



Enrollment and the Great Recession

During the Great Recession community colleges experienced historically high enrollment growth in response to negative economic circumstances (Barr & Turner, 2015; Hillman & Orians, 2013). Notably, the Great Recession, which was infamous for high unemployment rates, produced significant changes in higher education. Mullin and Philippe (2009) found enrollment expansion caused by the Great Recession resulted in many colleges adapting to changes by increasing capacity, altering policies, and extending community outreach to populations most affected. Schmidt (2018) explored postsecondary enrollment before, during, and after the Great Recession and found total postsecondary enrollment increased from 17.2 million students in 2006 to 20.4 million students in 2011, and then decreased to 19.1 million students after the peak of the Great Recession subsided. Schmidt (2018) showed that a majority of the enrollment increases occurred at the undergraduate level, and that students not enrolled prior to the Great Recession contributed the most to enrollment increases. Furthermore, gains in enrollment during the Great Recession were significantly impacted by growth among underrepresented minorities and older students, and the growth was most prevalent at 2-year and for-profit institutions. Despite the clear association between the economy and postsecondary enrollment, few studies have explored how this association might be used to predict future enrollments at community colleges and inform strategic planning and enrollment initiatives. In this research report we explore how the Great Recession impacted KCTCS enrollments and how we can use this information to predict what might happen in the future.

Growth in postsecondary enrollment during a period of significant economic decline may seem counterintuitive to many observers, but past research shows enrollment follows a countercyclical pattern (Hillman & Orians, 2013). Gustman and Steinmeier (1981) explored the enrollment and labor decisions of teenagers in the 1970s and found that the unemployment rate and wages were important factors in their decision to go to college. Betts and McFarland (1995) found that a 1% increase in unemployment predicted a 4% increase in full-time community college enrollment and Dellas and Sakellaris (2003) showed postsecondary enrollment exhibited a strong countercyclical relationship with the economy. Hillman and Orians (2013) found a 1% increase in unemployment was associated with a 1-3% increase in enrollment demand at community colleges. These studies highlight the role that the economy plays in the choice to attend college and shows institutions may benefit from this knowledge by anticipating changes in the economy.

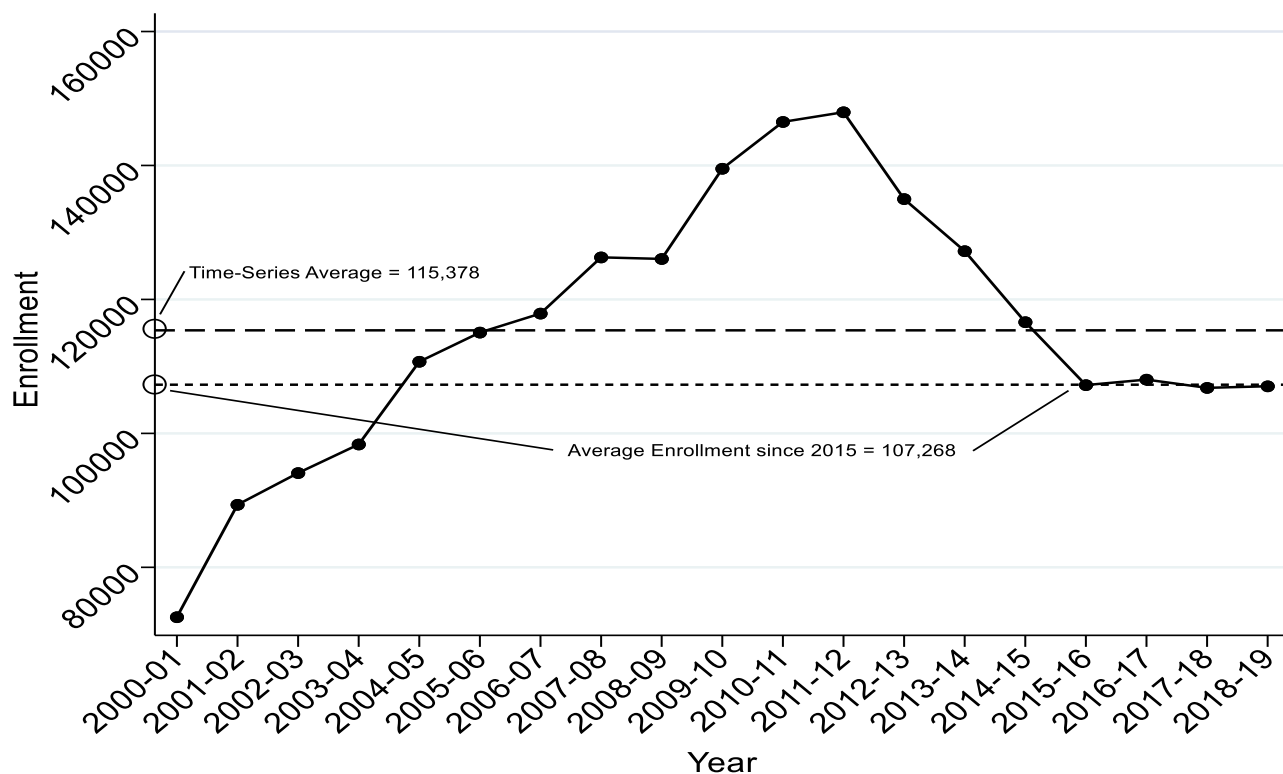
Based on past evidence suggesting the economy has countercyclical effects on postsecondary enrollment, it is important to note that the economic climate since the peak of the Great Recession is characterized by historically low unemployment rates and overall strong market performance. For example, according to U.S. Labor Department (2019), the national unemployment rate in 2018 was 3.9% compared to an average unemployment rate in the peak of the Great Recession of approximately 10%. Demonstrating the relationship between the positive economic environment after the Great Recession and community college enrollments, data from the National Student Clearinghouse Research Center (2019) shows that two-year public enrollment declined from 5,291,753 students in 2018 to 5,114,013 students in 2019, representing a 3.4% decline. Thus, the current state of enrollment at community colleges is characterized by consistent enrollment decline and/or stagnation.

