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Academics vs. Athletics: Career Concerns for NCAA Division I Coaches

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ACADEMICS VS. ATHLETICS:
CAREER CONCERNS FOR NCAA DIVISION I COACHES

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ABSTRACT

We analyze the promotions and firings of NCAA Division 1 college basketball and college football coaches to assess whether these coaches are rewarded for the academic performance of their players in promotion and retention decisions. We find that an increase in *Academic Progress Rate*, as measured by the NCAA, for a college team in either sport significantly reduces the probability that the coach is fired at the end of the season. We find little to no evidence that an increase in the Academic Progress Rate enhances the chances of advancement (in the form of outside job offers) for these coaches.

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1. Introduction

American college sports has become a big business. Each year, millions of people watch college football and college basketball on television, and television networks pay whopping fees for the rights to show these games. “March Madness”, the cultural phenomenon associated with the NCAA college basketball tournament, has become so pervasive that there is a noticeable downtick in library research at universities during the first week of the tournament (Clotfelter, 2011). In addition to direct financial gain through ticket sales and payments for television rights, colleges benefit in many indirect ways from their major sports teams. A successful college team promotes future applications to the college (Pope and Pope, 2009 and 2014), may increase alumni donations (Anderson 2012, Meer and Rosen, 2009; Turner, Meserve, and Bowen, 2001 provide mixed evidence on this point) and enhances the political influence of college administrators (Clotfelter, 2011).

There is an inherent conflict in the dual-role of the student-athletes on college teams, for it is difficult to pursue academic and athletic excellence simultaneously. This conflict predates college enrollment: “Division I sports today require longtime full-time commitment. A recruited football player has most likely attended some coach's summer camp since the ninth grade, perhaps middle school, and he has worked year-round to make himself impressive to college recruiters.”[1] Colleges relax their admission standards in reviewing the applications of recruited athletes, and then upon enrollment, those players tend to have even poorer academic records than

[1] Michael Oriard, “Back Talk; Football Glory and Education Are a Team No More,” New York Times, December 23, 2001.

might be expected given their prior grades and test scores (Bowen and Levin, 2003; Shulman and Bowen (2001)), and to complete BA degrees at relatively low rates.[2] Yet, as Michael Lewis observes, this phenomenon is not surprising: "If serious college football players are students first, why — even after a huge N.C.A.A. push to raise their graduation rates — do they so alarmingly fail to graduate? … Unlike the other student[s] on campus, they have full-time jobs: playing football for nothing. Neglect the task at hand, and they may never get a chance to play football for money."[3]

Division I college coaches can play a critical role in mediating the conflict between sports and academics. As Harry Edwards summarized in 1973 in The Sociology of Sport, "Because of his historically unchallenged authority as `father surrogate', the coach has assumed the burden of accountability for the total behavior of `his sons'". The NCAA implicitly endorses the view that the coach can be held specifically accountable for academic performance by making "Academic Progress Rate" (*APR*) searchable by coach as well as by team on its website (LaForge and Hodge, 2011 emphasize this point). Yet, it seems almost inevitable that coaches will be evaluated almost solely on the athletic accomplishments of their teams. As long-time college coach Royce Waltman said when he lost his job at Indiana State in 2007, "if you get fired for cheating you can get rehired, but if you get fired for losing it's like you have leprosy. … Cheating and not graduating players will not get you in trouble, but that damn losing will."[4]

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[2] For example, using publicly available data for 58 colleges with prominent teams, Clotfelter (2011) computed average graduation rates of 42% for college basketball players and 56% for college football players by comparison to an average overall graduation rate of 72% at those colleges.

[3] Michael Lewis, "Serfs of the Turf," New York Times, November 11, 2007. Shulman and Bowen (2001) find different patterns at highly selective schools, whereby male athletes graduate at relatively high rates and go on to earn even more on average than their classmates, in part because these athletes tended to pursue jobs in business-oriented fields.

[4] "Royce Waltman Talks about Being Let Go by ISU", Tribune Star, March 3, 2007.

