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Modeling Illinois Community College Online Enrollments versus the Economy from 2008-2018

by

John D. Jennings

B.S., Northwestern University, 1990

Thesis

Submitted in partial fulfillment of the requirements

For the Degree of Master of Science with a Major in Mathematics

Governors State University

University Park, IL 60484

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## **Abstract**

Online enrollment at Illinois community colleges and Illinois public universities has increased from 2008-2018. The purpose of this study was to examine and model the statistical significance between Illinois community college online enrollment and key economic indicators from 2008-2018. The economic indicators chosen for the model were the Illinois Coincident Index and a binary dummy variable that represented typical Illinois state funding or lack thereof during the Illinois Budget Impasse. The method of modeling chosen was the ordinary least squares method. The research questions addressed the statistical significance of the Illinois Coincident Index and the dummy funding variable in 2008-2018 and 2008-2019 online enrollment models. The results of this study offer Illinois community college administrators a statistically significant, predictive model for online enrollment. Future modeling considerations to improve the statistical significance could include Illinois public university enrollment and the availability of federal and Illinois financial assistance.

*Keywords:* Illinois Community College Online Enrollment, Illinois Coincident Index, Illinois Budget Impasse, economy, modeling.



## **Chapter 1**

### **INTRODUCTION**

The purpose of this research is to analyze the relationship between enrollment trends in Illinois Community College (ICC) online courses and certain economic indicators. Enrollment data for the years 2008-2018 will be studied. Economic data will be taken from the Illinois Coincident Index (ICI), a measure that combines four state-level variables to summarize economic conditions in a single statistic (Research, n.d.), will be used. The analysis will also attempt to determine if the Illinois Budget Impasse of 2015-2017 had an impact on online enrollments.

In the next section of this paper, a historical perspective is included for Illinois public universities and Illinois community colleges. Undergraduate enrollment and online enrollment trends will be summarized. A bar chart will be presented for Illinois public universities and community colleges enrollments from 2008-2018.

#### **Illinois Public Universities**

In 1862 Abraham Lincoln established 37 land grant institutions in the United States. In 1868, the first public university in Illinois, The University of Illinois in Urbana-Champaign, enrolled its first student. (University of Illinois, n.d.) Over the next 100 years, 9 additional public universities were established in Illinois. In 1969, Governors State University and the University of Illinois at Springfield were established bringing the total number of Illinois public universities to 12. From 2008-2011, Illinois public university undergraduate headcount enrollment remained steady at approximately 152,000, but gradually decreased to approximately 134,000 in 2018. (Illinois Board, n.d.).

In 1960, The University of Illinois created a system of linked computer terminals ushering in the age of online communication and education. In 1986, the nationwide Electronic University Network, offered its first online course, and by 1994 email and internet usage were exploding. In 1997, the University of Illinois Online was established to support its campuses at Urbana, Springfield, and Chicago. (About, n.d.). By 2008, Illinois public university total online enrollments had reached a level of approximately 53,000 and had grown over 300% to almost 216,000 by 2018. (University Academic, n.d.).

### **Illinois Community Colleges**

The first Illinois junior college established was Joliet Junior College in 1901. In 1965, the Illinois General Assembly established the Illinois Community College Act placing the junior colleges under the jurisdiction of the Illinois Board of Higher Education. (Illinois General, 1965). Waubensee Community College was established in 1966 bringing the total number of Illinois community colleges to 49 in 2018. Illinois community college full time headcount enrollment rose from 2008 to 2010 peaking at over 318,000 students, then steadily decreased to approximately 212,000 in 2018. Similarly, part time enrollments rose from 2008 to 2011 peaking at over 805,000 students then steadily decreased to less than 600,000 in 2018. (Illinois Community, n.d.).

In 1998, the Illinois Community College Presidents Council (Presidents Council) identified the need for a coordinated system-wide approach to community college online degree and certificate delivery. On September 11, 2001, the Illinois Community College Online (ILCCO) organization began college training with an emphasis in curriculum, faculty, and technology development to rollout ILCCO statewide. Trainings occurred throughout the fall and prepared colleges for participation in ILCCO, which opened for statewide operation in the fall

2002 semester. (Kai, n.d.) Illinois total online enrollments have nearly doubled from approximately 165,000 in 2008 to 302,000 in 2018. (University Academic, n.d.).

In Figure 1, the line chart displays the online enrollment for Illinois community colleges and public universities for the 2008-2018 fall terms. From 2008-2018, Illinois community college online enrollment increased by approximately 67 %, but Illinois public university online enrollments increased by approximately 400 %. Community college online enrollments consistently outpaced Illinois public university enrollments from 2008-2011. From 2012-2018, however, Illinois public university online enrollment closed the gap. By 2018, the online enrollments for Illinois community colleges and public universities were approximately equal. A notable decrease in the Illinois public university online enrollment in 2016 can be observed, and that decrease coincided with the Illinois Budget Impasse. An overview of the budget impasse is also included in this chapter.

