INFLUENCE OF NCAA ATHLETIC SCANDALS ON APPLICANTS

A THESIS

Presented to

The Faculty of the Department of Economics and Business

The Colorado College

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Arts

By

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May 2014

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Economics

Abstract

This paper investigates the influence of National Collegiate Athletic Association (NCAA) men's basketball and football scandals on the quantity and quality of collegiate applicants. Athletic, academic, and socioeconomic data from the past 16 years are used to examine the immediate and lasting effects of an athletic scandal. The occurrence of a football or basketball scandal increased both the quantity and quality of applicants.

KEYWORDS: (National Collegiate Athletic Association, Athletic Scandals, Football, Basketball, Applicants, Quantity, Quality)

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CHAPTER I

INTRODUCTION

It's nearly impossible to turn on the news, open the newspaper, or go on the Internet without finding some mention of a political, celebrity, or athletic figure who has committed a scandal. In the competitive world of college athletics, many teams and individuals across all sports and divisions have been found guilty of committing athletic scandals. Not only do the actions of the wrongdoers have negative implications for themselves, their actions can lead to substantial losses for their teams and universities as well. Following the allegations of sexual misconduct against the University of Colorado's football program, the university suffered a loss of the Chancellor, the Athletic Director, the Football Coach, and the University President. Additionally, the university faced over one million dollars in financial losses due to the investigation (Hughes and Shank, 2008). Considering the impact that an athletic scandal can have on a university, this paper explores the influence of collegiate athletic infringements on the quantity and quality of college applicants.

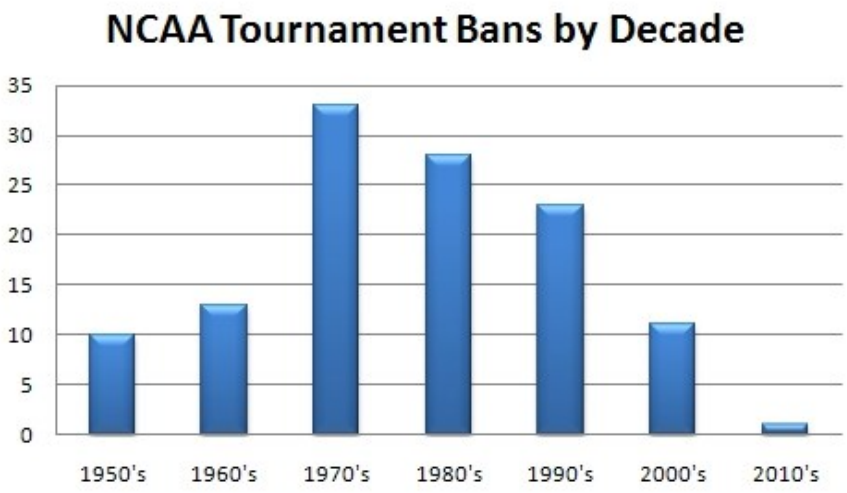
Although some studies have been conducted on the positive and negative effects of college athletic programs for universities, the literature lacks research on the relationship between athletic scandals and prospective students. Past studies have concluded that athletic success leads to improvements in a school's reputation (Chressanthis & Grimes, 1993; Murphy & Trandel, 1994; Toma & Cross, 1998; Jain,

2004; McEvoy 2005; Roy et al., 2008; Pope & Pope, 2009; Anderson, 2012; Castsle & Kostelnik, 2011; Desrochers, 2013). On the contrary, athletic probations and post-season bans negatively impact a university's reputation (Chressanthis & Grimes, 1993). Because applicants are essential to a university's future, the goal of this study is to determine the relationship between NCAA athletic scandals and collegiate applicants.

Since not every scandal can make headline news, a large number of athletic scandals fail to receive public attention. As a result, many people don't realize just how many schools have experienced athletic scandals throughout their program's history. In fact, more schools than not have had at least one of its sports teams placed on probation. Only 54, or 15%, of the Division I basketball teams and 44, or 35%, of the Football Bowl Subdivision (FBS) teams have never been placed on NCAA probation. One of the most severe punishments a team can receive is a ban from post-season play. As of 2011, the NCAA had given out basketball tournament bans or affirmed a team's self-inflicted ban 119 times. Schools currently in the FBS have faced a total of 136 seasons under a bowl ban as of 2012, with Auburn and Southern Methodist tied for the most total bowl bans at nine each (McKillop 2011; McKillop 2012). Figure 1.1 displays the NCAA basketball tournament bans by decade and table 1.1 shows the football and basketball programs that have experienced the greatest number of post-season bans.

FIGURE 1.1

BASKETBALL TOURNAMENT BANS



Source: McKillop, 2011

TABLE 1.1

NCAA FOOTBALL AND BASKETBALL PROGRAMS
WITH MOST POST-SEASON BANS

Football Programs	Bowl Bans	Basketball Programs	Tournament Bans
Auburn (AL)	9	Centenary	7
Southern Methodist (TX)	9	North Carolina St.	7
Southern California	6	UL Lafayette	6
Florida	5	Illinois	5
Houston (TX)	5	Cincinnati	4
Kansas St.	5	Kansas	4
Miami (FL)	5	Memphis	4
Oklahoma	5	Minnesota	4
Oklahoma St.	5	New Mexico St.	4
Indiana	4	San Francisco	4
North Carolina St.	4	Tulane	4
Penn St.	4	UT Pan American	4
Texas A&M	4	Wichita St.	4
UCLA	4		

Source: McKillop, 2011; McKillop 2012

The number of teams that have been sanctioned throughout their program's history illustrates the magnitude of the issue of athletic scandals. The actions of teams and individual players and coaches not only have negative implications for their athletic programs, but also reflect negatively on their schools. Since athletics are one of the most visible aspects of a school to the public community, the publicity received after a violation is committed can damage the school's reputation. In a world where colleges compete for applicants, the public attention schools receive may make or break a student's decision to apply there.

The next section begins by exploring the relevant literature on the factors that influence college applicants and the importance of athletic programs for colleges and universities. In the following section, a theoretical model is developed which yields testable hypotheses. The subsequent section presents the data and methodology used to test the models, including descriptive statistics and an explanation of each variable. Finally, the results of the analysis are presented along with the conclusions and suggestions for future research.

CHAPTER II

LITERATURE REVIEW

There are many factors that affect students' decisions about whether or not to apply and enroll at a college or university. This is exemplified by The Princeton Review, which ranks colleges in 62 categories within the topics of academics and administration, campus life, town life, schools by type, politics, quality of life, extracurricular, and the social scene (The Princeton Review, 2013). Schools compete for students; therefore, they must address and meet the needs and expectations of prospective students. To do so, universities must ask themselves what factors and programs impact a student's enrollment decision most. The existing research suggests a relationship between athletic programs and college admissions, but is inconclusive on the degree of impact, sports type and division level, thus leaving room for future studies.

Determinants of College Applications

Since students are all somewhat different from each other, how does an institution of higher education predict and earn a high application volume through the utilization of its athletic programs? Economic conditions are significant in one's decision to apply to a college or university, and thus must be controlled for in studies (Holley & Harris, 2010). One study illustrated that students rely most on parents, guardians, and friends when choosing a college (Galotti & Mark, 1944). Another study concluded that students primarily focus on the academic and institutional reputation, as well as the cost and

location when making their enrollment decision (The Brand Called U, 2003). Canale and Dunlap (1996) concluded that the most influential college characteristics are teacher attributes, areas of study offered, costs, and academic reputation. Their results illustrate that 75% of students believed sports and extracurricular programs were very important or somewhat important factors in deciding what school to attend. Roy, Graeff, and Harmon (2008) suggest that a school's reputation is more influenced by sports than academics. Since sports programs serve a pivotal role at many large universities, it is interesting to look at how these programs positively or negatively affect a school overall.

