10-1-2017

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Does Athletic Success Influence Persistence at Higher Education Institutions? New Evidence using Panel Data

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Abstract

This study examines the relationship between athletic success and student persistence toward a degree. We build an updated panel of NCAA Division I institutions and utilize within-institution variation to identify the effects of athletic success. Using a ranking of all institutions, we find that having more successful men's basketball and football teams has a significant positive effect on first-year retention rates. We also find some evidence that improved basketball rankings increase graduation rates, and that success in the NCAA tournament may have a sizable impact on retention. Although the estimated effects are generally modest in scale, we find rather limited evidence of other institutional factors affecting persistence, suggesting that athletics can be one avenue for institutions of higher education to engage and retain students.

JEL Codes:
I23; Z20; L83

Keywords:
Educational economics; student persistence; NCAA athletics; higher education

1. Introduction

There is an ongoing debate among both stakeholders and the public as to the proper role of athletics in American institutions of higher education (IHEs). Recently, factors such as the amount of resources devoted to athletics, the integrity of the student-athlete experience¹, and the oversight role of the National Collegiate Athletic Association (NCAA) have been increasingly scrutinized. These concerns are prominent enough that in 2014 Congressional representatives proposed the creation of a Presidential commission to oversee the interaction between athletics and academics in higher education (Strauss, 2014). In proposing this commission, Representative Jim Moran noted athletic coaches were the highest paid public employees in 40 states (Fischer-Baum, 2013), while only 20 Division I athletic programs were profitable (Fulks, 2014). Such information may imply that the presence of athletics serves to distract from an institution's academic mission.

There are also potential benefits to having athletics as a part of higher education. As discussed further in the next section, several studies investigate channels through which athletics may benefit not only the student-athletes, but the entire student body and the institution itself. For example, athletic success may help advertise the institution to the general public, which could improve the status in the mind of potential students, as well as donors. Once students arrive on campus, athletics may help them become more engaged in the campus community, perhaps improving student persistence towards graduation.

This study provides new evidence on how athletic success relates to the academic success of the undergraduate student population. Specifically, we focus on how athletics impact student persistence towards a degree, as measured by both first-year retention and graduation rates. Several previous studies, most notably those by Mixon and Trevino (2005), and Tucker (1992,

¹ These include, for example, the rise of "one-and-done" student-athletes in men's basketball and the academic scandal involving student-athletes at the University of North Carolina.

2004) have studied similar relationships. We build on these by providing more recent results, as well as utilizing improved data sources to make two key empirical improvements. First, we create a panel dataset, allowing us to implement an institutional fixed effects model. Thus, we examine how variations in athletic success within an institution affect the academic outcomes of students, while holding important time-invariant unobserved variables constant. The breadth of the institutional data further allows us to control for numerous key variables that change within institutions over time. Second, we utilize more complete athletic ranking information that allows us to include the full spectrum of institutions participating in NCAA Division I athletics. Previous studies tend to focus on institutions in so-called “power conferences” such as the Big 10, Atlantic Coast Conference (ACC), and Southeastern Conference (SEC). While athletics are particularly important in these types of institutions, the debate over the appropriate role of athletics is not unique to the power conferences. Further, there is likely to be more variation in the level of success experienced by non-power conference institutions, which aids in identifying the specific impact of athletic outcomes on particular cohorts of students.

Our results indicate that success in the two most prominent sports, football and men’s basketball, leads to significant increases in the freshman retention rate. We also find some evidence of a positive impact of basketball success on graduation rates. These results are robust to different sets of rankings and alternative measures of success as well as an alternative first-difference approach, and hold up against a series of falsification tests. While modest in magnitude, the results indicate athletics may foster student engagement on campus. Furthermore, as discussed more in the next section, previous studies have found remarkably few institutional factors that positively influence retention rates in a significant way. We next present a brief review of related research to provide more context for the study at hand.

2. Review of Related Literature

This study contributes to two strands of the higher education literature. The first examines factors influencing student persistence, and the second examines the impact athletic success has on academic outcomes. Studies on the topic of student persistence in higher education generally focus on two primary outcomes. The most commonly examined outcome is the level of attainment, typically measured as attainment of a degree (at the individual level), or graduation rate (at the institutional level). The second main outcome is the freshman retention rate. This statistic measures the percentage of first-time degree-seeking students that begin the fall semester of a given year that are still enrolled at the institution the following year. We utilize both measures, though we focus primarily on the freshman retention rate.²

Early work into why students emerge from higher education without a degree emphasized the importance of a student's first year experience. Examples include studies by Tinto (1975), Bean (1980), and Astin (1984) discussing how levels of student engagement and involvement, as well as social and psychological factors, are important in retaining students. For a more comprehensive look at theories regarding student retention, as well as a more detailed look at this strand of the literature, see Tinto (1993) and Tinto (2006).

Much of the economics literature on persistence in higher education focuses on the role of financial variables. In particular, a great deal of research is dedicated to determining how institutional expenditures may be related to retention and graduation rates. For example, Ryan (2004) finds that institutional expenditures on instruction and academic support have a positive

² Our emphasis on the retention rate is because we believe we can more closely associate athletic success in a given year with student outcomes in that particular year. When measuring graduation rates, by comparison, it is not as straightforward to establish the direct relationship between the outcomes of athletic competition and the academic outcomes of a cohort. For example, during the four to six years in which graduation rates are measured, the athletic program at a particular institution may have had both successful and unsuccessful years.

relationship with graduation rates, while expenditures on student services and administration have no significant effect. Gansemer-Topf and Schuh (2006) find that expenditures on academic support services are positively associated with both retention and graduation rates, while spending on student services is negatively related with these outcomes. Pike et al. (2006) point out that the contradictory results in such studies may be due to confounding factors related to institutional and individual differences in levels of student engagement. Many studies in the persistence literature do not implement institutional fixed effects models (commonly due to data constraints), which leaves questions as to the validity of the results. Webber and Ehrenberg (2010), for example, use a model with a rich set of institutional control variables to show that expenditures on student services have a positive effect on graduation and retention rates. Despite the fact they utilize panel data, the annual variations in expenditures are not sufficient to allow the use of institutional fixed effects. Our use of institutional fixed effects limits one potential source of bias that is present in much of the persistence literature to date.³

Researchers have also examined non-financial institutional characteristics to determine the impact on student persistence. Some examples include: gender composition of faculty (Robst et al., 1998), academic standing and qualifications of faculty (Ehrenberg and Zhang, 2005; Bettinger and Long, 2010), and selectivity of the institution (Kim, 2007; Titus, 2004). Chen (2012) conducts a comprehensive analysis of how both student and institutional characteristics affect dropout rates in higher education. She shows that numerous student-level characteristics are important, but virtually no institutional-level factors matter. In fact, the one variable that is statistically

³ Zhang (2009) provides an example of a study that does include institutional fixed effects, and finds that there is a small positive link between state financial support for higher education and graduation rates. In addition to institutional and state expenditures, many studies have been conducted as to the relationship between expenditures on financial aid and rates of student persistence. As examples, see Dynarski (2003) and Singell (2004), and for more comprehensive reviews see Bettinger (2004) and Hossler et al. (2009).

significant, expenditures on student services, has a negative relationship with persistence. Overall, while researchers agree on the importance of engagement in student persistence toward a degree, few institutional factors are reliably proven to have a meaningful impact. Policies based on the few significant effects that emerge, such as relying less on part-time and non-tenure-track faculty (Ehrenberg and Zhang, 2005) or increasing expenditures on student services (Webber and Ehrenberg, 2010), are difficult to put into practice in times of tightening institutional budgets.