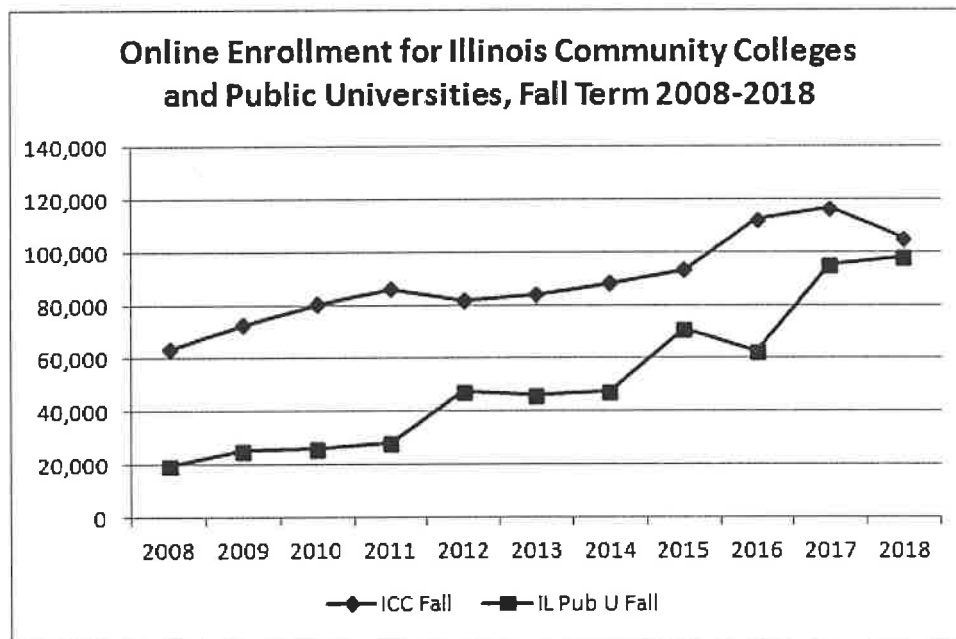


Figure 1. Online Enrollment for Illinois Community Colleges and Public Universities, Fall Semester 2008-2018.

In the following sections, key economic conditions and indicators for the U.S. and Illinois will be discussed, including an overview of the U.S. depression from 2007-2009. A bar chart comparing U.S. and Illinois unemployment rates from 2008-2018 will be included. Finally, an overview of the Illinois Budget Impasse of 2015-2017 will be presented including the subsequent decrease in funding to Illinois public universities and community colleges.

### **The U.S. Economy.**

According to Mishkin (2008), in 2005, the single-family housing market peaked; however, in 2006 more homeowners began defaulting on mortgage payments. In 2007, home sales continued to fall, mortgage defaults continued to increase, and this combination triggered a recession that engulfed the United States and the banking and financial services industries. “A recession is a significant decline in economic activity spread across the economy, lasting more than a few months. Its beginning is marked with a peak of economic activity and ends when the economy reaches its trough.” (National, 2003, p.3). The Business Cycle Dating Committee of the National Bureau of Economic Research determined that an economic recession began in December 2007 and ended in June 2009. (National, 2008).

Immediately following the recession, the U.S. unemployment rate peaked in late 2009 at a level of approximately 10%. (Civilian, 2019). The price of gold and silver peaked in 2011 (U.S.A, n.d.). The number of U.S. housing starts dropped to their lowest points in 2011 as well. (Housing, 2019). Although the recession officially ended in 2009, the aftershocks were felt through 2018 throughout the country, particularly within the state of Illinois.

**The Illinois Economy**

The Illinois unemployment monthly rate peaked in January 2010 at a rate of 12.1% (Federal, 2019). Illinois housing starts followed the U.S. trend and hit minimum levels in 2011 (Housing, 2019). From the fourth quarter of 2007 to the fourth quarter of 2016, the Illinois personal income growth rate was 0.8%, ranking it last in the nation (Personal, n.d.). The line chart in Figure 2 displays the annual unemployment rates in the U.S and Illinois from 2008-2018. Overall, the chart illustrates that Illinois and U.S unemployment rates are highly correlated. The recession began in 2007 and ended in 2009. Following the official end of the recession, the annual unemployment rates, which are a lagging economic indicator, hovered near 10 % from 2010-2012. Illinois unemployment rates were consistently higher than the U.S. rates from 2008-2018. Both unemployment rates have steadily decreased from 2010-2018.