Consistent with this view, the prior academic literature identifies a strong connection between a team's athletic performance and the head's coach's salary and longevity (see, for example, Holmes, 2011), but generally does not consider the academic performance of the players.[5]

This paper builds on previous work, which studied direct and indirect financial incentives for NCAA football coaches (Cadman and Cassar, 2016), to assess whether Division I college basketball and college football coaches are rewarded in retention and promotion decisions for the academic performance of their players. In other words, do career concerns provide positive incentives for college coaches to encourage team members to succeed in their classes? To address this question, we compile ten years of publicly available data from the National Collegiate Athletic Association (NCAA) website, including yearly ratings of the academic records of players on each college team, as well as the job history of all Division I college basketball and football coaches who were employed during this time period. After controlling for the records of their teams, we find – perhaps surprisingly – a clear and statistically significant relationship between academic performance of players and coaching retention: all else equal, a coach of a team with a lower academic score is significantly more likely to be fired than a coach of a team with a higher academic score. However, we find no obvious relationship between academic performance of players and coaching promotion, whereby a coach is recruited away from his current position to take a different position as head coach. Together, these findings suggest that there may be a threshold in academic performance that is required for the coach to retain employment, but that coaches do not receive marginal benefit if their players exceed that threshold level of academic achievement.

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[5] Two exceptions are Fogerty, Soebbing and Agyemang (2015) and Grant, Leadley, and Zygmont (2013), which find little or no connection between a team's *APR* score and the head coach's salary.

The paper proceeds as follows. Section 2 provides institutional history and describes the details of initiatives used by the NCAA to track and promote academic achievement of athletes. Section 3 describes the data and presents descriptive statistics. Section 4 provides results of our statistical analysis of the determinants of "Firing" and "Promotion" of head coaches. Section 5 presents alternate hypotheses that can explain these results and provides sensitivity analysis to test them. Section 6 discusses possible interpretations of the results. Section 7 concludes.

2. Institutional History

In the past three decades, the NCAA has adopted three different approaches to promote the academic achievement of student-athletes. First, it set minimum academic standards for athletic eligibility. Proposition 48, which was adopted in 1983, was notable because it extended these standards to academic performance prior to college, requiring a high school GPA of 2.0 or higher in combination with a minimum combined (Verbal and Math) score of 700 or higher on the SAT for eligibility to play as a freshman. Second, it began formally tracking graduation rates, in part to assess the effect, if any, of Proposition 48 on college graduation rate. Since 1990, colleges have been required to report graduation rates both to the federal government and to the NCAA according to a specific formula now known as the "Federal Graduation Rate". The NCAA developed an alternative formula (Graduation Success Rate or *GSR*) in 2002. Third, it introduced the Academic Progress Rate (*APR*) in 2003 and subsequently imposed a system of escalating penalties to be imposed upon colleges (or specific teams) failing to meet minimum standard *APR* scores.[6]

[6] See http://www.ncaa.org/about/resources/research/ncaa-graduation-rates-quarter-century-tracking-academic-success and http://www.ncaa.org/about/resources/research/academic-progress-rate-timeline for detailed timelines of NCAA activity.

While outside commentators and NCAA regulators have long agreed on a goal of improving college graduation rates for student-athletes, there is considerable difficulty in developing a scheme to provide incentives that are directly tied to those graduation rates. In addition to difficulties in defining a formula for "graduation rate" (LaForge and Hodge, 2011 provide detailed discussion of this point), graduation rates can only be computed with a long lag time, whatever the formula. The Federal Graduation Rate (*FGR*) is a "six year rate", meaning that results for a cohort of students who enroll in Fall 2008 only become available after the end of the 2013-2014 academic year. But, as we discuss in Section 3 below, head coaching positions are notoriously unstable: an average of 15% of college basketball coaches and 17% of college football coaches change jobs each year. So, by the time that it is possible to compute a graduation rate for a given cohort of players, many teams will have new coaches and regimes, and so that graduation rate may be obsolete.