In one of the first studies to examine the relationship between athletic success and academic outcomes, McCormick and Tinsley (1987) investigate how the presence of a “big-time” athletic program influences the type of students an institution is able to attract. They show that being in a major athletic conference and having a higher football winning percentage both lead to higher SAT scores among entering students. The authors conclude that athletic success produces an “advertising effect” for the institution. More students become interested in a particular university because of its athletics, allowing the university to be more selective in admissions. Subsequent studies also find athletic success has a positive impact on the quality and quantity of applicants (Tucker, 2005; Pope and Pope, 2009; Anderson, 2015)⁴. Other outcomes of athletic success include increased alumni donations (Humphreys and Mondello, 2007) and improved position in subjective media rankings (Trenkamp, 2009).

A few recent studies have shown that big-time college athletics may have a detrimental effect on the academic performance of students. Clotfelter (2011) finds that the usage of certain library resources decreases during the NCAA basketball tournament at institutions that participate in the tournament. This effect is especially pronounced for institutions that experience

⁴ In an interesting follow-up study Pope and Pope (2014) found that success in both football and basketball (for example, making it to the Final Four) significantly increased the likelihood that a high school student would send his or her SAT score to that school when completing the test.

unanticipated success. Lindo et al. (2012) analyze student grade performance at the University of Oregon, and find that the performance of male students decreased (relative to females) in the fall quarter during more successful football seasons.⁵ While not the focus of the study, the authors also examine how dropout rates respond to football winning percentage. They find no overall effect of success on dropout rates for males, while the dropout rate for females with low SAT scores are reduced when the football team is successful.⁶

Several previous studies have focused specifically on the relationship between athletic outcomes and student persistence. Tucker (1992) utilizes a sample of 64 universities and finds that having a successful men's basketball team (as measured by rankings) has no association with graduation rates, while having a successful football team is negatively associated with graduation rates. In a subsequent study Tucker (2004) revisits the issue with new data and finds that football success does, in fact, have a positive and significant association with graduation rates at the institution. Tucker's (2004) analysis of this cross-sectional sample of 78 institutions from major athletic conferences again shows that success in men's basketball is not related to graduation rates. Mixon and Trevino (2005) expand on this by analyzing the freshman retention rate (as well as the graduation rate) and looking at whether or not a school has a rich heritage of football success. Using the same sample, they find that schools with stronger football programs do have higher retention and graduation rates. The authors conclude that athletics may serve to provide a diversion, as well as to engage students in campus activities.

In recent years, there have been improvements in the quantity and quality of data available to test the relationship between athletic success and student persistence. Notably, we utilize

⁵ In a subsequent study based on data from Clemson University, Hernandez-Julian and Rotthoff (2014) find that male grades were unaffected by football success, while the grades of females were negatively affected.

⁶ While the findings relating to impacts by gender in this and other studies are an important consideration, unfortunately, IPEDS does not provide information on retention rates by gender.

updated IPEDS data to follow institutions over several years. In addition, we leverage publicly-available comprehensive rankings systems to include more schools and to form a more complete analysis of how athletics and academics interact. We next describe the data in more detail before outlining our empirical methodology.

3. Data Description

We merge two primary data sources for our analysis. The first source is the institutional data from The Integrated Postsecondary Education Data System (IPEDS) from the National Center for Education Statistics (US Department of Education, Institute of Education Sciences, National Center for Education Statistics, 2015). The second source is the basketball and football rankings data from The Kenneth Massey rankings comparison website (Massey, 2015). In each case, our unit of observation is an institution of higher education for a given year. We form a nine year panel spanning the academic years of 2003-2004 through 2011-2012 for all institutions (for which all variables included in our analysis are reported) with Division I athletic programs.

3.1 Institutional Data

The IPEDS database is an extensive collection of information gathered from higher education institutions in the United States. Any such institution that participates in any federal financial assistance program is required to complete the surveys on an annual basis. We use this database to collect our key variables on student persistence: the freshman retention rate and the 6-year graduation rate for each cohort of students entering an institution.⁷ As mentioned previously, the

⁷ The IPEDS surveys include numerous variations of many variables, including retention and graduation rates. Here we choose to utilize measures most commonly observed in our review of the literature: the freshman retention rate among full-time students, and the 6-year graduation rate (as opposed, for example, to the 4-year graduation rate).

fact that these variables are publicly available for a large number of institutions on an annual basis is a distinct advantage of our study as compared to previous related works.

In addition to the core outcome variables, we also make use of the wealth of information available in IPEDS to construct a rich set of institutional control variables that may change within an institution over time, and that are likely to influence the student persistence measures. These include factors related to the selectivity of the institution, expenditures by category, composition of the faculty by academic status, as well as variables relating to the makeup of the student body.

3.2 Athletic Data

Previous research has focused mainly on how success of football and men's basketball programs affects educational outcomes (Mixon and Trevino, 2005; Pope and Pope, 2009; Tucker, 2004). This is reasonable since football and men's basketball programs are often the most visible, attracting the most fans and media attention. As such, we also focus on the rankings of the football and men's basketball teams for our key measures of athletic success. There are many different ranking systems for both basketball and football teams. For example, Kenneth Massey maintains a website that compares the various systems and currently lists 46 ranking systems of college basketball and 115 ranking systems of college football (Massey, 2015).

In choosing a ranking system, we aim to select a system that is comprehensive and consistent. Some ranking systems are only available for certain years and some systems do not rank all of the teams. We eliminate these from contention. For consistency, we elect to concentrate on ranking systems that provide rankings for both basketball and football programs. One could make arguments in favor of or against any given ranking system that meets these criteria. However, the differences between the various systems are typically at the margin. Again, referring to the

Massey comparison site, one can see that the various rankings are heavily correlated. A valuable feature of the Massey comparison site is that it provides a “consensus” ranking for both basketball and football which is “determined using a least squares fit based on paired comparisons between teams for each of the listed ranking systems. If a team is ranked by all systems, the consensus is equal to the arithmetic average ranking. When a team is not ranked by a particular system, its consensus will be lowered accordingly” (Massey, 2015). Therefore, the Massey consensus ranking represents the wisdom of the crowd. Presumably, this consensus ranking system has less noise compared to the other ranking systems that reflect one particular information source. Massey (2015) makes the ordinal rankings publicly available; these are the rankings we utilize.⁸

Our use of the Massey consensus results in one ranking system for all NCAA Division I basketball teams; the most recent ranking lists 351 basketball teams. In contrast, there are separate rankings for FBS (I-A) and FCS (I-AA) football teams. FBS schools are the principal football schools, so we utilize these rankings for the purposes of this analysis. The limitation here is that it significantly cut our sample size; the most recent ranking lists 128 FBS teams. Finally, we note that we utilize the final week’s rankings from each season. While the rankings can fluctuate throughout the season, the final rankings should provide the most accurate information as to the ultimate level of success for a given team in a particular season.

3.3 Merged Data

Merging together the two data sources results in a primary sample of 2,761 observations from 333 institutions with NCAA Division I athletic programs.⁹ Table 1 provides summary statistics for all

⁸ As a robustness check, we alternatively utilize the Sagarin rankings. This is discussed further in section 4.3.

⁹ The specific number of institutions included in each year of the dataset varies due to availability of the large number of variables included in the analysis. In specifications without covariates our sample size increases to 2,980 observations and includes 343 unique institutions. The control variables that are missing from IPEDS data (with the

variables. While all institutions in our sample participate in NCAA Division I athletics, the summary statistics make it clear that this is a diverse set of institutions. For example, the sample includes institutions in which 5 percent of entering students receive federal aid, as well as institutions in which 95 percent of such students receive federal aid. We note that the distributions of each of the expenditure variables is positively skewed, hence, we utilize a natural log transformation on these variables in our analysis.