Impact of Sports on Higher Education

The majority of schools, especially large universities, receive more publicity from their athletic programs than from their academic programs. Athletics are typically the most visible aspect of a school. This is most evident through ticket and merchandise sales, and attendance at sporting events by both members of the college community and the general public (Roy et al., 2008). Successful athletic programs help promote the institution by increasing exposure and prestige. Specifically, men's football and basketball teams attract widespread television coverage, endorsement deals, and multimillion-dollar coaching contracts (Desrochers, 2013).

Athletic Success

Increased spending on college athletic programs is often justified by the fact that athletic success improves the name recognition and reputation of an institution, therefore increasing donations and attracting applicants (Anderson, 2012; Castle & Kostelnik, 2011; Desrochers, 2013). Anderson (2012) concluded that winning football games improves the quantity and quality of student applicants. Notably, Anderson's study

showed that following a winning football season, the average SAT scores of applicants for football schools were higher than in previous years. Even further, schools with winning football records receive an increased number of applicants, allowing the institution to be more selective in admitting students (Murphy & Trandel, 1994). It must be noted that while there is evidence that a successful season, especially in football, leads to an increase in applications, the boost only lasts a year or two (Desrochers, 2013).

Type of Sport and Post-Season Play. Certain studies hold that universities benefit most from successful football and men's basketball seasons. For the top 20 football schools and the top 16 basketball schools, the number of applications received following a successful football or basketball season increased between 2% and 8% per year (Pope & Pope, 2009). Chressanthis and Grimes (1993) studied data on football and basketball win-loss records, postseason play, and TV appearances for teams at Mississippi State University from a 21-year period. The study concluded that a one percent increase in the percentage of football wins from the previous season resulted in a 3.8% increase in first-year student enrollment demand.

The success of a team during post-season play also impacts a university's applicant pool. Judah (2010) looked at NCAA football and men's basketball championship tournament success. The results concluded that the further a team made it in the tournament, the greater the percent increase in student applicants received for the following year. A similar study by Toma and Cross (1998) looked at the impact of championship seasons on undergraduate applications. They found that in contrast to championship football seasons that have an immediate impact of the number of applications received, there is a lag time associated with a championship basketball

season. Specifically, championship seasons in basketball typically lag three years in affecting application rates. One possible explanation for this is the timing of the championship game for basketball compared to football. While the championship game for football is held in January each year, the championship basketball game takes place in March each year. Since the time between the championship football game and the start of the application submission period is further apart, there is more time for students to factor this into their decisions (Toma & Cross, 1998).

Despite previously discussed studies suggesting a positive relationship between athletic success and increases in applications, some studies have concluded that the impact of sports success on the number of applicants is minimal or has no affect. Murphy and Trandel (1994) determined that there was a slight positive increase in the number of applications received by major Division I-A universities following a successful sports season. According to their results, an increase in a school's football winning record by 25% led to an average applicant increase of 1.3% for the following academic year. A similar study by McEvoy (2005) looked at football and men's basketball teams with dramatic increases, decreases, or no change in winning percentage. When looking at the results for football, the findings were consistent with previous studies: a positive relationship exists between college football success and the number of applications received by NCAA Division I-A universities. However, this study found no significant relationship between success in men's basketball and the number of applicants. Conflicting results obscure a true relationship between athletic success and applicant totals, making this research interesting to examine.

Level of Competition. Evidence has shown that the relationship between athletic success and the number of applications received by a school not only varies based on the type of sport, but is affected by the division of the sports team as well. A study by Jain (2004) used 20 Division I colleges and 18 Division III colleges from 1993-2002 to analyze the effects of winning percentages and playoff percentages on the quality, quantity, and enrollment rate of applicants. The results showed that the effects vary in magnitude and direction based on the type of sport and division. Increased winning percentages in football resulted in a decreased enrollment rate at Division III schools, but a slightly increased enrollment rate at Division I schools. While basketball playoff success had a negative impact on application numbers at Division III schools, there was no significant impact on the number of applications received by Division I schools. Despite these findings, the study was unable to explain why increases in winning percentages and playoff percentages affected the quality, quantity, and enrollment rate of applicants differently based on the type of sport and division.

It is clear that more research needs to be performed on the relationship between the success of sports teams and the number of applications received. There is a significant amount of information in the study performed by Jain (2004) that cannot be explained, such as why the type of sport and division benefits a university differently. Additionally, the conflicting results of studies finding varying magnitudes of impact between athletic success and increases in applications make it difficult to discern a true relationship between aspects of athletics and collegiate applicants.

Athletic Losses and Scandals

As demonstrated above, the literature tends to cluster around the questions regarding the impact of positive sports outcomes. Much less has been done to examine the impacts of negative sports outcomes. McEvoy (2005) studied the relationship between a considerable decrease in team performance and applicant totals for school with football, men and women's basketball, and women's volleyball, but found no significance. Chressanthis and Grimes (1993) concluded that while general TV appearances for Mississippi State University's football team have no effect on first-year enrollment, losing on TV negatively affects prospective students' enrollment in a university. Additionally, their study showed that NCAA sanctions decreased the football team's winning percentage, which not only adversely affected publicity to the university, but also lowered the first-year enrollment. Contrary to this, a study by Hughes and Shank (2008) found that sports scandals led to an increase in freshman applicants at some universities. Based on the conflicting results of previous studies and the limited research about the impacts of athletic scandals, there is room for future studies on this topic.

Conclusion

Opportunities exist to conduct additional research on the connections between the higher education sector and intercollegiate sports. Given that several studies have found a positive relationship between sports success and the quantity and quality of applicants, enrollment rates, and alumni donations, it would be exciting to further investigate the impact of sports scandals. This paper will examine whether a collegiate athletic scandal impacts the quantity and quality of applications received by a school in the years following the incident.

CHAPTER III

THEORY

Higher education is an integral part of society in America. Many students are faced with a difficult choice about which university to attend upon graduating from high school. With such a vast number of schools to choose from, students rely on many factors to narrow down their application decisions, and ultimately enroll in a university. Assuming all applicants are rational, they will choose the university that maximizes their utility. The academic and social reputation and quality of the university heavily influence students' happiness at an institution. Every student has to deal with scarcity, and is therefore limited to a budget constraint when considering higher education. Based on the competitiveness between universities, further analysis will show why students choose to apply to certain schools over others, and which factors are most influential in making these decisions. An individual's decision to attend higher education is represented by the following utility function:

$$U = (R, Q) \tag{3.1}$$

In this function, U represents their total utility with Q signifying the academic and student life quality of the institution and R indicating the academic and athletic reputation of the university. Individuals also face a budget constraint when deciding to attend a university of higher education, represented in figure 3.2.

$$I = P_R R + P_Q Q \tag{3.2}$$

Within the budget constraint, I represents an individual's income available for consumption. P_R indicates the price of a university's reputation, while R represents a schools reputation. P_Q displays the price of a university's quality, while Q indicates the quality of a school. The corresponding Lagrangian is:

$$\mathcal{L} = R^{\alpha}Q^{\beta} + \lambda\{I - RP_R - QP_Q\} \tag{3.3}$$

Through the Lagrangian multiplier method, equations for the optimal quantities of reputation and quality are derived and represented in figures 3.4 and 3.5. Appendix A displays the steps to obtain these equations.

$$R = \left(\frac{\alpha}{\alpha+\beta}\right)\frac{I}{P_R} \tag{3.4}$$

$$Q = \left(\frac{\alpha}{\alpha+\beta}\right)\frac{I}{P_Q} \tag{3.5}$$

Each student will attempt to reach their maximum level of satisfaction based on the constraints they are subject to.

The literature shows a positive relationship between athletic success and improvements in a university's reputation (Chressanthis & Grimes, 1993; Murphy & Trandel, 1994; Toma & Cross, 1998; Jain, 2004; McEvoy 2005; Roy et al., 2008; Pope & Pope, 2009; Anderson, 2012; Castsle & Kostelnik, 2011; Desrochers, 2013). Previous work also shows that athletic sanctions negatively impact a university's reputation (Chressanthis & Grimes, 1993). An improvement in a school's reputation heightens a student's utility from applying to that university, and thus leads to an increase in applicant quantity and quality. On the contrary, an athletic scandal negatively impacts a school's reputation. This leads to a decrease in a student's expected utility from applying

to that school, and therefore should result in a decline in the quantity and quality of applications received.