KCTCS Enrollment Before, During, and After the Great Recession

In the years leading up to the Great Recession (i.e., prior to 2007), KCTCS experienced annual increases in enrollment. Figure 1 shows KCTCS enrollment increased from 72,567 in 2000-01 to 126,281 in 2007-08, which is just before the Great Recession started to enter its peak years. During this period KCTCS experienced dramatic changes in its structure. For example, Lexington Community College was transferred to KCTCS in 2004-05, which had immediate effects on enrollment. During the period typically associated with the Great Recession (2008-2011), KCTCS again experienced a growth in enrollment. From 2008-09 to 2011-12, KCTCS's enrollment increased from 126,047 to 147,952, which is a 17.4% increase. Since the end of the Great Recession KCTCS's enrollment has regressed back to pre-recession levels. For example, since the peak enrollment in 2011-12, enrollment at KCTCS dropped to 107,034 in 2018-19, a decline of 27.7% corresponding to a reduction of 40,918 students.

A final important trend to point out in the time-series between 2000-01 and 2018-19 is that KCTCS has experienced a clear normalization of the mean and variation in enrollment. Between 2015-16 and 2018-19, average enrollment stabilized at 107,268 with a standard deviation of 534 students. This normalization of enrollment can be compared to the entire time-series where the mean enrollment was 115,378 students and the standard deviation was 19,603 students. This trend indicates that recent economic stabilization may have produced similar stabilization in KCTCS enrollments. However, one should be aware of potential scenarios that could impact KCTCS enrollments in the future. The previous section described the explanation for the relationship between the economy and the increase in enrollment, and later sections project how KCTCS enrollments might change in responses to various economic circumstances that are currently only hypothetical.

Figure 1: KCTCS Enrollment 2000 - 2018



Forecasting KCTCS Enrollments

Regression Analysis

The first step in the analysis was to estimate ordinary least squares regression (OLS) models to test the significance of variables that have strong theoretical connections with postsecondary enrollment. Also, the regression analysis allows us to determine how much change in enrollment we should expect given changes in specific variables. These variables were the Kentucky unemployment rate, the Index of Consumer Sentiment, population, the number of high school graduates in the previous year, and the tuition rate. We do not report the results of the original OLS model as it was primarily used to check the appropriateness of including all the variables together in one model. We used a diagnostic statistic called variation inflation factors as a post-hoc test of the OLS model, which revealed that the tuition rate variable caused instability in the model because it was too highly correlated with other variables. Thus, the tuition rate variable was excluded, which greatly improved the overall fit of the models. Next, because the data were modeled as a time-series it was important for the regression model to account for autocorrelation, which is a condition that occurs when the previous year's enrollment predicts the following year's enrollment, and thus, the data points are not independent of one another (a serious problem in regression analysis). Thus, an adjustment was made to the standard errors in the model using a technique developed by two statisticians named Newey and West. The results of the Newey-West model are presented below.