Each observation in our sample represents one cohort from a given institution. For example, for the cohort that arrived on campus during the fall semester of 2010 at Institution A, we match the explanatory variables from Institution A for the academic year 2010-2011 with the institution's first-year retention rate of the same cohort (i.e. the percentage of these students returning for academic year 2011-2012). We have cohort-level measures of SAT scores¹⁰ and the percentage of students receiving financial aid. That is, these measures are specific to the first-time students at the institution for a given year. The other explanatory variables are institution wide measures for a given year; these include enrollment, gender and racial/ethnic composition, and percentage of instructors who are tenure track.

We also note that there is relatively little variability in the retention and graduation rates within institutions. The median standard deviation in retention rates within institutions is 1.73

percentage of the original sample missing in parentheses) are: SAT/ACT scores of entering class (4.1%), institutional expenditures by category (2.8%), and percentage of instructors that are tenure track (1.0%). The results of the analyses to follow are robust to focusing on the balanced panel sample of institutions for which data is available in each year. The results to follow exclude the 4 outlier observations for which retention rate is less than 49%. Several of these correspond to Gulf of Mexico area schools in the 2004-2005 cohort and are thus likely attributable to Hurricane Katrina (August 2005). Results are nearly identical when including these 4 observations and are available upon request.

¹⁰ Technically, average SAT scores are not reported in the IPEDS database. This variable is calculated as the average of the 25th and 75th percentiles of the SAT scores of the entering class. Not all institutions report SAT scores of the incoming class, but some that do not report ACT scores instead. In these cases, we find the "average" of the composite ACT score of the entering cohort and convert this to the equivalent SAT score using the guide provided on the ACT's official website (<https://www.act.org/aap/concordance/index.html>).

percentage points and the median standard deviation in graduation rates within institutions is 1.44 percentage points. Relative to the median overall sample retention rate of 82 percent and graduation rate of 63.2 percent, these standard deviations within institutions are small. Thus, even relatively small changes in these rates can be considered economically significant.

4. Empirical Strategy

4.1 Retention Rates Model

We are primarily interested in the relationship between athletic success and retention rates. Retention rates are likely affected by many factors other than athletic success, including characteristics of the student body and institutional characteristics. We can observe and directly control for many of these characteristics, but there are likely other characteristics that are unobservable to us and that are correlated with athletic success and retention rates. Thus, we specify a model for retention rate that includes an unobserved heterogeneity component,

$$Retention_{it} = \alpha + \beta \ln R_{it} + X_{it}\delta + \gamma_i + Y_t + \varepsilon_{it}, \quad (1)$$

where $\ln R_{it}$ is the natural log of basketball or football team ranking and X_{it} is a vector of controls including the percentage of male students, racial/ethnic composition, percentage of students receiving federal aid, percentage of instructors who are tenure track, and the average SAT score of students for institution i in year t . It has been shown that institutional expenditures on instruction, academic support, and student services can be important for explaining retention and graduation rates (Webber and Ehrenberg, 2010) so we also include these as controls. We flexibly control for common time trends in retention with year fixed effects, Y_t . Finally, γ_i represents the unobservable time-invariant characteristics of institution i . In all cases, a ranking of 1 corresponds to the best team for the year. It is quite possible that the marginal effect is not constant throughout the ranking.

Taking basketball as an example, it is doubtful that an improvement in ranking from 300 to 275 will have the same effect on retention as an improvement from 50 to 25. Thus, we take the natural log of the rank as our independent variable.¹¹ We cluster standard errors at the institution level to account for any serial correlation within an institution.

We assume that the γ_i are fixed for the duration of the panel, but potentially correlated with the athletic ranking and retention rate. A specification that ignores the unobserved institutional heterogeneity could result in a biased estimate of the ranking coefficient. For example, if there are time-invariant unobservable characteristics that are positively related to retention rate and also positively correlated with ranking, an OLS estimate of β will be upwards-biased. Nonetheless, there is more variation in athletic ranking across institutions than within institutions so we lose potentially valuable information with an institutional fixed effects framework. For this reason and for comparability with aforementioned studies, we present results for both OLS and institutional fixed effects estimations.¹²

Furthermore, unobservable factors that influence retention may change within an institution over time. The time effects in equation (1) will be sufficient to prevent bias in our estimate of β if the trends in unobservables are homogeneous across institutions. However, if these changes in unobservables are correlated with changes in athletic rankings across institutions, and are not common across institutions, the time effects in equation (1) will not be sufficient to identify the effect of athletic ranking. To control for such heterogeneous trend rates, we next modify

¹¹ We also show specifications in the appendix that discretize the rankings into the groups of 1-25, 26-50, and 51 or greater.

¹² When running OLS specifications of the model we include state fixed effects and fixed effects at the level of Carnegie classification of the institution, in order to account for some of the unobserved heterogeneity that exists across the institutions in our sample.

equation (1) to add school-specific linear trends, $\varphi_i t$. This results in the random trend model¹³ (hereafter IHE-specific trends model) (Wooldridge, 2010),

$$Retention_{it} = \alpha + \beta \ln R_{it} + X_{it} \delta + \gamma_i + Y_t + \varphi_i t + \varepsilon_{it}. \quad (2)$$

The benefit of the IHE-specific trends model is that it allows athletic ranking to depend on IHE-specific trends in retention (φ_i) in addition to the IHE-specific level of retention (γ_i) (Wooldridge, 2010). In other words, the strict exogeneity condition for the IHE-specific trends model is $E(\varepsilon_{it} | \ln R_{it}, X_{it}, \gamma_i, \varphi_i) = 0$, which is less restrictive than the strict exogeneity condition of the basic fixed effects model of $E(\varepsilon_{it} | \ln R_{it}, X_{it}, \gamma_i) = 0$. In our context, this implies that time-varying omitted variables that drive changes in both athletic rankings and retention rates at the IHE level are not a problem for our identification so long as a linear trend can capture the relationship between the omitted variables and retention rates. We present results in section 5 for equations (1) and (2), but note that the IHE-specific trends model (2) is our preferred specification because it allows for heterogeneity in trends and hence is less susceptible to biases from time varying omitted variables.¹⁴

4.2 Graduation Rates Model

Retention rates represent a good metric of success for institutions of higher education. When a higher percentage of students return after their first year, it could mean that students are happier with their educational experience. More athletic success could feasibly translate into an enhanced

¹³ This is a standard model that takes the standard FE model and adds an IHE-specific linear trend. Others, such as Pope and Pope (2009) use this model in related analyses. As noted by Wooldridge (2010, pg 375), the terminology “random trend” unfortunately conflicts with the normal usage of random versus fixed effects so we adopt the terminology “IHE-specific trends model” in the remainder of the paper. The IHE-specific trends model does not impose restrictions on correlations among the time-invariant unobservables, IHE-specific trends, athletic rankings, or other observable controls and is hence of the fixed effects variety (Wooldridge, 2010).

¹⁴ The tradeoff is that more time periods are needed for the IHE-specific trends model compared to the standard FE model (at least 3 time periods for a linear trend) and the IHE-specific trends model generally leads to less precise estimates because of the loss in variation (Wooldridge, 2010).

student experience, which could explain a higher retention rate. However, ultimately degree attainment is the outcome both students and institutions rely on to measure success. As mentioned in the review of the literature, greater success in first-year retention should have a significant effect on graduation rates, though this is not necessarily the case. For example, it could be the case that students come to later regret this decision to return and then transfer at a later date. It could also be the case that more students are retained from the first year due to athletic success and subsequently struggle academically, ultimately departing without a degree. We investigate these possibilities by specifying a second model with graduation rates as our dependent variable.

