Issues in Political Economy, Vol 21, 2012, 82-116

Can Football Buy Smarter Students?: The Effect of Athletic Spending on Football Championship Subdivision Academic Institutions

Tyler Zoda, Elon University

There is a mentality across universities that money spent on athletics might be better spent on things that directly impact the academic environment of the institution. For example, in order to better the university one may argue that money spent on upgrading the library is more appropriate than money spent on renovating the stadium. The more general issue is the conflict between spending on academics verses athletics in the college environment. Since resources are scarce, colleges need to find the optimal allocation of funds in order to maximize benefits across the institution. Colleges get exposure from their sport teams; but are the benefits gained from this exposure enough to justify funneling money away from academics? In addition, do funds spent on athletics really detract from the academic success of its students? More specifically, my research question is: *does money spent on Division I-AA athletics, and specifically football, help increase the prestige of the university by attracting brighter students?*

Previous studies have suggested that success on the football field may lead to smarter students, thus simultaneously advancing the academic goals of the university. The majority of these studies have focused on colleges which compete in the Football Bowl Subdivision (FBS), formerly known as Division I-A. This is the highest level of competition in terms of NCAA football, and thus by extension it also gets the most media coverage. My research however will focus on the correlation between football athletic spending and academic success in the lower tier Division I-AA Football Championship Subdivision (FCS) schools. To my knowledge, the relationship between academic and athletic spending at this level of intercollegiate football has not yet been studied, and therefore this research will add an important element to the existing literature. As we generally think of resources as being relatively more scarce at these smaller Division 1-AA institutions, it is crucial to analyze the tradeoff between spending money on sports versus academics in this environment. Since Division 1-AA schools do not attract the money or the media attention of Division 1-A schools, every decision school leaders at this level make about resource allocation is important because there are relatively fewer funds to go around and the rewards are not as obvious.

The current study is heavily grounded in the literature, but at the same time is quite different. While previous studies show that success of the football program helps large FBS schools by looking at the number of wins on the field compared to a variety of university inputs, this study will be looking at the actual amount of money spent on athletics at FCS schools. With new data on actual athletic expenditures, I am able to capture the true impact of spending, instead of simply using the number of wins as a proxy for spending which previous studies have done. This study is also unique because, to my knowledge, nobody has done any scholarly research on FCS schools exclusively. The goal of the project is to see if spending on football affects academics, or if the two are mutually exclusive. If spending *is* shown to be mutually exclusive, this implies that money spent on football only benefits the athletic department (i.e. the effect of the spending is “exclusive” to the department in which it is spent) and thus does not improve the academic quality of the university at all. If the benefit of athletic spending *is not* exclusive to athletics, then it opens up alternative possibilities in regards to how to allocate resources, because it shows that money spent on athletics may also improve the academic success of the university.

After analyzing previous theory and the literature, my hypothesis is that spending on athletics does in fact enhance the academic reputation of the institution. One way to proxy whether a university's academics are getting better is to analyze whether it is attracting smarter students.[1] Therefore to test this hypothesis, I will develop a model that will test to see if allocating additional resources to athletics, particularly the football program, significantly affects the average SAT scores of the incoming class.

This study is important because it will give quantitative support for university leaders in making decisions regarding the opportunity cost of funds. Resources are limited since many of the FCS schools do not have large endowments. This study may help to give university leaders empirical evidence that they can use in order to make the best, most educated decision on how to improve the quality of their universities.

I. LITERATURE REVIEW

In the article "Athletics versus Academics? Evidence from SAT Scores," Robert McCormick and Maurice Tinsley examine this question of resource allocation as it pertains to university spending across large FBS institutions. In particular, the authors look to see if football expenditures have an impact on the quality of academics by testing whether overall student quality (as measured by freshman SAT scores) has improved with athletic success. The authors evaluate SAT scores as a function of the quality of university inputs, specifically tuition, salary of faculty at the school, number of book volumes in the library, student/faculty ratio, among others. Using a regression analysis, the authors found that schools that play in the larger FBS sports conferences, such as ACC or SEC, tend to have smarter undergraduate student bodies on average than schools that do not. The study also analyzed individual schools' football in-conference winning percentages and compared them to the same variables that were used in the function to evaluate SAT scores, and found that athletic success *did* help improve the SAT of incoming freshmen.[2] This is an important basis for my own research, as it is one of the first studies to tackle the resource allocation question in the context of institutional spending. It differs from my current research however in that it ignores FCS institutions and the unique problems they face.

In response to McCormick and Tinsley's findings, Bremmer and Kesselring conducted a follow-up study which found that success in university athletics does *not* increase incoming freshmen SAT scores. The authors argue that incoming freshman SAT scores are primarily determined by admissions standards and university policy, and are not affected by athletics at all. They also found that membership in a major FBS conference does not have a significant effect on SAT scores.[3] This research is important because it essentially finds the exact opposite results as McCormick and Tinsley and thus highlights the importance of the choice of data and methodology on research outcomes. It also shows that research in this area is far from a consensus and emphasizes the need for additional investigation into this question.

Other studies have explored this topic as well, most notably Sigelman in 1995 and Tucker and Amato in 1993. Tucker and Amato analyzed a model where SAT scores are a function of football success, men's basketball success and a number of other key academic variables. The main focus of the research was to see if there is any evidence of positive spillovers from a high quality athletic program to the academic components of the university. To analyze this question, the authors analyzed SAT scores as a function of academic and athletic characteristics. The specific academic characteristics used were the number of volumes in the library, faculty salary, student faculty ratio, tuition, enrollment, whether the university was private, and age of the university. To measure success on the gridiron or hardwood, they use the final Associated Press rankings in football and basketball, respectively, instead of using win/loss records, as this takes into account strength of. They find that football success in the FBS improves the average SAT scores over time, but a highly successful basketball team does not. The findings suggest that academic inputs are the most significant determinants of SAT scores; however since FBS football success does contribute positively to SAT scores of incoming freshmen, it seems there are also some spillover effects from athletic spending onto academic performance.[4] It should be noted however that the authors only looked at Division I-A FBS football schools, not FCS schools. This impacts my current research by posing the possibility that the effect of athletic success on academics may not be uniform across sports. The authors also pose the question of whether the cost of running and maintaining a top-quality athletic program is worth the high costs. This is something that will also be addressed in my research.

Another study that influenced my research is “Intercollegiate Athletics and Student Choice: Exploring the Impact of Championship Seasons on Undergraduate Applications,” by Douglas Toma and Michael Cross. The authors analyzed the FBS men’s basketball and football national championship winners over the past 20 years and compared the number of applications before and after each school won the national championship. The authors compared the increase or decrease in applications to the increases or decreases that peer institutions saw over those same years. For example, when Clemson won the football national championship in 1981, the authors compared the change in number of applicants Clemson received the next year with that of NC State, North Carolina, Virginia Tech, Auburn, and Mississippi. They found that winning a national championship in either football or men’s basketball translated into an increased number of admissions applications received, but unfortunately their study did not take into account changes in the *quality* of the students applying. The authors also lagged admissions, waiting until the year after to look at the effects of athletic success since they knew if a school won a championship, it will not affect the incoming class until the next fall.[5] While my research looks at a broader sample of institutions, rather than just national championship winners, the expectation that athletic success also significantly impacts admissions (lagged) is one of the basic hypotheses of my research.

More recently, the NCAA commissioned an independent study conducted by Robert Litan, Jonathan Orszag and Peter Orszag, to analyze the effects of college athletics. The study, entitled “The Empirical Effects of Collegiate Athletics,” primarily focuses on the financial effects of spending on FBS schools. The authors ran regressions on a number of economic models where real athletic department revenue was dependent on real spending, school controls, and year controls. The authors could not prove that spending money on football was a statistically significant determinant of an increase in athletic revenue. In fact, the data showed that over the medium-term of approximately 8 years, an increase in operating expenses on football or the men’s basketball teams were not associated with any change in net revenue or increase of winning percentage. More importantly, the authors could not prove their hypothesis that “increased operating expenditures on sports affect measurable academic quality.” They found no relationship between incoming SAT scores or the percentage of applicants accepted and operating expenditures. This is important as it emphasizes the uncertainty surrounding the impact that athletic spending has on academic success.[6]

A very similar study, also by Jonathon Orszag and Peter Orszag, is called "Empirical Effects of Division II Intercollegiate Athletics." It focuses on Division II schools, which are one step down from the FCS schools that my research will focus on. The authors analyze how spending on athletics affects athletic revenue. They found that an increase in athletic operating expenses and total athletic spending cause declines in net revenue for the institution. The authors also looked at roughly 50 schools that have moved from Division II to Division I. This is important to my study because these schools move from Division II to the FCS. The authors found that on average a move from Division II to FCS does not increase net revenue. There have been schools that have been exceptions however; the authors note the College of Charleston as a positive example of a school whose net revenues increased after making the jump from Division II to FCS.[7]

Clearly, the literature on this topic is mixed. On one hand, you have studies such as Toma and Cross suggesting that athletic success has a positive effect on academic quality. Yet there are also more recent studies that find no relationship between athletic spending and the academic quality of the institution. As these studies looked primarily at the FBS level, this may indicate no uniform effect across this level of institutions; however, no study to date has looked specifically at the FCS level. I would like to be the first to look at how the FCS is affected when dealing with questions surrounding athletics, money, and academics.

II. THEORY

The problem of resource allocation for universities can be modeled as a welfare-maximization problem. In this context, the high-level administrators can be thought of as the decision-makers, or the social planner, choosing the optimal allocation of resources across the university so as to maximize the overall welfare of the institution. The welfare function of the institution itself may be hard to specify, but most likely includes factors such as the academic success of its students, enrollment and faculty-student ratios, some measure of faculty and/or student diversity, and the success of its athletics programs.

In the past, university spending has been seen as an either/or type situation, where leaders could spend money on either academics or athletics. If this is the case, the implication is that the utility or welfare function of the institution is separable in spending on athletics and spending on academics. This means the two factors are additively separable from each other in deciding the level of utility so that the utility function would look like:

$$U(ATH, ACAD) = S(ATH) + T(ACAD) \quad (1)$$

Where S(·) is a function which dictates the efficiency of spending on athletics, and T(·) is a function which dictates the efficiency of spending on academics. The aggregate utility function in this form would imply that increasing spending on athletics ($\uparrow ath$) will increase utility, but have no impact on the academics of the institution, and vice versa. That is, an additively separable utility function would imply:

(2) $$\frac{\partial^2 U}{\partial ATH \partial ACAD} = 0$$

Given however that much of the literature disputes this claim, this suggests that the welfare function for university spending may in fact *not* be separable.