Forecasting Models

Given our focus on predicting future enrollment at KCTCS, we also estimated forecasting models that are designed to predict future enrollments based on multiple variables that the regression analysis shows have significant effects. To accomplish this, we used a modelling technique called Autoregressive Integrative Moving Average, or ARIMA for short. This approach is used when diagnostic tests reveal that the time-series exhibits significant autocorrelation and a condition called stationarity, both of which are present in the data.

For the multivariate time-series models, it is important to point out that the values used to project future enrollment are themselves projections because they too have not yet happened. For example, when unemployment is used to estimate future enrollments in 2020, the 2020 unemployment rate is also unknown. Our analysis looked at four potential scenarios that the U.S. and Kentucky economy could face in the coming years: a static economy, a weak recession, a moderate recession, and a strong recession. Table 1 shows the conditions for each of the hypothetical economic scenarios. The static economy model assumes that the economy will not change in the future. While this is unlikely, it provides a point of context to which other models can be compared. The average unemployment rate in Kentucky for 2018 was 4.34%, which we carry forward for four years into the future. The weak recession model assumes the unemployment rate will increase by 0.5% per year. The moderate recession model assumes the unemployment rate will increase by 1.0% per year. Finally, the strong recession model assumes the unemployment rate will increase by 1.5% per year. To determine the values for consumer sentiment it was assumed it would change proportionally with the unemployment rate. To determine the projected values for consumer sentiment, we estimated an OLS regression model regressing consumer sentiment on unemployment. We found that a 1% increase in unemployment results in a 5.33-point reduction in consumer sentiment. Thus, for each of the hypothetical models we multiplied the percent increase in unemployment by 5.33 to determine how much consumer sentiment should decline. For example, in the weak recession model unemployment is assumed to increase by 0.5% per year; therefore, to determine the proportional change in consumer sentiment 0.5 is multiplied by -5.33 which gives a reduction of 2.67 in consumer sentiment per year. For the moderate recession, the proportional reduction in consumer sentiment was $1(-5.33) = -5.33$, and the proportional reduction in consumer sentiment for the strong recession was $1.5(-5.33) = -8.0$.

Table 1: Economic Forecast Scenarios

Model	Unemployment	Consumer Sentiment	High School Graduates	Kentucky Population
Static Economy Model				
2019	4.34	98.37	42,077	4,483,148
2020	4.34	98.37	42,358	4,497,942
2021	4.34	98.37	42,082	4,512,785
2022	4.34	98.37	41,211	4,527,678
Weak Recession Model				
2019	4.84	95.7	42,077	4,483,148
2020	5.34	93.04	42,358	4,497,942
2021	5.84	90.37	42,082	4,512,785
2022	6.34	87.71	41,211	4,527,678
Moderate Recession Model				
2019	5.34	93.04	42,077	4,483,148
2020	6.34	87.71	42,358	4,497,942
2021	7.34	82.38	42,082	4,512,785
2022	8.34	77.05	41,211	4,527,678
Strong Recession Model				
2019	5.84	90.38	42,077	4,483,148
2020	7.34	82.39	42,358	4,497,942
2021	8.84	74.4	42,082	4,512,785
2022	10.34	66.41	41,211	4,527,678

Regression Results

Table 2 presents the results of the Newey-West regression model estimating the effects of the independent variables on enrollment. The results show that all of the variables in the model except high school graduates are significant ($p < .10$). The result for the unemployment rate show that a 1% increase is expected to increase KCTCS enrollment by 5,404 students. Consumer sentiment has a significant negative effect on KCTCS enrollment where a one unit increase in consumer sentiment reduces the expected enrollment at KCTCS by 709 students. Thus, it appears that an increase in the local unemployment rate increases enrollment while improvement in the national economy decreases enrollment. Both effects support the hypothesis that a declining economy increases enrollment at KCTCS while controlling for population size and the number of high school graduates.

The results of the Newey-West regression model were very robust given the number of variables included in the model. The R^2 value describes how much of the variation in enrollment is explained by the variables in the model. Combined, the variables included in the model explained 85% of the variation in enrollment - a very strong relationship. However, this result means that there is an additional 15% of the variation in enrollment that is unaccounted for by the model. This implies there are other non-economic sources of enrollment variation that might include enrollment initiatives, scholarships, and dual credit/dual enrollment.

