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Understanding the Effects of Campus Safety on College Student Retention: A Panel Data Analysis

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ABSTRACT

Student success can be defined positive student outcomes based on the operational activities and support provided by a learning institution. Student success outcomes measurements primarily focus on advancement towards persistence, graduation, and good academic standing but there are non-academic experiences that can also impact student success. This paper explores the relationship between campus safety and student outcomes pertaining to retention and completion rates. One hundred and thirty public and private Research Tier 1 (R1) universities were used in this analysis. The R1 universities meet the highest benchmarks in research activity and expenditures as measured by the Carnegie Classification of Institutions of Higher Education. In developing analysis, data were collected from the College Scorecard database and the official website of Campus Safety and Security. The data was then curated and analyzed using different statistical procedures in SAS® Enterprise Guide® and SAS® Viya®. Our analysis does not show a strong association between campus security and student retention or completion rates, however socio-economic and admissions related factors do present themselves as affecting student success.

INTRODUCTION

Higher education student retention is influenced by social forces other than students' own academic performance. Socio-economic factors such as educational attainment of parents and family income, contextual factors such as institutional size and the extent to which students receive financial aid, and psychological factors such as self-confidence, academic motivation, and social support have been found to affect college student retention (Lotkowski, Robbins, & Noeth, 2004). However, there is a lack of evidence in the effects of environmental factors (e.g., college crime) on college student retention. Previous research has revealed that students do not prioritize college crime in the college selection process, compared to their parents (Mansfield & Warwick, 2006). However, it is unknown whether the campus safety environment would have an impact on students' decision to retain at the same college after the first year, transfer to another college, as well as the ability to graduate from the college. This paper focuses on the predictors of retention and completion at R1 universities. We analyze the distribution of college crime between public and private R1 universities, the relationship between campus safety and retention/completion, as well as the relationship between socio-economic and contextual factors and retention/completion.

DATA

Institutional-level data was collected from two available sources, College Scorecard and Campus Safety and Security Data Analysis Cutting Tool, both administered by the U.S. Department of Education. We use an identifier in the College Scorecard dataset (CCBASIC=15) and select all Research Tier One (R1) universities (N=131). We later excluded CUNY-Graduate Center from our analysis (N=130) as campus crime data was missing.

PROBLEM/RESEARCH QUESTIONS

We propose three research questions as follows.

1: How does campus crime distribute among public and private R1 universities?

2: How does campus crime affect student retention and completion?

3: How do socio-economic and contextual factors influence retention and completion?

DATA CLEANING AND PROCESSING

Data in College Scorecard is reported in academic years and is cohort-based (e.g., Fall 2015 cohort means students attended college the first time in Summer/Fall 2015). The cohorts selected for this analysis are Fall 2008, 2009, 2010, 2011, and 2012 because retention, completion, and transfer rate, as well as the cost of attendance, have been reported in those specific cohorts only. Campus crime data is reported in calendar years. The average crime per capita for all selected R1 universities was calculated as:

$$\text{Average Crime per Capita} = \frac{\text{Total Crimes Excluding Hate Crimes}}{\text{Total Enrollment}}$$

For example, for the fall 2008 cohort, we calculate average crime per capita from the calendar year 2008 to 2009 for first-year retention analysis, from 2008 to 2012 for 4-year completion analysis, and from 2008 to 2014 for 6-year completion and transfer analysis.

ANALYSIS

DESCRIPTIVE STATISTICS

Among the selected 130 universities in the United States, 28.5% of them are privately owned (N=37) and 71.5% of them are public universities. In general, a student studying in an R1 university would experience 0.14, 0.35, and 0.49 cases of crime over the one, four, and six years of enrollment.

| **Table 1. Public Universities with the Highest 6-Year Average Crime Per Capita**		
Public Institution ▲	6yr Completion Rate	6yr Crime per Capita ▼
University of California-Santa Cruz	0.77	2.05
University of Colorado Boulder	0.70	1.62
West Virginia University	0.58	1.48
University of Hawaii at Manoa	0.58	1.10
University of Wisconsin-Madison	0.86	1.08
University of California-San Diego	0.86	1.01
University of Oregon	0.71	1.01
University of Michigan-Ann Arbor	0.91	0.86
Michigan State University	0.79	0.86
Colorado State University-Fort Collins	0.68	0.85

Table 2. Private Universities with the Highest 6-Year Average Crime Per Capita		
Private Institution ▼	6yr Completion Rate	6yr Crime per Capita ▼
Boston College	0.92	1.81
University of Rochester	0.86	1.24
Syracuse University	0.82	1.22
Duke University	0.95	1.08
Case Western Reserve University	0.82	0.98
Johns Hopkins University	0.93	0.97
Brandeis University	0.89	0.85
Vanderbilt University	0.93	0.84
Washington University in St Louis	0.94	0.83
Dartmouth College	0.95	0.82