This paper suggests that spending on athletics and spending on academics is non-separable, which would imply the utility function is of the type:

(3) $$U(ATH, ACAD) = S(ATH) * T(ACAD)$$

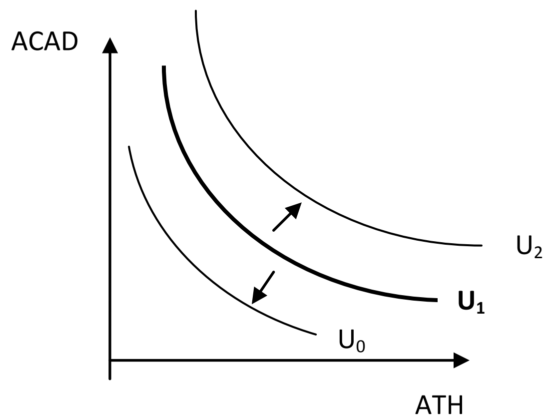
This means any increase in spending on athletics or academics will lead to a change in the marginal effect of the other variable, as well as increasing the overall utility. The problem with this new way of thinking is that it is theoretically unclear which way the change in the marginal effect should go. That is, if a school increases spending on athletics, does that in itself make spending money on academics more or less valuable? This is a question what will be addressed in my research.

The constrained utility maximization problem of the university can be illustrated in terms of the budget constraint and a set of indifference curves. As the choice between spending on academic pursuits versus athletics is the main focus of this paper, for simplicity we will abstract from those other factors which may affect the welfare function of the university, however the model is easily extended to *n* choice variables. In general, the choices of the institution are limited by the amount of resources (or income) available to them. Mathematically, we can illustrate this in terms of a budget constraint.

(4) $$p^{ath} * ATH + p^{acad} * ACAD \leq I$$

where p^{ath} represents the price of athletic spending, ATH represents the level of athletic spending, p^{acad} represents the price of spending on academic pursuits, ACAD represents the level of spending on academics at the university, and I represents the income of the university. Intuitively, the budget constraint represents the possible combinations of spending on athletics and academics given the price of each and the fixed income of the institution. The slope of the budget constraint represents the trade-off between spending on athletics and academics, and mathematically can be shown to be equal to $-\frac{p^{ath}}{p^{acad}}$.

An indifference curve represents all the various combinations of athletic/academic spending that produce the same level of utility for the university. That is, at any point on the curve U_1, the university is indifferent between that spending combination, and another on the same curve. Any point to the right of the curve U_1 would generate a higher level of utility for the university, U_2; any point to the left of U_1 would generate a lower level of utility, U_0.



(1) Indifference Curve

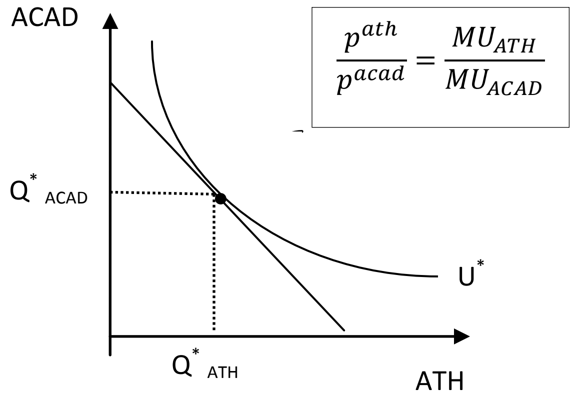
The slope of the indifference curve represents the rate at which spending may be exchanged without altering the overall level of utility of the institution. Mathematically, the slope of the slope is equal to the ratio of the marginal utilities, or

(5) $$-\frac{\partial U}{\partial ATH}\Big/\frac{\partial U}{\partial ACAD} = -\frac{MU_{ATH}}{MU_{ACAD}}$$

The absolute value of the slope of the indifference curve is known as the marginal rate of substitution (MRS). Intuitively, the MRS represents the amount that athletic (academic) spending must increase by in order to offset a 1-unit decrease in academic (athletic) spending in order to keep utility constant.

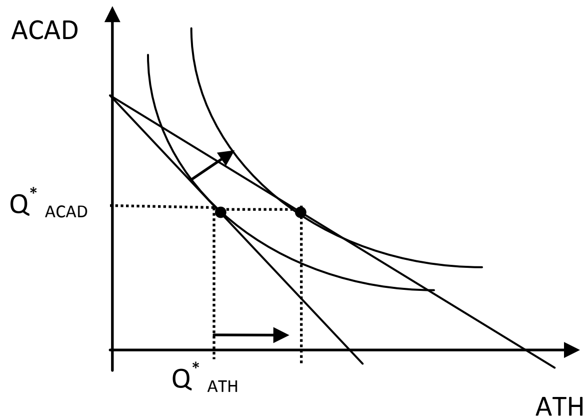
The solution to the university's constrained utility maximization problem yields a set of optimal spending choices that put the university on the highest indifference curve possible, while not exceeding their budget constraint. This optimal combination of spending occurs at the point where the indifference curve is tangent to the budget constraint. At this point the absolute value of the slopes will be equal, and thus the utility-maximizing solution will occur where

(6) $$\frac{p^{ath}}{p^{acad}} = \frac{MU_{ATH}}{MU_{ACAD}}$$



(2) Utility Maximizing Figure with Separability

Any change in the income of the university will shift the budget constraint outward, thus shifting the utility-maximizing spending combination to new, higher levels, and thus a new, higher overall utility level. Similarly, any change in the relative price of athletic versus academic spending will change the optimal outcome. In this scenario however, the slope of the budget line will be altered, thus pivoting the original budget line. This scenario is important in the context of this paper, because if the utility function of the university is non-separable in spending, then as explained previously, this nonseparability will also affect the overall value, and hence the relative prices, of athletic versus academic spending. Specifically, if increased spending on athletics has a positive influence on the marginal utility of academic spending, then this essentially lowers the relative price of athletic spending in relation to academic spending. If this is the case, then as athletic spending becomes relatively cheaper the budget line shown above will become flatter. The optimal quantities of athletic versus academic spending will also change as well, as shown in the figure below.



(3) Utility Maximizing with Non-Separability

III. DATA

The most crucial part of any study is acquiring reliable data. Luckily, two databases have already been identified that together contain information on all the variables and observations needed to conduct this research. Data on athletic spending can be found on the Equity in Athletics Disclosure Act (EADA) website, which consists of athletics data submitted by all co-educational postsecondary institutions. Data on university spending can be found on the Integrated Post Secondary Education Data System (IPEDS) Data Center website, which is a government sponsored website that contains data on all US colleges. The data goes up to the 2008-2009 school-year, however the 2007-2008 school year was used so as to avoid any effects that the 2008-2009 recession may have had on spending by universities.

Like Toma and Cross, data on athletics is lagged to assure that there is no simultaneity and to give the proper time for spending on football to affect SAT scores of incoming freshmen. To illustrate this, suppose a Division I-AA team is successful in year t, and garners much media publicity. Even if this increased exposure causes more, and perhaps brighter, high school students to want to attend the university, at the earliest the students will not be able to enroll until the following year (t+1). In addition, since football is a fall sport, a team that is successful in the late fall of 2005 - which is right after the time high school seniors choose which college to attend for the following year - will mostly likely not see a change in the number and/or quality of freshmen applicants until fall of 2007 (i.e. year t+2). It is possible that there may be a change in applications in the immediate next year (i.e. 2006-2007 school year), however I predict the full effect will not be seen until 2 school years after. Therefore, the academic data collected from EADA will be for the 2007-2008 academic year and, since football is a fall sport, athletics data from 2005 will be utilized (from the same EADA data source). These years were chosen as they were the most recent available. The data were merged to create a final dataset which will be used to estimate the empirical model.

The specific variables used to measure spending on both athletics and academics are based on previous research. SAT scores, as previous literature suggests, is a good proxy to the overall integrity of the institution because if a university has more prestige and better academics, incoming freshmen should be smarter.[8] Unfortunately the IPEDS data did not report specific SAT scores of incoming freshmen, so the SAT 75th percentile score was used as a substitute. This variable reports that 75% of incoming students got a certain score or higher on the critical reading and the mathematics portion of the SAT. The 75th percentile scores of the critical reading and the mathematics sections were added together to produce an aggregate SAT 75th variable for the universities' 2007-2008 class. This variable will be utilized as the dependent variable in the empirical analysis. In the econometric equation its variable name is *satcr75.*

Athletic spending per football player was used to measure athletic spending and accurately compare schools. Since football is typically the most media-covered, and attended sport in the mid-major/Division I-AA level, increasing spending on football has the potential to affect academics the most. Spending on football was chosen instead of overall athletic spending because when athletic directors and other university leaders of FCS institutions need to make resource allocation decisions that maximize spending, they often copy the spending models of the major institutions. In particular, a strategy followed by many Division I-A athletic programs is to heavily invest booster money into the football program and use the financial success of this sport to increase spending in the other non-profitable sports. In fact, that is how many advocates for big-time college football justify the millions of dollars being spent on facilities and such.[9] As a result, per-student spending on football programs may actually be a better indicator of the commitment on average to athletic spending than athletic spending itself.

A key variable in the model is academic spending per pupil. This variable is a logical choice to explain academic quality of the institution, because if a university was investing more in its students, it should attract brighter students given its ability to afford more/better resources. McCormick and Tinsley used the number of volumes in the library as a proxy for spending per pupil in their regression.[10] However, since data on university spending is now available, we use this data directly so as to avoid any bias as a result of proxies. Academic spending per pupil comes from 2007-2008 school-year data. The predicted sign of spending per pupil is positive. The prediction is positive because as a school invests more in its current students, it makes sense that the school will become more desirable to prospective students. It is also based on Sigelman's findings in his 1995 paper.[11] In the econometric equation (and results tables) its variable name is *lexpper0708stud.*

Athletic spending per football player, which is measured as the total football operating expenditure per athlete, is the main variable of interest in the model. Although the literature is mixed, the predicted sign for spending per football athlete is positive. I hypothesize that investing more in football will increase the success of the football team. However given that football is the most popular and revenue producing sport at the FCS/mid major level, this on-field success will also help attract smarter students. The variable of spending per athlete in a particular sport is taken from the Litan and Orszag paper.[12] Spending per football player comes from 2005 data from the EADA. In the econometric equation its variable name is *exp05perath.*

Football and academic spending were measured in spending-per-athlete and spending-per-student in order to take into account size of both the institution as well as the football team itself. By measuring spending in per-capita terms, this allows us to control for the differences in large universities versus small universities as well as larger football teams versus smaller teams.

The percent of freshman receiving financial aid should affect average incoming freshmen SAT scores because a higher number of freshmen receiving financial aid should make a university more accessible to all students, thus increasing its number of applications. This would allow a school to become more selective, thus increasing the academic integrity of the institution. This specific variable has not been used in empirical studies such as this before, but Brownstein talked of how colleges spend money through financial aid to attract and keep smart potential students.[13] Thus the predicted sign for financial aid per undergraduate is positive. Financial aid per freshman comes from 2007-2008 year data. In the econometric equation in the appendix its variable name is *frosh0708finaid.*

The retention rating is the percent of freshmen who come back to the university as sophomores. This is an important statistic because it shows how overall pleased and happy the student body is at the university. A school that has a low retention rating means students are transferring or dropping out, neither of which is good for the college nor the student. A low student retention rate potentially makes a college less desirable for prospective students since it sends a signal to prospective students as to the satisfaction of current/former students with the college. A low retention rate signals that students seem to be less satisfied with the institution and thus choose to transfer/drop out. Not wanting to make the same mistake, many prospective students shy away from schools with low retention rates. Based on this, I predict that as the retention rate of an institution increases, it tends to attract an increased number of high achieving students, so the predicted sign is positive. The variable name is *retention0708*.

