Calculator. Accessed October 20, 2018.

Figure 6.



Source: UNO Factbooks, Digital Commons, University of Nebraska at Omaha. Accessed October 20, 2018.

Figure 7. Residuals vs Fitted Values – Average Age Model

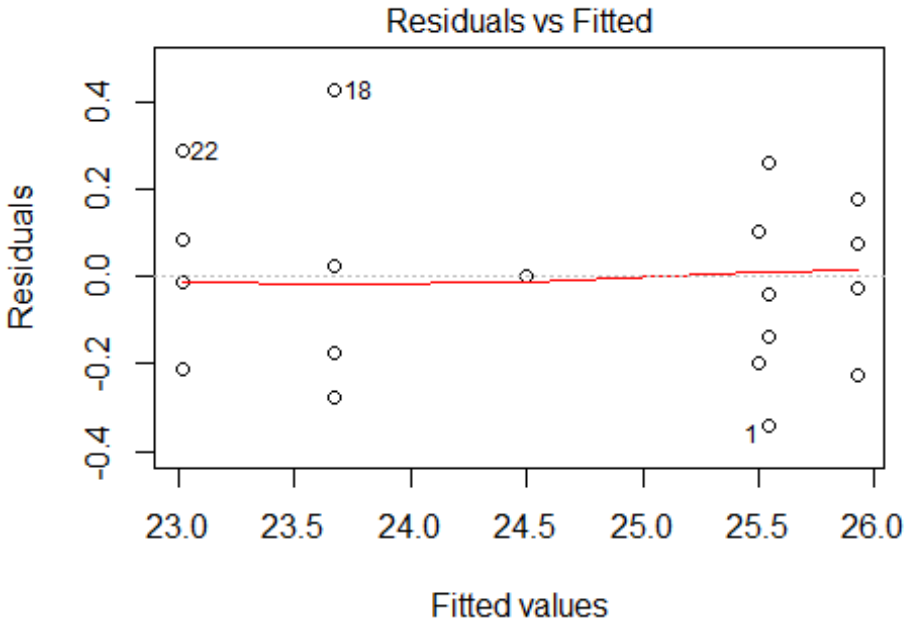