Graduation rates for a given cohort are affected by what happens throughout the cohort's duration at the institution. Since we focus on 6-year graduation rates, we follow Webber and Ehrenberg (2010) in constructing 6-year averages of each of the explanatory variables. We simply take Equation 1 and substitute graduation rate for retention rate and the 6-year averages for ranking and other explanatory variables¹⁵, resulting in the empirical specification,

$$GradRate_{it} = \alpha + \beta \ln \bar{R}_{it} + \bar{X}_{it} \delta + \gamma_i + Y_t + \varepsilon_{it}. \quad (3)$$

Note that this graduation rate model substantially reduces our sample size because, given the time period of our sample, we can only calculate six-year averages for four academic cohorts (cohorts entering first year 2003-2004 to 2006-2007).

4.3 NCAA Basketball Tournament Model

As an extension to our primary analysis described in section 4.1, we use an alternative measure of athletic success. Here, we focus on the success of basketball teams as measured by NCAA

¹⁵ In the results displayed in the subsequent section we utilize a smaller set of control variables as compared to the retention rate models. In particular, the demographic composition variables are omitted as they are not found to be meaningful in the context of averaging across cohorts. The results presented are robust to the inclusion of these additional controls.

tournament appearances and wins. The NCAA basketball tournament provides national exposure to institutions, generates considerable revenue¹⁶, and potentially creates excitement on campus. Each year, 64 teams¹⁷ are selected for the tournament with much fanfare on “Selection Sunday.” The single elimination tournament stretches for several weeks in March, culminating in the Final Four and national championship game. Due to the single elimination nature of the tournament, some teams will underperform their ranking and others will perform better than expected. Whereas marginal changes in rankings of basketball teams may not concern a majority students, unexpected success or failure in the NCAA tournament may be more salient. For example, if a historical basketball powerhouse does not make the tournament, this may be a significant disappointment to students. Conversely, a tournament run by a school not known to be a basketball power may be a source of considerable student excitement and engagement.

To estimate these potential effects we amend equation (2) by replacing the ranking variable with categorical variables representing NCAA tournament success. We have,

$$Retention_{it} = \alpha + \beta_1 Round_of_64 + \beta_2 Tourney_win + X_{it}\delta + \gamma_i + Y_t + \varphi_i t + \varepsilon_{it},^{18} \quad (4)$$

where *Round_of_64* represents making the tournament and losing in the first round, *Tourney_win* represents winning at least one NCAA tournament game, and the omitted comparison category is not making the round of 64. Here, we are identifying β_1 and β_2 with the average deviation from an institution’s retention rate trend when falling into the respective category, controlling for common time effects. These difference-in-difference estimates exploit the temporal variation in tournament success within institutions. As such, we opt for these 3 categories of tournament

¹⁶ For example, the NCAA basketball tournament generated over \$700 million dollars of revenue in 2014. Under the NCAA’s member school payment formulas, success in the tournament can have millions of dollars in revenue implications for individual institutions (Hobson, 2014).

¹⁷ There have actually been more than 64 teams since 2001. From 2001-2010 there were 65 teams. From 2011-present there have been 68 teams. There are play-in games to determine which 1 (4) team(s) advance to the round of 64. For this analysis, we define the round of 64 to be the teams that make the tournament.

¹⁸ We also estimate the model omitting the institution-specific trends.

success instead of the 8 possible categories.¹⁹ There is likely not enough within-institution variation to precisely identify the effects of each separate round.

4.4 Robustness Checks

We estimate several alternative model specifications to examine the robustness of the results for the retention rate models. In each case, we focus on the IHE-specific trends model since it is our preferred specification. Our primary analysis, discussed in 4.1, estimates separate models for basketball and football rankings. Here, we instead specify a model with both football and basketball rankings. Additionally, we examine an alternative rankings system. One of the most well-known systems is the Sagarin ranking of both basketball and football teams.²⁰ Jeff Sagarin is a statistician who has reported rankings to USA Today since 1985. Various versions of Sagarin's football rankings were part of the formula for the Bowl Championship Series (BCS) standings from 1998 to 2014 (when the BCS was replaced by the College Football Playoff). Sagarin's basketball rankings have been utilized by the NCAA basketball tournament selection committee since 1984 (West, 2006). Thus, we utilize the final (end of season) Sagarin rankings for both basketball and football as archived on Massey's comparison site to determine whether our findings are unique to our choice of the Massey consensus ranking.

One potential concern with our identification strategy is that athletic success has been shown to help IHEs attract better students (Anderson, 2015; McCormick and Tinsley, 1987; Mixon, 1995). Better quality students may improve retention. If so, the current year's retention

¹⁹ The eight possible categories would be not making the tournament, 6 tournament rounds, and national champion.

²⁰ Several related studies, such as Trenkamp (2009) and Rishe (2003) also use the Sagarin ratings as measures of athletic success. Rishe makes the case that these ratings are preferable to other measures, such as Associated Press Top 25 rankings, because they are based on statistical models (rather than voting) and include a ranking for all teams. We use the overall Sagarin rating, which is a synthesis of several underlying rating methods. The exact methods used by Sagarin to develop the overall rating are not publicly available.

rate may be a function of the previous year's athletic success. Previous athletic success may also be correlated with current athletic success so we could have an endogeneity problem. The IHE-specific trends model lessens this identification threat if athletic success and retention have been changing over time and within a school in a linear fashion. However, another way to address this concern is to use a measure of unexpected success. One measure of unexpected success is to compare the athletic ranking at the end of the season during a student's freshman year with the athletic ranking at the end of the season prior to the student arriving on campus. We can do this through a first-difference approach²¹,

$$\Delta retention_{it} = \alpha + \beta \Delta \ln R_{it} + \Delta X_{it} \delta + Y_t + \Delta \varepsilon_{it}. \quad (5)$$

Here, Δ denotes a one-period difference (for example, $\Delta X_{it} = X_{it} - X_{it-1}$), and Y_t are year fixed effects to account for aggregate trends. Like the fixed effects estimator, the first-difference estimator eliminates any time-invariant unobservables (Wooldridge, 2010). As noted by Wooldridge (2010), very different estimates from the fixed effects and first difference estimators can signal endogeneity concerns. Thus, comparing the first difference estimates to the fixed effects estimates is a useful robustness exercise.

As a final robustness check, we consider the issue of athletic conference alignment and the extent to which this may factor into our observed relationship between athletic success and retention rates. In particular, we are concerned that an institution's athletic success may be correlated with a change in conference affiliation. Previous research has shown that conference realignment is correlated with measures of athletic success, such as football attendance (Groza, 2010). Studies have also found athletic conference affiliation is correlated with academic outcomes, such as how an institution's status is perceived (Lifschitz et al. 2014), as well as an

²¹ We thank an anonymous reviewer for this suggestion.

institution's overall competitive strategy and aspirational goals (Sweitzer, 2009). To account for this potential source of bias, we re-estimate our preferred IHE-specific trends specifications from equation 2 with the addition of dummy variables for the athletic conference each team is affiliated with in each year.