Percent of applicants admitted is included as an independent variable to control for admission policy changes.[14] For example, if a goal of the institution is to increase the size of its student body, it may decide to simply relax their admission standards. If this is the case, then changes in admissions standards will have important effects on the academic quality of the institution. The percent of applicants admitted comes from 2007-2008 year data. If more freshmen are being admitted the university cannot be as selective, so the predicted sign for percent admitted is negative. In the econometric equation its variable name is *percentadmit0708.*

A private school dummy is included to see the effect of whether the university's public/private status has an effect on incoming freshmen SAT. Since state-supported universities are very different from private schools, it makes sense to separate them in the regression. Theory shows that attending an elite private college significantly impacts earnings, so in theory brighter students may prefer to go to a private school.[15] University's public or private status was obtained through their respective websites. I predict if it is a private school, it will positively impact SAT scores of incoming freshmen. In the econometric equation, the baseline is 'public', and thus the dummy variable is named *private.*

As stated previously, the main focus is on whether spending per football player is statistically significant. If it is significant, and if it's coefficient has a positive value, then it means that spending money on football improves the academic integrity of the institution by attracting smarter students. If it is statistically significant and negative, it may show that spending money on football actually detracts from the integrity by attracting less-smart students. Again, either way the policy implications will be significant. To test this, an Ordinary Least Squares (OLS) regression was run. Specifically we test:

(7) $lnSAT0708 = \beta_0 + \beta_1 ln(EXPPER0708STUD) + \beta_2 ln(EXP05PERATH) + \beta_3 FROSH0708FINAID + \beta_4 RETENTION0708 + \beta_5 PERCENTADMIT0708 + \beta_6 PRIVATE + \epsilon$

The dependent variable, as well as expenditures per student and per athlete, have been logged because of non-linearity in the data. Taking the log of these three variables linearizes the parameters and allows us to take the appropriate steps to run an OLS regression. Correct functional form was tested for using the Mackinnon-White-Davidson (MWD) test. The MWD test is specifically designed to see whether a log-linear model is appropriate based on the data, and thus the null hypothesis is that the log model is correct. Tables 5 and 6 in the appendix show the steps and the results of this test. After running the MWD test, I found that z^2 was insignificant at a t score level of -1.99, which means I fail to reject the null hypothesis at a .01 significance level. The results support the assumption that model is in fact linear in the parameters shown and thus proceeding with an OLS model is appropriate.

IV. RESULTS

The results from the baseline OLS regression are shown in Table 1 in the appendix. In the baseline regression athletic spending has a positive but not significant impact on SAT scores. The data also shows that spending per student is positive. This means that according to the data there was a positive correlation between football spending, spending per pupil, and incoming freshmen SAT scores. While neither athletic spending nor spending per pupil was statistically significant, it does raise the possibility that there might be some indirect benefits of increasing spending on athletics. The coefficients on the control variables, retention rate, percent admitted, and whether the university is private, are all positive and significant. The variable financial aid is significant and negative. The fact that the main variables being studied, spending per student and spending per football athlete are not significant lead to some suspicions that there might be some econometric errors in the OLS regression. Below, the baseline OLS regression is tested for econometric problems.

A. MULTICOLLINEARITY

Multicollinearity is a statistical phenomenon where two or more variables in a model are highly correlated. Existence of multicollinearity may bias the estimated coefficients in the model. The variance inflation factor (VIF) was used to check for multicollinearity. The results are shown on Table 1. The VIF is an econometric tool that quantifies the severity of the multicollinearity in an OLS regression. There usually is a problem with multicollinearity if the VIFs are greater than 5. Fortunately, the VIFs for all the variables are under 5, with retention rate variable having the highest at 2.95. This is probably due to the fact that the retention rate may contain some of the same information as the percent of students admitted and/or the percent of freshmen receiving financial aid.

B. AUTOCORRELATION

To analyze whether the results of the OLS were biased by autocorrelation, a Durbin-Watson d test was conducted; the results of which are shown in Table 2 in the appendix. This test yielded a Durbin-Watson d value of 1.937. An equation with no autocorrelation has a Durbin-Watson d value of 2. As you can see, 1.937 is very close to 2, and thus we can conclude that our results are not biased by autocorrelation. The lack of autocorrelation is not surprising given that this study utilizes cross-sectional data and autocorrelation is typically only a problem that occurs in time series data analysis.

C. OMITTED VARIABLES

Omitted variables are the source for numerous of problems such as biased coefficients in the OLS model, so it was important to test for this problem in order to verify the results. A Ramsey RESET test was conducted, with the results shown in Table 3 in the appendix. A partial F test was conducted on the new regression (see Table 4 for more information) and the result was an F-value equal to -0.1707. The critical $F_{.01}$ level is 6.92, and therefore since the value of .1707 is less than 6.92, we fail to reject the null hypothesis that there are no omitted variables at a 0.01 level. This means there does not appear to be an omitted variable and the coefficients in the model do not appear to be biased.

D. MEASUREMENT ERROR

Looking at the raw data, there did not seem to be any egregious measurement error. Since the data were self-reported there might be some selection bias. This, unfortunately, is unavoidable. However, the data that does get reported to both the EADA and IPEDS also goes to the federal government, with stiff consequences if a school is caught providing false information. This provides confidence that the data used are both reliable and verified. These data were also used in many of the latest studies commissioned by the NCAA, such as the papers "*Empirical Effects of Collegiate Athletics*" and "*Empirical Effects of Division II Intercollegiate Athletics"* co-written by the Orszags. Some of the previous studies that I based my research on were seminal papers and were cited extensively, particular the Bremmer and Kesselring, Toma and Cross, and McCormick and Tinsley papers. The data sets I used were not available at the time the previous papers were written. A potential source of measurement error in my data set is that out of a sample size of 121 schools, 19 were missing at least 1 variable. A more complete dataset may have yielded more comprehensive results, however with observations across over 100 different institutions, this is still a large enough dataset that we can have a high degree of confidence in the results.

E. HETEROSCEDASTICITY

When heteroscedasticity is present in a model, the variance of the residuals is no longer constant across the variables. A good way to spot heteroscedasticity is to look at a scatter plot that graphs the residuals and the predicted values. If the residuals look random and homoscedastic (i.e. constant variance around mean zero), most likely there is no problem with heteroscedasticity. On Graph 1 in the appendix however, one can see that the residuals of the OLS model look fairly linear (i.e. not random) with some major outliers - this is not a good sign.

Since the data has a relatively small number of observations (n=101), the Park test was run. The Park test is not the most powerful test for heteroscedasticity, but it is the most accurate when there is a small number of observations. If I had a much larger n, I could run White's test, which is a far more powerful test. The Park test results are reported in Table 7 in the appendix. Specifically, the Park test regresses the predicted values from the initial regression (p) on the residual values (r). The variables are logged in order to keep the parameters linear. If the relationship between r and p is significant, then heteroscedasticity is a problem. The results of the Park test were as follows:

(8) $$\ln(\mathrm{r}) = 73.15 - 40.77\ln(p) + u$$ With a t value of -3.35

At the 0.1 significance level, the critical t-value is 2.63. Therefore since the absolute value of -3.35 is greater than 2.63, we reject the null hypothesis that there is no heteroscedasticity and thus conclude that there *is* a heteroscedasticity problem.

To remedy this problem, the OLS regression must be abandoned in favor of a Generalized Least Squares (GLS) model. By dividing the entire equation by one of the independent variables, the residuals become homoscedastic. The question however becomes: which variable to divide by? One with a trained econometric eye can find which variable to divide by looking at scatter plots of the squared residuals against each variable. A scatterplot without heteroscedasticity should have points that are scattered and completely random. A scatterplot with heteroscedasticity should have points that follow a pattern or a trend. This is unscientifically known as the "Scatterplot Eye Test." Plots for each of the independent variables are shown in graphs 2 thru 6 in the appendix. By looking at the graphs, it is easy to spot that the variance of errors are larger when expenditures per student are low, the percentage of freshmen with financial aid is high, the percent admitted is high, and the retention rate is low. Knowing this, the heteroscedasticity error should be eliminated by dividing by the square root of any of these four variables. I tried with all four variables, with the results recorded in Table 8 in the Appendix. I chose to divide by the log of academic spending because when I did it not only passed the Park test but also the Scatterplot Eye Test, whereas none of the other variables did.

After dividing every variable by the square root of the log of academic spending per student, the heteroscedasticity problem is resolved. Re-running the Park test under the new equation gives (full results shown in Table 9 in the appendix):

(9) $$\ln(\mathrm{r}) = -21.11 + 15.02\ln(p) + u$$ With a t value of 1.48

Since the t value is not significant (i.e. is less than the critical value of 2.63), this means that we have eliminated the problem of heteroscedasticity with the GLS model.

V. FINAL RESULTS

The final results of the GLS model are shown below.

Table 1: Final Results

Variable	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	6.03258	0.29860	20.20	<.0001
Spending per Student	0.06385	0.02528	2.53***	0.0132
Spending per Athlete	-0.02942	0.01814	-1.62	0.1081
Financial Aid %	-0.00295	0.00092286	-3.20***	0.0019
Retention Rate	0.00855	0.00164	5.20***	<.0001
Admittance Rate	0.00244	0.00076618	3.19***	0.0019
Private Dummy	0.07532	0.03082	2.44***	0.0164

*** Statistically significant at 0.1, 0.5, and 0.01 level
(See table 10 for full table)

In particular, we learn that as academic spending per student goes up by 1%, incoming freshmen receiving scores in the 75th percentile go up 0.063%. This finding is consistent with the literature. For example, Tucker and Amato, find that university inputs have the biggest impact on raising incoming freshmen SAT scores.[16] This shows that as a university invests more per student, it has the potential to be a recruiting tool to attract smarter incoming students. The results also show that as athletic spending per athlete goes up by 1%, SAT 75th percentile scores go down 0.029%. It is important to note that this variable is not statistically significant. There were numerous papers that I based my theory and my research on that found athletic success has a *positive* impact on SAT scores of incoming freshmen. Although the negative coefficient on this independent variable does not directly support the findings of these other articles, it also does not necessarily contradict their findings either. The majority of these articles focused on the effects of athletic success, whereas I analyzed the effects of increasing athletic spending. This difference could be significant in explaining the conflicting conclusions present in the literature.

