2018

Examining the Impact of University Sports Success on Freshman ACT Scores: An Empirical Analysis

Connor Yackels
University of Mississippi. Sally McDonnell Barksdale Honors College

EXAMINING THE IMPACT OF UNIVERSITY SPORTS SUCCESS ON FRESHMAN ACT SCORES: AN EMPIRICAL ANALYSIS

By Connor Alexander Yackels

A Thesis presented in fulfillment of the requirements for completion of the Sally McDonnell Barksdale Honors College.

Oxford, MS

May 2018

Approved by:

____

Advisor: Professor Walter Mayer

____

Reader: Professor Xin Dang

____

Reader: Professor Andrew Mullins

ABSTRACT

CONNOR ALEXANDER YACKELS: Examining the Impact of University Sports Success on Freshman ACT Scores: An Empirical Analysis

(Under the direction of Dr. Walter Mayer)

My study presents a model in which incoming freshman ACT scores are a function of football, basketball, and baseball regular season and postseason success, using academic variables as controls. I contribute to the existing literature by including baseball in the analysis in addition to football and basketball, using ACT scores instead of SAT scores, using a unique and expanded set of variables to measure sports success, and more recent data. For the time period 2006-2014, I find weak evidence that supports the hypothesis that athletic success positively influences ACT scores.

TABLE OF CONTENTS

Introduction

The Grove at the University of Mississippi offers a tailgating experience unlike that offered at any other college campus. On Saturdays in the fall, thousands of fans gather to prepare to watch the Ole Miss football team compete. The Grove has a well-earned reputation of being one of the premier hotspots for tailgating, and its appeal draws in sports enthusiasts from all over the country. College sports competitions and the associated pageantry captures the attention of millions of people, including those who have yet to experience college for themselves. This raises the question as to what extent do college sports influence the choice of where to attend college? It is reasonable to assume that a prospective student would, all else equal, want to attend a university with a more successful sports program. Thus, a college sports program that performs well can increase the number of submitted applications to that school. In this way, university athletics functions as advertising does by promoting the university. If we surmise that such a university receives an increased number of applications, school administrators can choose to either take in more students, tighten admission restrictions, or apply some combination of both. If the latter approach is taken, the influx of applications would result in a better-prepared incoming freshman class as measured by standardized test scores like the SAT and ACT. My study will attempt to analyze the effect that football, basketball, and baseball performance have on the ACT scores of incoming freshmen and whether this effect is statistically significant. Sports performance can be measured in a variety of ways including winning percentage, postseason performance, or national championships. If such a link is found between sports success and the quality of incoming freshmen, then investment in athletic programs becomes more appealing to university administrators who wish to attract better students. In the Literature Review section, I will summarize previous research related to this topic. These studies have analyzed the effects that sports (football and/or basketball) performance has on factors such as the number of applications received, incoming freshman SAT scores, graduation rates, and others.

Literature Review

Previous studies have investigated some of the key underlying relationships my study tries to uncover. These can be categorized by the sports analyzed and the effect that success had on a multitude of dependent variables. For example, McCormick and Tinsley (1987) use football success measures to explain incoming freshman SAT scores, Tucker (2004) uses football and basketball success to explain graduation rates and alumni giving rates, and Murphy and Trandel (1994) use football success to explain the number of applications received. The studies that are analyzed in this section can also be further broken down in terms of what variables are used to measure sports success, the type of data set, and the analysis tools employed. The rest of this section will discuss how these studies are structured and their results