The framework for examining the effects of an athletic scandal on a school's reputation can be understood through the lens of utility maximization. This paper will use six models to study the quantity and quality of applications received by a university. Each model will be regressed three times with different lags to study the lasting impact of a scandal. Football and basketball scandals will be modeled separately and together to see if the type of sport is significant. To model the quantity of applicants, the natural log of the number of freshman applications will be used as the dependent variable. The log of applications is taken to avoid overweighting larger schools compared to smaller schools (Pope & Pope, 2009). The natural log of the average SAT scores of enrolled freshman will be used as the dependent variable to determine the quality of applications. Based on Anderson's findings, which showed that winning football games leads to an increase in average incoming SAT scores, this model will determine whether athletic scandals have a similar impact on the quality of applicants.

By building on the primary model designed by Murphy and Trandel and improved by Castle and Kostelnik, this study adds value by expanding the list of variables included and using more recent data. The models used in this study are expressed as follows:

Applicant Quantity:

$$LnApply_{i,t} = \beta FB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (3.6)$$

$$LnApply_{i,t} = \beta BB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (3.7)$$

$$LnApply_{i,t} = \beta FB_{i,t-1,t-2,t-4} + \beta BB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (3.8)$$

Applicant Quality:

$$LnSAT_{i,t} = \beta FB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (3.9)$$

$$LnSAT_{i,t} = \beta BB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (3.10)$$

$$LnSAT_{i,t} = \beta FB_{i,t-1,t-2,t-4} + \beta BB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (3.11)$$

Where: $LnApply_{i,t}$ is the log of the number of freshman applications,
$LnSAT_{i,t}$ is the log of the average SAT scores of enrolled freshman,
i is the university,
t is the year,
$\beta FB_{i,t-1,t-2,t-4}$ is a dummy variable indicating a football probation or bowl ban lagged one, two, and four years,
$\beta BB_{i,t-1,t-2,t-4}$ is a dummy variable indicating a basketball probation or tournament ban lagged one, two, and four years,
$\beta LnIncome_t$ is the log of the household median income by state,
$\beta LnTuition_{i,t}$ is the log of the tuition per year,
$\beta LnFAid_{i,t}$ is the log of the amount of financial need-based aid offered,
$\beta LnControl_i$ is a dummy variable indicating a public institution,
$\beta FacPhD_{i,t}$ is the percent faculty with PhDs,
$\beta LnSFRat_{i,t}$ is the log of the student-to-faculty ratio,
$\beta State_i$ is a dummy variable indicating the state the university is in,
$\beta Year_{i,t}$ is a dummy variable indicating if the school exists in that year, and
$e_{i,t}$ is the error term.

The preceding models are based on the work of Murphy and Trandel (1994), who examine the impact of football success on the quantity of applicants, and Castle and Kostelnik (2011), who used the same model as the structural basis for their research but modified it to determine the quality of applicants. The equation designed by Murphy and Trandel (1994) contains fixed-effect, school-specific dummies, time dummies, and variables that control for factors relating to applications that change over time. Their model is represented in figure 3.12:

$$Apply_{it} = \alpha_i + \alpha_t + \beta_1 FBR_{it-1} + \beta_2 GRAD_{it} + \beta_3 INC_{it} + \beta_4 COST_{it} + \beta_5 SALARY_{it-1} + e_{it} \quad (3.12)$$

Murphy and Trandel's study focuses on the variable FBR, which is defined as the football winning percentage within conference lagged one year, and measures the potential advertising effect of athletic success. In order to look at the impact of negative athletic programs and publicity, this paper will replace the variable FBR with two dummy variables, FB and BB, indicating whether a school had a football or basketball probation or post-season ban each year. These variables will be lagged by one year to account for the impact of a sanction on the following year's application pool, and lagged by two and four years to determine if sanctions have a lasting effect on applicants. Since the study by Toma and Cross (1998) indicated varying effects between championship football and basketball seasons and the lag time associated with application rates, this study will test to see if athletic scandals have a similar lagged effect. Additionally, a study by Judah (2010) found that the further a team made it in post-season play, the greater the percent increase in student applications received for the following year. Based on the findings of Judah's research, this study will test whether being banned from post-season games affects application rates.

Although Murphy and Trandel use GRAD, defined as the public high school graduates in the same state as the university, to control for the size of a university's potential applicant pool, this variable is not included in the models for this paper. With state universities recruiting and enrolling an increasing amount of out-of-state students, the number of public high school graduates from the state where the university is located is becoming an obsolete measure of the university's applicant pool (Hoover & Keller, 2011). In order to roughly control for the size of a university, this study has limited the

included schools to only those with NCAA DI football bowl subdivision and men's basketball programs.

The variable INC, defined as the real per capita income in the same state as the university, is used in Murphy and Trandel's model to control for two potential influences on applicant totals. The first is influences related to the business cycle that may impact an individual's decision about attending or not attending college. The second is the changes in the state's demographic makeup that might alter the fraction of high school students wishing to attend college. A study by Holley and Harris (2010) emphasizes the impact of economic challenges on applicants and the need for admissions offices to implement new strategies in order to maintain the quantity and quality of applications during times of economic distress. Since there is a demonstrated connection between economic realities and application statistics, the models used in this study will control for these factors by including an income variable indicating the median household income by state per year.

The COST variable, defined as the in-state tuition plus room and board costs, is used in Murphy and Trandel's model to capture two possible effects that could impact applicant totals. The first is a pure demand-curve effect, in which a high cost would lead to a decrease in applications, and the second is a quality-signaling effect, meaning that higher costs signal higher quality and thus lead to an increase in applications. The models used in this study will include a tuition variable indicating the tuition per year. Additionally, the models will include a variable representing the amount of financial need-based aid offered and a dummy variable indicating the school's control. Financial aid plays a crucial role in the application and enrollment decisions of prospective students. Since economic conditions threaten state funding, federal support, and financial

aid allocations, it is important to consider financial aid and school control when studying the quantity and quality of applications received by a university (Holley & Harris, 2010).

To control for the academic quality of an institution, Murphy and Trandel use the variable SALARY, representing the lagged average salary of professors. For the purpose of this study, two different variables will be used to account for the academic quality of a school. The first is the percent of faculty that have a PhD, and the second is the student-to-faculty ratio. Canale and Dunlap (1996) found that teacher attributes are one of the most influential factors prospective students considered when applying to universities. While most incoming freshman are not aware of the average professor salary, many students consider the average class sizes when making their application decisions. Since the percent of faculty with a PhD and the student-to-faculty ratio measure the academic quality of an institution, these variables will be controlled for in this study.

TABLE 3.1

VARIABLE EXPLANATIONS

Variable	**Definition**	**Predicted Sign Quantity**	**Predicted Sign Quality**
LnApply	Log of number of freshman applicants	N/a	N/a
LnSAT	Log of average SAT scores of enrolled freshman	N/a	N/a
$BB_{t-1,t-2,t-4}$	Dummy variable for basketball probation or ban	-	-
$FB_{t-1,t-2,t-4}$	Dummy variable for football probation or ban	-	-
LnIncome	Log of median household income by state	+	+
LnTuition	Log of tuition per year	-	+
LnFAid	Log of amount of need-based aid offered	+	+
Control	Dummy variable for public school	+	-
FacPhD	Percent faculty with PhD	+	+
LnSFRat	Log of student-to-faculty ratio	-	-

Note: Predicted sign indicates the effect this variable will have on applicants as it increases, or if it occurs in the case with the dummy variables. Hypothesized signs are the same for each lagged model.