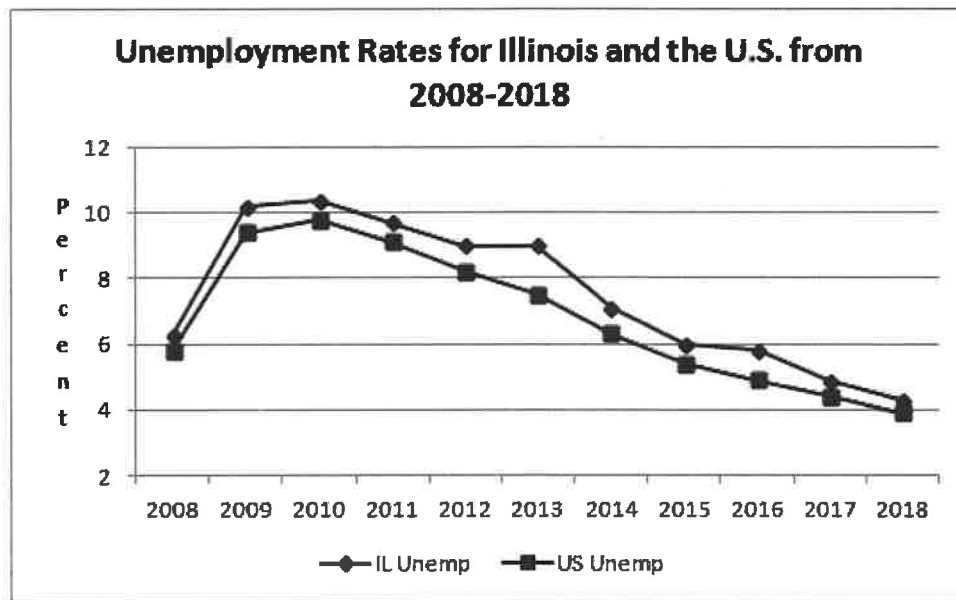


Figure 2. Unemployment Rates for Illinois and the U.S. from 2008-2018

In addition to the national and Illinois economic downturns during the 2008-2018 timeframe of this study, an Illinois budget impasse occurred from 2015-2017 and impacted Illinois public universities and community colleges. In Figure 3, the line chart displays state

funding levels for Illinois community colleges, local tax base funding for Illinois community colleges, and Illinois state funding for public universities from 2008-2018.

The chart shows a relatively steady level of funding from the State of Illinois for community colleges from 2008-2018. The amount of local tax base funding to support Illinois community colleges has gradually increased during that time. In contrast, local tax base funding does not support Illinois public universities. In addition, Illinois state funding for Illinois public universities has steadily decreased since 2010. The effect of the Illinois Budget Impasse is evident in 2016. However, the community college local tax base funding remained steady in 2016. Consequently, the decrease in state funding in 2016 showed a more drastic net funding decrease for Illinois public universities than for Illinois community colleges.

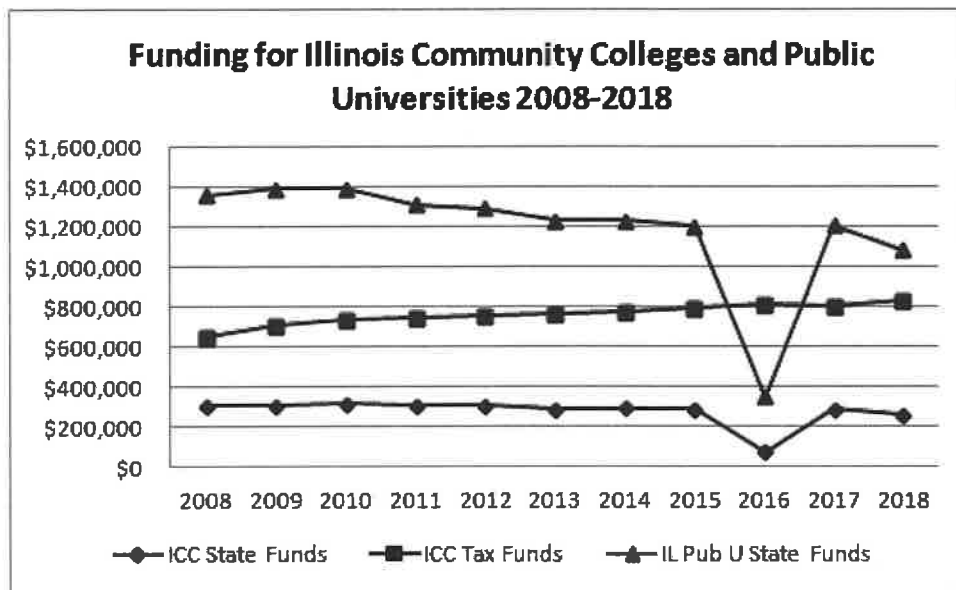


Figure 3. Funding for Illinois Community College State Funding, Illinois Community College Local Tax Funding, and Illinois Public University State Funding from 2008-2018.

### **The Illinois Budget Impasse and funding for Illinois Public Universities and Community Colleges**

The Illinois budget impasse lasted for 736 days beginning July 1, 2015. According to Mendoza (2018) “without a complete budget, many state commitments – mostly payments for social service programs, higher education, agency operations and state employee health insurance payments – remained insufficiently appropriated, creating uncertainty in payments for many reliant on state support” (p. 1). The Institute for Illinois’ Fiscal Stainability (2017) reported in fiscal year 2016, without a fully funded, appropriated budget, state spending on four-year universities fell by 70.77 %. Likewise, state funding decreased by 74.25 % at Illinois community colleges (Illinois Community, n.d.). However, as previously noted, funding for Illinois community colleges from local property taxes remained steady during the budget impasse.

During the budget impasse, from 2015 to 2016, fall online enrollment at Illinois public universities decreased by 11.8 %. In contrast, Illinois community college fall online enrollment increased by 20.1 % from 2015-2016, by far the greatest annual increase observed in this study from 2008-2018. (University Academic, n.d.). Full time enrollments at Illinois public universities (Illinois Board, n.d.) and community colleges (Illinois Community, n.d.) steadily decreased for the fall semesters from 2013-2018. Based on this data, the budget impasse coincided with in a sharp decrease in Illinois public university online enrollments and a sharp increase in Illinois community college online enrollment. In addition to the Illinois budget impasse and the impact at Illinois community colleges, research has shown other contributing factors associated with community college enrollments. In the next section of the paper, prior

research and reports on factors reported to influence community college enrollments are presented.