On the other hand, many of the papers in the literature *did* support the conclusion my paper reached when it came to college athletics and SAT scores. Bremmer and Kesselring also found that university athletics does not affect incoming freshmen SAT scores. They even went as far as to contest McCormick and Tinsley's findings.[17] They disagreed with the way McCormick and Tinsley ran their tests so they ran their own tests using the same data and the same variables. They found that the only statistically significant variable for public institutions was the change in the percent admitted. For private schools, the only significant variables were change in percent admitted and student faculty ratio. The research conducted by Orszag, the most recent paper available, was mandated by the NCAA and thus would seemingly have the most to gain by finding a positive correlation between athletics and incoming SAT scores. Even the Orszag paper did not find a significant impact of a change in athletic expenses in either football or basketball in Division I-A on the incoming SAT scores of freshmen.[18]

Other results of the model show that as the percent of freshmen receiving financial aid goes up by 1 percentage point, SAT 75th percentile scores go down 0.295%. As predicted, the percentage of freshmen who return as sophomores goes up 1 percentage point, SAT 75th percentile scores go up 0.855%. Higher retention rates also have a positive effect on attracting brighter students, which matched predictions. This makes theoretical sense, since if a university retains more of its freshmen, it must be more attractive to students, allowing it to attract brighter students. A surprising result was that as the admittance rate goes up 1 percentage point, SAT 75th percentile scores go up 0.244%. Bremmer and Kesselring found the acceptance rate to be a negative variable, so this goes against previous literature. They found that as a university's admittance rate goes up, on average SAT scores go down. This non-matching of literature could be the result of an endogenity problem with the data. The results also show that private schools tend to have SAT 75th percentile scores of incoming freshmen that are 5.36% higher than public schools. The private dummy having a positive effect also matched my theoretical predictions as studies have shown that there is this significant economic return to attending an elite private institution in terms of labor market premium[19], thus attracting smarter students.

VI. Endogeneity

Even though empirical tests show the final results to be valid, it is still curious that the coefficient on the percent admitted variable is positive when the previous literature, and theory, predict it to be negative. This is problematic because it is suggestive of an endogeneity problem in the model. More specifically, the model is based on the assumption that athletic and academic spending are not correlated with each other. If however there is some endogeneity, or correlation, between the two variables, this would bias the coefficients and thus could account for the percent admitted variable not lining up with expectations. In order to account for potential endogeneity, a two stage least squares (2SLS) model is run. One of the most important aspects to running a 2SLS test is finding an instrumental variable(s) (IVs) that will only affect athletic spending and have nothing to do with academic spending.

The conferences the schools are in were chosen to be the IVs. With the Ivy League being the exception, conferences are set up geographically and not based on the academics of the schools. For example, the Southern Conference has schools that are in the Southeastern United States. Seven of its twelve members are public institutions and enrollment ranges from Wofford College, with only 1,439 students, to Georgia Southern University, with 20,212 students.[20] This suggests that a dummy variable representing a school's conference is a good choice for the IV, since the conference a school is in, the Ivy League aside, should certainly have an impact on its athletic department/spending, however should be unrelated to the academics of the institution.

Since the Ivy League schools are the clear exception, these schools were eliminated from the 2SLS analysis. Below are the results of the 2SLS with conferences as the IVs and the Ivy League removed (the full table is found under Table 13 in the Appendix):

Table 2: 2SLS Results

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	6.021365	0.392685	15.33	<.0001
lexpper0708stud	0.035153	0.034596	1.02	0.3124
lexp05perath	0.002218	0.022545	0.10	0.9219
frosh0708finaid	-0.00284	0.001173	-2.42***	0.0176
retention0708	0.008730	0.001870	4.67***	<.0001
percentadmit0708	0.002674	0.000828	3.23***	0.0017
private	0.084678	0.033794	2.51***	0.0141

*** Statistically significant at 0.1, 0.5, and 0.01 level
(See table 10 for full table)

VII. Discussion

These results are interesting for a number of different reasons. One factor to take into consideration when viewing the results is that money may not directly buy success. Smart and Wolfe found that the biggest factor of gridiron success is the coaching staff. Investing money in a football team by upgrading facilities and student-athlete resources does not immediately show impacts on the field or is a significant factor in a sustainable competitive advantage.[21] To use examples from Division I-A, Oregon has only recently experienced success on the football field, even though Phil Knight, founder and CEO of Nike, has been piping money into the Oregon athletic department for years. T. Boone Pickens donated $165 million to Oklahoma State in the early 2000's. Although it is the single largest gift to any athletic department ever it has only allowed them to beat in-state rival Oklahoma once, in 2011. Those examples were given to show that even though a school might increase funding to the athletics department, the dividends might not be seen immediately on the field

VIII. Relation to Theory

Based on these results, it would be simple to say to spending money on academics provides a clear benefit in terms of attracting smarter students to the university, while spending money on athletics does not seem to provide these same benefits. This conclusion however implicitly assumes that the welfare function of the university is additively separable. As our original theory suggested however this may not be the case, and as a result, the significance of athletic spending on the average intelligence of entering freshmen may be masked in both this model as well as the other previous models which have made the same assumptions. In particular, a paper by Mixon and Hsing's paper finds that one of the biggest factors in determining why a high school student may choose to attend a university out-of-state is because they have a successful football program.[22] This suggests that sports programs may essentially be a type of marketing arm for the university. If this is the case, then the benefits of money spent on athletics may also have an indirect effect on the academic achievement of incoming students.

In order to test whether spending on athletics and academics are non-separable in the utility function, a new GLS was created with an interaction variable that multiplied spending on athletics and academics to see if there was a significant relationship. Specifically, an interaction variable (Academic Spending*Athletic Spending) variable was created to empirically test the non-separability across spending that our theory suggests. If this interaction variable is statistically significant, then it implies that while athletic spending on its own may not *directly* impact the overall SAT scores of incoming freshmen, there may still be some indirect effect through the interaction of athletic and academic spending. The results are in Table 11 in the Appendix. The coefficient for this interaction variable is positive at .00174, but yields a t-value of only 0.38. The value of this t-score however may be biased due to the multicollinearity that exists by introducing the interaction term, and hence a partial f-test was conducted to test whether or not the addition of the interaction term leads to a more effective model. The resulting F-value of this new GLS is -.00429, which is significantly insignificant. Specifically, this means that the addition of the interaction variable does not increase the statistical significance of the model overall, and hence does not support our theory about the non-separability of athletic spending and academic spending.

IX. Policy Implications

These results can be used by universities when it comes to budget allocation decisions. University leaders want to find the spending combination(s) that maximize the welfare of the institution. The results of this study support the literature in showing that increased spending on academics significantly increases the SAT score of incoming freshmen. The results however do not find statistical support for the idea that additional spending on athletics may have an indirect effect on the academic integrity of the institution. This would indicate that additional spending on athletics does not alter the slope of the budget line (i.e. does not alter the relative returns to academic/athletic spending). While our data does not show that increased spending on athletics has an indirect effect of increasing academics, it does however show that increases in spending on athletics, does *not* in itself make spending money on academics any less valuable. This seems to indicate that while institutions certainly still face decisions on how to allocate scarce resources across athletics and academics, they need not worry about spending on athletics detracting from the money spent on academics.

Clearly, when it comes to formulate a university budget, to get the most out of its endowment a university should invest heavily in its academics. Even though the effect was inconclusive, athletics still may have a role to play when determining a college’s value-offered to prospective students.

X. Conclusion

This study adds to the diverse mix of literature about the impact of spending on intercollegiate college athletics. The results show that spending on athletics and academics may in fact be additively separable across the welfare function of the institution. These results would support the implicit assumptions in previous papers, thus giving more support to the existing literature. The results also show that while increases in academic spending do in fact lead to an increase in the academic prestige of the institution, spending on athletics may not necessarily have benefits beyond the athletic programs. This paper however does not endorse reducing the money spent on intercollegiate football or athletics, it merely adds to the existing literature. A constraint of the paper was that it only looked at one year. An extension of this paper could be a time series study over the past decade. This would allow us to see trends, instead of just a snapshot. Another suggestion is to include winning percentage as part of the equation.

XI. APPENDIX A

Table A1: Baseline OLS

The REG Procedure

Model: MODEL1

Dependent Variable: lsat0708

Number of Observations Read	120
Number of Observations Used	101
Number of Observations with Missing Values	19

Root MSE	0.11508	**R-Square**	0.6259
Dependent Mean	7.07091	**Adj R-Sq**	0.6020
Coeff Var	1.62747		

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	1	5.80647	0.35687	16.27	<.0001	0
lexpper0708stud	1	0.05514	0.02814	1.96	0.0530	2.66105
lexp05perath	1	0.00719	0.01984	0.36	0.7180	1.19880
frosh0708finaid	1	-0.00283	0.00107	-2.63	0.0100	1.97200
retention0708	1	0.00849	0.00178	4.78	<.0001	2.94275
percentadmit0708	1	0.00244	0.00078959	3.09	0.0026	2.29436
private	1	0.08822	0.03243	2.72	0.0078	1.98961

Table A2: Durbin-Watson D Test

The REG Procedure

Model: MODEL1

Dependent Variable: lsat0708

Test of First and Second Moment Specification		
DF	**Chi-Square**	**Pr > ChiSq**
26	15.90	0.9386

Durbin-Watson D	1.937
Number of Observations	101
1st Order Autocorrelation	0.030

Table A3: Ramsey RESET Results

The REG Procedure

Model: MODEL1

Dependent Variable: lsat0708

Number of Observations Read	120
Number of Observations Used	101
Number of Observations with Missing Values	19

Root MSE	0.11559	**R-Square**	0.6266
Dependent Mean	7.07091	**Adj R-Sq**	0.5985
Coeff Var	1.63470		

Parameter Estimates

Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	B	17.05800	27.24021	0.63	0.5327
lexpper0708stud	B	0.33243	0.67187	0.49	0.6219
lexp05perath	B	0.04203	0.08668	0.48	0.6289
frosh0708finaid	B	-0.01686	0.03398	-0.50	0.6210

retention0708	B	0.04997	0.10044	0.50	0.6200
percentadmit0708	B	0.01428	0.02867	0.50	0.6196
private	B	0.52546	1.05897	0.50	0.6209
p2	B	-0.34965	0.84643	-0.41	0.6805
p3	0	0	.	.	.

Table A4: Partial F test

$$\frac{(new\ ESS - old\ ESS)/\#\ of\ new\ variables}{\frac{RSSnew}{df\ new}}$$

Which equaled:

$$\frac{(2.08515 - 2.08287)/1}{1.24254/93} = 0.1707$$

Critical F levels

The critical $F_{.01}$ level is 6.92

The critical $F_{.05}$ level is 3.94

The critical $F_{.1}$ level is 2.76

Table A5: MWD data

Two programs were run during the MWD test; the first, Table 5, was to get the data. The second, Table 6, was actually doing the test.