5. Results

5.1 Retention Rates Results

We begin by examining the impact of basketball rankings on retention rates. The results of the various modeling specifications used to identify this relationship are presented in Table 2. In each of the specifications a more successful basketball team (a decrease in the numerical ranking) has a significant positive impact on the first-year retention rate (with at least a 10% level of significance). As expected, the OLS point estimates in the first column are larger than the corresponding fixed effects estimates. This reflects the idea that institutions with more successful athletic programs also tend to have other unobservable characteristics that lead to higher retention rates. It likely also reflects the fact that there is more variation in athletic success across institutions, as opposed to within institutions over time, with which to identify an impact.²² The second column presents results from the fixed effects model without covariates, and the third column present this parsimonious specification for the IHE-specific trends model. In each case, the presence of a successful basketball team in a given year increases retention at that institution as compared to years with a less successful team. The fourth and fifth columns present the results of these two models when additional explanatory variables are included. Finally, the sixth column presents results from the sample of institutions that do not also have a football team. Given that football

²² It is worth noting again here that our OLS estimates do include state and Carnegie classification fixed effects, which alleviates some of the concern over omitted variable bias.

and men's basketball are typically the most prominent sports on campus, it may be that basketball success has a stronger impact on a campus that does not have football. The results provide some evidence for this theory, with the magnitude of the coefficient tripling in size as compared to the full sample.²³

At the bottom of Table 2, we present the estimated marginal effects on retention from slipping one place in the rankings for reference rankings of 5, 10, and 25. While the estimated magnitude of the marginal effects in each of the non-OLS specifications is relatively small, it is important to note that few variables significantly impact retention rates at all in the institutional fixed effects and IHE-specific trends models. The only variables besides basketball ranking that are significant with at least the 10 percent level in both specifications are the average SAT score of the incoming class and the level of expenditures on student services. Moreover, changes in rankings over years within an institution are often more substantial. For example, consider the impact of an institution improving its basketball ranking from 50 to 10. This would be a large improvement, but this amount of variation is not at all unusual during the period of our sample. The IHE-specific trends model in column 5 estimates that this improvement would increase the retention rate by approximately two-tenths of a percentage point. This is about the same as increasing the average SAT score of the incoming class by around 22 points. Results in appendix Table A1 also demonstrate the magnitude of the effects. Relative to being ranked at 51 or higher, moving into the ranking range of 1-25 increases retention by around 0.38 percentage points for basketball and 0.45 percentage points for football.

Table 3 presents the results of specifications estimating the effect of football success on retention rates. The results are similar in that increased performance of the athletic program is

²³ We use Stata's `suest` framework to test for a difference in the coefficients between the samples. We fail to reject the null of 0 difference at conventional levels ($p\text{-value}=0.16$).

shown to have a positive effect on retention, as well as the fact that the coefficient from the OLS specification is large compared to those of the fixed effects and IHE-specific trends variations. Since we limit the sample to institutions participating at the FBS level, the sample size is roughly a third of that from the basketball specifications. Using this sample, we again find that there are very few institutional factors that are found to have a statistically significant impact on the likelihood that a first-time student returns for his or her second year. Besides the football ranking, the only variables estimated to be significant in the IHE-specific trends specification are the SAT scores of incoming students, and expenditures on student services.

5.2 Graduation Rates Results

In Table 4 we present the results from estimating the model using 6-year graduation rates as the dependent variable. As with retention rates, we present OLS, fixed effects, and IHE-specific trends specifications focusing separately on success in men's basketball and football. Overall, we find less statistical significance in the impact of athletic success on academic outcomes. For the basketball rankings, there is some modest evidence of a positive impact on graduation rates. The OLS coefficient is highly significant, while the IHE-specific trends coefficient is significant at the 10 percent level. On the other hand, there is no evidence that football success has a significant impact on 6-year graduation rates.

One explanation for the lack of significance in graduation rates is that while athletic success may be a factor in increasing a student's initial engagement level with an institution, it is likely not a strong enough factor to impact persistence all the way to a degree. Another factor in the lack of results may be the short time period of available information, which is particularly an issue in the fixed effects and IHE-specific trends specifications. Finally, as discussed in section 4, the

matching of 6-year averages for the variables may create too noisy of a measure of athletic success. The average of the basketball team's ranking over 6 years may be influenced by one particularly bad or particularly good year, and two similar average rankings may mask considerably different year to year outcomes.

5.3 NCAA Basketball Tournament Results

We utilize rankings as our primary measure of athletic success because they provide a way to quantify success for each team in NCAA Division I athletics and provide a great deal of variation with which to identify potential impacts. However, with around 350 basketball teams participating, it may be possible that even large changes in rankings may not be particularly noticeable to those around campus. For instance, would students become more engaged in an institution if the basketball team improved its ranking from the previous year from 300 to 200? Perhaps a more discrete measure of success would allow for a more realistic estimate of the impact on academic outcomes. The NCAA basketball tournament provides a way to discretely quantify the success of a team in a particular season. As described in section 4, the results in Table 5 are obtained by replacing the basketball ranking variable with two categorical variables: whether the team made the round of 64 in the tournament (and lost), and whether the team won at least one game. The reference category in these specifications are the teams that did not make the round of 64.

The first two columns show results for the full sample of schools, using fixed effects and IHE-specific trends specifications, while columns 3 and 4 use the sample of schools that do not have a football program. The spirit of the results are similar in all four specifications; making it into the tournament has no significant effect on retention rates, but winning at least one game has

a positive and significant effect on retention. The magnitude and significance of the effect are particularly strong for the schools in which there is no football program. Again it must be pointed out that including the fixed effects and institution-specific trends makes it difficult to find other institutional factors that significantly impact retention. Having success in the NCAA tournament is estimated to have a practically significant impact on retention in this case. If we examine the results in column 2 of Table 5, we see an estimated impact of winning at least one game of 0.275 percentage points. Based on the median entering cohort of the institutions in our sample (1,905 students), this suggests that an additional 5.2 students would be retained in a year in which the basketball team won a tournament game. This is the equivalent to raising the average SAT score of the cohort by around 31.8 points. The effect is larger yet for the subsample of non-football institutions; column 4 with IHE-specific trends estimates that the retention rate increases by around 1 percentage point with an NCAA basketball tournament win.²⁴ The median institution in this subsample has an entering cohort of 1201 students suggesting that an additional 12.1 students would be retained with a tournament win. This could be a difference of hundreds of thousands of dollars in tuition revenue for these institutions.

5.4 Robustness Checks

Table 6 presents the results of some robustness checks of our primary results.²⁵ These checks focus on the model using retention rates as the dependent variable and our preferred specification of IHE-specific trends. To begin, we account for the fact that separating football and basketball

²⁴ We again use Stata's `suest` framework and find that the coefficients on "tournament win" are statistically different between the full sample and the subsample of IHEs with no football program (p-value = 0.035 for IHE-specific trends specifications).

²⁵ In Table 6 and all subsequent tables, we omit reporting the estimated coefficients on the IHE level controls for brevity. The IHE level controls for all tables are the same (i.e. those found in Tables 2, 3, and 5). Full results for all tables are available upon request.

success into distinct specifications may cause us to misstate the impact of success in one particular sport. The first two columns of Table 6 present results in which the basketball and football rankings of each institution are included simultaneously, first in a parsimonious specification and then including the covariates. The estimated impacts of success in each sport are significant, and the magnitudes of each coefficient are similar to those obtained when estimating separate specifications.

Columns 3 through 6 of Table 6 present the results when we replace the Massey consensus ranking from our primary analysis with an alternative ranking system, the Sagarin rankings. When examining basketball rankings using the Sagarin system, we find a significant impact on retention in the parsimonious specification, but the effect is no longer significant when the covariates are added. For football rankings, both specifications find significant results indicating that improved football rankings increase the first-year retention rate. The magnitudes of the coefficients are quite similar to those using the consensus ranking (displayed in Table 3).

Next, we proceed to the first difference estimates, as specified by equation 5. These first-difference estimates, which may be a better indicator of the effects of unexpected success, are shown in Appendix Table A2. We show results with and without the additional time-varying IHE level controls, where the controls are the same as those used in the prior tables. Basketball results are shown in columns 1-4 of Table A2. Comparing these to the fixed effects and IHE-specific trends columns of Table 2, we see that the estimated effects of ranking on retention are essentially the same. Likewise, the estimated effects of football ranking on retention shown in columns 5-6 of Table A2 agree with what we find in Table 3. Therefore, our measure of unexpected success produces the same results as our main specifications.