### **Prior Research and Reports on Factors that Influence Community College Enrollments**

Prior research and studies have presented economic and non-economic factors that influence community college enrollments. Harris (2012) reported in the article, Student Motivations for Choosing Online Classes, “Students enroll in online programs and courses for reasons that are primarily related to access, convenience and flexibility” (p. 2). Likewise, Noel (2010) indicated the three primary motivations for students choosing online programs were convenience, flexible programs, and the ability to fit education into their work schedule.

A 2012 survey of students at Eastern Oregon University (EOU) supported the reasons and priorities outlined above. Presented with a variety of motivating statements, the survey participants top motivating factors for selecting online versus face-to-face courses included; 62 % confirmed that “I can complete my coursework in an online course when it is convenient for me”, 51 % confirmed that “I live too far away from EOU’s La Grande campus or regional centers to easily commute”, 45 % confirmed that “online classes allow me to earn my degree and honor family obligations”, and 45 % confirmed that “online classes allow me to meet my class requirements and keep my job” (Harris, 2012, p.4).

In a study of enrollments and unemployment rates, Hillman (2013) reported that during years of increasing unemployment rates, community college “enrollments grew in the years leading up the 2001 recession and then weakened in the years that followed. A similar, though sharper, pattern emerges when looking at the Great Recession (2007-2009)” (p. 772). Likewise, in Illinois, unemployment rates (Federal, n.d.) and community college full time enrollment grew



from 2008 to 2010 (Illinois College, n.d.). At both the national and Illinois state level, it appears that rising unemployment rates send market signals to potential students, where individuals opt for investing in human capital as the economy begins to slow (Hillman, 2013). Conversely, “from 2012-2017, two-year college enrollment dropped 11 % nationwide. One of the most widely accepted reasons behind the decline is related to an improving economy” (Economy, 2019, pg 1)

### **Chapter Summary**

In summary, the introduction included a historical perspective and an enrollment summary for Illinois public university and Illinois community college enrollments from 2008-2018. An overview of the U.S. and Illinois economy was presented for 2008-2018. The discussion included an account of the great recession from 2007-2009 and the Illinois Budget Impasse from 2015-2017 that coincided with significant online enrollment changes. Prior research and studies were included that related to economic and non-economic factors reported to influence community college enrollments. The method of modeling for Illinois community college online enrollment from 2008-2018 is presented in the next chapter.

## Chapter 2

### METHOD OF MODELING

This model for this research project was constructed to find the relationship between the Illinois Coincident Index (ICI), and Illinois Community College (ICC) online enrollments from 2008-2018. From this model, improved forecasting could be made for Illinois community college online enrollments. This chapter includes the following topics: research design, research questions, research hypotheses, the ICC online enrollment dependent variable, ICI independent variable, funding (dummy) independent variable, sources and collection of data, data analysis process, and a chapter summary.

#### Research design

The modeling method chosen for this research project was ordinary least squares regression. The ordinary least squares method assumes a normal distribution of the residuals. In the case of this model, the residuals are the difference between the actual Illinois community college online enrollments and the predicted enrollments for 2008-2018. Time series modeling was chosen to obtain an understanding of the underlying forces and structure that produced the underlying data and to proceed to forecasting (National, 2012). The months and days chosen for the time series modeling were January 1, July 1, and October 1. Those dates coincide with spring, summer, and fall enrollment dates. The independent variables considered for this model were chosen carefully and methodically. Economic variables were considered from the United States, the Midwest, and from Illinois.

Two economic indicators for the United States and Illinois were highly correlated from 2008-2018. Using the time series dates above, the Illinois and United States unemployment rates showed a statistically significant positive correlation,  $r(31) = 0.964$ ,  $p < .001$ . The Illinois and

United States housing starts also showed a strong positive correlation,  $r(31) = 0.689$ ,  $p < .001$ .

Regarding these two economic indicators, the Illinois economy mirrored the United States economy with respect to unemployment and housing starts. As a result of this high correlation, the decision was made to narrow the field of variables from U.S. to Midwest and Illinois economic indicators.

When considering only the Illinois unemployment rate and Illinois housing starts from 2008-2018, the results showed a strong negative correlation,  $r(31) = -0.668$ ,  $p < .001$ . Instead of choosing unemployment or housing starts, an effort was made to find another economic indicator. The Federal Reserve Bank of Chicago was consulted regarding an appropriate economic index to include in this model.

First, the Midwest Economy Index (MEI) was considered and discussed as a potential independent variable; however, it is an indicator for the Midwest economy and not for the Illinois economy. A business economist for the Federal Reserve Bank of Chicago, recommended using the Illinois Coincident Index (ICI). The coincident index combines four state-level indicators to summarize current economic conditions in a single statistic. The four state-level variables in each coincident index are nonfarm payroll employment, average hours worked in manufacturing by production workers, the unemployment rate, and wage and salary disbursements deflated by the consumer price index (U.S. city average) (Federal, 2019). As a result, the ICI data was included in the analysis and used in the model.