With this in mind, the NCAA introduced the "Academic Progress Rate" in 2003. *APR* tracks two things - athletic eligibility and continuing enrollment – on a semester-by-semester basis for each player with an athletic scholarship, assigning up to 2 points each per player-year for eligibility and for enrollment. *APR* is simply the proportion of possible points attained by the players on a team. The NCAA reports *APR* as an equally weighted, four-year moving average. This score is scaled from 0 to 1000, so a team that attains 95% of possible points would be given a score of 950. The *APR* measure has the virtues of measuring variables that are related to graduation and of immediately incorporating each year's academic results in a "real-time snapshot of a team's academic success".[7] While there is no direct means of converting *APR* into

[7] http://www.ncaa.org/about/resources/research/academic-progress-rate-timeline

a graduation rate, the NCAA initially reported that an *APR* of 925 was roughly equivalent to a 50% graduation rate (LaForge and Hodge, 2011). A key feature of the *APR* is that the NCAA systematically penalizes teams that fail to meet a minimum threshold. Initially, the threshold was set at 900, then gradually adjusted over time to its current value of 930. Teams with scores below the threshold have been penalized with losses of athletic scholarships and reductions of practice time and have also been declared ineligible for postseason play. The penalties associated with *APR* are of sufficient importance that it has generated some controversy – with well-known coaches Jim Boeheim of Syracuse and Bruce Pearl (then) of Tennessee criticizing its methodology and US Secretary of Education Arne Duncan defending its use.[8]

Figures 1a and 1b show that *APR* scores have systematically increased by an average of approximately 30 points per team from 2004-2005 to 2013-2014, with similar increases for college basketball (from 928 in 2004-2005 to 961 in 2013-2014) and college football (from 930 in 2004-2005 to 961 in 2013-2014).[9] (We adopt the convention of referring to the "Year" as the calendar year corresponding to the end of the academic year in Figures 1a and 1b and throughout the paper.) These increased *APR* scores have been accompanied by corresponding reductions in the number of penalties imposed by the NCAA for low *APR* scores – even though the NCAA increased the minimum *APR* score during this time period. As shown in Figure 1c, approximately 15% of college basketball and college football teams received penalties associated with their 2006-2007 *APR* scores, but in recent years, fewer than 5% of these teams have been penalized for low *APR* scores.

[8] "Education Chief: Low Grad Rate Should Mean No Tourney Invite", USA Today, March 17, 2011.
[9] The NCAA provides similar results in its May 2015 report "National and Sport-Group *APR*-Averages and Trends", http://www.ncaa.org/sites/default/files/May2015_public-release_FINAL.PDF.

3. Data and Coding for Coaching Histories

We compile data on Academic Progress Rates (and NCAA penalties associated with them), NCAA violations, and average attendance at college basketball and football home games from the NCAA website. *APR* data is available for each sport for the ten years from 2004-2005 to 2013-2014.

The NCAA announces *APR* scores and penalties each spring, usually in May. These scores are announced with a one year lag – presumably to allow for validation of results sent by colleges at the end of the previous academic year. Thus, *APR* scores announced in May 2015 were based on the academic progress of recruited athletes from 2010-2011 to 2013-2014. Both because of this lag and to allow for the possibility that the departure of a coach in the middle of the academic year could reduce the academic performance of players in the remainder of that academic year, we only use the *APR* (and associated penalties) corresponding to year **t-1** (though announced in year **t**) to predict firing and promotion of coaches in year **t**. Thus, for this ten year period of *APR* scores, our sample period of coaching histories consists of the academic years from 2005-2006 to 2004-2015, corresponding to the football seasons from (Fall) 2005 to 2014 and to the basketball seasons from (Spring) 2006 to 2015.