The REG Procedure

Model: MODEL1

Dependent Variable: lsat0708

Number of Observations Read	120
Number of Observations Used	101
Number of Observations with Missing Values	19

Root MSE	0.11508	**R-Square**	0.6259
Dependent Mean	7.07091	**Adj R-Sq**	0.6020
Coeff Var	1.62747		

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	1	5.80647	0.35687	16.27	<.0001	0
lexpper0708stud	1	0.05514	0.02814	1.96	0.0530	2.66105
lexp05perath	1	0.00719	0.01984	0.36	0.7180	1.19880

frosh0708finaid	1	-0.00283	0.00107	-2.63	0.0100	1.97200
retention0708	1	0.00849	0.00178	4.78	<.0001	2.94275
percentadmit0708	1	0.00244	0.00078959	3.09	0.0026	2.29436
private	1	0.08822	0.03243	2.72	0.0078	1.98961

The REG Procedure

Model: MODEL1

Dependent Variable: SAT0708

Number of Observations Read	120
Number of Observations Used	101
Number of Observations with Missing Values	19

Root MSE	100.93941	**R-Square**	0.7450
Dependent Mean	1195.00990	**Adj R-Sq**	0.7287
Coeff Var	8.44674		

Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**	**Variance Inflation**
Intercept	1	430.05033	152.76100	2.82	0.0059	0
expper0708stud	1	0.00148	0.00041006	3.61	0.0005	2.09308
exp05perath	1	0.00089849	0.00104	0.86	0.3906	1.13008
frosh0708finaid	1	-2.75196	0.92865	-2.96	0.0039	1.91351
retention0708	1	9.45301	1.45982	6.48	<.0001	2.58259
percentadmit0708	1	2.06706	0.67413	3.07	0.0028	2.17373
private	1	89.39620	28.24771	3.16	0.0021	1.96175

Table A6: The MWD Test

The REG Procedure

Model: MODEL1

Dependent Variable: SAT0708

Number of Observations Read	120
Number of Observations Used	101
Number of Observations with Missing Values	19

Root MSE	101.48843	**R-Square**	0.7449
Dependent Mean	1195.00990	**Adj R-Sq**	0.7258
Coeff Var	8.49269		

Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	-237.58214	314.78276	-0.75	0.4523
lexpper0708stud	1	74.48912	24.82066	3.00	0.0035
lexp05perath	1	2.15653	17.50814	0.12	0.9022
frosh0708finaid	1	-3.54365	0.98071	-3.61	0.0005
retention0708	1	9.20491	1.56923	5.87	<.0001
percentadmit0708	1	2.55499	0.74628	3.42	0.0009
private	1	105.61251	29.56378	3.57	0.0006
z2	1	-1.02206	0.51247	-1.99	0.0490

The critical t values for an equation with a degree of freedom 61 are:

0.01=	2.629732
0.05=	1.985802
0.1=	1.661404

Graph A1: The residuals of the OLS regression

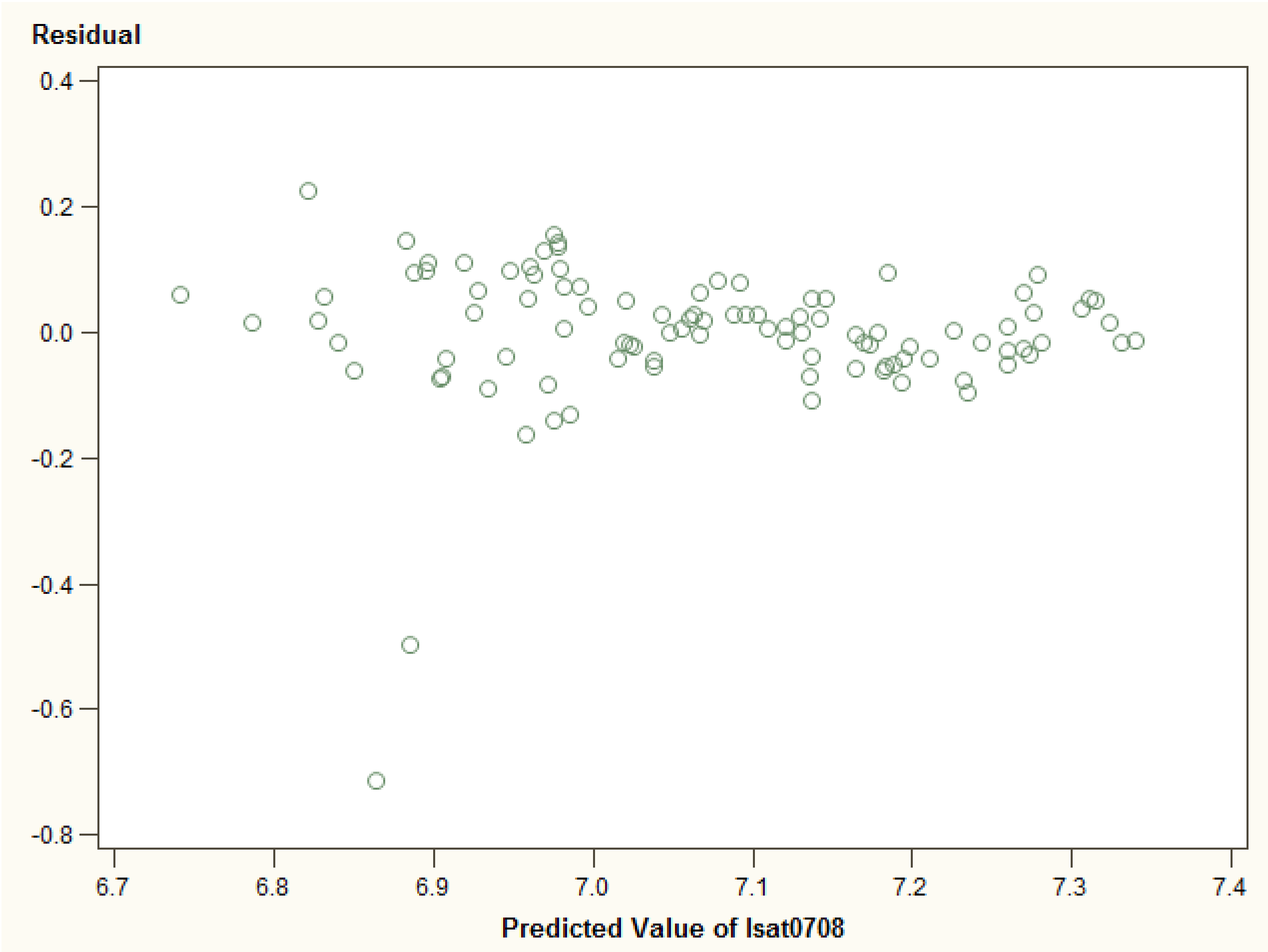


Table A7: Park Test

The REG Procedure

Model: MODEL1

Dependent Variable: lnr2

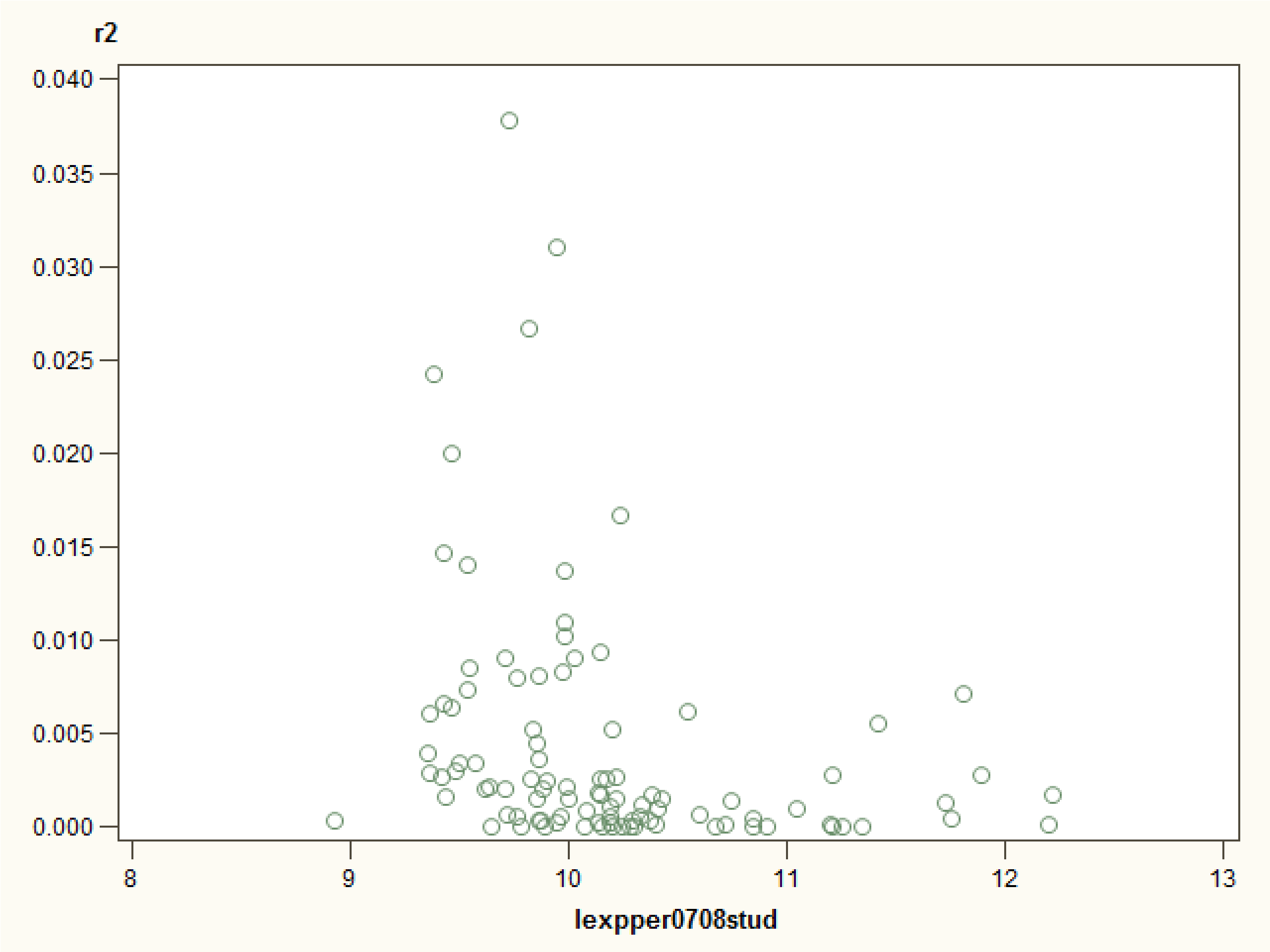
Number of Observations Read	120
Number of Observations Used	101
Number of Observations with Missing Values	19

Root MSE	2.48463	**R-Square**	0.1019
Dependent Mean	-6.59075	**Adj R-Sq**	0.0928
Coeff Var	-37.69877		