### **Research Questions**

The research questions for this study are as follows:

1. What is the relationship between the Illinois Coincident Index and Illinois community college online enrollments from 2008-2018?
2. What is the relationship between the Illinois Coincident Index and Illinois community college online enrollments from 2008-2019?
3. What is the relationship between the Illinois Budget Impasse and Illinois community college online enrollments from 2008-2018?

### **Hypotheses**

The null hypotheses for this study are as follows:

- Ho1. No statistically significant relationship exists between the Illinois Coincident Index and Illinois community college online enrollment from 2008-2018.
- Ho2. No statistically significant relationship exists between the Illinois Coincident index and Illinois community college online enrollment from 2008-2019.
- Ho3. No statistically significant relationship exists between the Illinois Budget Impasse and Illinois community college online enrollments from 2008-2018.

### **Variables**

The dependent variable included in this study was the Illinois community college online enrollment. The independent variables included were the Illinois Coincident Index and a dummy variable related to Illinois General Assembly funding or a significant lack thereof for the Illinois community colleges from 2008-2018. The time series model chosen used the months and dates of January 1, July 1, and October 1, however the funding data reported by the Illinois Board of Higher Education was annual. Therefore, a dummy variable was included in the model for

funding or a significant lack thereof. The following table is a summary of the variables considered for use in the modeling process.

Table 1.

*Dependent and Independent Variables Considered or Accepted in Forecasting Model*

Variable	Description	Final Status
Illinois Community College Online Enrollment	Dependent Variable. 2008-2018 spring, summer and fall semester enrollments	Spring and fall semester data accepted.
U.S. and Illinois unemployment rates	Independent variables. Monthly rates matched to spring (January 1), summer (July 1), and fall (October 1) semester enrollment dates.	Rejected.
Illinois Housing Starts	Independent variable. Monthly values matched to semester enrollment dates.	Rejected.
Midwest Economy Index	Independent variable. Monthly index matched to semester enrollment dates.	Rejected
Illinois Coincident Index	Independent variable. Monthly index matched to semester enrollment dates.	Accepted
Illinois funding for Illinois community colleges	Independent variable. Dummy variable. A value of 1 indicated funding. A value of 0 indicated no funding during the Illinois Budget Impasse.	Accepted

### **Sources and Collection of Data**

The unemployment rates for Illinois and the United States were obtained from the Federal Reserve Bank of St. Louis' Federal Reserve Economic Data (FRED). Data for January 1, July 1, and October 1 2008-2018 were analyzed and used to calculate the correlation coefficient and p-values. The housing starts data for Illinois and the United States were obtained from FRED. Data for January 1, July 1, and October 1 2008-2018 were analyzed and used to calculate the correlation coefficient and p-values. The Midwest Economy Index data were obtained from the Federal Reserve Bank of Chicago. Data for January 1, July 1, and October 1 2008-2018 were analyzed. The Illinois Coincident Index was obtained from the Federal Bank of Chicago. Data for January 1, July 1, and October 1 2008-2018 were analyzed.

Data for the Illinois community college funding from the Illinois General Assembly were obtained from the Illinois Board of Higher Education. (IBHE Dynamic, n.d.) This annual data was referenced to determine a dummy variable and binomial values related to funding. The dummy variable used in the model was created by considering the annual funding from the Illinois General Assembly for Illinois community colleges for the years 2008-2018. For the time period of July 1, 2015 to August 31, 2017, public institutions of higher education received limited or no funding due to the Illinois Budget Impasse. The dummy variable was used to determine if this lack of funding had an impact on online enrollment during the time period of 2015-2017. The value of 1 was assigned for the presence of typical funding and the value of 0 was assigned to the absence of typical funding. Dummy variable (funding) values for January 1, July 1, and October 1 2008-2018 were entered in the model.

The data for dependent variable, Illinois community college online enrollment, were obtained from the University of Illinois University Academic Programs and Services Department

(University Academic, n.d.). Specifically, the data is from the distance education enrollment reports. The data for spring (January 1), summer (July 1), and fall (October 1) enrollments were analyzed (University Academic, n.d.).

### **Data Analysis Process**

The independent variable data analysis began by determining if those variables yielded a high correlation coefficient. Illinois and U.S. unemployment and housing starts were highly correlated. According to Anderson, Sweeney, and Williams (2005), “multicollinearity is a potential problem if the absolute value of the sample correlation coefficient exceeds .7 for any two independent variables” (p. 655). In this case the values were  $r = 0.964$  for Illinois and U.S. unemployment and  $r = 0.689$  for Illinois and U.S. housing starts. The r-value for housing starts did not exceed 0.7, but it was only 0.011 units less. Similarly, the correlation coefficient for Illinois unemployment and Illinois housing starts was  $r = -0.668$ . The negative correlation was expected, and the value was within 0.032 units of  $|0.7|$ . Consequently, the decision was made to eliminate U.S. unemployment, U.S. housing starts, Illinois unemployment, and Illinois housing starts from the model.