Table 1 and Table 2 indicate the top 10 public and private universities with the highest 6-year per capita crime rates. See Table 3 and Table 4 in the Appendix for institutions with

the lowest crime. The analysis of crime rate and completion rates shows that the average 6yr crime rate has increased for Private R1 universities from 2008 to 2012 cohort while it has decreased for Public R1 universities. However, the average 6yr completion rate has increased for all cohorts for both sectors (Figure 1 and Table 5 - Appendix). The crime rates are lower in public institutions, while the college completion rate is higher in private institutions. Table 5 presents the mean score of the dependent and independent variables used. The results confirm private universities are more selective with higher SAT, less affordable, attract more international students, and score higher retention and completion rates. However, they also report a higher crime rate than public institutions. We further explore the relationship between campus crime and retention/completion using advanced statistical models.

Figure 1. Crime Rates and Completion Rates by Institution Type
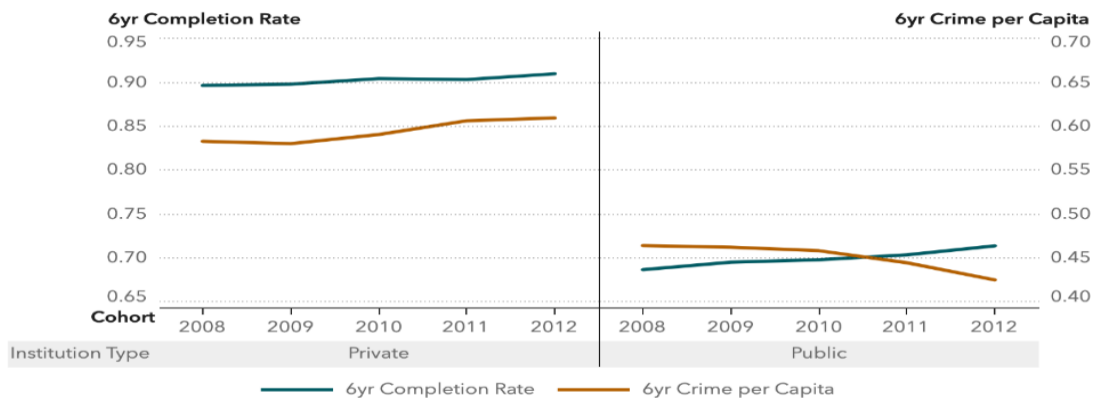
INFERENTIAL STATISTICS

For this study, four different regression models in the PANEL procedure of SAS® Enterprise Guide® were used. The regression models were first-year retention rate, four-year completion rate, six-year transfer rate, and six-year completion rate among the 130 selected institutions. The model building procedures as recommended by Gutierrez and Sanford (2015) were followed. This included the random-effects model using the RANONE option in the MODEL statement. Below is an example modeling first-year retention rate (ret_ft4) as a function of 1-year campus crime per capita (crime1_p) and other factors.

```
proc panel data = cohort_crime_merged_c;
     id unitid cohort;
     model ret_ft4 = control adm_rate sat_avg inexpete avgfacsal petfac
     petpell pctfloan income_cost ugds_nra ugds_women crime1_p/RANONE;
run;
```

If the Hausman Test for Random Effects indicates a p<0.05, the next step would be to run the fixed-effects model using the FIXONE option in the MODEL statement. The following process would be fitting the Hausman and Taylor model using the HTAYLOR option in the MODEL statement. The correlated variables would then be specified in the INSTRUMENTS statement before the MODEL statement. If the Hausman Test against Fixed Effects suggests a p>0.05, the results from the Hausman and Taylor model would be accepted and the results from the fixed-effects model would be rejected. Finally, the Hausman and Taylor model is adopted for first-year retention analysis, the fixed-effects model is accepted for four-year completion analysis and six-year completion analysis. Whereas, the random-effects model is selected for six-year transfer analysis.

The results of the four panel regression models are presented in Table 6 (see Appendix). It can be inferred that: (1) campus crime is not associated with student retention, transfer, or completion, (2) private universities and higher SAT scores are related to higher first-year retention rate, (3) higher SAT, a higher percent of Pell grant awardees, and lower affordability are related to higher 4-year completion rate, (4) lower SAT and a lower percent of full-time faculty are related to higher 6-year transfer rate, and (5) higher SAT, a higher percent of Pell grant awardees, lower affordability, and a higher percent of female students are related to higher 6-Year completion rate.