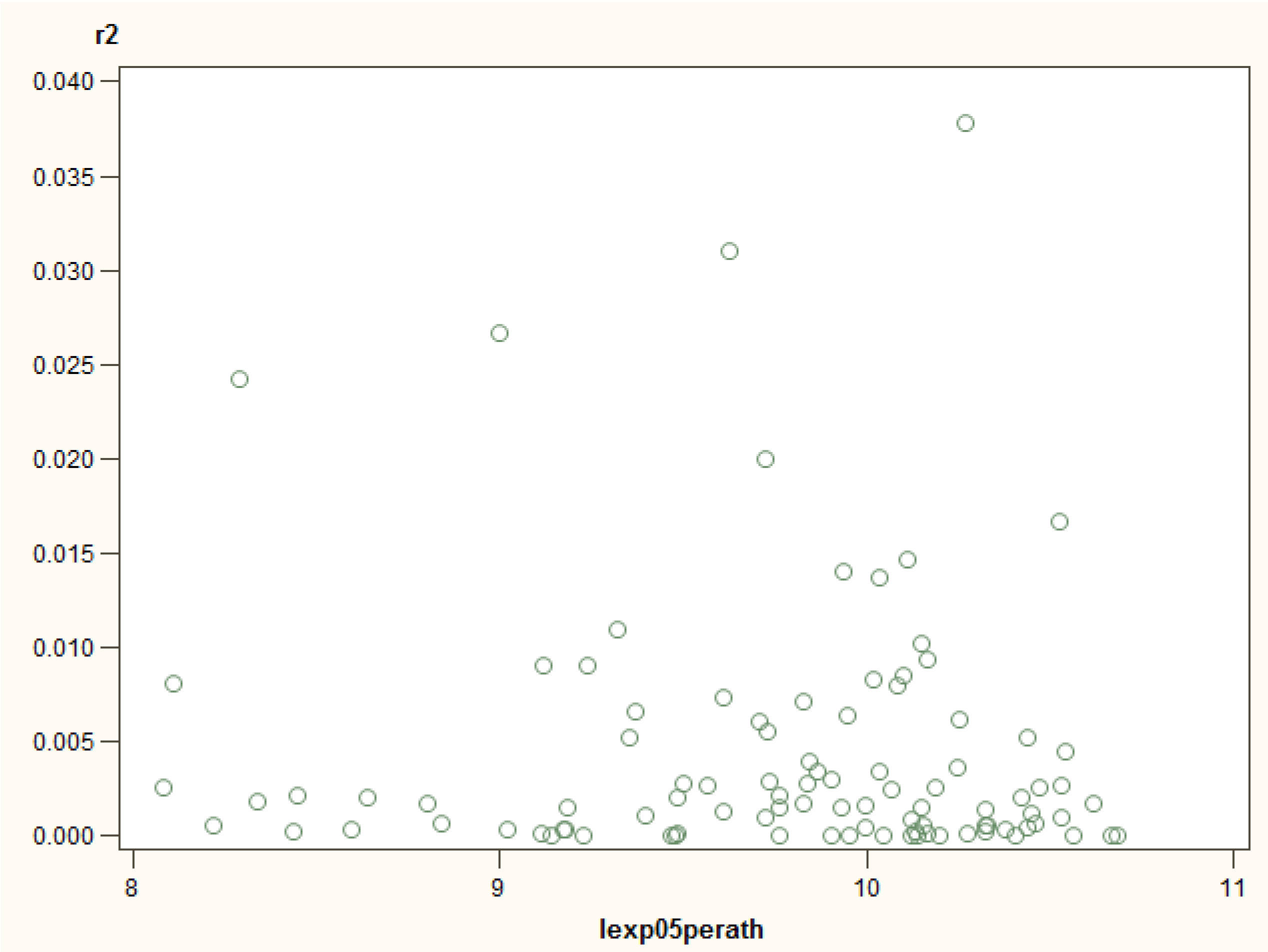
Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	73.15370	23.79779	3.07	0.0027
lnp	1	-40.77368	12.16726	-3.35	0.0011