Figure 8. Normal Q-Q Plot – Average Age Model

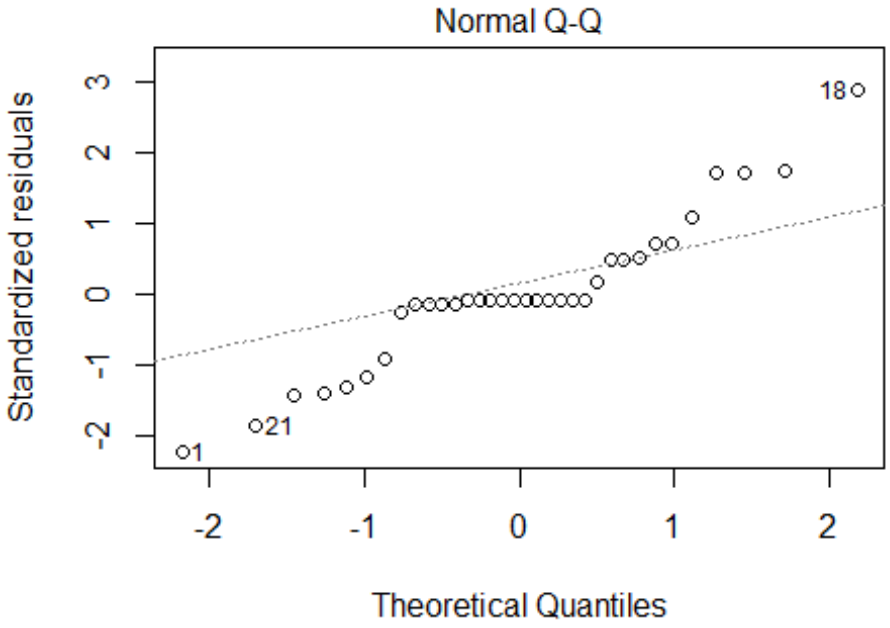


Figure 9. Cook's Distance Plot – Average Age Model

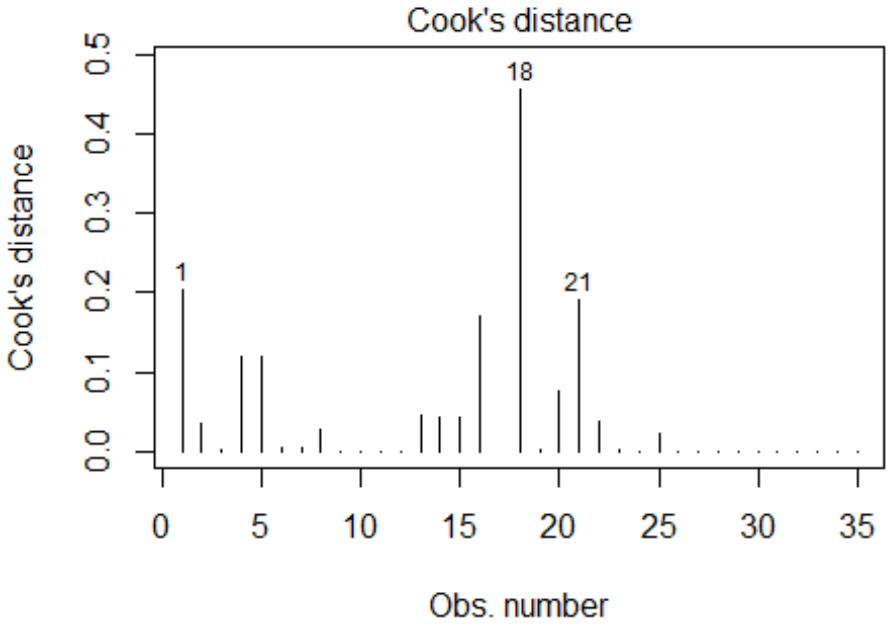


Figure 10. Residuals vs Fitted Values – Enrollment Per Capita Model