CHAPTER IV

DATA AND METHODS

Data Set

The panel data examined in this project contains athletic scandal, academic, and socioeconomic information for 343 colleges and universities from 1996 to 2012. These schools have either a men's football or basketball program, or both programs. Academic data was obtained from the College Board's Annual Survey of Colleges. In its original format, the academic data utilized in this study reported 74 variables for 351 schools between 1996 and 2012. Eight institutions were dropped from the original academic dataset due to missing data on key variables or the lack of relevant athletic programs. Of the schools that were dropped due to insufficient data, only one had experienced an athletic scandal in the time period examined. All of the schools in the data set have a men's basketball program, whereas only 122 of the 343 schools have a football program.

In order to effectively measure the impact of athletic scandals on applicant quantity and quality, scandal data, location data, and socioeconomic data were merged together with the cleaned academic data set. Athletic scandal data was collected from an online blog and verified with the NCAA Legislative Services Database (McKillop, 2011; McKillop, 2012; NCAA, 2014). A total of 196 basketball and 139 football sanctioned years were included in the data set. To capture socioeconomic effects, yearly median income of the state in which the school is located were gathered from the United States

Census Bureau's website and merged together with the academic and scandal data set (USCB, 2013).

It must be noted that the data utilized in this project was separated into three subsamples: a basketball scandal data set, a football scandal data set, and a combined scandal data set. This was done to account for the dramatic differences in the total number of schools with football programs versus basketball programs.

The following table displays all of the variables in this project and summary statistics for each subsample of the data set. The combined subset of data contains the same number of observations as the football data set because football is the variable with fewer observations. Therefore, the summary statistics of the football data set are not displayed.

TABLE 4.1

DESCRIPTIVE STATISTICS
COMBINED FOOTBALL AND BASKETBALL

Variable	**Observations**	**Min**	**Max**	**Stan. Dev.**	**Mean**
LnApply	1529	7.179	11.194	0.652	9.399
LnSAT	1558	6.819	7.300	0.098	7.045
BB_{t-1}	1585	0	1	-	-
BB_{t-2}	1585	0	1	-	-
BB_{t-4}	1585	0	1	-	-
FB_{t-1}	1585	0	1	-	-
FB_{t-2}	1585	0	1	-	-
FB_{t-4}	1585	0	1	-	-
LnIncome	1585	10.287	11.182	0.149	10.705
LnTuition	1585	7.086	10.728	0.754	8.766
LnFAid	1319	5.193	19.036	1.832	15.688
Control	1585	0	1	-	-
FacPhD	1327	1.359	100	17.352	76.042
LnSFRat	1433	1.188	3.623	0.350	2.614

Note: For Control 1 indicates a public university and for BB and FB 1 indicates a scandal.

TABLE 4.2

DESCRIPTIVE STATISTICS
BASKETBALL

Variable	Observations	Min	Max	Stan. Dev.	Mean
LnApply	4194	5.652	11.194	0.818	8.972
LnSAT	4307	6.593	7.333	0.117	7.012
BB_{t-1}	4431	0	1	-	-
BB_{t-2}	4431	0	1	-	-
BB_{t-4}	4431	0	1	-	-
LnIncome	4457	10.287	11.182	0.160	10.735
LnTuition	4450	6.712	10.764	0.914	9.014
LnFAid	3536	5.193	19.206	1.844	15.576
Control	4457	0	1	-	-
FacPhD	3647	1.359	100	18.273	68.396
LnSFRat	4021	1.048	3.623	0.389	2.502

Note: For Control 1 indicates a public university and for BB 1 indicates a scandal.

Dependent Variables

The models used in this study contain different dependent variables in order to measure both the quantity and quality of applicants received by a university. The first model uses (LnApply) the natural log of total applicants to examine the quantity of applicants. While some universities reported the total number of applicants, other schools reported the number of men and women applicants separately. To obtain a variable for total applicants, the number of men and women who applied were added together. Finally, the natural log of total applicants was calculated. The second model uses (LnSAT) the natural log of SAT scores as a measure of applicant quality. To compute this variable, the combined SAT math and verbal scores from the enrolled freshman class were averaged, and then the natural log was taken.

Athletic Variables

Using data from 1996 to 2012 and lagging each variable by one, two, and four years, this study is able to determine the immediate and lasting impact of an athletic scandal on applicants. The data was manually entered in the form of dummy variables to create a data set. For the purpose of this study, a scandal is defined as any incident that led to an individual or team probation or post-season ban. Sanctions that occurred during the season are recorded for the year that the season ended; for example, if the probation happened during the 2010-2011 season it is recorded as a dummy in 2011.

Basketball

Basketball ($BB_{t-1,t-2,t-4}$) is a dummy variable that equals one if the university faced a basketball probation or tournament ban or zero otherwise. When the NCAA places a basketball team or individual member on probation, they are under the watchful eye of the organization and may face additional punishment depending on the committed violation.

The post-season basketball tournament commonly known as "March Madness" is the highlight event of the season, attracting widespread public attention. Many people follow the tournament closely and create a bracket predicting the results. There are two ways teams can earn a bid to the tournament. The first is by being one of the 32 teams to win its conference's championship, earning an automatic bid, and the second is by being awarded one of the 36 at-large-bids determined by the selection committee based on the teams' in-season record. When a team is banned from post-season play, it becomes ineligible to receive a bid to this prestigious tournament. The banned team not only misses out on the opportunity to become the national champion, it also loses valuable

press attention and might even face negative publicity as a result of its actions (NCAA, 2014).

Football

Football ($FB_{t-1,t-2,t-4}$) is a dummy variable that equals one if a university experienced a football probation or bowl ban or zero otherwise. Similar to the restrictions of basketball probation, when the NCAA places a team or individual on probation, they are under the scrutinizing watch of the NCAA and may receive additional punishment based on the severity of their actions.

Bowl games are highly anticipated and prestigious events that take place at the end of the collegiate football season. Teams receive bowl bids based on their in-season records. To be eligible for a bowl bid, a team must have won at least six games in a 12-game schedule or seven in a 13-game schedule, or be the champion of its conference. Additionally the team must not be on any probation that excludes it from post-season play. Since bowl games attract a great deal of public attention, being banned from a bowl game could prevent a university from receiving recognition and may even draw negative publicity to the school (Bowls, 2013).

Academic Variables

The included variables are based on the results and conclusions of the studies surveyed in the literature.

Tuition

The tuition (LnTuition) variable represents the natural log of the tuition per year in current dollars. While a higher tuition may lead to a smaller applicant pool due to

affordability, some students might use tuition as a measure of quality. It is possible that students will perceive universities with higher tuitions to be of higher quality.

Financial Aid

The financial aid (LnFAid) variable used in this study represents the natural log of need-based aid offered in current dollars. Although some schools are able to meet a high percent of students' need-based aid, other schools are not able to provide as much aid to students. For students who are eligible for financial aid, this variable is a good proxy for how much aid they will be offered.

Control

Control (Control) is a dummy variable that equals one if the university is a public institution or zero for a private institution. Since most public schools are state universities founded and operated by state government entities, they typically charge in-state students a lower tuition than out-of-state students. As a result, the applicant pool is affected.

Percent Faculty with a PhD

As a variable, the percentage of faculty with a PhD (FacPhD) is used to measure the quality of an institution. The variable is calculated by dividing the number of faculty with a PhD by the total number of faculty at the university, multiplied by 100. A higher percent of faculty with a PhD is likely to result in a greater quality of academics at the university.

Student-Faculty Ratio

The student-to-faculty ratio (LnSFRat) is defined as the log of the total number of students compared to the total number of faculty at a university. This variable is calculated by dividing the total number of students by the total number of faculty and

then taking the natural log. Institutions have different reporting methods, and as a result the student-to-faculty ratio is not always given but is easily calculated using the reported total student and faculty numbers. The smaller the ratio, the greater the individual attention students are able to receive from their professors. This is likely to lead to a higher level of achievement from students, and could therefore attract a higher quality of students to apply to the university.