VISUALIZATION

Figure 2. Geographic Distribution of 6yr Campus Crime per Capita

6-Yr CR (Crime Rates) by Institution Type
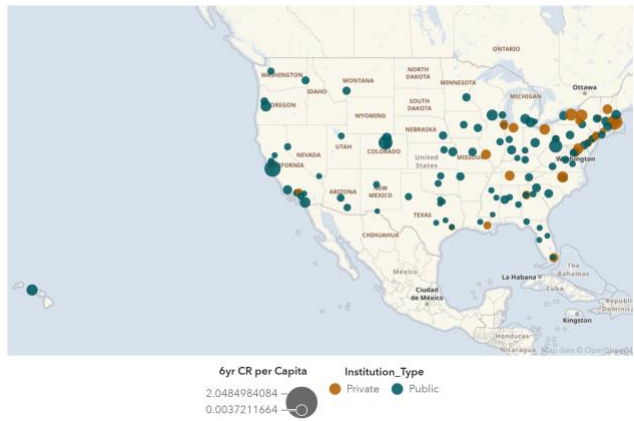
Figure 3. Correlations among Selected Variables
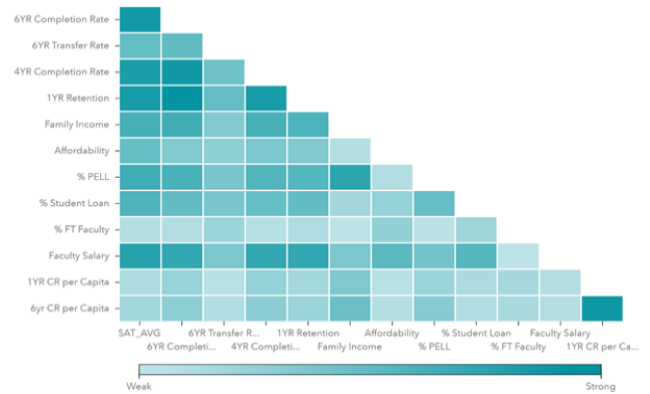

Correlation of Selected Measures

Figure 2 is generated by the SAS® Visual Analytics Geo Map in SAS® Viya®. It can be observed that there is a larger number of private R1 schools clustered in the Northeast of the U.S. Those institutions are in predominantly metropolitan areas where the larger populations might lead to higher crime rates and crime reporting rates. Figure 3 summarizes Pearson's correlation coefficient among 13 focused variables. SAT score (SAT_AVG) has a strong correlation (87%) to 1-year retention (RET_FT4). Average faculty salary (AVGFACSAL) has a strong (73%) correlation to 1-year retention. Family Income (FAMINC) has a somewhat strong (63%) correlation to SAT.

GENERALIZATION

The analysis in this research focused on the R1 public and private universities in the United States of America. The research is provided so that non-technical researchers can use the data and results to make decisions for universities to study and improve upon. There are different types of crimes that contribute to the overall crime number on campus. But for this analysis, the sum of crimes in each university was used instead of analyzing each type of crime separately.

SUGGESTIONS FOR FUTURE STUDIES

Being that the generalization analysis was focused on R1 universities, the research can be expanded to colleges and universities across the U.S. that are less research-focused and more teaching-oriented. Although no evidence was found for the negative impact of campus crime on student retention and completion in R1 universities, more research is needed among other institutions. Future research could benefit from the comparison between

campus crime and crime in the university zip code area so that we can examine whether campus crime is under-reported or overrated.

CONCLUSIONS

This analysis facilitated to conclude that there is no significant association between campus safety and college students' completion and retention rate. SAT average score is the prime determinant for retention and completion. Mixed-effects of socio-economic and institutional factors on retention and completion rates were found through the analysis. A university with more students who are Pell grant awardees and is less affordable to attend tends to have more students completing the degree in four and six years. The decision to return after one year of attendance is influenced by students' SAT scores and institution type, suggesting that the selectivity of private universities is closely related to retention. Campus crime has been used to determine the safety situation on campus by parents when selecting a college (Mansfield & Warwick, 2006), but this analysis shows that it is not a deciding factor for continuing education. Students might give quality of education, the profile of the faculty, and other opportunities more importance while choosing their higher education pathways.

ACKNOWLEDGMENTS

REFERENCES

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Lotkowski, V. A., Robbins, S. B., & Noeth, R. J. 2004. "The Role of Academic and Non-Academic Factors in Improving College Retention." *ACT Policy Report*. American College Testing ACT Inc.

Mansfield, P. M., & Warwick, J. 2006. "Gender Differences in Students' and Parents' Evaluative Criteria when Selecting a College." *Journal of Marketing for Higher Education*, 15: 47-80.