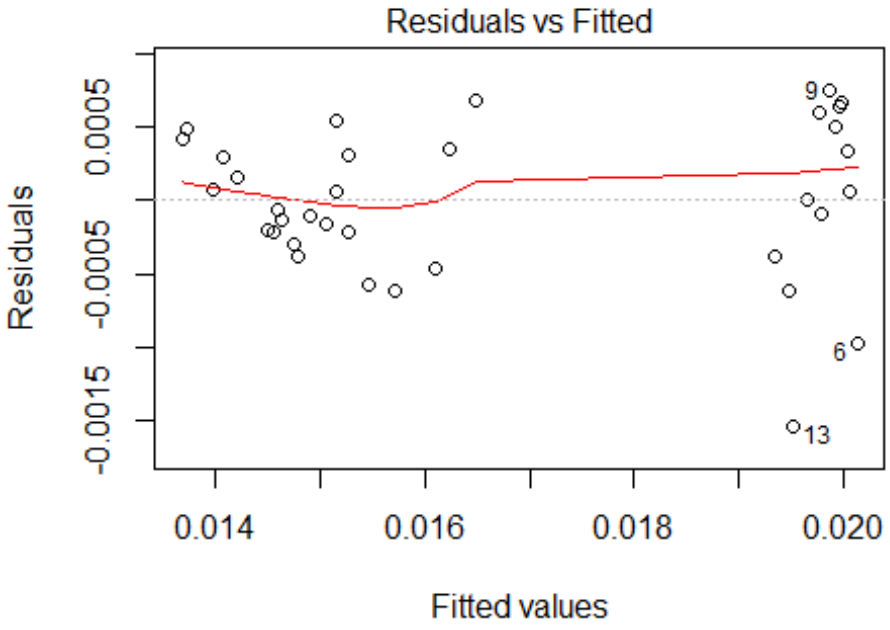


Figure 11. Normal Q-Q Plot – Enrollment Per Capita Model

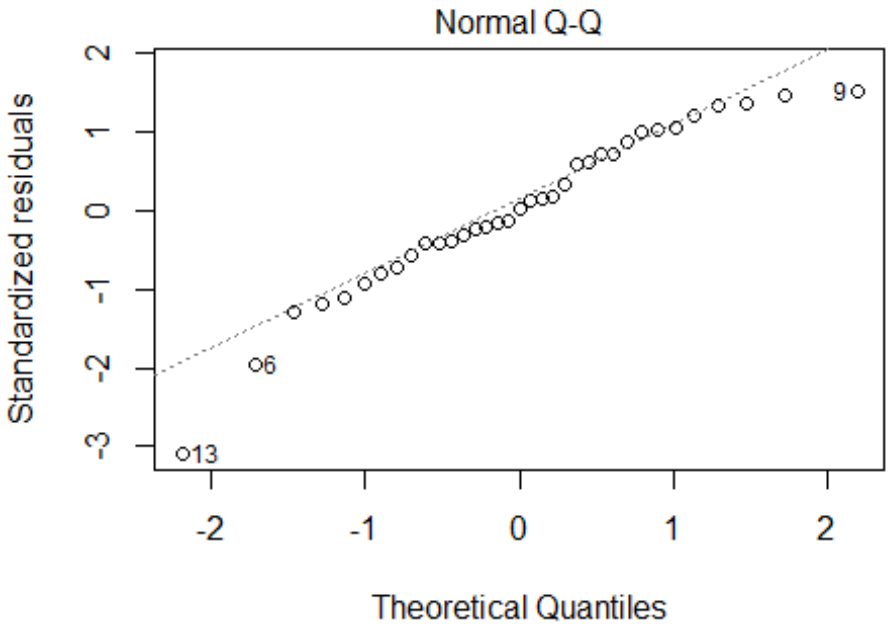


Figure 12. Cook's Distance Plot – Enrollment Per Capita Model

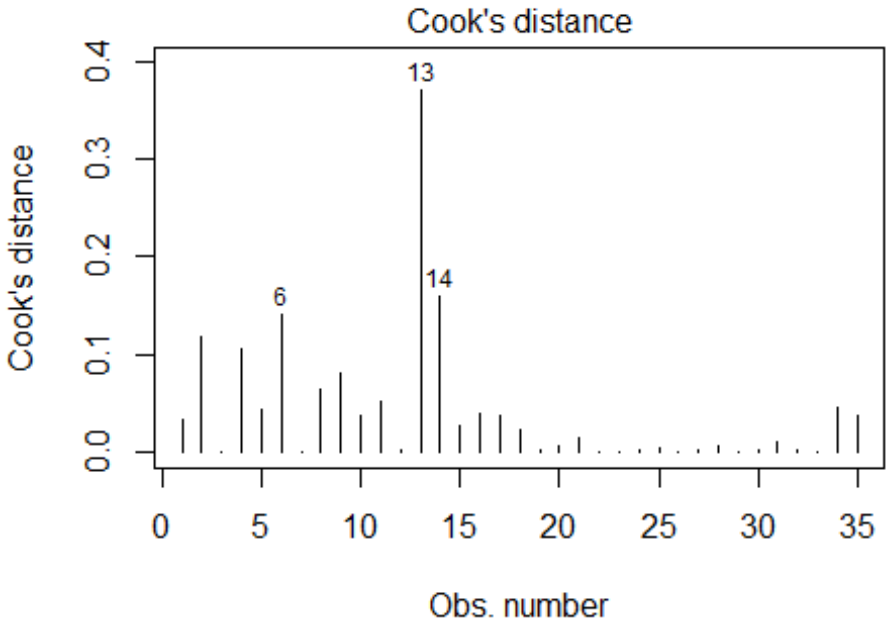