McCormick and Tinsley (1987) question whether athletics detracts from or supports academics. Citing several examples of schools in which admission applications vastly increased in the admission cycle following a national championship, they test whether “big-time” sports success can lead to increases in incoming freshman SAT scores and, thus, support the theory that athletics supports academics. In the first part of their analysis, McCormick and Tinsley examine 150 schools of various sizes from across the country, some of which do not have athletics programs. They use a dummy variable to indicate the presence of university athletics on campus. Next, they regress freshman SAT scores against the athletics dummy variable, while controlling for tuition, professor salary, and other academic factors. They find that the athletics dummy variable is significant and that on average led to a 3% increase in SAT scores. This finding suggests that a university that participates in college athletics is more likely, all else equal, to have a more intelligent student body. In the second part of their study, they analyze the effect of big-time college football success on freshman SAT scores. “Big-time” is defined as a sports program that has membership in one of the top conferences. They measure football success using in-conference winning percentage for each year over a 4-year period. To capture how football success is associated with changes in SAT scores over time, they regress the change in average SAT score over the 4-year period on the trend in winning percentage as well as the change in the academic variables. The football winning percentage trend variable ends up being positive and significant, indicating that football success plays a statistically significant role in determining incoming freshman SAT scores. The results from both parts of McCormick and Tinsley’s analysis suggest that athletics plays a role in boosting university academics.

Posing a different question, Tucker (2004) asks whether big-time football and basketball success play a significant role in determining graduation rates and alumni giving rates after controlling for academic factors. The graduation rate is measured as the percentage of students who graduate in six years or fewer while the alumni giving rate is the percentage of alumni who donate to the university in a given year. Tucker uses three measures of football and basketball success. For football, he uses overall winning percentage, a dummy variable for bowl appearance, and final AP poll ranking. For basketball, he uses overall winning percentage, a dummy variable for appearance in the NCAA tournament, and final AP poll ranking. He takes data from 78 colleges in the largest conferences in terms of enrollment. After first regressing graduation rates against the athletic and academic variables, he finds that all three measures of success are positive and significant for football but none are significant for basketball. A possible explanation for this result that he suggests is that a successful football program encourages students to stay and graduate. He reports that a 10 percentage point increase in winning percentage increase the graduation rate by 2% on average. Tucker finds similar results when regressing alumni giving rates on the same variables. In this case, the three football variables are positive and significant while again the basketball variables are not. The main takeaway from Tucker's study is that sports can have positive spillovers into academics, but football plays a much more significant role than does basketball.

The effect of athletic success on the number of applications is investigated by Murphy and Trandel (1994). They preface their study in much the same way that McCormick and Tinsley do by asking whether the investment into college athletics is worth the benefits it brings, both in student enjoyment and its spillover effects on academics. They specifically look at football success, using in-conference winning percentage as a proxy for athletic success. They then construct a panel data set for 10 years. Control variables include population characteristics such as the number of high school graduates, income per capita, and traditional academic variables like tuition and professor salary. Also, by using a fixed-effects estimation technique, Murphy and Trandel are able to control for unobservable time-invariant characteristics of a university that do not change over time. They find that football record is positively significant even while using robust standard errors. However, the effect is fairly moderate: an average 1.3% increase in applications for every 25 percentage point increase in football winning percentage. The results of this study support the hypothesis that a successful sports program can increase the popularity of the school among the population of prospective students.

Toma and Cross (1998), in a similar study, examine the effects of both football and basketball success on application totals. They seek to answer three key questions: Did winning a national championship affect the number of applications received? Are these changes significant compared to peer schools? Was the application increase temporary or did it persist into the following years? They proceed by analyzing the teams that won football or basketball championships over a 13-year period, and compare the changes in applicant totals to that of their peer schools. They find that 14 of the 16 football championship winning schools saw increases in applicant totals and that the increase persisted over a 3-year period following the championship. They also find that these increases outpaced those of their peer schools in the vast majority of cases. Similarly, 10 of the 13 basketball championship winning schools saw increases in applicant totals in both the following year and over a 3-year horizon, but the increases were in most cases not as large as the increase due to winning a football championship. They conclude that winning championships in either sport does have a prominent impact on applicant totals even when compared to peer schools, but the effect of football success is greater.