After considering the Midwest Economy Index, and consulting the Federal Reserve Bank of Chicago, the Illinois Coincident Index was included in the modeling process. A dummy (funding) variable was also created and included in the statistical models. The dependent variable was the online enrollment data at Illinois community colleges for January 1 (spring), July 1 (summer), and October 1 (fall). Ultimately the model that resulted in statistical significance was Illinois community college online enrollments as a function of the ICI and funding from the State of Illinois (dummy variable).

During the modeling process, Pearson correlation coefficients and variance inflation factor (VIF) statistics were generated to test for multicollinearity between the independent variables. Q-Q plots and P-P plots were generated to validate the normality of the dependent variables. A boxplot was generated to confirm the absence of any outliers in the dependent variable data. A scatter plot of the dependent variable regression standardized residuals versus the regression standardized predicted values was generated to confirm the homoscedasticity of the model. F statistics and p-values were generated to check the overall significance of the model. T-statistics and levels of significance were generated to check the significance of each independent variable. Finally, an adjusted  $R^2$  value was generated to check how closely the model fits the actual data. An adjusted  $R^2$  value was chosen due to the multiple linear regression characteristic of the model.

### **Chapter Summary**

In summary, the model chosen for this analysis was the ordinary least squares method incorporating time series modeling. The research questions were defined to determine if a significant statistical relationship existed between Illinois community college online enrollments and the ICI. Variables were defined as were the sources and collection of data. Finally, the data analysis procedure was defined for this study. The findings of that analysis are present in the next chapter.



### Chapter 3

#### FINDINGS

The findings in this chapter are based on a revision to the model proposed in Chapter 2 for statistically significant reasons outlined below. When spring, summer, and fall data was included in the multiple linear regression model, the F-statistic and p-value generated to check the overall statistical significance of the model were confirmed ( $F(2,30) = 6.994, p < 0.05$ ), where  $F_{cv}(2,30) = 3.316$ . The t-statistic and p-value calculated to check the statistical significance of the Illinois Coincidence Index (ICI) were also confirmed ( $t(30) = 2.32, p < 0.05$ ), where  $t_{cv} = 2.0423$ . However, for the dummy variable (Illinois funding), the absolute value of the t-statistic was low, and the p-value was high ( $t(30) = -1.23, p > 0.200$ ). Consequently, the decision was made to complete the analysis using enrollment numbers for fall and spring semesters and to exclude the summer term.

This was based on the different characteristics of summer enrollments. First, the students who take summer classes are not representative of the community college student because many students who return home for summer from 4-year universities and out-of-state schools often take classes at their local community college to use for transfer credits. During the summer term, the number of courses offered is markedly reduced for a variety of reasons that may include limited financial aid and faculty teaching schedules. Lastly, students may choose not to enroll in an online class for summer because many summer terms are reduced in length making the course more challenging. As a result, the statistical significance of the model improved from 2008-2018 including: ( $F(2,19) = 20.389, p < 0.001$ ), ICI variable ( $t(19) = 3.925, p = 0.001$ ), and the dummy (funding) variable ( $t(19) = 2.167, p < 0.05$ ).

### Research Question 1

Research question 1 was “What is the relationship between the Illinois Coincident Index and Illinois community college online enrollments from 2008-2018?” The result of the multiple linear regression model indicated a statistically significant relationship between Illinois community college online enrollments and the ICI from 2008-2018 ( $F(2,19) = 20.389$ ,  $p < 0.001$ ). The adjusted  $R^2$  statistic was 0.649. The ICI variable was examined and found to be a statistically significant predictor in the model ( $t = 3.925$ ,  $p = 0.001$ ).

The null hypothesis related to research question 1 was “No statistically significant relationship exists between the Illinois Coincident Index and Illinois community college online enrollment from 2008-2018.” This hypothesis was rejected at a 0.05 level of significance based on the statistical analysis: ( $F(2,19) = 20.389$ ,  $t = 3.925$ , and  $p < 0.001$ ). The adjust  $R^2$  value indicated that 64.9% of Illinois community college online enrollment variance from 2008-2018 can be explained by the ICI.

### Research Question 2

Research question 2 was “What is the relationship between the Illinois Coincident Index and Illinois community college online enrollments from 2008-2019?” In this analysis, spring 2019 data was included in the model. The results of this multiple linear regression model showed statistical improvement from the prior model and indicated there was a statistically significant relationship between Illinois community college online enrollments and the ICI from 2008-2019 ( $F(2,20) = 23.538$ ,  $p < 0.001$ ). The adjusted  $R^2$  statistic was 0.672. The ICI variable was examined and found to be a statistically significant predictor in the model ( $t = 4.875$ ,  $p < 0.001$ ).

The null hypothesis related to research question 2 was “No statistically significant relationship exists between the Illinois Coincident Index and Illinois community college online enrollment from 2008-2019.” This hypothesis was rejected at a 0.05 level of significance based on the statistical analysis: ( $F(2,20) = 23.538$ ,  $t = 4.857$ , and  $p < 0.001$ ). The adjust  $R^2$  value indicated that 67.2% of Illinois community college online enrollment variance from 2008-2019 can be explained by the ICI.