Figure 13. Residuals vs Fitted Values – Undergrad Percentage Model

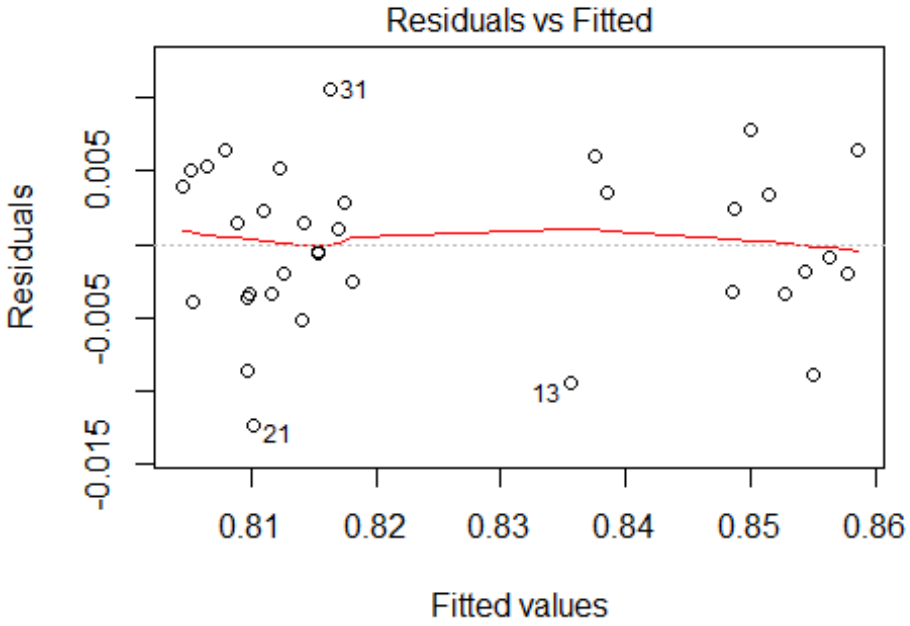


Figure 14. Normal Q-Q Plot – Undergrad Percentage Model

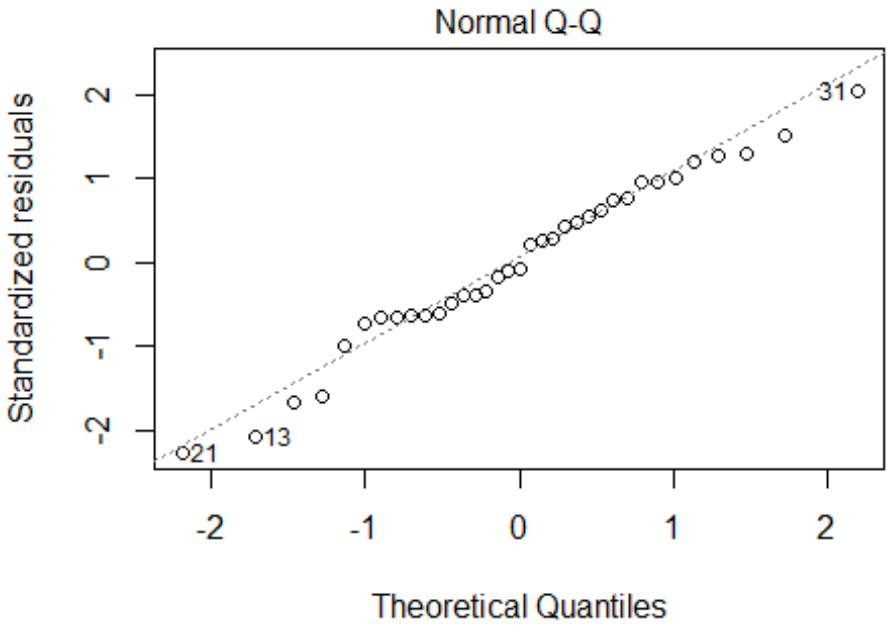
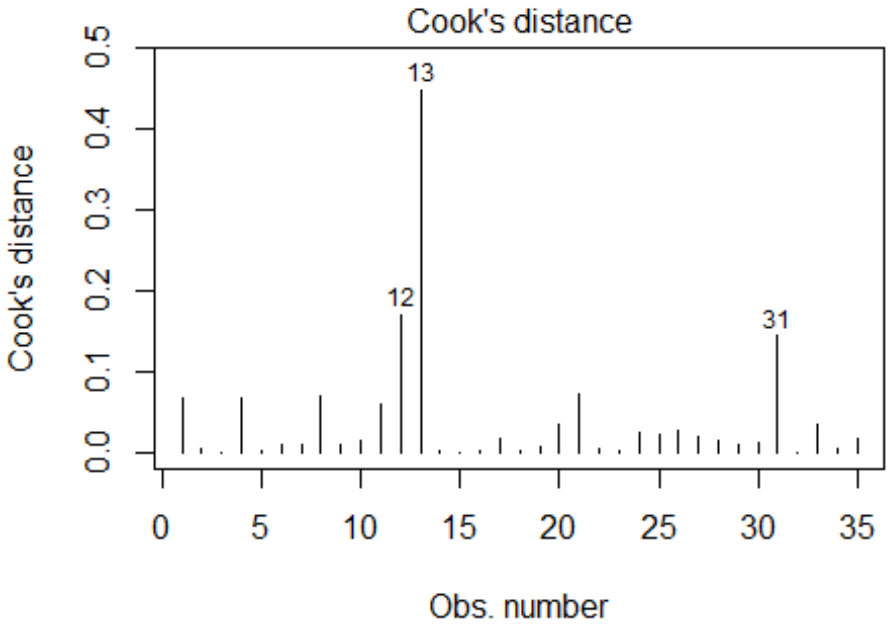