Tucker and Amato (1993) use a slightly different approach when measuring football and basketball success as they try to explain SAT scores. Instead of using the traditional proxies like winning percentage or national championship wins, they use a points system based on final AP rankings. For example, a team that finishes number one in the final AP poll (that is, the national champion) for a given year would receive 20 points, the team that finishes second would get 19 points, and so on. They examine 63 large-conference schools over a 10-year period and add up the point totals for each school. They regress the change in average SAT scores against the point total and changes in academic variables and found that the point total is significant for football but not for basketball. Thus, they conclude that football strength does contribute to increases in SAT scores over time, indicating that better-prepared students gravitate towards schools which have higher-performing football teams.

In a much more recent study, Pope and Pope (2014) use a panel data approach to investigate the relationship between football and basketball success versus application totals. They use dummy variables for winning a championship, whether a team finished in the top 10 of the AP rankings, and also a dummy variable for each round of the NCAA basketball tournament that would indicate the round to which a team advanced. They estimate a fixed-effects model using applicant totals as the dependent variable and including robust standard errors. They find that winning a championship, finishing in the top 10 of the AP poll, and making it to the later rounds of the NCAA championship all contribute significantly to increases in the number of applications received.

In summary, the literature suggests that there is a link between athletic and academic success. Using measures for sports success, these studies suggest that having a successful sports program increases applicant totals, SAT scores for incoming freshman, graduation rates, and alumni giving rates.

Data Collection and Description

The data for the present study are on 64 universities from the Power 5 Conferences (ACC, Big 10, Big 12, Pac-12, and SEC) between 2006-2014 and organized into a panel. These schools are among the largest in the country and their sports programs most visible. Consequently, they have the greatest chance of having the performance of their sports program known to prospective students. Despite spanning nine years, the data set includes only seven years because *Peterson's Guide to Four-Year Colleges* did not report several of the academic variables in the 2010 and 2015 editions. However, the seven years covered by the data set should be sufficiently large to analyze lagged and persistent effects. Each variable included in the analysis can be broken down into three categories: test score, academic, and athletic. All variables are described in Table 1 of the appendix. Test score variables are taken directly from past editions of *Peterson's Guide to Four-Year Colleges* and measure the testing performance of incoming freshman. They are reported as a percent of students earning higher than a given threshold. For example, the percentage of students who earned greater than 700 on the SAT math section and the percentage of students who earned greater than a 24 on the ACT are reported, as are other similar figures with different thresholds. Academic variables are measures of the academic strength of a university. They include tuition, student faculty ratio, and age. Data for these are also obtained from *Peterson's Guide to Four-Year* Colleges.

Athletic variables measure the success of a university's football, basketball, and baseball team by reporting regular season and postseason success. They include winning percentage, lagged winning percentage, bowl appearance, national championship, and conference championship. The athletic data sets were obtained from Boyd's World, an online database for college baseball and Sports Reference, another online database for college football and basketball. The objective is to explain test score variables in terms of the academic and athletic variables. The focus is on the impact of the athletic variables using the academic variables as controls.

As indicated in Table 1, the *act24* variable measures the percentage of students who earned greater than a 24 on the ACT. Since most schools within the sample have ACT ranges from the low 20s to the high 30s, the *act24* variable most accurately represents the core group of students applying to these universities, as opposed to *act18* which generally includes too many students, or *act30* which generally excludes too many. From Table 2, the average value of *act24* is 74.4 which indicates that the average school in the sample admits 74.4% of students who earn greater than a 24 on the ACT, whereas the average value of *act18* is 98.1. Thus *act24* has the greatest variation among ACT test score measures and is more sensitive to changes due to external factors like athletic success. Some descriptive statistics about the academic variables are as follows.

The average age of the universities is 155 years, the average endowment is approximately $1.6 billion, average enrollment is about 22,000, and the average student faculty ratio is 16.6.