Table 2: Newey-West Regression Results

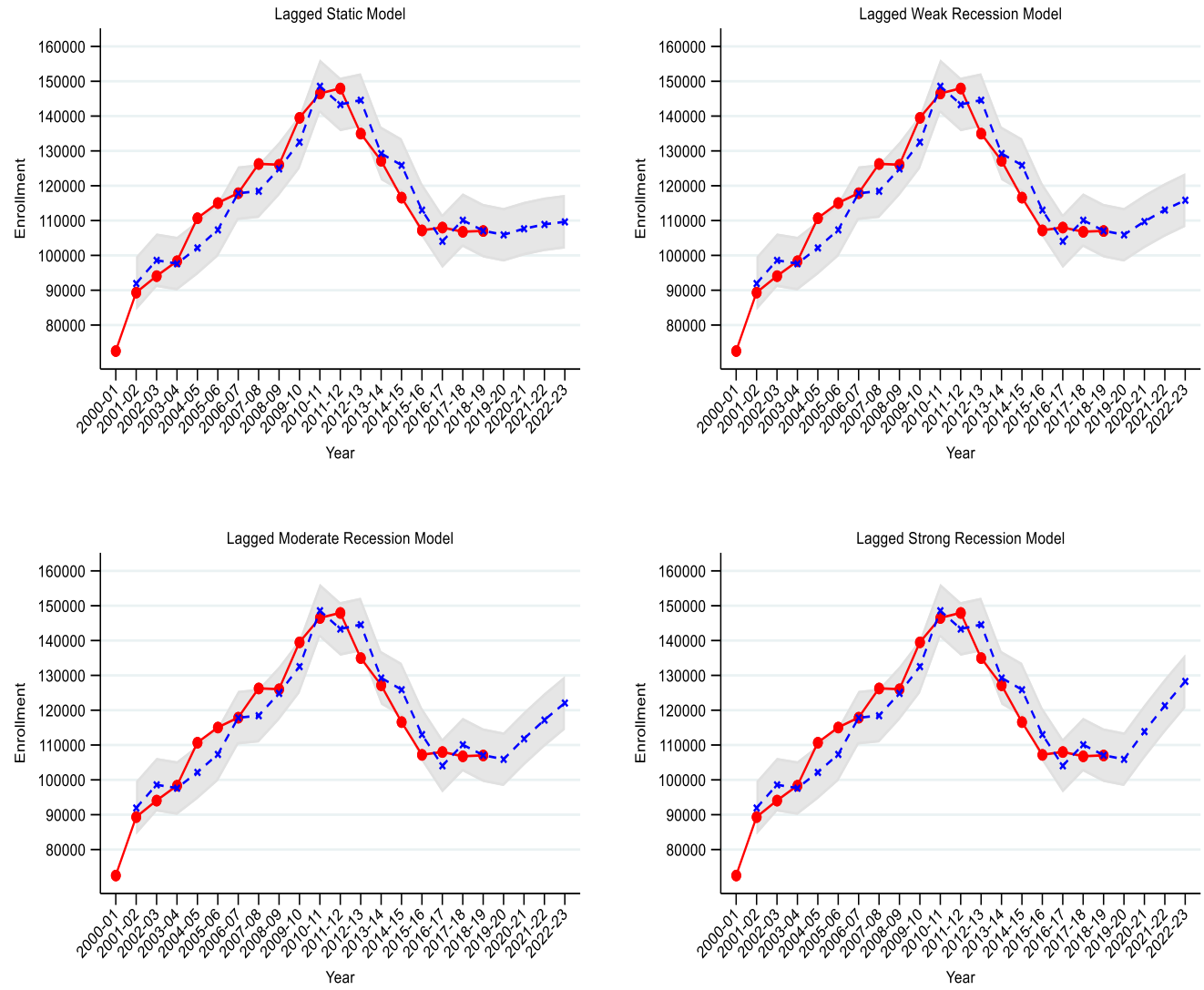
Variable	b	se	p
Unemployment	5403.9	1978.6	0.017
Consumer Sentiment	-709.0	336.14	0.055
Population	0.1	0.04	0.028
High School Graduates	-4.5	2.71	0.123
Intercept	-118715	85737	0.189
R^2	0.85		



Forecasting Model Results

The models presented in Figure 2 estimate KCTCS enrollments as a function of the economy and population. The assumption under consideration in the models is that the influence of poor economic circumstances are not immediate, but rather, take time to fully manifest their effects on enrollment (i.e., the effects are lagged). The results of the forecast models show that each projected economic scenario estimates a short-term decline in enrollment from 107,034 in 2018-19 to 105,923 in 2019-20. However, after the short-term decline in enrollment the models estimate increases in enrollment. In 2020-21, the static model estimates enrollment is 107,668 students and the weak recession model estimates enrollment will be 109,739. The models estimating more severe economic decline predict higher enrollments in 2020-21. The moderate recession model estimates 2020-21 enrollment will be 111,810 and the strong recession model estimates enrollment will be 113,878. Under the most extreme conditions, the strong recession model estimates that the 2022-23 enrollment will be 128,299.