### **Research Question 3**

Research question 3 was “What is the relationship between the Illinois Budget Impasse and Illinois community college online enrollments from 2008-2018?” The results of the multiple linear regression model indicated that there was a statistically significant relationship between Illinois community college online enrollments from 2008-2018 and the Illinois Budget Impasse ( $F(2,19) = 20.389$ ,  $p < 0.001$ ). The adjusted  $R^2$  statistic was 0.649. The Illinois Budget Impasse dummy variable was examined and found to be a statistically significant predictor in the model ( $t = -2.167$ ,  $p < 0.05$ ).

The null hypothesis related to research question 3 was “No statistically significant relationship exists between the Illinois Budget Impasse and Illinois community college online enrollment from 2008-2019.” This hypothesis is rejected at a 0.05 level of significance based on the statistical analysis: ( $F(2,19) = 20.389$ ,  $t = -2.167$ , and  $p < 0.05$ ). The adjust  $R^2$  value indicated that 64.9% of Illinois community college online enrollment variance from 2008-2018 can be explained by the Illinois Budget Impasse.

### **Model Prediction Equation**

The modeling indicated statistical significance between Illinois community college online enrollments, the Illinois Coincident Index and Illinois state funding. The model prediction equation for the 2008-2019 model with the greater adjusted  $R^2$  value of 0.672, where  $X_1$  is the Illinois Coincident Index value, and where  $X_2$  is the dummy Illinois state funding binary value, was:

$$\text{Illinois Community College Online Enrollment} = 1,163.783X_1 - 13,732.586X_2 - 17,270.819$$

Supplemental statistical significance of the model including results and statistics supporting the assumptions of normality, homoscedasticity, linearity, and the absence of multi-collinearity are presented below to support the research.

### **Supplemental Statistical Significance of the Model**

Tests were performed to check for the normality of the dependent, online enrollment data. Normal Q-Q plots of Illinois community college enrollment expected normal values versus observed values were generated for 2008-2018 and 2008-2019. In both graphs, the data points were tightly concentrated about the Q-Q plot line. Likewise, normal P-P plots were generated for 2008-2018 and 2008-2019. The P-P points were tightly concentrated about the P-P plot line. The Q-Q and P-P plots support the assumption of normal distribution for the dependent enrollment variable.

Stem and leaf plots were generated for the Illinois community college online enrollments from 2008-2018 and 2008-2019. These plots indicated there were no outliers in the dependent variable data sets. Homoscedastic scatter plots for Illinois community college enrollments regression standardized residuals versus predicted values were generated for 2008-2018 and 2008-2019. In both graphs the scatter plot was randomly dispersed in a rectangular pattern with

no discernable pattern. These scatter plots indicated that the residuals were equally distributed. The results of the Q-Q, P-P, and homoscedastic scatter plots support the assumption of linearity for the model.

The Pearson correlation coefficients for the ICI and the dummy (funding) variables were calculated. The correlation coefficient from 2008-2018 was  $-0.533$ . The correlation coefficient from 2008-2019 was  $-0.458$ . These statistics indicated that the independent variables were not highly correlated. In addition, the variance inflation factor (VIF) statistic was 1.266 for 2008-2018 and 1.398 for 2008-2019. O'Brien (2007) noted that "the rule of 10 – associated with VIF are regarded by many practitioners as a sign of severe or serious multi-collinearity" (p. 674). The low VIF statistics support the lack of correlation between the independent variables.

The following chapter includes a discussion of the research project including the research questions and hypotheses. Model construction, model findings and conclusions from the research are presented. Finally, recommendations for future research are given for modeling Illinois community college online enrollment.

## Chapter 4

### DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The purpose of this research was to model the relationship between Illinois community college online enrollments and economic indicators from 2008-2018. With this research, Illinois community colleges may be able to better forecast online enrollments due to economic conditions. The two economic indicators chosen were the Illinois Coincident Index and Illinois General Assembly funding for higher education. Illinois unemployment rates, housing starts, and the Midwest Economy Index were considered, however, the Illinois Coincident Index was chosen. The coincident index combines four state-level indicators to summarize current economic conditions in a single statistic (Federal, 2019).

Illinois General Assembly funding for higher education before, during, and after the 2015-2017 Illinois Budget Impasse was analyzed and included in the research as a binary dummy variable. The research included three research questions. The method chosen for the analysis was the ordinary least squares method incorporating time series modeling. Summer semester data was removed from the analysis due to a low t-statistic and high p-value.

#### Discussion

Research Question 1 examined the relationship between the Illinois Coincident Index and Illinois community college online enrollments from 2008-2018. The null hypothesis was that no statistically significant relationship exists between these variables. The result of the model indicated a statistically significant relationship between the ICI and Illinois community college online enrollment from 2008-2019, and the null hypothesis was rejected ( $F(2,19) = 20.238, p < 0.001$ ). The adjusted  $R^2$  value was 0.649. The ICI variable was examined and found to be a

statistically significant predictor of the model ( $t = 3.925, p = 0.001$ ). This finding shows a statistically significant economic relationship between the ICI and Illinois community college enrollments from 2008-2018.