Conceptual or Theoretical Framework

Previous studies offer two theories to explain the effects of athletic success in the student college choice model, as summarized by Pope and Pope (2014). In short, one theory is that students may prefer future consumption and put more weight on academic success and future earnings while the other theory suggests that sports success acts as an advertisement tool and draws in students, implying that the student attaches more weight to present consumption.

To explain test scores, a model including both academic and athletic variables will be specified and estimated. The reason for including both sets of variables as independent variables is to control for the academic factors of a university, which are included in the academic variables category, to capture a ceteris paribus relationship between the athletic variables and the test score variables, namely *act24*. The expected signs for the academic variables age and endowment are positive since presumably an older university has more prestige, academic resources, and better funding, and a higher endowment generally indicates more funding that can be allocated to academic departments. Enrollment and tuition may have either sign since a higher enrollment may attract students or push them away depending on student preferences, while a higher tuition could indicate strong academic performance but may drive students away due to the high cost. We would expect student-faculty ratio to have a negative effect on *act24* since a higher student-faculty ratio indicates larger class sizes which means students receive less individual attention.

The expected signs of all the athletic coefficients are positive according to the “advertising effect” (the second school of thought) which proposes that successful athletics acts as a form of positive advertisement to prospective students. Following from this effect, more students will thus apply, and admissions can accept higher quality students. The athletics variables explain athletic success by accounting for both regular season and postseason performance. Winning percentage is the primary measure of regular season success, but postseason success, which is arguably more important, is measured in different ways for each sport: bowl appearance, bowl win, conference championship, and national championship for football; conference championship, NCAA tournament appearance, and national championship for basketball and baseball. The postseason success variables like bowl games and NCAA tournaments are clearly the most visible for prospective students.

Econometric Estimation and Results

The following model will be estimated:

$$act24_{it} = a_i + u_{it} + \boldsymbol{\beta}_1\boldsymbol{X}_{it} + \boldsymbol{\beta}_2\boldsymbol{A}_{it}$$

where the percentage of incoming freshmen earning a 24 or higher on the ACT for school i during year t depends on $\boldsymbol{X}_{it}$, a vector containing academic variables, and $\boldsymbol{A}_{it}$, a vector of athletic variables. The model also specifies an intercept for each observation as well as an error term. The model is estimated using both fixed-effects and random-effects methods. The fixed-effects model controls for various time-invariant factors that affect each university by differencing them out of the model, whereas the random effects model assumes these factors are uncorrelated with the independent variables. All models are estimated using robust standard errors.

Table 3 contains the results of a level-level fixed-effects estimate. The academic factors of age, endowment per student, and tuition are significant, with age having a positive effect, and the other two a negative effect. The sign of age is consistent with economic theory, but the sign of endowment per student is not. A possible explanation is that endowment per student is highly correlated with the other academic variables, which leads to the unexpected result. The signs and significance of the athletic variables pose interesting questions. Winning the baseball national championship is negatively significant, which provides evidence against the advertising effects framework assumption. One possible explanation for this result is that the schools that won the national title come from a subset of the sample with lower ACT scores compared to the rest of the sample. Another consideration is that the result is due to spurious correlation or an omitted variable bias. According to the estimate, winning the baseball national title corresponds to an average decrease in *act24* of 6.77. For football, winning a national championship is positively significant, which is consistent with previous studies. Winning the football national title is associated with an increase of 3.09 to *act24* on average. Basketball contains no significant variables, even though in most studies, winning a national championship had a positively significant effect. Again this may be because teams who won the national title had on average lower ACT scores relative to the sample, which is especially possible in this case since only seven observations for basketball national championship are used.