Socioeconomic Variable

Median Income

To control for economic factors that could impact the quantity and quality of applicants, this study uses a variable for the natural log of the median household income by state in current dollars (LnIncome). A higher median household income is likely to result in more people able to afford and attend college.

Methodology

To examine the impact of athletic scandals on the quantity and quality of applicants, the data is regressed using an ordinary least squares model (OLS). OLS is a method of estimating the unknown parameters in a linear regression model. An estimator is said to be a best linear unbiased estimator (BLUE) if the following conditions hold: it is linear, unbiased, and has minimum variance. According to the Gauss-Markov Theorem, under the assumption of the classical linear regression model, the least squares estimators have minimum variance and are therefore BLUE. Performing an OLS regression provides the coefficients for a straight line that is the line of best fit. Minimizing the errors, equal to the difference between the yhat (fitted) value on the line and the observation value, generates the line of best fit (Gujarati & Porter, 2008).

When using OLS estimators, normality is a defensible assumption for large data sets. The central limit theorem provides the theoretical justification for the normality assumption. The central limit theorem states that as the number of observations get larger, the distribution of the residuals approaches normality (Gujarati & Porter, 2008).

In order to run an OLS regression with the panel data set used in this study, dummy variables for each state and year except one were included. The state Alabama and year 2000 dummy variables were omitted to avoid the dummy trap. The following equations were estimated using Stata 13. The first three models measure the change in applicant quantity while the next three measure the change in applicant quality following an athletic scandal, with other factors being controlled for.

Applicant Quantity:

$$LnApply_{i,t} = \beta FB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (4.1)$$

$$LnApply_{i,t} = \beta BB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (4.2)$$

$$LnApply_{i,t} = \beta FB_{i,t-1,t-2,t-4} + \beta BB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (4.3)$$

Applicant Quality:

$$LnSAT_{i,t} = \beta FB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (4.4)$$

$$LnSAT_{i,t} = \beta BB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (4.5)$$

$$LnSAT_{i,t} = \beta FB_{i,t-1,t-2,t-4} + \beta BB_{i,t-1,t-2,t-4} + \beta LnIncome_t + \beta LnTuition_{i,t} + \beta LnFAid_{i,t} + \beta Control_i + \beta FacPhD_{i,t} + \beta LnSFRat_{i,t} + \beta State_i + \beta Year_{i,t} + e_{i,t} \quad (4.6)$$

CHAPTER V

RESULTS & CONCLUSIONS

Regression Analysis

To analyze the impact of athletic scandals on the quantity and quality of applicants, 18 individual regressions were run, tested, and corrected. The initial regressions were tested for heteroskedasticity and serial correlation, with the results showing that both issues were present. The results of both tests are displayed in Appendix B (Breusch & Pagan, 1979; Wooldridge, 2010). To correct the problems, Newey-West corrected standard errors were calculated. A one-year lag was used to perform the Newey-West correction, since students apply to colleges and universities each year. As a result of having logged dependent variables, the marginal effects were computed in order to interpret the coefficients. Appendix C displays the equations used to compute the marginal effects for continuous and dummy variables (Halvorsen & Palmquist, 1980). The results of the regressions run with the Newey-West corrected standard errors and marginal effects are displayed in tables 5.1 and 5.2 (Newey & West, 1987; StataCorp., 2013).

TABLE 5.1

QUANTITY MODEL MARGINAL EFFECTS RESULTS

Dependent Variable LnApply									
Model / Variable	BB 1	BB 2	BB 4	FB 1	FB 2	FB 4	FB & BB 1	FB & BB 2	FB & BB 4
BB_{t-1}	0.289* (4.40)	- -	- -	- -	- -	- -	0.210* (4.26)	- -	- -
BB_{t-2}	- -	0.290* (4.13)	- -	- -	- -	- -	- -	0.193* (3.83)	- -
BB_{t-4}	- -	- -	0.239* (3.53)	- -	- -	- -	- -	- -	0.166* (3.35)
FB_{t-1}	- -	- -	- -	0.058 (1.26)	- -	- -	0.006 (0.13)	- -	- -
FB_{t-2}	- -	- -	- -	- -	0.090 (1.76)	- -	- -	0.039 (0.82)	- -
FB_{t-4}	- -	- -	- -	- -	- -	0.139* (2.75)	- -	- -	0.102* (2.10)
LnIncome	0.080 (1.35)	0.076 (1.29)	0.080 (1.35)	0.227* (2.56)	0.222* (2.51)	0.213* (2.41)	0.228* (2.60)	0.213* (2.42)	0.213* (2.43)
LnTuition	0.240* (4.14)	0.241* (4.17)	0.242* (4.19)	0.036 (0.41)	0.026 (0.29)	0.013 (0.15)	0.025 (0.28)	0.020 (0.23)	0.007 (0.08)
LnFAid	0.000* (12.34)	0.000* (12.35)	0.000* (12.34)	0.000* (6.62)	0.000* (6.59)	0.000* (6.51)	0.000* (6.57)	0.000* (6.51)	0.000* (6.44)
Control	2.625* (11.26)	2.634* (11.29)	2.645* (11.31)	0.260* (2.38)	0.251* (2.30)	0.231* (2.13)	0.231* (2.17)	0.223* (2.09)	0.203 (1.89)
FacPhD	69.473* (7.93)	69.365* (7.93)	69.645* (8.01)	52.657* (3.74)	51.720* (3.69)	51.813* (3.68)	51.529* (3.71)	50.963* (3.74)	51.645* (3.87)
LnSFRat	60.503 (1.35)	61.844 (1.31)	58.284 (1.23)	139.905* (2.20)	137.278* (2.15)	136.492* (2.13)	148.163* (2.34)	147.529* (2.33)	143.625* (2.25)

*Indicates significance at the 5% level.

Note: Each column provides the coefficient and z-statistic for the basketball (BB), football (FB), and combined (FB & BB) models for each lag (1, 2 and 4).

TABLE 5.2

QUALITY MODEL MARGINAL EFFECTS RESULTS

Dependent Variable LnSAT									
Model / Variable	BB 1	BB 2	BB 4	FB 1	FB 2	FB 4	FB & BB 1	FB & BB 2	FB & BB 4
BB_{t-1}	0.015* (2.04)	- -	- -	- -	- -	- -	0.016* (2.56)	- -	- -
BB_{t-2}	- -	0.014 (1.75)	- -	- -	- -	- -	- -	0.017* (2.63)	- -
BB_{t-4}	- -	- -	0.009 (0.99)	- -	- -	- -	- -	- -	0.023* (3.12)
FB_{t-1}	- -	- -	- -	0.020* (3.13)	- -	- -	0.015* (2.43)	- -	- -
FB_{t-2}	- -	- -	- -	- -	0.016* (2.42)	- -	- -	0.011 (1.68)	- -
FB_{t-4}	- -	- -	- -	- -	- -	0.008 (1.12)	- -	- -	0.003 (0.40)
LnIncome	0.000 (0.51)	0.000 (0.47)	0.000 (0.49)	0.002 (1.68)	0.001 (1.52)	0.001 (1.47)	0.002 (1.69)	0.001 (1.46)	0.001 (1.50)
LnTuition	0.005* (6.43)	0.005* (6.44)	0.005* (6.46)	0.002 (1.61)	0.002 (1.56)	0.002 (1.64)	0.002 (1.55)	0.002 (1.53)	0.002 (1.59)
LnFAid	0.000* (8.69)	0.000* (8.70)	0.000* (8.71)	0.000* (6.15)	0.000* (6.16)	0.000* (6.13)	0.000* (6.12)	0.000* (6.14)	0.000* (6.17)
Control	0.071* (4.87)	0.071* (4.89)	0.071* (4.91)	-0.031 (-1.73)	-0.031 (-1.73)	-0.030 (-1.68)	-0.032 (-1.82)	-0.033 (-1.83)	-0.033 (-1.87)
FacPhD	2.537* (14.62)	2.537* (14.61)	2.539* (14.63)	1.646* (6.76)	1.633* (6.72)	1.644* (6.72)	1.639* (6.79)	1.628* (6.75)	1.642* (6.96)
LnSFRat	-6.826* (-10.88)	-6.818* (-10.86)	-6.836* (-10.88)	-6.284* (-8.92)	-6.293* (-8.86)	-6.254* (-8.81)	-6.222* (-8.80)	-6.211* (-8.74)	-6.163* (-8.72)

*Indicates significance at the 5% level.
Note: Each column provides the coefficient and z-statistic for the basketball (BB), football (FB), and combined (FB & BB) models for each lag (1, 2 and 4).