The results of our final robustness check, addressing potential bias from changes in conference alignment, are presented in Appendix Table A3. The main coefficients displayed in Table A3 are very similar in magnitude to the analogous results in Tables 2 and 3. The results in column 2 are now significant at the 5 percent level (previously at 10 percent level), while the result for the sample of non-football schools in column 3 is no longer significant at the 10 percent level ($p\text{-value} = 0.110$).

6. Falsification Tests

A previously mentioned concern for our identification is that prior year athletic success can potentially affect both current athletic success and the composition of incoming students, which in turn can affect retention. If this is true, we would have an endogeneity problem and our results could be biased. Therefore, we conduct falsification tests to see whether or not athletic success in the previous year affects current retention. We take equation (2) and replace current athletic ranking with the previous year's athletic ranking. A significant coefficient on previous year's ranking would then cast doubt on our identification strategy. Similarly, future athletic success should not affect current retention so we also modify equation (2) with future athletic ranking in place of current athletic ranking. In each case, we investigate for both basketball and football rankings.

Table 7 presents results for the previous year's ranking and Table 8 shows results for the future year's ranking. The first (last) 2 columns in Tables 7 and 8 are specifications with and without time varying IHE controls for basketball (football). The third column shows results for basketball rankings when excluding IHEs with football programs. There are no statistically significant findings on football or basketball rankings in any of the specifications from Tables 7

and 8. Moreover, the point estimates on the rankings coefficients are smaller in magnitude than their counterparts from Tables 2 and 3 and often even positive. These null findings for the falsification tests provide more confidence that we are identifying the effect of rankings on retention in our main results in Tables 2 and 3.

Next, we also estimate equation (2) by simultaneously including previous athletic success, current athletic success, and future athletic success. Columns 1-5 of Table 9 show these results. Encouragingly, there are no significant coefficients on the past or future years' rankings and coefficients on the present year's ranking are strikingly similar to the corresponding coefficients in Tables 2 and 3. Altogether, we do not find any evidence to support an endogeneity story of recent athletic performance driving current retention. Similarly, once controlling for IHE specific retention levels and linear trends, we find no evidence that future athletic performance significantly relates to current retention.²⁶

Another potential concern is it may simply be that athletic programs tend to improve at the same time as other unobservable aspects of the IHE. It could be these unobservables that are driving changes to the retention rate and we are misattributing the effect to the athletic success; we may have an omitted variables bias. Again, to the extent that these improvements occur in a linear manner, the trends of the IHE-specific trends model will account for these changing unobservables. Nevertheless, we turn to a less visible sport, women's basketball, for a falsification test. The logic is that success in this less visible sport should not significantly affect retention rates. A significant relationship between women's basketball success and retention could be a good indication that other time variant unobservable factors are driving the results. Comprehensive rankings of women's basketball are not available so we utilize data on NCAA tournament success. Table 10

²⁶ We also conduct the analogous falsification tests using previous and future year's NCAA tournament success. Once again, we find no statistically significant effects. These results are available upon request.

shows the results for this falsification test. Columns 1 and 3 provide results for the same sample of IHEs that comprise the men's basketball ranking sample. Columns 2 and 4 narrow the sample to only IHEs that make appearances in the women's NCAA basketball tournament within our sample period. In all cases, there is no statistical difference in retention rates from making the round of 64 and losing or from winning at least one tournament game, relative to the base category of not making the tournament. This provides some evidence against the argument of an omitted variables bias problem.

7. Conclusion

Athletics, for better or for worse, have historically been a major part of many higher education institutions in the United States. Their role in promoting or detracting from the academic missions of these institutions has long been a source of debate. On the one hand, major athletic programs may serve to divert scarce institutional resources and distract students (both athletes and otherwise) from their academic pursuits. On the other hand, athletics may create a stream of revenue, while promoting the institution to the public, and perhaps provide a means to increase student engagement on campus. This increase in engagement may, in turn, increase the likelihood that a student continues in his or her education, and ultimately attains a degree.

In this study, we provide new evidence on the relationship between the success of an institution's athletic programs and the persistence rates of the student body. We primarily use rankings in men's basketball and football as our measures of athletic success and utilize panel data, allowing us to focus on variations occurring within the same institution over time. The ability to analyze within-institution variation on the full set of NCAA Division I institutions represent key empirical additions to previous studies on the topic. Our results suggest that success in the two

most prominent sports has significant positive effects on retention rates, and that basketball success may increase graduation rates.

Furthermore, we implement a series of falsification tests to address concerns of the potential endogeneity of athletic success to student persistence. A leading threat to our identification is that athletic success may be persistent over years and success in a previous year may improve current retention due to student composition effects. The falsification tests do not provide any evidence to support this concern. A second identification concern is that there may simply be time-varying omitted variables that are correlated with both retention and athletic success. We address this concern by including IHE specific linear trends and by testing the effect of success in a less visible sport, women's basketball, on retention. The null results here strengthen our case that the main results are not simply being driven by omitted variables.

While the estimated effects are modest in magnitude, it is important to note that very few institutional-level variables have been shown to impact student retention in a meaningful way. In addition, we find the impacts may be more substantial for a more noticeable measure of success, such as winning a game in the NCAA basketball tournament. These findings do not resolve the debate on the role that athletics should play in American institutions of higher education, but they do support the notion that there can be benefits to the student body in promoting the success of the athletic program.

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Table 1. Summary Statistics

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
Retention Rate	2761	81.17	82	9.68	53.00	100.00
Graduation Rate	1188	62.44	63.19	18.19	13.85	97.93
Basketball Ranking	2761	165.87	163	98.02	1	347
Football Ranking	986	58.56	58	34.46	1	120
NCAA Tournament						
Team in Tournament (no wins)	2761	.097			0	1
Team won at least one game	2761	.100			0	1
Percentage Male	2761	45.75	45.20	7.01	22.26	94.42
Percentage Indian	2761	0.61	0.38	0.90	0.00	9.64
Percentage Asian	2761	6.12	3.02	8.04	0.00	64.74
Percentage Black	2761	14.14	6.44	22.41	0.35	98.27
Percentage Hispanic	2761	6.39	3.73	7.95	0.03	89.97
Percentage Alien	2761	2.98	2.14	2.55	0.00	18.37
Percentage Receiving Federal Aid	2761	27.45	23	15.89	6.00	95.00
Percentage Instructors Tenure Track	2761	59.49	59.00	15.97	16.72	100.00
SAT Average	2761	1114.71	1110	134.67	755	1500
Instruction Expenditures ⁺	2761	156.37	90.65	206.17	7.20	2533.18
Academic Support Expenditures ⁺	2761	42.83	23.65	63.48	0.73	612.74
Student Service Expenditures ⁺	2761	23.04	16.34	22.62	2.05	216.74