Table 4 contains results similar to those in Table 3, but instead a log-level fixed-effects model is estimated, which is the reason for the slight changes in the t-statistics and p-values. The academic variables that were significant in the level-level model are significant in the log-level model. Furthermore, the same athletic variables that were significant in the first estimate are significant in this case, with the addition of baseball conference championship. Similar to baseball national championship, baseball conference championship is also negative. Winning the conference title and national title for baseball corresponds to an average decrease of 2.83% and 16.4% in *act24,* respectively. In addition, winning the football national championship is associated with an average increase in *act24* of 3.98%.

Table 5 contains the results of a level-level random effects model estimate, and there are a few notable differences compared to the first two estimates. Endowment per student becomes insignificant while tuition becomes highly, positively significant as opposed to negative previously. Baseball winning percentage and conference championship lose their significance, as does national championship, which falls just outside the 10% p-value range. The results for football are similar to those of the fixed-effects log-level model, with national championship remaining significant and representing a 3.66 increase in *act24* on average.

Table 6 contains the results of three joint hypothesis tests of the level-level fixed-effects estimate, using all of the variables for a given sport. The null hypothesis is that the athletic factors are all zero. Both baseball and football are significant at the 1% level, while basketball is significant at the 10% level.

Since none of the basketball success measures were significant in any of the specifications, it is of interest to analyze how the estimates change when basketball is dropped from the model. Table 7 contains the results of a level-level fixed-effects estimate with only baseball and football. In this specification, the only variable that is significant is baseball winning percentage, which has a large positive effect on *act24*. Contrary to the other specifications, baseball national championship and football national championship are no longer significant. Thus the effect of baseball changes greatly when basketball is removed, which may be the result of correlation between the sports success measures.

Other model specifications were estimated which varied by the sports success measures that were included. However, these estimates did not change the overall results, so they are not presented here.

A Durbin-Wu-Hausman test was performed to determine whether a fixed-effects model or a random effects model is more suitable. A significant p-value provides evidence for using the fixed-effects model. Table 8 reports the Wu-Hausman statistic and its p-value of 0.9772, which strongly indicates that a random effects model is preferred due to higher efficiency of the estimators.

What these results indicate is that sports success has an ambiguous effect on ACT scores. For example, in the fixed-effects models, baseball had both positively and negatively significant variables, which seem to contradict each other. The effect of a football national championship was positively significant in all three models, while basketball did not contain a significant variable in any of the models. There are many possible explanations for why my results differ from some previous studies. For one, some of the variables may be significant due to spurious correlation or an omitted variable bias, which can produce misleading results. Second, the athletic factors may have high multicollinearity due to the fact that they all measure sport success in one way or another. My choice in variables could be refined and possibly produce results more consistent with other studies. For example, more trend variables could be added to the model to better capture changes over time.

Conclusion

The complicated relationship between university athletics and academics remains largely a mystery. My study attempts to unravel the relationship between the two. I find weak evidence for the hypothesis that athletic success positively influences ACT scores, which means more investigation into the relationship is warranted. What my study suggests is that the academic strength of a university does more to explain the quality of students it attracts than do athletic success factors, but such factors can have their own significant influence. Further avenues of research may include using more trend variables to capture effects over time, or using some other measure of sports success entirely. Overall, investigation of this relationship remains important today for school administrators who wish to attract the best-prepared students as possible, and they can use their sports programs as a means to possibly achieve that end.

Appendix

Table 1

Variable Descriptions		
Variable	**Category**	**Description**
year	time	year corresponding to the fall admissions cycle for which the athletic and academic variables explain
id	cross-section	identification number for each school
satcr500	test score	% of freshman who earned greater than 500 on critical reading portion of SAT
satmath500	test score	% of freshman who earned greater than 500 on math portion of SAT
satwriting500	test score	% of freshman who earned greater than 500 on writing portion of SAT
satcr600	test score	% of freshman who earned greater than 600 on critical reading portion of SAT
satmath600	test score	% of freshman who earned greater than 600 on math portion of SAT
satwriting600	test score	% of freshman who earned greater than 600 on writing portion of SAT
satcr700	test score	% of freshman who earned greater than 700 on critical reading portion of SAT
satmath700	test score	% of freshman who earned greater than 700 on math portion of SAT
satwriting700	test score	% of freshman who earned greater than 700 on writing portion of SAT
act18	test score	% of freshman who earned greater than 18 on ACT
act24	test score	% of freshman who earned greater than 24 on ACT