NCAA violations not directly associated with *APR* score are infrequent and typically result after long periods of investigation. We find empirically that coaching changes are especially likely in the year before an NCAA violation is announced. This is consistent with the casual observation that these violations are often anticipated during the course of the investigation that precedes the formal announcement of NCAA penalties and sanctions. For this reason, we use dummy variables of "Violation Next Year" to predict coaching changes in our analysis below.[10]

We compile data on coaching histories and team records for these seasons from Sports-Reference (available at www.sports-reference.com). As described below, we conducted additional internet searches to classify each change of college coach that occurred during this time period; we were able to find news stories to pinpoint the reason for essentially every change. We augment this data with additional data of coach salaries derived from line-by-line analysis of individual contracts of Division I football coaches in 2006, 2007, 2009, and 2010. While limited to a subset of the ten years in the sample, this salary data is especially useful for our analysis because it enables us to identify internal promotions (renegotiated contract) in addition to external promotions (change of job). Unfortunately, we have no means for identifying internal promotions of basketball coaches or for identifying internal promotions of football coaches in any years except 2006, 2007, 2009, and 2010.

In addition to "Wins" and "Losses", we identify several additional measures of team performance for each sport. Successful teams in each sport are invited to post-season play: the "NCAA" and "NIT" tournaments for basketball teams and bowl games for football teams. We create binary variables for college basketball to capture participation in these tournaments and also to identify bowl game winners in college football. Many different analysts produce statistical rankings of the teams in all sports. Since the rankings of different analysis are typically highly correlated with each other, we simply select one prominent statistical ranking for

[10] Our results are robust to changes in timing in the measurement of this variable and also to the exclusion of the NCAA violation variable in each specification.

each sport: Ken Pomeroy's ranking for college basketball teams and Football Outsiders' ranking for college football teams, where each ranking is computed on a season-by-season basis. In each case, we convert ordinal team rankings into percentile rankings ranging from 0 (worst) to 100 (best), first on a national basis, then separately by conference, so that that the most positively rated team in a conference is assigned a Conference Percentile ranking of 100 and the least positive rated team in a conference is assigned a Conference Percentile ranking of 0.[11]

A total of 356 colleges fielded Division I basketball teams and a total of 128 colleges fielded Division I football teams for at least one season during this time period. We restrict our analysis to the 327 basketball teams and 119 football teams that were active in Division I for each of the 11 seasons from 2004-2005 to 2014-2015; though we do not include the 2004-2005 season in our analysis, we do use the APR data for that academic year. Our resulting sample includes 95.3% (3,270 of 3,432) of the Division I basketball team-seasons and 97.9% (1,190 of 1,215) Division I football team-seasons from 2005-2006 to 2014-2015. We identify approximately 60 Basketball and 70 Football teams as belonging to "major conferences" in each year.[12]

[11] Conference Percentile scores based on these statistical team ratings need not overlap precisely with "Conference Standings" based on win and loss records.

[12] We consider the so-called "Power Five" conferences (ACC, Big 10, Big 12, Pac 12, and SEC) to be major conferences in both sports and also include the Big East as a major conference in our basketball analysis. A small number of teams changed conference during the sample period, so the exact number of major conference teams varies slightly across sample years.

3.1 Coaching Transitions

We identify 476 coaching changes for basketball teams and 211 coaching changes for football teams in our sample, where a coaching change is defined as any instance where a team has different coaches at the start of consecutive seasons.[13] Coaching changes are mildly unusual in each sport: as shown in Table 1a, the coach retains his job from season to season 85% of the time in college basketball and 82% of the time in college football. We conducted internet searches to identify the details of each coaching change and classify these changes into six categories.

We first distinguish between coaching changes where (1) the coach left a position and did not have another coaching position in place ("Loss of Job"), which we broadly classify as a negative outcome and (2) the coach resigned from a position to take another coaching position ("Change of Job"), which we broadly classify as a positive outcome. However, there are exceptions within each broad category, as we describe below.

Within the first category (Possible Firing), we identify three separate cases of extenuating circumstances that motivated the coach to leave the position. First, some coaches left their positions due to publicly disclosed "***Heath Issues***". Second, a number of long-time coaches formally "***Retired***", though it is not always clear that the retirement decision was entirely a matter of the coach's choice.[14] A cynic might suggest that a stated health problem or retirement might be a convenient label for public consumption, and that some of these coaches were actually fired. We have no good way to assessing this claim, though there is evidence in some

[13] Although the 2015-2016 college basketball season is not complete at the time of this writing, we were able to identify the coach of each team at the start of the season and to classify the coaching changes that took place between 2014-2015 and 2015-2016 for both basketball and football.