Research Question 2 examined the relationship between the ICI and Illinois community college online enrollments from 2008-2019. The null hypothesis was that no statistically significant relationship exists between these variables. The result of the model indicated statistical significance between the ICI and Illinois community college online enrollments from 2008-2019, and the null hypothesis was rejected ( $F(2,20) = 23.538, p < 0.001$ ). The adjusted  $R^2$  value was 0.672. The ICI variable was examined and found to be a statistically significant predictor of the model ( $t = 4.875, p < 0.001$ ). This finding shows an economic relationship that is statistically significant between the ICI and Illinois community college enrollments from 2008-2019. In addition, the F-statistic and adjusted  $R^2$  value for the 2008-2019 model were greater than the 2008-2018 model. This statistically significant improvement in the model concluding in 2019 indicates, if not reinforces, an opportunity for future study.

Research question 3 examined the relationship between the Illinois Budget Impasse and Illinois community college online enrollments from 2008-2018. The null hypothesis was that no significant relationship exists between these variables. The result of the model indicated a statistically significant relationship between the Illinois Budget Impasse and Illinois community college online enrollments from 2008-2018, and the null hypothesis was rejected ( $F(2,19) = 20.389, p < 0.001$ ). The adjusted  $R^2$  value was 0.649. The Illinois Budget Impasse dummy variable was examined and found to be a statistically significant predictor of the model ( $t = -2.167, p < 0.001$ ). This finding is also statistically significant and shows an economic

relationship that is statistically significant between the Illinois Budget Impasse and Illinois community college enrollments from 2008-2019.

### **Conclusions**

This purpose of this research was to examine and model the relationship between Illinois community college enrollments and the economy from 2008-2018. Prior research indicated that students are motivated to enroll in online courses by ease of access, convenience, and flexibility (Harris, 2012). Additional research indicated that the ability to fit education into students' work schedules is a contributing factor (Noel, 2010). A study at Eastern Oregon University indicated that honoring family obligations was a key contributing factor for enrolling online (Harris, 2012). Economic factors also contribute to community college online enrollment.

The Illinois unemployment rate (Federal, n.d.) and community college full time enrollment grew from 2008 to 2010 (Illinois College, n.d.) However, "from 2012-2017, two-year college enrollment dropped 11% nationwide, one of the most widely accepted reasons behind the decline is related to an improving economy" (Economy, 2019, pg 1). Individuals may opt to invest less in human capital as the economy grows (Hillman, 2013). As full-time enrollment at Illinois community colleges decreased, online enrollment increased.

Illinois community college enrollments have nearly doubled from approximately 165,000 in 2008 to 302,000 in 2018 (University Academic, n.d.). However, a significant increase in Illinois community college online enrollment occurred during the Illinois Budget Impasse from 2015-2017. In contrast, a sharp decline in Illinois public university online enrollments was observed during the impasse. The economic impact for Illinois community colleges was lessened during the impasse as local tax-based funding for Illinois community colleges remained steady. Within the Illinois budget impasse era from 2015-2017, the economic condition related



to Illinois state funding coincided with increased Illinois community college online enrollment and decreased Illinois public university online enrollment.

Although the budget impasse lasted for two years during this study, the Illinois Coincident Index increased from 2009-2018. During that time, Illinois community college online enrollments nearly doubled to 302,000 in 2018, but Illinois public university online enrollments increased by nearly 400%. In 2018, Illinois community college and public university online enrollments were approximately equal. Since the spring semester of 2017, Illinois community college online enrollments have decreased by approximately 3% while Illinois public university online enrollments have increased by 56%. Although the models did not include Illinois public university online enrollment data as an independent variable, future modeling could consider Illinois public university online enrollment as an independent variable.

The adjusted  $R^2$  value of the 2008-2018 model was 0.649, and the adjusted  $R^2$  value for the 2008-2019 model was 0.672. An additional 2.3% of Illinois community college online enrollment variance was explained by the economic variables in the 2008-2019 model. Both models confirmed the normality of the dependent data and statistics supported a lack of correlation between the independent variables. The predictive nature of the model ending in 2019 improved. However, an  $R^2$  value of 67.2% could be viewed with some skepticism from Illinois community college administrators that are planning for the future of their online programs. In the following section, recommendations for future research are given for modeling Illinois community college online enrollment.

### **Recommendations for Future Research**

The findings of this study proved that a statistically significant relationship exists between Illinois community college enrollment and two economic indicators: the Illinois Coincident Index and Illinois state funding for higher education from 2008-2018 and 2008-2019. The forecasting model ending in 2019 improved by 2.3% over the model ending in 2018. However, the  $R^2$  value for the 2008-2019 model was 67.2%. Further research is needed to improve the predictive nature of the model.

In 2018, Illinois public university online enrollment fall enrollment was 98,504 and nearly surpassed Illinois community college enrollment of 105,024. An analysis including Illinois public university online enrollment raw data could be considered. In addition, growth rates of Illinois public university online enrollments could be included in the model and checked for statistical significance. Data for the ratios, sums, and differences between Illinois community college and Illinois public university online enrollments could also be generated and analyzed for statistical significance in the model. Illinois community college administrators may find additional value in a predictive model that considers Illinois public university online enrollment data.

Additional research could also include economic statistics related to the financial need of students. For example, Federal Pell Grant applicant and recipient data could be included in the model as another economic indicator. This type of national economic indicator, directly related to post-secondary education, may improve the statistical significance of the model and increase the perceived value of the model to Illinois community college administrators planning for the future of online education.

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