logact24	test score	natural logarithm of *act24*
act30	test score	% of freshman who earned greater than 30 on ACT
privateschool	academic	= 1 if university is private, 0 otherwise
age	academic	age in years of university
logage	academic	natural logarithm of *age*
endowmentmillions	academic	university endowment in millions of dollars
logendowmentmillions	academic	natural logarithm of *endowmentmillions*
enrollment	academic	undergraduate enrollment
logenrollment	academic	natural logarithm of *enrollment*
endowmentperstudent	academic	*endowmentmillions* divided by enrollment
logendowmentperstudent	academic	natural logarithm of *endowmentperstudent*
tuition	academic	average of in-state and out-of-state tuition
logtuition	academic	natural logarithm of *tuition*
studentfacultyratio	academic	total number of students divided by number of faculty
logstudentfacultyratio	academic	natural logarithm of *studentfacultyratio*
big10	academic	= 1 if university is in Big 10, 0 otherwise
big12	academic	= 1 if university is in Big 12, 0 otherwise
acc	academic	= 1 if university is in ACC, 0 otherwise
pac12	academic	= 1 if university is in Pac 12, 0 otherwise
baseballwinning	athletic	baseball winning percentage
baseballwinninglagged	athletic	baseball winning percentage from the previous year
baseballwinningmovingaverage	athletic	a moving average of baseball winning percentage up to and including the current year

baseballconferencechampionship	athletic	= 1 if team won baseball conference tournament, 0 otherwise
baseballnationalchampionship	athletic	= 1 if team won baseball national championship, 0 otherwise
baseballncaatournamentappearance	athletic	= 1 if team made NCAA baseball tournament, 0 otherwise
footballwinning	athletic	football winning percentage
footballwinninglagged	athletic	football winning percentage from the previous year
footballwinningmovingaverage	athletic	a moving average of football winning percentage up to and including the current year
footballconferencechampionship	athletic	= 1 if team won football conference championship, 0 otherwise
footballnationalchampionship	athletic	= 1 if team won football national championship, 0 otherwise
footballbowlappearance	athletic	= 1 if team made bowl game, 0 otherwise
footballbowlwin	athletic	= 1 if team won bowl game, 0 otherwise
basketballwinning	athletic	baseball winning percentage
basketballwinninglagged	athletic	basketball winning percentage from the previous year
basketballwinningmovingaverage	athletic	a moving average of basketball winning percentage up to and including the current year
basketballconferencechampionship	athletic	= 1 if team won basketball conference tournament, 0 otherwise
basketballncaatournamentappearance	athletic	= 1 if team made NCAA basketball tournament, 0 otherwise
basketballnationalchampionship	athletic	= 1 if team won basketball national championship

Table 2

Summary Statistics				
Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
satcr500	84.13	11.53	52	100
satmath500	89.16	9.45	60	100
satwriting500	86.57	12.35	48	100
satcr600	49.21	20.56	12	96
satmath600	60.35	20.70	17	97
satwriting600	54.67	23.96	12	97
satcr700	15.25	13.73	1	78
satmath700	22.59	18.32	2	82
satwriting700	19.05	17.86	1	76
act18	98.11	2.43	85	100
act24	74.37	16.60	38	100
act30	27.65	20.65	4	91
age	154.54	32.52	83	250
endowmentmillions	1573	2366	178.5	18700
endowmentperstudent	0.116	0.311	0.006	2.648
tuition	19225	12683	5542	59200
studentfacultyratio	16.68	3.72	5	26
baseballwinning	0.581	0.120	0.231	0.842
footballwinning	0.574	0.213	0	1
basketballwinning	0.603	0.152	0.194	0.949