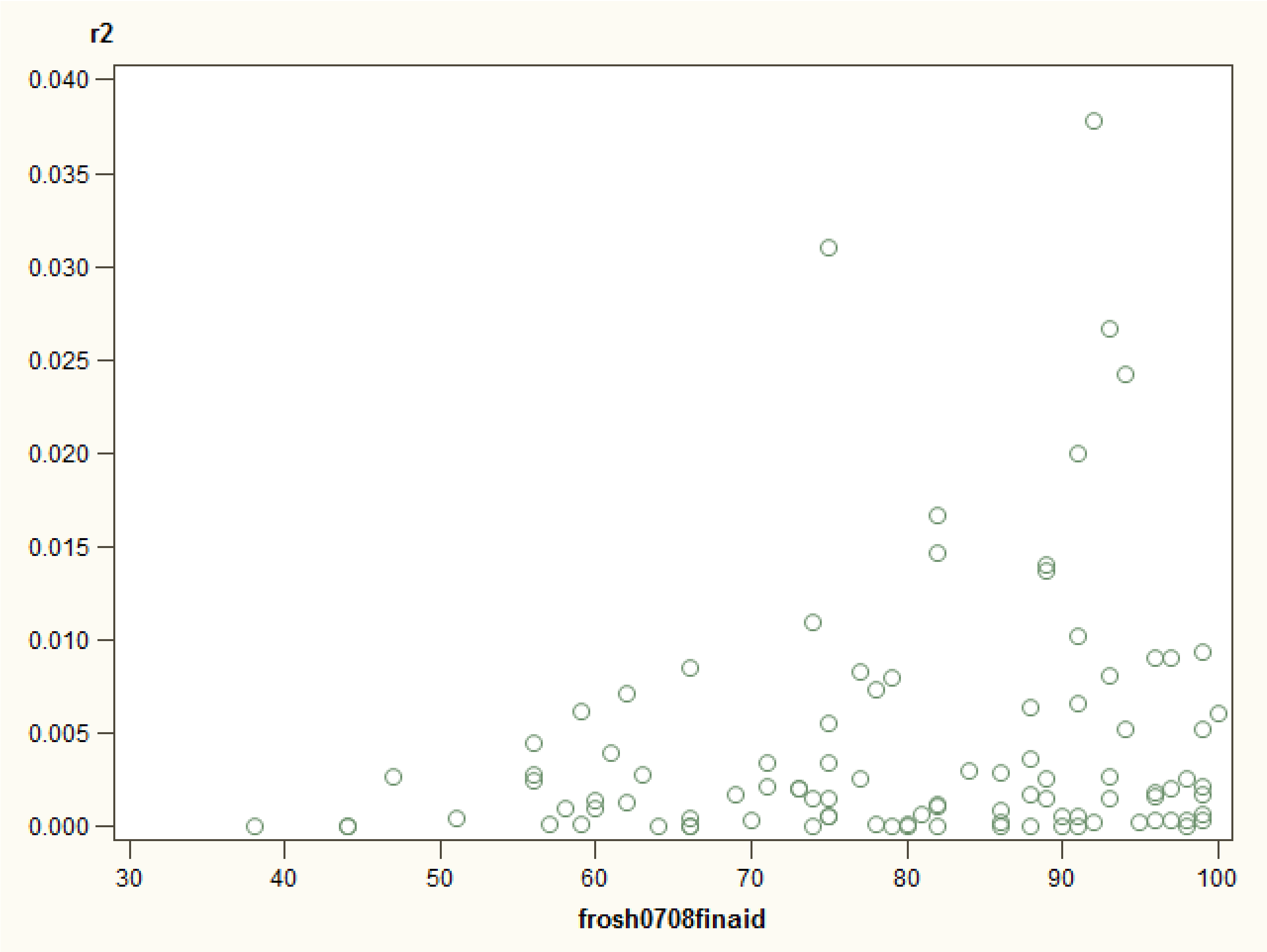
Graph A2: Spending per Student



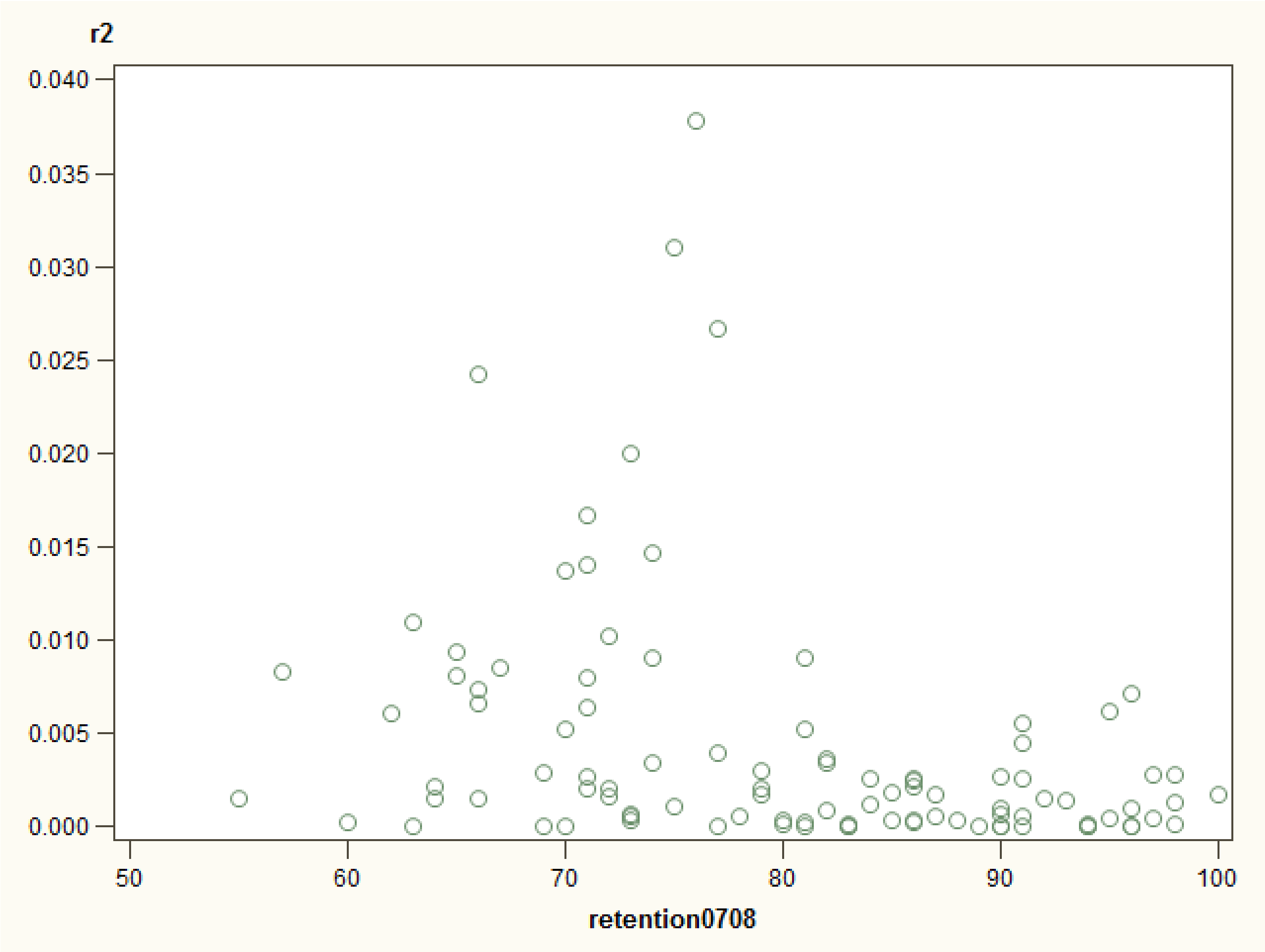
Graph A3: Spending per Athlete



Graph A4: Percent of Freshmen receiving Financial Aid



Graph A5: Retention Rate



Graph A6: Percent Admit

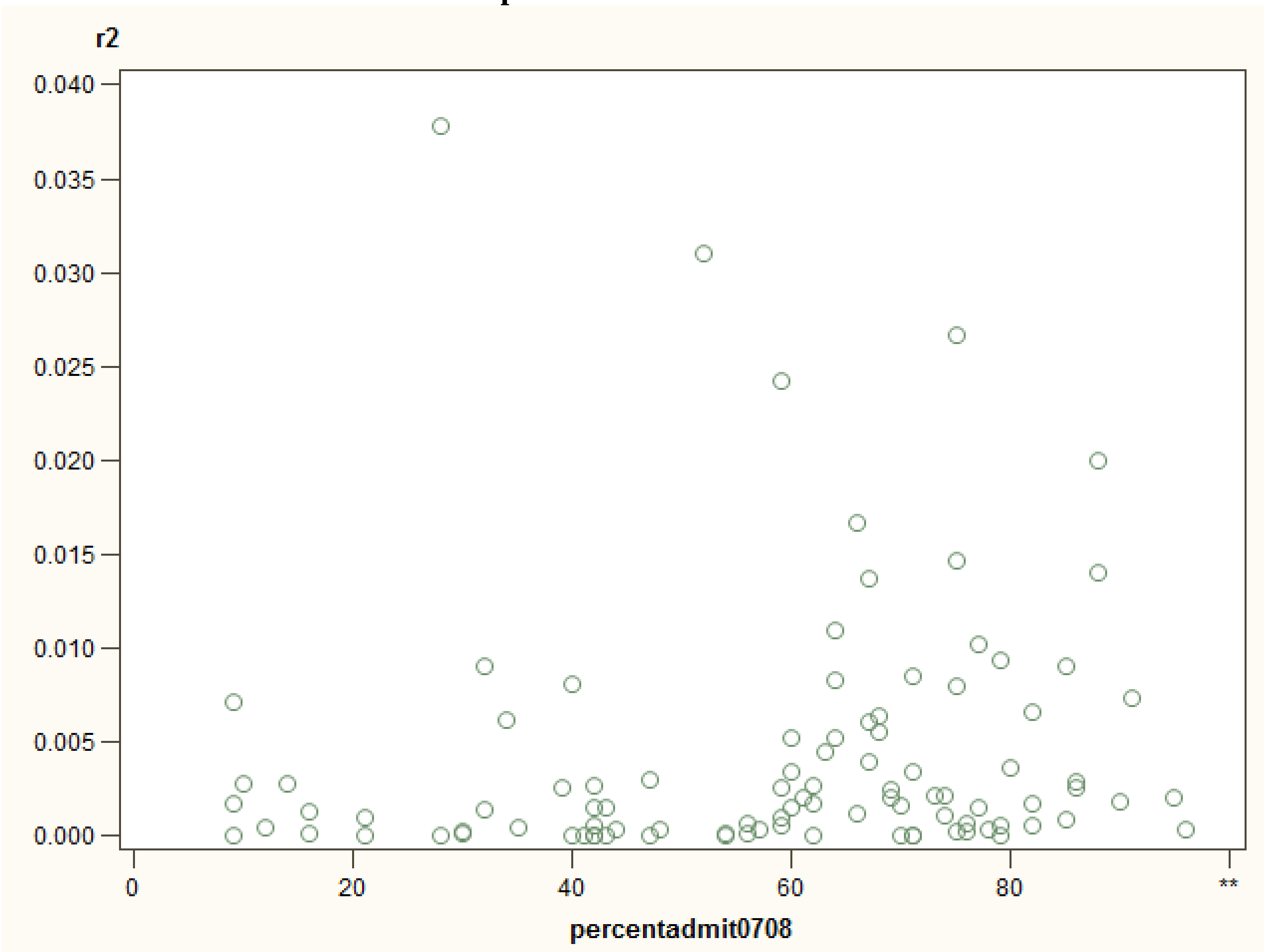


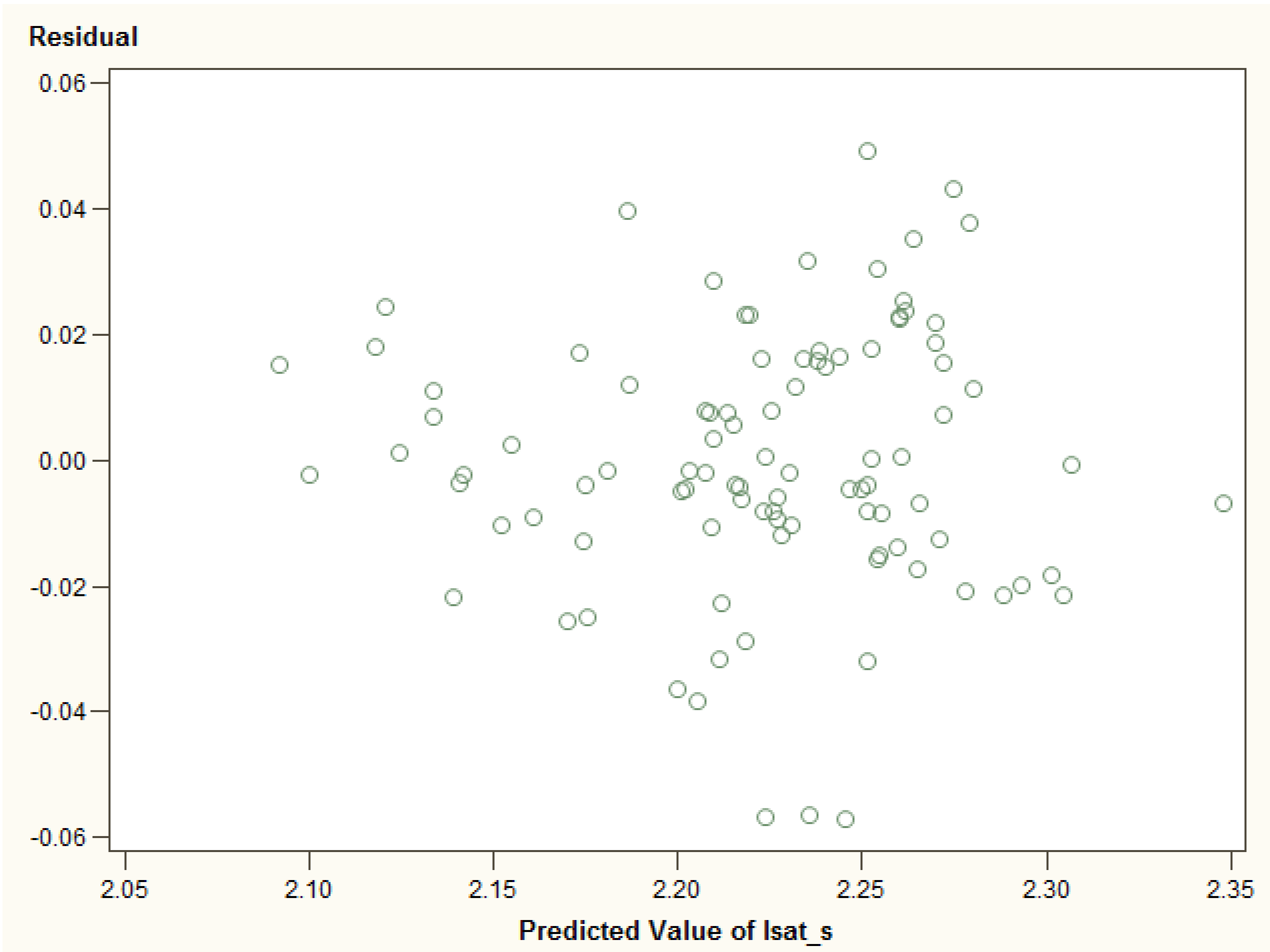
Table A8: GLS results with Different Variables

Variable Dividing By (Square Root)	Park Test Score	Pass Park Test	Pass Scatterplot eye test	beta of athletic spending	t score of athletic spending
Log Academic Spending	1.48	yes	yes	-0.01603	-1.4
Freshmen Financial Aid	-1.69	yes	no	-0.01325	-1.18
Percent Admitted	0.35	yes	maybe	-0.02005	-1.88
Retention Rate	3.75	no	yes	-0.01698	-1.52

As you can see, the equation divided by square root of retention rate does not pass the Park Test, so it is thrown out. As you can see in the table, dividing by square root of all four brought about negative betas of spending per athlete, which is the primary variable to look at.

The t scores for spending per athlete were higher as well, but with only the variable percent admitted having a significant t score at the 0.1 level. The equation divided by square root of freshman financial aid is also thrown out because it does not pass the scatter plot eye test, meaning the residuals still look heteroscedastic. That leaves log of academic spending and percent admitted, which both pass the Park test; percent admitted did not have as homoscedastic scatter plot as academic spending, which is why I chose to divide by the square root log of academic spending. Here are the scatter plots of the equations divided by the square root of the two variables to compare:

Graph A7: Log(Academic Spending)