⁺ signifies variable is measured in millions of 2004 dollars

Table 2. Regression Results: Retention Rates, Basketball Rankings

	(1) OLS	(2) FE	(3) IHE- Specific Trends	(4) FE	(5) IHE- Specific Trends	(6) IHE-Specific Trends
ln(Ranking)	-0.603*** (0.152)	-0.162** (0.0752)	-0.167** (0.0739)	-0.133* (0.0704)	-0.120* (0.0677)	-0.359* (0.210)
Percentage Male	0.0217 (0.0288)			-0.0556 (0.0802)	-0.149 (0.149)	-0.167 (0.272)
Percentage Indian	-1.411*** (0.257)			-0.244 (0.265)	-0.268 (0.314)	-1.528*** (0.332)
Percentage Asian	0.00263 (0.0348)			-0.0179 (0.0396)	-0.0547 (0.0650)	-0.139 (0.163)
Percentage Black	0.0484*** (0.0177)			-0.0857 (0.0588)	-0.00938 (0.0414)	-0.00770 (0.180)
Percentage Hispanic	0.0449 (0.0415)			0.183** (0.0796)	0.0940 (0.132)	-0.107 (0.194)
Percentage Alien	-0.228*** (0.0780)			0.0439 (0.0671)	0.0791 (0.0975)	0.0920 (0.205)
% Receiving Fed. Aid	-0.143*** (0.0246)			-0.0324* (0.0168)	-0.0174 (0.0182)	-0.0161 (0.0274)
% Inst. Tenure Track	0.0235* (0.0132)			0.00736 (0.0107)	0.00368 (0.0137)	-0.0132 (0.0129)
SAT Average	0.0447*** (0.00252)			0.0155*** (0.00296)	0.00889** (0.00360)	0.0159** (0.00656)
ln(Instruction Exp.)	-0.351 (0.574)			-0.626 (0.743)	-1.146 (0.900)	-0.519 (1.951)
ln(Acad. Support Exp.)	1.323** (0.515)			0.523 (0.355)	-0.325 (0.617)	1.029 (1.084)
ln(Stud. Service Exp.)	-0.0546 (0.531)			0.813** (0.392)	1.338*** (0.512)	0.267 (1.200)
Observations	2,761	2,980	2,980	2,761	2,761	779
Number of Institutions	333	343	343	333	333	101
Sample	All	All	All	All	All	No Football program
Marginal Effect at Rank=5	-0.1206***	-0.0324**	-0.0334**	-0.0266*	-0.0242*	-0.0717*
Marginal Effect at Rank=10	-0.0603***	-0.0162**	-0.0167**	-0.0133*	-0.0121*	-0.0359*
Marginal Effect at Rank=25	-0.0241***	-0.0065**	-0.0067**	-0.0053*	-0.0048*	-0.0143*

Dependent variable is retention rate. OLS regression includes Carnegie FE and State FE. All regressions include Year FE. Robust standard errors in parentheses are clustered at the institution level.

*** p<0.01, ** p<0.05, * p<0.1

Table 3. Regression Results: Retention Rates, Football Rankings

	(1) OLS	(2) FE	(3) IHE-Specific Trends	(4) FE	(5) IHE-Specific Trends
ln(Ranking)	-0.385* (0.199)	-0.203** (0.0975)	-0.189** (0.0921)	-0.222** (0.101)	-0.173* (0.0994)
Percentage Male	-0.0315 (0.0477)			-0.109 (0.0755)	0.00141 (0.0970)
Percentage Indian	-0.339 (0.355)			0.547 (0.332)	-0.235 (0.284)
Percentage Asian	0.0175 (0.0558)			-0.0276 (0.0392)	-0.0397 (0.0559)
Percentage Black	-0.198*** (0.0723)			-0.243** (0.0975)	-0.0399 (0.141)
Percentage Hispanic	0.0393 (0.0384)			0.206* (0.106)	0.117 (0.178)
Percentage Alien	-0.0605 (0.0980)			0.0342 (0.0795)	0.146 (0.0919)
% Receiving Fed. Aid	-0.0318 (0.0334)			0.00681 (0.0182)	-0.00127 (0.0203)
% Inst. Tenure Track	0.00782 (0.0224)			0.00600 (0.0182)	-0.00371 (0.0190)
SAT Average	0.0396*** (0.00280)			0.0180*** (0.00456)	0.0144*** (0.00450)
ln(Instruction Exp.)	1.190 (0.782)			-1.510 (0.919)	-1.061 (1.038)
ln(Acad. Support Exp.)	0.604 (0.431)			0.483 (0.392)	0.185 (0.663)
ln(Stud. Service Exp.)	0.391 (0.619)			0.766 (0.520)	1.374** (0.596)
Observations	986	1,040	1,040	986	986
Number of Institutions	115	117	117	115	115
Marginal Effect at Rank=5	-0.077*	-0.0406**	-0.0378**	-0.0442**	-0.0346*
Marginal Effect at Rank=10	-0.0385*	-0.0203**	-0.0189**	-0.0221**	-0.0173*
Marginal Effect at Rank=25	-0.0154*	-0.00812**	-0.00167**	-0.00884**	-0.00692*

Dependent variable is retention rate. OLS regression includes Carnegie FE and State FE. All regressions include Year FE. Robust standard errors in parentheses are clustered at the institution level.

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Regression Results: Graduation Rates

	(1) OLS	(2) FE	(3) IHE-Specific Trends	(4) OLS	(5) FE	(6) IHE-Specific Trends
ln(Basketball Ranking)	-2.387*** (0.578)	0.430 (0.454)	-1.503* (0.861)			
ln(Football Ranking)				-1.535 (1.111)	-0.549 (0.556)	-1.395 (0.983)
% Receiving Fed. Aid	-0.239*** (0.0472)	-0.0645 (0.0689)	-0.351 (0.277)	-0.262*** (0.0814)	0.0787 (0.0839)	-0.288 (0.275)
SAT Average	0.0952*** (0.00475)	0.0414*** (0.00889)	0.0151 (0.0251)	0.0933*** (0.00677)	0.0678*** (0.0173)	0.0659 (0.0470)
ln(Instruction Exp.)	-2.808** (1.262)	-2.317 (2.714)	-4.694 (8.420)	4.017** (1.709)	-2.260 (4.061)	5.231 (8.614)
ln(Acad. Support Exp.)	0.986 (0.998)	1.506 (1.502)	-0.541 (6.743)	-0.871 (1.482)	3.320 (2.528)	-12.92 (7.887)
ln(Stud. Service Exp.)	0.178 (1.076)	0.856 (1.380)	3.321 (6.402)	-2.627 (1.691)	-0.966 (2.593)	7.717 (9.837)
Observations	1,260	1,260	1,260	449	449	449
Number of Institutions	323	323	323	115	115	115
Marginal Effect at Rank=5	-0.477***	0.086	-0.301*	-0.307	-0.110	-0.279
Marginal Effect at Rank=10	-0.239***	0.043	-0.150*	-0.154	-0.055	-0.140
Marginal Effect at Rank=25	-0.0955***	0.0172	-0.060*	-0.061	-0.022	-0.056

Dependent variable is graduation rate. All OLS regressions include Carnegie FE and State FE. All regressions include Year FE. Robust standard errors in parentheses are clustered at the institution level.

*** p<0.01, ** p<0.05, * p<0.1

Table 5. Regression Results: NCAA Basketball Tournament

	(1) FE	(2) IHE-Specific Trends	(3) FE	(4) IHE-Specific Trends
Round of 64	0.153 (0.140)	0.104 (0.145)	0.131 (0.266)	0.150 (0.329)
Tournament Win	0.278* (0.154)	0.275* (0.154)	0.844** (0.363)	1.010** (0.420)
Percentage Male	-0.0564 (0.0802)	-0.0634 (0.138)	-0.280** (0.140)	-0.167 (0.272)
Percentage Indian	-0.247 (0.265)	-0.356 (0.297)	-1.153** (0.479)	-1.530*** (0.332)
Percentage Asian	-0.0173 (0.0399)	-0.0640 (0.0663)	0.0311 (0.107)	-0.120 (0.165)
Percentage Black	-0.0855 (0.0587)	-0.0115 (0.0430)	-0.0769 (0.0700)	-0.00694 (0.181)
Percentage Hispanic	0.183** (0.0799)	0.0739 (0.128)	-0.0388 (0.106)	-0.109 (0.193)
Percentage Alien	0.0448 (0.0672)	0.0735 (0.0941)	-0.147 (0.107)	0.125 (0.208)
% Receiving Fed. Aid	-0.0321* (0.0169)	-0.0104 (0.0179)	-0.0246 (0.0227)	-0.0162 (0.0275)
% Inst. Tenure Track	0.00715 (0.0107)	0.00315 (0.0128)	0.00175 (0.0124)	-0.0138 (0.0126)
SAT Average	0.0155*** (0.00296)	0.00873*** (0.00328)	0.0233*** (0.00550)	0.0160** (0.00657)
ln(Instruction Exp.)	-0.631 (0.744)	-1.211 (0.828)	-0.833 (1.688)	-0.573 (1.930)
ln(Acad. Support Exp.)	0.530 (0.356)	-0.204 (0.562)	1.112* (0.619)	1.056 (1.071)
ln(Stud. Service Exp.)	0.819** (0.393)	1.408*** (0.498)	0.736 (0.979)	0.332 (1.177)
Observations	2,761	2,761	780	780
Number of Institutions	333	333	102	102
Sample	All	All	No Football Program	No Football Program