[14] We classify (unexpected) mid-season retirements as "Firings".

cases of genuine health problems that derailed the careers of successful coaches, including three unexpected off-season deaths. Third, some coaches were only in the temporary position of "*Interim Coach,*" either as emergency replacements after an unexpected departure of a coach, or because (in one case) the college announced in advance that it was disbanding the team at the end of the season. With the exception of these three types of extenuating circumstances, we consider all other cases where a coach left a position and had no other job in place as "*Firing*", though some of these changes were formally described as resignations.[15]

Within the second category (Change of Job), we distinguish between two types of new job for the original head coach. We classify each instance where the head coach changed jobs voluntarily to become a head coach for a different college or professional team as a "*Promotion*". Most of these cases are clear cut promotions - moves to higher profile and/or higher paying positions – though there are some instances where news stories suggested that the coach moved in part because he was in danger of losing his original position. We classify each instance where the head coach changed jobs voluntarily to become a head coach for a different college or professional team as a "*Possible Promotion*". These cases are uncommon and hard to classify as they sometimes involve a choice by an ambitious young coach to change career trajectory by becoming an assistant coach at a prominent major conference team and sometimes involve a choice by an embattled coach to secure a stable long-term position.

As shown in Table 1b, more than 90% of college basketball coaching changes and more than 85% of college football coaching changes fall into our two main categories of "*Firing*" and

[15] We classify six cases where a coach moved to an administrative position as "Firings".

(unambiguous) "*Promotion*". Given the ambiguity associated with the other four categories of coaching changes ("Health Issues", "Retirement", "Interim Coach", "Possible Promotion"), we simply exclude these remaining cases from our main analysis below, though we do include them in sensitivity analysis in Section 5.

Further, as shown in Table 1a, the distribution of year-by-year coaching outcomes is quite similar for college basketball and college football. Approximately ten percent of the team-seasons in each sport result in a firing of the head coach. Firing is a bit more than twice as common as promotion for each sport, though promotion is slightly less common (relative to firing) for college basketball than for college football, while retirements are more commonly observed for college football than for college basketball. Given the similar distributions of coach outcomes across the two sports, we make a conscious effort to develop and apply a single common analytic framework to apply to the two sports in order to promote comparisons of our results across the sports.

There is a clear time pattern to the coaching cycle, as shown in Figures 2a and 2b, which graph the probability of promotion and firing as a function of the tenure of the coach with a given team in our sample. Coaching transitions are rare for coaches in the first two seasons with a team, suggesting that new coaches are given time to bring in recruits and establish routines.[16] Coaching transitions are especially common in seasons 4 to 6 of tenure, when approximately 20% of coaches leave their positions (each year) – with much more likelihood of firing than

[16] We exclude three coaches (Tom Asbury – Pepperdine basketball; Paul Cormier – Dartmouth basketball; Bill Snyder - Kansas State football) who returned late in their careers to teams that they had coached earlier in their careers from analyses based on coaching tenure.

promotion. Our sample falls off dramatically by coaching year – with more than 450 observations of college basketball coaches in the first or second year on the job, but fewer than 60 observations or less for college basketball coaches in year 13 or beyond. We include fewer years of tenure in Figure 2b for college football than in Figure 2a for college basketball because of the smaller number of teams and observations for college football.

3.2 Descriptive Statistics

Tables 2a and 2b provide descriptive statistics for the 3,270 team-seasons for college basketball and for the 1,190 team-seasons for college football in our sample. The results in Columns 2 through 4 of these tables suggest sharp differences in observable results for coaches depending on their job outcome at the end of the season. The coaches who were promoted had strikingly positive records in the previous year, as reflected by winning percentage, post-season participation, ordinal ranking of their teams, and average attendance. By contrast, coaches who were fired tended to have teams that finished toward the bottom of their conferences.   One distinction between the two sports is that promotion seems to be associated with higher average attendance at home games for college basketball, but not for college football. (Retention is associated with higher average attendance than firing in both sports.) This difference may suggest that attendance may be more responsive to in-season performance for basketball than for football given that greater number of games in a basketball season than in a football season.