The Newey-West regressions were tested for normality, with the results showing that non-normally distributed errors were present. The results of this test are shown in Appendix B (Jarque & Bera, 1987). This study assumes asymptotically normally distributed errors because of the large number of observations included in the data set. According to the central limit theorem, as the number of observations increases the distribution approaches normality. Instead of deriving the exact distribution, an asymptotic distribution is used as an approximation. This allows normality to be assumed

and hypothesis testing to continue normally. It should be noted, however, that as a result of the standard errors being larger due to non-normality, the significance of the resulting t-statistics is deflated (Kennedy, 2003).

To visually inspect the distribution, a kernel density plot was created using Stata. Kernel density estimators are used to approximate the density $f(x)$ from observations on x. The plot displays the kernel density estimate over the normal density, therefore showing the areas of non-normality (StataCorp., 2013). Appendix D displays three plots created from the football, basketball, and combined one-year lag quantity models.

The following tables display the predicted signs compared to the actual signs produced by the regressions.

TABLE 5.3

QUANTITY MODEL SIGNS

Dependent Variable LnApply				
Variable	**Predicted Sign**	**BB Model Sign**	**FB Model Sign**	**FB & BB Model Sign**
$BB_{t-1,t-2,t-4}$	-	+	N/a	+
$FB_{t-1,t-2,t-4}$	-	N/a	+	+
LnIncome	+	+	+	+
LnTuition	-	+	+	+
LnFAid	+	+	+	+
Control	+	+	+	+
FacPhD	+	+	+	+
LnSFRat	-	+	+	+

Note: Hypothesized and actual signs were the same for each lagged model.

TABLE 5.4

QUALITY MODEL SIGNS

Dependent Variable LnSAT				
Variable	**Predicted Sign**	**BB Model Sign**	**FB Model Sign**	**FB & BB Model Sign**
$BB_{t-1,t-2,t-4}$	-	+	N/a	+
$FB_{t-1,t-2,t-4}$	-	N/a	+	+
LnIncome	+	+	+	+
LnTuition	+	+	+	+
LnFAid	+	+	+	+
Control	-	+	-	-
FacPhD	+	+	+	+
LnSFRat	-	-	-	-

Note: Hypothesized and actual signs were the same for each lagged model.

Athletic Results

Although not always statistically significant, the coefficients for the basketball and football scandal dummy variables are positive in all the tested models. This result is interesting and unexpected, as it was predicted that the coefficients on these variables would be negative. This prediction was based on the fact that a scandal can prevent a team from competing in post-season play and attract negative publicity to the school. The fact that these coefficients are positive suggests that gaining name recognition and public attention impacts prospective students more than the type of publicity that is received. Additionally, it is possible that after a school experiences a football or basketball scandal, the quantity of applicants increases as a result of students suspecting it might be easier to get accepted.

Basketball

To determine the impact of a basketball scandal on the quantity and quality of applicants, basketball scandal data was regressed individually as well as with football scandal data using a series of different lags. Although statistically significant in all the quantity models, basketball scandals had a greater impact on applicant quantity when regressed without the football scandal data. Using just the basketball data, the results showed that a basketball scandal occurring one, two, and four years ago led to an increase in applicant quantity by 28.9%, 29%, and 23.9% respectively. When regressed using the football and basketball data, a basketball scandal that occurred one, two and four years ago increased the number of applicants by 21%, 19.3%, and 16.6% respectively.

This study found that basketball scandals had less of an impact on applicant quality than on applicant quantity. When performing the regressions using only basketball scandal data, basketball scandals lagged one year was the only basketball variable found to have statistical significance. A basketball scandal occurring one year ago led to a 1.5% increase in the average SAT scores of enrolled freshman. When the regressions were performed using the football and basketball data, all three basketball variables were statistically significant, with the basketball variable lagged four years having the greatest impact on applicant quality. While a basketball scandal occurring one and two years ago resulted in a 1.6% and 1.7% increase in average SAT scores respectively, a basketball scandal occurring four years ago led to an increase in average SAT scores by 2.3%.

Football

Football scandal data was also regressed individually and with basketball scandal data in order to determine the impact of a football scandal on the quantity and quality of applicants. The football scandal variable lagged four years was the only football variable with statistical significance in the quantity models. When performing the regressions using only the football data, a football scandal occurring four years ago led to an increase in applicant quantity by 13.9%. When including the basketball and football data in the regression, a football scandal that occurred four years ago resulted in a 10.2% increase in the number of applicants.

Similar to the impact of basketball scandals on applicant quality, football scandals also had a smaller impact on applicant quality compared to applicant quantity. When the regressions were run using only the football data, the football scandal variables lagged one and two years were statistically significant, with a football scandal occurring one and two years ago increasing the average SAT scores of freshman by 2% and 1.6% respectively. When the basketball data was included with the football data, the only football variable with statistical significance was the one-year lagged variable, which increased average SAT scores by 1.5%.

While the athletic results are surprising and unexpected, this study determined that the occurrence of a basketball or football scandal increased applicant quantity and quality. Both basketball and football scandals had a larger effect on the quantity than on the quality of applicants. Additionally, when the basketball and football scandal data was regressed separately, the magnitude of impact was greater than when the data was regressed together.

Academic Results

Tuition

While it was expected that the coefficients for tuition would be positive for the quality models, it was unexpected that they would be positive for the quantity models as well. Schools with higher tuitions are likely perceived as being of higher quality, therefore increasing both the quantity and quality of applicants.

When studying the impact of tuition on the quantity and quality of applicants, tuition was only statistically significant in the models regressed using just the basketball data. Tuition had a greater impact on the quantity than on the quality of applicants. The marginal effects for tuition appear small as a result of tuition being measured in current dollars with a sample average of $12,433.51 for the basketball models and $9,005.81 for the football and combined models. Therefore, a one-dollar increase in tuition had a relatively small marginal effect on the number of applicants and the average SAT scores. The elasticity of tuition displayed in Appendix E can be used to see the percent change in the quantity of applicants and average SAT scores resulting from a one percent increase in tuition.

Financial Aid

The amount of need-based aid offered had a positive coefficient in both the quantity and quality models as predicted. It was anticipated that as financial aid increases, the quantity and quality of applicants would increase as well. The more need-based aid a school is able to provide, the greater the number of students requiring aid will apply. The financial aid variable was statistically significant in all the tested models. The results showed that financial aid had the greatest impact on both the quantity and quality of

applicants in the models using just basketball data. Additionally, financial aid had a greater impact on the quantity of applicants than on the quality of applicants.

Since financial aid is also measured in current dollars with a sample average of $17 million for the basketball models and $18.1 million for the football and combined models, the marginal effects for financial aid appear very small. A one-dollar increase in financial aid had a relatively small marginal effect on the volume of applicants and average SAT scores. It is therefore applicable to use the elasticity of financial aid displayed in Appendix E to observe the percent change in applicant quantity and quality from a one percent increase in financial aid.

Control

The dummy variable control had a positive coefficient for all the quantity models as expected. Since public schools tend to be larger than private schools, it is logical that public institutions would receive a higher quantity of applicants. Control was statistically significant in all of the quantity models except for the four year lagged model using both football and basketball data. The greatest impact was seen in the models utilizing only the basketball scandal data.