Table 3

Level-Level Fixed-Effects Estimate		
Variable	**Coefficient (Robust Standard Error)**	**p-value**
age	1.65 (0.386)	0.000***
enrollment	-0.000305 (0.000319)	0.342
endowmentperstudent	-6.92 (3.98)	0.088*
tuition	-0.000532 (0.000301)	0.084*
studentfacultyratio	-0.599 (0.442)	0.181
baseballwinning	8.33 (6.66)	0.217
baseballwinninglagged	-4.08 (5.33)	0.448
baseballwinningmovingaverage	-12.8 (27.2)	0.639
baseballconferencechampionship	-0.997 (0.988)	0.318
baseballnationalchampionship	-6.77 (3.47)	0.057*
baseballncaatournamentappearance	1.11 (0.931)	0.239
footballwinning	0.371 (4.27)	0.931
footballwinninglagged	-0.418 (3.54)	0.907
footballwinningmovingaverage	2.73 (13.9)	0.845
footballconferencechampionship	1.10 (1.39)	0.435
footballnationalchampionship	3.09 (1.58)	0.057*
footballbowlappearance	-0.239 (1.39)	0.864
basketballwinning	-1.65 (6.71)	0.807
basketballwinninglagged	3.47 (3.82)	0.368

basketballwinningmovingaverage	14.6 (16.7)	0.383
basketballconferencechampionship	1.64 (1.33)	0.309
basketballncaatournamentappearance	-1.37 (1.33)	0.309
basketballnationalchampionship	-3.25 (2.54)	0.213
constant	-159 (49.8)	0.002***

Table 4

Log-Level Fixed-Effects Estimate		
Variable	**Coefficient (Robust Standard Error)**	**p-value**
age	0.0252 (0.00585)	0.000***
enrollment	-0.00000525 (0.00000539)	0.335
endowmentperstudent	-0.115 (0.0550)	0.041**
tuition	-0.00000891 (0.00000446)	0.051*
studentfacultyratio	-0.0119 (0.00675)	0.085*
baseballwinning	0.159 (0.0977)	0.109
baseballwinninglagged	-0.0431 (0.0804)	0.594
baseballwinningmovingaverage	-0.313 (0.384)	0.418
baseballconferencechampionship	-0.0283 (0.0160)	0.084*
baseballnationalchampionship	-0.164 (0.0541)	0.004***
baseballncaatournamentappearance	0.0172 (0.0128)	0.186
footballwinning	-0.00567 (0.0695)	0.935
footballwinninglagged	-0.0251 (0.0531)	0.638
footballwinningmovingaverage	0.149 (0.223)	0.508
footballconferencechampionship	0.00877 (0.0200)	0.662
footballnationalchampionship	0.0398 (0.0230)	0.089*
footballbowlappearance	-0.00793 (0.0229)	0.730
basketballwinning	0.00573 (0.105)	0.957
basketballwinninglagged	0.0523 (0.0578)	0.369

basketballwinningmovingaverage	0.109 (0.258)	0.674
basketballconferencechampionship	0.0431 (0.0366)	0.243
basketballncaatournamentappearance	-0.0202 (0.0200)	0.316
basketballnationalchampionship	-0.0517 (0.0409)	0.212
constant	0.832 (0.740)	0.266