Figure 2: KCTCS Enrollment Forecasts



Note: In each graph, the red line represents the observed enrollment (real data) and the blue line represents the forecast model.

Conclusions

The analysis presented in this research brief highlights the relationship between KCTCS enrollment and the economy. The report explored this relationship across a period that included one of the worst economic recessions in U.S. history, and in doing so, demonstrated that KCTCS enrollment moves closely with the economy. The relationship demonstrated in this report showed that about 85% of the variation in KCTCS enrollment between 2000 and 2018 was due to the unemployment rate, consumer sentiment, population, and the number of recent high school graduates. However, the results show that the unemployment rate is likely the most impactful variable. These results support past scholarly work on the association between postsecondary enrollment and the economy by showing there is a strong countercyclical relationship – as the economy gets worse KCTCS enrollments increase. This highlights an important relationship that KCTCS has with the state’s labor force.

Evidence from past studies suggest the relationship between the economy and enrollment is likely true for all postsecondary institutions, but the literature also suggests community colleges are particularly sensitive to changes in the economy. Community and technical colleges have specific mission statements that are geared toward serving the local labor force by providing training in specific areas of need, as illustrated by the KCTCS mission statement: “At KCTCS it is our mission to enhance the quality of life and the employability of the citizens of the Commonwealth by serving as the primary provider of college and workforce readiness, transfer education, and workforce education and training.” It is clear from KCTCS’s mission that a central pedagogical focus is the training and education of Kentucky’s workforce. Given this mission, it is logical that enrollment at KCTCS is sensitive to changes in the labor market. This relationship shows that KCTCS acts as a safeguard for the people of the Commonwealth by providing a buffer during difficult economic environments. However, the relationship also shows that periods of strong economic performance lead to

lower enrollment and tuition revenue. This should not be understood as a failure of enrollment initiatives put forward by KCTCS, but rather, the sensitivity of KCTCS enrollment to economic cycles. The results presented in this report should also not be interpreted as meaning KCTCS can do nothing about enrollment. Future research should explore the possibility that enrollment initiatives put in place throughout the system helped stave off even steeper declines during recent periods of economic strength. Further, 15% of the variation in enrollment remains unexplained by the model, leaving room for KCTCS to significantly impact future enrollment. Finally, the results presented in this report highlight the potential for coming gains in enrollment as the economy cycles back to normal levels of economic performance. Current economic outlooks are uncertain, but historic trends suggest that the economy will not continue to perform at peak levels.

References:

- Barr, A., & Turner, S. (2015). Out of work and into school: Labor market policies and college enrollment during the Great Recession. *Journal of Public Economics*, 124, 63-73.
- Betts, J. R., & McFarland, L. L. (1995). Safe port in a storm: The impact of labor market conditions on community college enrollments. *Journal of Human Resources*, 741-765.
- Dellas, H. & Sakellaris, P. (2003). On the cyclicity of schooling: Theory and evidence. *Oxford Economic Papers*, 55(1), 148-172.
- Gustman, A. L., & Steinmeier, T. L. (1981). The impact of wages and unemployment on youth enrollment and labor supply. *The Review of Economics and Statistics*, 553-560.
- Hillman, N. W., & Orians, E. L. (2013). Community colleges and labor market conditions: How does enrollment demand change relative to local unemployment rates?. *Research in Higher Education*, 54(7), 765-780.
- Mullin, C.F., & Phillippe, K. (2009). *Community college enrollment surge. AACC policy brief series*. Washington D.C.: American Association of Community Colleges.
- National Student Clearinghouse Research Center (2019). Current term enrollment 2019. Retrieved from <https://nscresearchcenter.org/currenttermenrollmentestimate-spring2019/>.
- Schmidt, E. (2018). *Postsecondary enrollment before, during, and since the great recession*. Washington D.C.: United States Department of Commerce: Economics and Statistics Administration.