This study predicted that control would have a negative coefficient for the quality models, meaning that being a public university would result in a lower quality of applicants. While the coefficient for control was negative in the quality models regressed using the football and combined football and basketball data, it was statistically insignificant in each of these models. Control was statistically significant in the quality models regressed with basketball data, but the coefficient was surprisingly positive. This means that public universities not only receive a greater quantity of applicants, but obtain

a higher quality of applicants as well. The results conclude that being a public university increases the number of applicants by a greater percentage than it increases the average SAT scores.

Percent Faculty with a PhD

The percent of faculty with a PhD variable had a positive coefficient for all the models as expected. This study used the percent of faculty with a PhD variable as a measure of a university's quality. It was anticipated that the greater the percentage of faculty with a PhD, the higher the quantity and quality of applicants received.

The percent faculty with a PhD variable was statistically significant in all of the quantity and quality models. A one percent increase in faculty with a PhD resulted in a greater increase for the number of applicants than for the average SAT scores of enrolled freshman.

Student-Faculty Ratio

It was predicted that the student-to-faculty ratio would have a negative coefficient for both the quantity and quality models. As expected, the coefficients for all the quality models were negative. Since this study used the student-to-faculty ratio as a measure of a university's quality, it is logical that as the student-to-faculty ratio increases, the quality of applicants decreases. The coefficients for all the quantity models were positive. Although this was unexpected, it can be argued that universities with larger class sizes have more students, and therefore receive a greater quantity of applicants.

The student-to-faculty ratio was statistically significant for all the quality models, with the magnitude of impact remaining fairly consistent. While this variable was statistically significant in the quantity models using the football and combined football

and basketball data, it was statistically insignificant for the quantity models utilizing just basketball data. A one-unit increase in the student-to-faculty ratio had a greater impact on the number of applicants than a one-unit decrease had on the average SAT scores.

Socioeconomic Results

Median Income

As expected, the coefficient for the median household income by state was positive. It is logical that as the median household income increases, more people are able to afford college and therefore the quantity of applicants rises. Median income was only statistically significant in the quantity models regressed using football and combined football and basketball data.

Measured in current dollars with a sample average of $46,545.46 for the basketball models and $45,091.36 for the football and combined models, the marginal effects for median income seem small. A one-dollar increase in median income had a relatively small marginal effect on the number of applicants and average SAT scores of enrolled freshman. To observe the percent change in applicant quantity and quality from a one percent increase in median income, the elasticity of median income shown in Appendix E can be used.

Conclusions

The main objective of this study was to determine the impact of NCAA Division I men's basketball and football scandals on the quantity and quality of applicants. Since schools compete for students each year, it is important that they understand the factors that influence a student's decision to apply to a university. Despite the importance of

athletic programs at schools, the relationship between athletics and applicants has not been fully researched.

While studies have focused on the positive impacts of athletic programs and winning seasons, hardly any research has been done on how negative athletic programs affect applicants. To fill this void in the research, the model developed by Murphy and Trandel (1994) and modified by Kostelnik (2011) was adapted to fit the objectives of this study. To control for the factors that impact applicants, athletic, academic, and socioeconomic data was collected and merged together.

Future research could build on the findings of this study by exploring the influences of different athletic and social instances that might attract negative publicity to a college or university. Additionally, it would be interesting to see if adding demographic information, for example the number of students turning 18 years old in a year, changes the results of the study. Finally, the generalized method of moments (GMM) could be used to overcome the shortcomings of non-normality since GMM doesn't assume normality.

The most interesting and important conclusion from this study is that both basketball and football scandals positively impacted the quantity and quality of applicants in each of the tested models. Based on intuition, this study predicted that the occurrence of a scandal would draw negative attention to a school, and as a result decrease the applicant quantity and quality. Since the results were in fact opposite of what was expected, this begs the question of whether there is negative publicity for a college or university.

APPENDIX A

LAGRANGIAN MULTIPLIER METHOD

$$U = (R, Q)$$

$$I = P_R R + P_Q Q$$

$$\mathcal{L} = R^{\alpha} Q^{\beta} + \lambda \{I - RP_R - QP_Q\}$$

$$\frac{\partial \mathcal{L}}{\partial R} = \alpha R^{\alpha-1} Q^{\beta} - \lambda P_R = 0$$

$$\frac{\partial \mathcal{L}}{\partial Q} = \beta R^{\alpha} Q^{\beta-1} - \lambda P_Q = 0$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = I - RP_R - QP_Q = 0$$

$$\frac{\alpha Q}{\beta R} = \frac{P_R}{P_Q}$$

$$R = \left(\frac{\alpha}{\alpha+\beta}\right) \frac{I}{P_R}$$

$$Q = \left(\frac{\alpha}{\alpha+\beta}\right) \frac{I}{P_Q}$$

APPENDIX B

TEST RESULTS

Quantity: Dependent Variable LnApply			
Test / Model	Breusch-Pagan Test for Heteroskedasticity Chi^2 H_0 = Homoskedasticity	Woolridge Test for Serial Correlation F-statistic H_0 = No serial correlation	Jarque-Bera Test for Normality Chi^2 H_0 = Normally distributed errors
BB 1	44.00 (3.84)	176.28 (3.84)	46.88 (5.99)
BB 2	43.60 (3.84)	176.59 (3.84)	46.71 (5.99)
BB 4	39.44 (3.84)	176.36 (3.84)	48.92 (5.99)
FB 1	39.79 (3.84)	41.44 (3.92)	58.86 (5.99)
FB 2	38.81 (3.84)	41.31 (3.92)	58.06 (5.99)
FB 4	37.98 (3.84)	41.25 (3.92)	58.51 (5.99)
FB & BB 1	40.90 (3.84)	41.61 (3.92)	65.88 (5.99)
FB & BB 2	43.07 (3.84)	40.62 (3.92)	65.31 (5.99)
FB & BB 4	39.67 (3.84)	41.27 (3.92)	62.13 (5.99)

Quality: Dependent Variable LnSAT			
Test / Model	Breusch-Pagan Test for Heteroskedasticity Chi^2 H_0 = Homoskedasticity	Woolridge Test for Serial Correlation F-statistic H_0 = No serial correlation	Jarque-Bera Test for Normality Chi^2 H_0 = Normally distributed errors
BB 1	142.76 (3.84)	5.10 (3.84)	677.50 (5.99)
BB 2	142.63 (3.84)	5.15 (3.84)	682.70 (5.99)
BB 4	140.38 (3.84)	5.04 (3.84)	678.50 (5.99)
FB 1	16.19 (3.84)	34.83 (3.92)	63.13 (5.99)
FB 2	15.08 (3.84)	35.02 (3.92)	60.93 (5.99)
FB 4	15.88 (3.84)	35.14 (3.92)	64.76 (5.99)
FB & BB 1	14.93 (3.84)	37.29 (3.92)	61.01 (5.99)
FB & BB 2	14.69 (3.84)	37.88 (3.92)	60.37 (5.99)
FB & BB 4	13.32 (3.84)	35.13 (3.92)	52.58 (5.99)