Table 5

Level-Level Random Effects Estimate		
Variable	**Coefficient (Robust Standard Error)**	**p-value**
age	0.150 (0.0521)	0.004***
enrollment	0.0000979 (0.000304)	0.747
endowmentperstudent	-0.200 (3.06)	0.948
tuition	0.000635 (0.000103)	0.000***
studentfacultyratio	-0.425 (0.401)	0.289
baseballwinning	3.55 (6.15)	0.564
baseballwinninglagged	-3.25 (4.93)	0.509
baseballwinningmovingaverage	0.963 (22.3)	0.966
baseballconferencechampionship	-0.372 (1.21)	0.759
baseballnationalchampionship	-7.30 (5.04)	0.148
baseballncaatournamentappearance	1.80 (1.12)	0.106
footballwinning	-3.16 (4.59)	0.491
footballwinninglagged	-3.22 (3.57)	0.367
footballwinningmovingaverage	17.7 (14.6)	0.224
footballconferencechampionship	1.23 (1.69)	0.469
footballnationalchampionship	3.66 (2.09)	0.079*
footballbowlappearance	-0.419 (1.62)	0.796
basketballwinning	-4.04 (6.66)	0.544
basketballwinninglagged	3.57 (4.18)	0.393

basketballwinningmovingaverage	15.9 (14.8)	0.283
basketballconferencechampionship	0.514 (2.39)	0.830
basketballncaatournamentappearance	0.514 (1.49)	0.830
basketballnationalchampionship	-0.249 (3.12)	0.936
constant	27.5 (17.69)	0.120

Table 6

Joint Hypothesis Test Results	
Variable Group	**F-test p-value**
Baseball	0.0086***
Football	0.0005***
Basketball	0.0778*

Table 7

Level-Level Fixed-Effects Estimate – No Basketball		
Variable	**Coefficient (Robust Standard Error)**	**p-value**
age	1.62 (0.277)	0.000***
enrollment	-0.000224 (0.000210)	0.288
endowmentperstudent	-9.63 (6.611)	0.149
tuition	-0.000524 (0.000238)	0.030**
studentfacultyratio	-0.813 (0.343)	0.020**
baseballwinning	11.40 (6.87)	0.101*
baseballwinninglagged	-0.93 (6.20)	0.881
baseballwinningmovingaverage	-24.58 (24.5)	0.318
baseballconferencechampionship	-1.59 (1.33)	0.234
baseballnationalchampionship	-4.11 (5.45)	0.453
baseballncaatournamentappearance	0.684 (1.19)	0.568
footballwinning	1.50 (4.00)	0.707
footballwinninglagged	-0.302 (3.20)	0.925
footballwinningmovingaverage	-4.33 (11.3)	0.703
footballconferencechampionship	1.67 (1.43)	0.246
footballnationalchampionship	3.32 (2.33)	0.159
footballbowlappearance	0.421 (1.32)	0.750
constant	-137 (37.9)	0.001

Table 8

Durbin-Wu-Hausman Test Results	
Wu-Hausman Statistic	**p-value**
10.13	0.9772

References

McCormick, R.E. and Tinsley, M. (1987) Athletics versus Academics? Evidence from SAT Scores. *J. Polit. Econ.* 95, 1103-1116

Murphy, Robert G. and Trandel, Gregory A. (1994) The Relation Between a University's Football Record and the Size of Its Applicant Pool. *Economics of Education Review.* 13, 265-270

Peterson's Guide to Four-Year Colleges (2006-2016 issues) Princeton, NJ: Peterson's Guides.

Pope, Devin G. and Pope, Jaren C. (2014) Understanding College Application Decisions: Why College Sports Success Matters. *Journal of Sports Economics, Vol. 15*, 107-131

Toma, J. Douglas and Cross, Michael E. (1998) INTERCOLLEGIATE ATHLETICS AND STUDENT COLLEGE CHOICE: Exploring the Impact of Championship Seasons on Undergraduate Applications. *Research in Higher Education, Vol. 39, No. 6,* 633-658

Tucker, I.B., III, and Amato, L. (1993) Does Big-time Success in Football or Basketball Affect SAT Scores? *Econ. Educ. Rev.* 12. 177-181

Tucker, I.B., III (2004) A reexamination of the effect of big-time football and basketball success on graduation rates and alumni giving rates. *Econ. of Edu. Review.* 23, 655-661