Figure 15. Cook's Distance Plot – Undergrad Percentage Model



References

BEA Data Tools. (n.d.). Retrieved October 20, 2018, from https://apps.bea.gov/iTable/index_regional.cfm

Chang, H. S., & Hsing, Y. (1996). A Study of Demand for Higher Education at Private Institutions in the US: A Dynamic and General Specification. *Education Economics, 4*(3), 267–278. https://doi-org.leo.lib.unomaha.edu/http://www.tandfonline.com/loi/cede20

Consumer Price Index Data from 1913 to 2018. (2018, October 11). Retrieved October 20, 2018, from http://www.usinflationcalculator.com/inflation/consumer-price-index-and-annual-percent-changes-from-1913-to-2008/

Hastings, J., Neilson, C. A., & Zimmerman, S. D. (2015). The Effects of Earnings Disclosure on College Enrollment Decisions. https://doi-org.leo.lib.unomaha.edu/http://www.nber.org/papers/w21300.pdf

Heller E., D. (1999). The Effects of Tuition and State Financial Aid on Public College Enrollment. *Review Of Higher Education, 23*(1), 65-89.

Koku, P. (1997) What Is in a Name? The Impact of Strategic Name Change on Student Enrollment in Colleges and Universities, *Journal of Marketing for Higher Education, 8*(2), 53-71, DOI: 10.1300/J050v08n02_05

Leppel, K. (1993). Logit Estimation of a Gravity Model of the College Enrollment Decision. *Research in Higher Education, 34*(3), 387-398. Retrieved from http://www.jstor.org/stable/40196054

Nebraska Department of Education: Quick Facts. (n.d.). Retrieved October 20, 2018, from https://drs.education.ne.gov/quickfacts/Pages/DistrictandSchoolInformation.aspx

Perez, S. J. (2012). Does Intercollegiate Athletics Draw Local Students to a University? *Journal of Sports Economics, 13*(2), 198–206. https://doi-org.leo.lib.unomaha.edu/http://jse.sagepub.com/content/by/year

Pollacia, L., & Lomerson, W. L. (2006). Analysis of factors affecting declining CIS enrollment. *Issues in Information Systems, VII*(1), 220-225. Retrieved October 20, 2018, from http://iacis.org/iis/2006/Pollacia_Lomerson.pdf

Remembering the History. (2017, June 29). Retrieved November 26, 2018, from https://omavs.com/sports/2017/6/29/remembering-the-history.aspx

Shin, J., & Milton, S. (2006). Rethinking Tuition Effects on Enrollment in Public Four-year Colleges and Universities. *Review of Higher Education, 29*(2), 213–237. Retrieved from http://search.ebscohost.com.leo.lib.unomaha.edu/login.aspx?direct=true&db=eue&AN=20167489&site=ehost-live&scope=site

Sidin, S. M.,Hussin, S. R.,Soon, T. H.(2003).An exploratory study of factors influencing the college choice decision of undergraduate students in Malaysia. *Asia Pacific Management Review, 8*(9),259-280.

Toma, J., & Cross, M. (1998). Intercollegiate Athletics and Student College Choice: Exploring the Impact of Championship Seasons on Undergraduate Applications. *Research in Higher Education, 39*(6), 633-661. Retrieved from http://www.jstor.org/stable/40196314

UNO Factbooks. (n.d.). Retrieved October 20, 2018, from https://digitalcommons.unomaha.edu/oiefactbooks/

UNO Common Data Sets. (n.d.). Retrieved October 20, 2018, from https://digitalcommons.unomaha.edu/oiecds/

Wetzel, J., O'Toole, D., & Peterson, S. (1998). An Analysis of Student Enrollment Demand. *Economics of Education Review, 17*(1), 47–54. https://doi-org.leo.lib.unomaha.edu/http://www.sciencedirect.com/science/journal/02727757