APPENDIX C

MARGINAL EFFECTS

Marginal Effects for Logged Student-Faculty Ratio Variable for BB 1 Quantity Model:

$$LnApply = \beta_0 + \beta_1 LnSFRAT$$

$$\frac{1}{Apply}\left(\frac{\delta Apply}{\delta SFRat}\right) = 0 + \frac{\beta_1}{SFRAT}$$

$$\left(\frac{\delta Apply}{\delta SFRat}\right) = Apply_{mean}\left(\frac{\beta_1}{SFRAT_{mean}}\right)$$

$$\left(\frac{\delta Apply}{\delta SFRat}\right) = 10427.13\left(\frac{0.0753113}{12.97916}\right)$$

$$\left(\frac{\delta Apply}{\delta SFRat}\right) = 60.503$$

Marginal Effects for Percent of Faculty with a PhD Variable for BB 1 Quantity Model:

$$LnApply = \beta_0 + \beta_1 FacPhD$$

$$\frac{1}{Apply}\left(\frac{\delta Apply}{\delta FacPhD}\right) = \beta_1$$

$$\left(\frac{\delta Apply}{\delta FacPhD}\right) = Apply_{mean}(\beta_1)$$

$$\left(\frac{\delta Apply}{\delta FacPhD}\right) = 10427.13(0.0066627)$$

$$\left(\frac{\delta Apply}{\delta FacPhD}\right) = 69.473$$

Marginal Effects for Basketball Dummy Variable for BB 1 Quantity Model:

$$LnApply = \beta_0 + \beta_1 BB_{t-1}$$

$$\left(\frac{\delta Apply}{\delta BB_{t-1}}\right) = e^{\beta_1} - 1$$

$$\left(\frac{\delta Apply}{\delta BB_{t-1}}\right) = e^{0.2538707} - 1$$

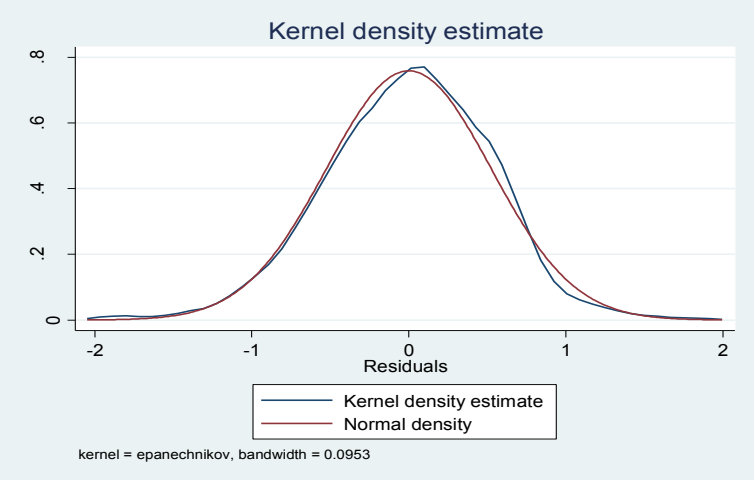
$$\left(\frac{\delta Apply}{\delta BB_{t-1}}\right) = 1.289005125 - 1$$

$$\left(\frac{\delta Apply}{\delta BB_{t-1}}\right) = 0.289 \; or \; 28.9\%$$

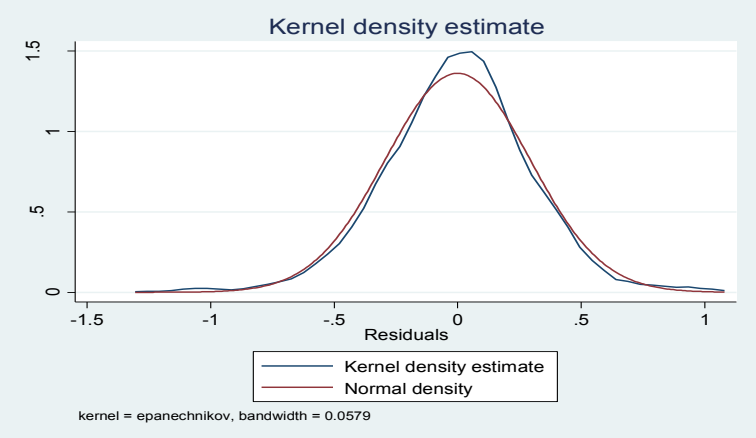
APPENDIX D

KERNEL DENSITY ESTIMATES

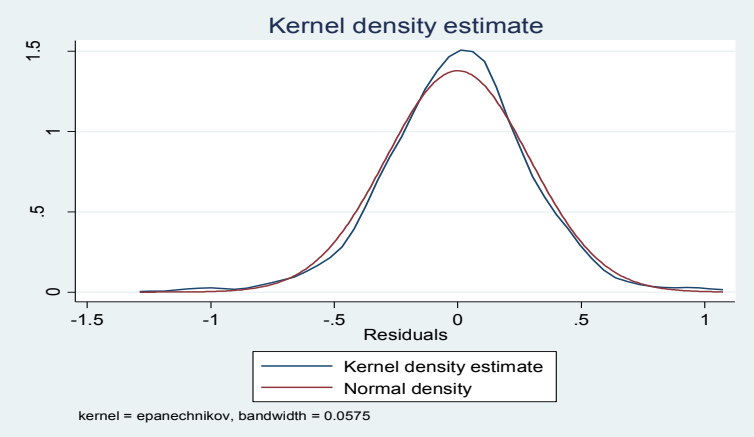
Quantity (Dependent Variable LnApply): BB 1



Quantity (Dependent Variable LnApply): FB 1



Quantity (Dependent Variable LnApply): FB & BB 1



APPENDIX E

ELASTICITY RESULTS

Quantity: Dependent Variable LnApply									
Model / Variable	BB 1	BB 2	BB 4	FB 1	FB 2	FB 4	FB & BB 1	FB & BB 2	FB & BB 4
LnIncome	0.359 (1.35)	0.341 (1.29)	0.357 (1.35)	0.713* (2.56)	0.698* (2.51)	0.668* (2.41)	0.717* (2.60)	0.669* (2.42)	0.669* (2.43)
LnTuition	0.286* (4.14)	0.288* (4.17)	0.289* (4.19)	0.022 (0.41)	0.016 (0.29)	0.008 (0.15)	0.015 (0.28)	0.013 (0.23)	0.004 (0.08)
LnFAid	0.182* (12.34)	0.182* (12.35)	0.181* (12.34)	0.096* (6.62)	0.097* (6.59)	0.096* (6.51)	0.098* (6.57)	0.098* (6.51)	0.096* (6.44)
FacPhD	0.007* (7.93)	0.007* (7.93)	0.007* (8.01)	0.004* (3.74)	0.004* (3.69)	0.004* (3.68)	0.004* (3.71)	0.004* (3.74)	0.004* (3.87)
LnSFRat	0.075 (1.35)	0.077 (1.31)	0.073 (1.23)	0.140* (2.20)	0.137* (2.15)	0.137* (2.13)	0.148* (2.34)	0.148* (2.33)	0.144* (2.25)

*Indicates significance at the 5% level

Note: Each column provides the coefficient and t-statistic for the basketball (BB), football (FB), and combined (FB & BB) models for each lag (1, 2 and 4).

Quality: Dependent Variable LnSAT									
Model / Variable	BB 1	BB 2	BB 4	FB 1	FB 2	FB 4	FB & BB 1	FB & BB 2	FB & BB 4
LnIncome	0.016 (0.51)	0.015 (0.47)	0.016 (0.49)	0.059 (1.68)	0.054 (1.52)	0.052 (1.47)	0.060 (1.69)	0.051 (1.46)	0.053 (1.50)
LnTuition	0.054* (6.43)	0.054* (6.44)	0.054* (6.46)	0.016 (1.61)	0.015 (1.56)	0.016 (1.64)	0.015 (1.55)	0.015 (1.53)	0.015 (1.59)
LnFAid	0.015* (8.69)	0.015* (8.70)	0.015* (8.71)	0.012* (6.15)	0.012* (6.16)	0.012* (6.13)	0.012* (6.12)	0.012* (6.14)	0.012* (6.17)
FacPhD	0.002* (14.62)	0.002* (14.61)	0.002* (14.63)	0.001* (6.76)	0.001* (6.72)	0.001* (6.72)	0.001* (6.79)	0.001* (6.75)	0.001* (6.96)
LnSFRat	-0.079* (-10.88)	-0.079* (-10.86)	-0.079* (-10.88)	-0.078* (-8.92)	-0.078* (-8.86)	-0.078* (-8.81)	-0.078* (-8.80)	-0.077* (-8.74)	-0.077* (-8.72)

*Indicates significance at the 5% level

Note: Each column provides the coefficient and t-statistic for the basketball (BB), football (FB), and combined (FB & BB) models for each lag (1, 2 and 4).

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