Dependent variable is retention rate. All regressions include Year FE. Robust standard errors in parentheses are clustered at the institution level. *** p<0.01, ** p<0.05, * p<0.1

Table 6. Regression Results: Robustness Checks

	(1) Consensus	(2) Consensus	(3) Sagarin	(4) Sagarin	(5) Sagarin	(6) Sagarin
ln(Basketball Ranking)	-0.129** (0.0653)	-0.138** (0.0686)	-0.141* (0.0749)	-0.100 (0.0691)		
ln(Football Ranking)	-0.183** (0.0903)	-0.166* (0.0971)			-0.185** (0.0885)	-0.175* (0.0965)
IHE Level Controls	No	Yes	No	Yes	No	Yes
Observations	1,040	986	2,980	2,761	1,040	986
Number of Institutions	117	115	343	333	117	115

Dependent variable is retention rate. All regressions include Year FE, institution FE, and institution-specific linear trends. Robust standard errors in parentheses are clustered at the institution level.

*** p<0.01, ** p<0.05, * p<0.1

Table 7. Previous Year Athletic Rankings Falsification Test

	(1) Basketball	(2) Basketball	(3) Basketball	(4) Football	(5) Football
ln(previous year ranking)	-0.104 (0.0785)	-0.0793 (0.0738)	0.0192 (0.225)	0.0121 (0.102)	0.0360 (0.110)
IHE Level Controls	No	Yes	Yes	No	Yes
Observations	2,968	2,751	775	1,037	983
Number of Institutions	343	333	101	117	115
Sample	All	All	No Football program	All	All

Dependent variable is retention rate. All regressions include Year FE, institution FE, and institution-specific linear trends. Robust standard errors in parentheses are clustered at the institution level.

*** p<0.01, ** p<0.05, * p<0.1

Table 8. Future Year Athletic Rankings Falsification Test

	(1) Basketball	(2) Basketball	(3) Basketball	(4) Football	(5) Football
ln(future year ranking)	0.0387 (0.0775)	0.0313 (0.0769)	-0.00348 (0.200)	0.100 (0.0999)	0.115 (0.102)
IHE Level Controls	No	Yes	Yes	No	Yes
Observations	2,983	2,764	781	1,043	988
Number of Institutions	343	333	101	121	119
Sample	All	All	No Football program	All	All

Dependent variable is retention rate. All regressions include Year FE, institution FE, and institution-specific linear trends. Robust standard errors in parentheses are clustered at the institution level.

*** p<0.01, ** p<0.05, * p<0.1

Table 9. Past, Present, and Future Year Athletic Rankings Falsification Test

	(1) Basketball	(2) Basketball	(3) Basketball	(4) Football	(5) Football
ln(past year ranking)	-0.0919 (0.0782)	-0.0688 (0.0717)	0.0445 (0.238)	0.0314 (0.111)	0.0572 (0.118)
ln(present year ranking)	-0.160** (0.0719)	-0.114* (0.0665)	-0.353* (0.211)	-0.189** (0.0949)	-0.167 (0.104)
ln(future year ranking)	0.0218 (0.0770)	0.0168 (0.0749)	0.0188 (0.199)	0.103 (0.110)	0.117 (0.111)
IHE Level Controls	No	Yes	Yes	No	Yes
Observations	2,960	2,743	769	1,037	983

Number of Institutions	342	332	101	117	115
Sample	All	All	No Fball Program	All	All

Dependent variable is retention rate. All regressions include Year FE, institution FE, and institution-specific linear trends. Robust standard errors in parentheses are clustered at the institution level.
*** p<0.01, ** p<0.05, * p<0.1

Table 10. Women's Basketball Success Falsification Test

	(1)	(2)	(3)	(4)
Round of 64	-0.0467 (0.156)	0.0115 (0.239)	-0.00521 (0.156)	0.101 (0.227)
Tournament Win	-0.208 (0.162)	-0.0679 (0.187)	-0.234 (0.169)	-0.0772 (0.187)
IHE Level Controls	No	No	Yes	Yes
Observations	2,980	1,161	2,761	1,104
Number of Institutions	343	165	333	163
Sample	All	Only Teams With Tournament Appearance	All	Only Teams with Tournament Appearance

Dependent variable is retention rate. All regressions include Year FE, institution FE, and institution-specific linear trends. Robust standard errors in parentheses are clustered at the institution level.
*** p<0.01, ** p<0.05, * p<0.1

Table A1. Categorical Rankings

	(1) Basketball	(2) Basketball	(3) Basketball	(4) Football	(5) Football
Rank 1-25	0.380** (0.163)	0.376** (0.167)	1.087** (0.500)	0.500** (0.200)	0.444** (0.210)
Rank 26-50	0.205 (0.135)	0.220 (0.139)	0.480* (0.283)	0.201 (0.140)	0.187 (0.144)
IHE Level Controls	No	Yes	Yes	No	Yes
Observations	2,980	2,761	779	1,040	986
Number of Institutions	343	333	101	117	115
Sample	All	All	No Football Program	All	All

Dependent variable is retention rate. All regressions include Year FE, institution FE, and institution-specific linear trends. Robust standard errors in parentheses are clustered at the institution level.
*** p<0.01, ** p<0.05, * p<0.1

Table A2. First-Difference Results

(1)	(2)	(3)	(4)	(5)	(6)
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	Basketball	Basketball	Basketball	Basketball	Football	Football
ln(Basketball Ranking)	-0.131** (0.0634)	-0.145** (0.0658)	-0.335* (0.190)	-0.498*** (0.184)		
ln(Football Ranking)					-0.188*** (0.0665)	-0.189*** (0.0712)
IHE Level Controls	No	Yes	No	Yes	No	Yes
Observations	2,642	2,535	757	713	922	892
Number of Institutions	343	339	106	102	117	117
Sample	All	All	No Fball	No Fball	All	All

Dependent variable is retention rate. All regressions include Year FE. Robust standard errors in parentheses are clustered at the institution level.

*** p<0.01, ** p<0.05, * p<0.1

Table A3. Regression Results: Retention Rates with Conference Dummy Variables

	(1) Basketball	(2) Basketball	(3) Basketball	(4) Football	(5) Football
ln(Basketball Ranking)	-0.180** (0.0739)	-0.137** (0.0681)	-0.344 (0.213)		
ln(Football Ranking)				-0.195** (0.0892)	-0.177* (0.0970)
IHE Level Controls	No	Yes	Yes	No	Yes
Dummy Variables for Conference Affiliation	Yes	Yes	Yes	Yes	Yes
Observations	2,980	2,761	779	1,040	986
Number of Institutions	343	333	101	117	115
Sample	All	All	No Football Program	All	All

Dependent variable is retention rate. All regressions include Year FE, institution FE, and institution-specific linear trends. Robust standard errors in parentheses are clustered at the institution level.

*** p<0.01, ** p<0.05, * p<0.1