Table 3. Public R1 Universities with the Lowest 6-Year Average Crime Per Capita

Public Institution ▲	6yr Completion Rate	6yr Crime per Capita ▲
The University of Texas at El Paso	0.39	0.04
University of Southern Mississippi	0.48	0.06
University of Houston	0.53	0.07
Texas A & M University-College Station	0.80	0.09
University of Central Florida	0.70	0.09
Wayne State University	0.40	0.10
The University of Texas at Arlington	0.47	0.10
Florida International University	0.57	0.10
The University of Texas at Austin	0.81	0.11
New Jersey Institute of Technology	0.62	0.11

Table 4. Private R1 Universities with the Lowest 6-Year Average Crime Per Capita

Private Institution ▼	6yr Completion Rate	6yr Crime per Capita ▲
University of Chicago	0.93	0.10
Harvard University	0.97	0.19
Rice University	0.93	0.20
Massachusetts Institute of Technology	0.93	0.21
Yale University	0.97	0.22
Stanford University	0.94	0.27
Carnegie Mellon University	0.89	0.27
Rensselaer Polytechnic Institute	0.83	0.27
Brown University	0.96	0.29
Tufts University	0.93	0.30

Table 5. Average Score of Dependent and Independent Variables

Variables	Average Score of	Public Universities	Private Universities
Dependent Variables	1yr Retention Rate	86.0%	95.3%
	4yr Completion Rate	46.6%	77.9%
	6yr Transfer Rate	9.6%	1.3%
	6yr Completion Rate	70.0%	90.3%
Independent Variables - Crime	1yr Crime per Capita	0.13	0.16
	4yr Crime per Capita	0.33	0.41
	6yr Crime per Capita	0.45	0.59
Independent Variables - Socioeconomic/Contextual Factors	Admission Rate	63.9%	26.3%
	SAT Score	1156	1389
	Instructional Expenditure per Student	$11,870	$39,225
	Faculty Salary	$9,324	$12,026
	Percent Full-Time Faculty	79.3%	74.2%
	Percent with Pell Grant	27.2%	15.1%
	Percent with Loan	45.4%	34.8%
	Percent Female Students	50.5%	49.9%
	Percent International Students	3.6%	8.1%
	Family Income	$66,591	$89,780
	Cost of Attendance	$21,418	$54,477

Table 6. Results of Panel Regression Modeling of Retention/Transfer/Completion

	1-year Retention	4-year Completion	6-year Transfer	6-year Completion
Institution Type	0.0755*** (0.0199)	N/A (Constant)	-0.0131 (0.0283)	N/A (Constant)
Admission Rate	-0.0069 (0.0109)	-0.0167 (0.0208)	-0.0148 (0.0339)	0.0003 (0.0150)
SAT	0.0002*** (<0.0001)	0.0004*** (<0.0001)	-0.0003*** (<0.0001)	0.0005*** (<0.0001)
Instructional Expenditure per Student	<-0.0001 (<0.0001)	<-0.0001 (0)	<0.0001 (0)	<0.0001 (0)
Faculty Salary	<-0.0001 (<0.0001)	<0.0001 (0)	<0.0001 (0)	<0.0001 (0)
Full-time Faculty	-0.0039 (0.0116)	0.0236 (0.0223)	-0.0714* (0.0333)	0.0130 (0.0161)
Pell Grant	0.0313 (0.0195)	0.0857* (0.0374)	0.0871 (0.0620)	0.0710** (0.0270)
Student Loan	-0.0178 (0.0139)	0.0261 (0.0267)	0.0616 (0.0422)	-0.0084 (0.0192)
Affordability (Income-Cost Ratio)	-0.0009 (0.0030)	-0.0286*** (0.0056)	0.0117 (0.0087)	-0.0088* (0.0041)
Percent Female	0.0268 (0.0544)	-0.1009 (0.1418)	-0.0681 (0.1127)	0.2043* (0.1018)
Percent International	0.0814 (0.0439)	0.0833 (0.0836)	0.1529 (0.1332)	0.0770 (0.0603)
1 yr. Crime per Capita	-0.0072 (0.0118)	-	-	-
4 yr. Crime per Capita	-	0.0073 (0.0134)	-	-
6 yr. Crime per Capita	-	-	0.0035 (0.0155)	0.0056 (0.0097)
Intercept	0.5509	0.1157	0.4064	0.1027
Observations	130	130	130	130
R-Squared	0.2588	0.9940	0.0918	0.9928
Model	Hausman & Taylor	Fixed-Effects	Random-Effects	Fixed-Effects

Note: *p<0.05, **p<0.01, ***p<0.001

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