Graph A8: Percent Admitted

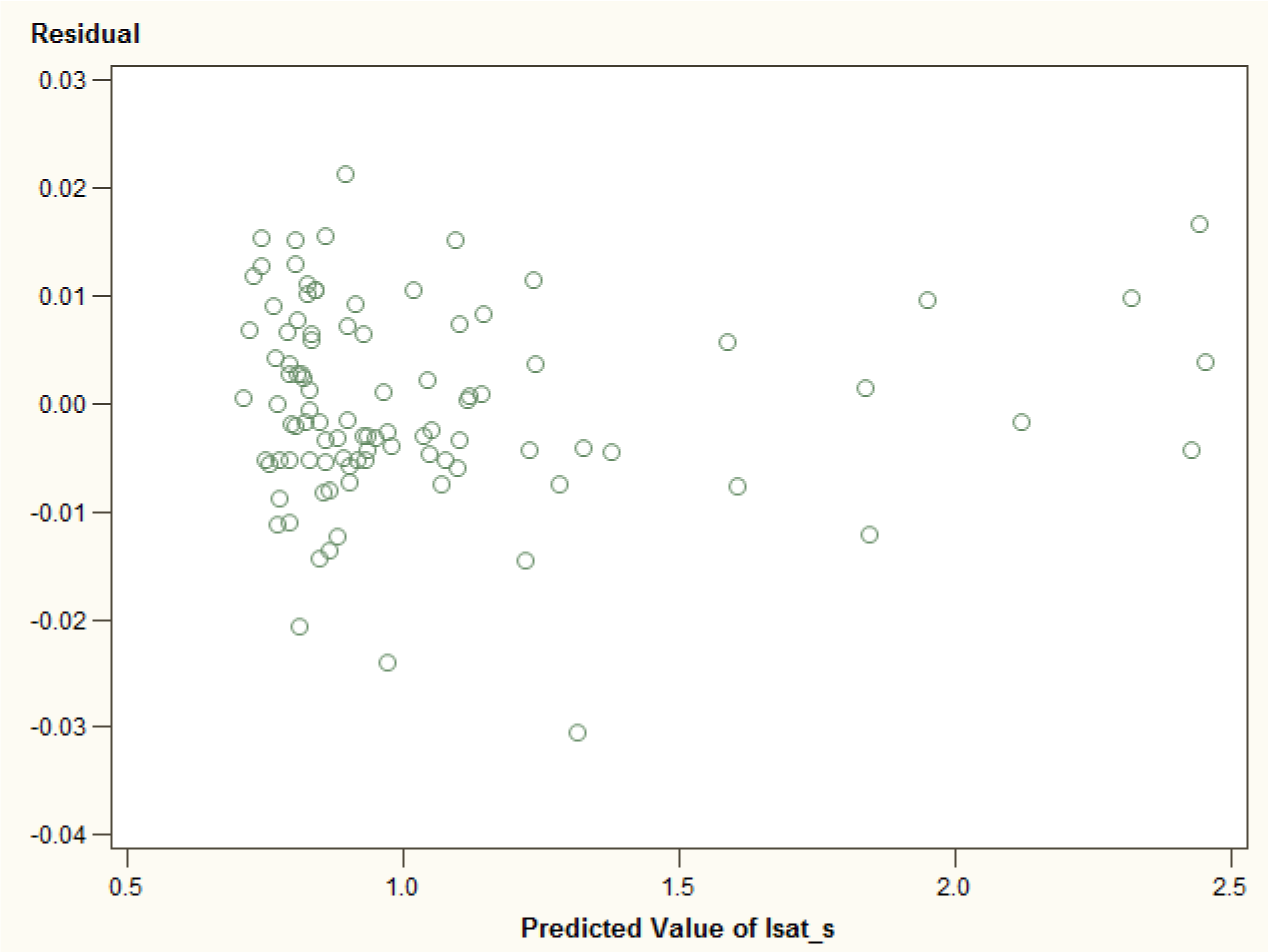


Table A9: New Park test after running GLS

The REG Procedure

Model: MODEL1

Dependent Variable: lnr2

Number of Observations Read	117
Number of Observations Used	98
Number of Observations with Missing Values	19

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	-21.11455	8.08565	-2.61	0.0105
lnp	1	15.02381	10.11955	1.48	0.1409

Table 10: GLS results

Number of Observations Read	120
Number of Observations Used	101
Number of Observations with Missing Values	19

Root MSE	0.01221	R-Square	0.9998
Dependent Mean	0.80501	Adj R-Sq	0.9998
Coeff Var	1.51640		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
int_s	1	6.03258	0.29860	20.20	<.0001
stud_s	1	0.06385	0.02528	2.53	0.0132
ath_s	1	-0.02942	0.01814	-1.62	0.1081
faid_s	1	-0.00295	0.00092286	-3.20	0.0019
ret_s	1	0.00855	0.00164	5.20	<.0001
admit_s	1	0.00244	0.00076618	3.19	0.0019
priv_s	1	0.07532	0.03082	2.44	0.0164

Table A11: GLS With Separable Variable

Number of Observations Read	117
Number of Observations Used	98
Number of Observations with Missing Values	19

Root MSE	0.02160	R-Square	0.9999
Dependent Mean	2.22320	Adj R-Sq	0.9999
Coeff Var	0.97153		

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
int_s	1	6.17602	0.21002	29.41	<.0001
stud_s	1	0.03667	0.03465	1.06	0.2927
ath_s	1	-0.01894	0.01380	-1.37	0.1734
faid_s	1	-0.00209	0.00065118	-3.21	0.0019

ret_s	1	0.00790	0.00106	7.42	<.0001
admit_s	1	0.00147	0.00047788	3.07	0.0029
priv_s	1	0.05413	0.01954	2.77	0.0068
multiple	1	0.00174	0.00459	0.38	0.7047

A12: Partial F Test for GLS with Separable Variables

$$\frac{484.60879 - 484.608792/1}{\frac{0.04199}{90}}$$

F Value = -.00429

Table A13: 2SLS with Ivy League Out and Conferences as the IVs

The SYSLIN Procedure

Two-Stage Least Squares Estimation

Root MSE	0.44673	R-Square	0.60121
Dependent Mean	9.74989	Adj R-Sq	0.54139
Coeff Var	4.58190		

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	9.660239	0.157943	61.16	<.0001
Northeast	1	-0.58371	0.217072	-2.69	0.0087
Southern	1	0.343098	0.223365	1.54	0.1285
OhioValley	1	-0.03589	0.254675	-0.14	0.8883
MEAC	1	0.208848	0.223365	0.94	0.3526
Patriot	1	0.648201	0.241262	2.69	0.0088
Pioneer	1	-0.92338	0.211903	-4.36	<.0001
GreatWest	1	-0.10200	0.273565	-0.37	0.7102
Southland	1	-0.12500	0.254675	-0.49	0.6249
BigSouth	1	0.257179	0.231205	1.11	0.2693
CAA	1	0.728844	0.203903	3.57	0.0006
BigSky	1	0.488287	0.241262	2.02	0.0463
MizzValley	1	0.451176	0.254675	1.77	0.0803

The SYSLIN Procedure

Two-Stage Least Squares Estimation

Root MSE	0.11872	R-Square	0.54615
Dependent Mean	7.04733	Adj R-Sq	0.51449
Coeff Var	1.68454		

Variable	DF	Parameter Estimate	Standard Error		Pr > |t|
Intercept	1	6.021365	0.392685	15.33	<.0001
lexpper0708stud	1	0.035153	0.034596	1.02	0.3124
lexp05perath	1	0.002218	0.022545	0.10	0.9219
frosh0708finaid	1	-0.00284	0.001173	-2.42	0.0176
retention0708	1	0.008730	0.001870	4.67	<.0001
percentadmit0708	1	0.002674	0.000828	3.23	0.0017
private	1	0.084678	0.033794	2.51	0.0141

XII. References

Bremmer, Dale S., and Randall G. Kesselring, “The Advertising Effect of University Athletic Success– A Reappraisal of the Evidence” *Quarterly Review of Economics and Finance 33* no 4 (1993): 409-421.

Brewer, Dominic J., Eric R. Eide, and Ronald G. Ehrenberg, “Does it Pay to Attend an Elite Private College? Cross-Cohort Evidence on the Effects of College Type on Earnings.” *The Journal of Human Resources 34*, no 1 (1999): 104-123.

Goff, Brian, “Effects of University Athletics on the University: A Review and Extension of Empirical Assessment,” *Journal of Sport Management 14,* (2000): 85-104.

Grimes, Paul W., and George A. Chressanthis. “Alumni Contributions to Academics: The Role of Intercollegiate Sports and NCAA Sanctions.” *American Journal of Economics and Sociology 53*, no. 1 (1994): 27-40.

McCormick, Robert E. and Maurice Tinsley. “Athletics versus Academics? Evidence from SAT Scores” *The Journal of Political Economy* 95, no. 5 (1987) 1103-1116.

Toma, J. Douglas, and Michael E. Cross. “INTERCOLLEGIATE ATHLETICS AND STUDENT COLLEGE CHOICE: Exploring the Impact of Championship Seasons on Undergraduate Applications.*” Research in Higher Education* 39 no 6 (1998): 633-661.

Mixon, Franklin G. and Yu Hsing. “The Determinants of Out-Of-State Enrollments in Higher Education: A Tobit Analysis.” *Economics of Education Review* 13 (1994): 329-335.

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

Naughton, Jim. "Women's Teams in NCAA's Division I See Gains in Participation and Budgets." *The Chronicle of Higher Education*, (1998).

Orszag, Jonathan, Robert Litan, and Peter Orzag. "*Empirical Effects of Collegiate Athletics*." A Study Commissioned by the NCAA, August 2003, p. 1-53.

Orszag, Jonathan and Peter Orzag. "*Empirical Effects of Division II Intercollegiate Athletics*." A Study Commissioned by the NCAA, January 2005, p. 1-50.

Sigelman, Lee. "It's academic, or is it? Admissions standards and big-time college football." *Social Science Quarterly* 76, no. 2 (1995): 247-261.

Smart, Dennis L., and Richard A. Wolfe. "Examining Sustainable Competitive Advantage in Intercollegiate Athletics: A Resource Based View." *Journal of Sport Management 14*, (2000): 133-153.

Stinson, Jeffrey L., and Dennis R Howard. "Scoreboards vs. Mortarboards: Major Donor Behavior and Intercollegiate Athletics." *Sports Marketing Quarterly 12*, no. 2 (2004): 129-140.

Tucker, Irvin B., and Louis Amato. "Does big-time success in football or basketball affect SAT scores." *Economics of Education Review* 12 (1993): 177-181.

Turner, Sarah E., Lauren A Meserve, and William G. Bowen. "Winning and Giving: Football Results and Alumni Giving at Selective Colleges and Universities." *Social Science Quarterly 8*, no. 4 (2001): 812-826.

XIII. Endnotes

[1] Sigelman, 1995
[2] McCormick and Tinsley, 1987
[3] Bremmer and Kesselring, 1993
[4] Tucker and Amato, 1993
[5] Toma and Cross, 1997
[6] Litan, Orszag, and Orszag, 2003
[7] Orsag and Orsag, 2005
[8] Sigelman focused on the difference between incoming student SAT scores and incoming scholarship football player SAT scores (Sigelman, 1995). He found that schools with higher academic quality attract freshmen with higher incoming SAT scores. This evidence supports using SAT scores as a proxy for the academic quality of the institution.
[9] Naughton, 1998
[10] McCormick and Tinsley, 1987

[11] Sigelman, 1995
[12] Litan et all, 2003
[13] Brownstein, 2001
[14] Bremmer and Kesselring (1993) find that McCormick and Tinsley do not in fact prove that athletic success attracts smarter students. They found that the only variable that was a significant determinant of a change in freshman SAT scores at both public and private institutions was changes in percentage admitted.
[15] Brewer, Eide, Ehrenberg, 1999
[16] Tucker and Amato, 1993
[17] Bremmer and Kesselring, 1993
[18] Orszag et all, 2003. The paper has a 2005 update, which does not change any of the variables I looked at.
[19] Brewer et all, 1999
[20] These numbers were taken from the individual school's websites
[21] Smart and Wolfe 2000
[22] Mixon and Hsing, 1994