Of particular interest for this study, average *APR* scores for coaches in both sports who were retained are higher than the average *APR* scores for coaches who were fired.   The difference of nearly ten points in average *APR* score (943.8 for Retained vs. 934.3 for Fired) for college basketball coaches is statistically significant, while the smaller difference in average *APR* scores (946.6 for Retained vs 943.4 for Fired) for football coaches is on the borderline of statistical significance at the .05 level in a two-sample t-test. Of course, these two-sample t-tests are merely suggestive, as they do not control for team performance or other explanatory variables.

In addition to the statistical associations suggested by Tables 2a and 2b between *APR* score and coaching outcomes, there is also a statistical connection between *APR* score and team performance. The correlation coefficient between *APR* score and winning percentage in the next season is approximately .25 for college football and approximately .20 for college basketball. In a simple ordinary least-squares (OLS) regression framework using only the *APR* score for the previous academic year as an independent variable, an increase of 1 win per season is predicted to result from an increase of 40 points in *APR* score for college football and from an increase of 35 points in *APR* score for college basketball.[17] We emphasize that all events affecting the *APR* score for the previous academic year predate the games for the next season.

In our analysis below, we control for team performance and other variables in separate OLS regressions to predict "Firing" and "Promotion" for college coaches in each sport. These regressions are designed to distinguish between the two most likely explanations for the association between *APR* score and "Firing" observed in Tables 2a and 2b – first, that there is a direct causal relationship between the *APR* score and "Firing" – second, that this association can be explained by other variables, especially by athletic records of the teams. We consider alternate explanations for this association in our sensitivity analysis in Section 6.

[17] There are an average of 12.5 games per season for the college football teams and an average of 32.1games per season for the college basketball teams in our sample.

4. Results

We include two sets of performance variables (and their squares) as explanatory variables in each analysis: "Wins" and "Conference Percentile Ranking".[18] We include "Wins" because it is a standard, widely observed measure of performance. We include "Conference Percentile" to incorporate a sophisticated statistical measure that is specifically designed to refine win/loss measures of performance. We have also investigated many other performance measures, but given the high degree of positive correlation across these measures, there is little variation in the results so long as at least one measure related to wins and at least one more sophisticated statistical measure is included as an independent variable in the analysis.

Table 3 report the results of a common set of OLS regression analyses to predict "Firing" of college basketball and college football coaches. In these regressions, we use a binary dependent variable with value 1 in cases where the coach is fired at the end of season and value 0 in all other cases (of either retention or promotion). Tables 4 reports the results using identical OLS regression specifications to predict "Promotion" of these coaches. In these regressions, we use a binary dependent variable with value 1 in cases where the coach is (unambiguously) promoted at the end of the season and value 0 in all other cases (of either retention or firing). As discussed in Section 3, we exclude observations where the interpretation of the coaching change is ambiguous (in the categories of "Health Issues", "Retirement", "Interim Coach", and "Possible Promotion") from the analyses reported in Tables 3 and 4.

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[18] To ease interpretation of the coefficient on the unsquared versions of these variables, we define the squared versions of them in terms of deviations from the sample mean so that, for example, $Wins^2 = [Wins - Mean(Wins)]^2$.

Columns 1 and 4 in Tables 3 and 4 report the results of a baseline specification, including all team-seasons.[19] The specifications in Columns 2 and 5 match the specifications in Columns 1 and 4 of these tables, with the sole distinction that we include dummy variables for each calendar year and for each year of coaching tenure in Columns 2 and 4. The coefficients on the coaching tenure dummy variables are jointly statistically significant in every case with "Firing" as the dependent variable, suggesting that different standards are used for retention of coaches with different levels of tenure.

Columns 3 and 6 of Tables 3 and 4 report results for a subsample that excludes coaches in their first and second year of tenure in the current position. We make this choice for two reasons. First, as shown in Figures 2a and 2b, coaching transitions are relatively rare (and likely idiosyncratic) for coaches in their first or second seasons. Second, since the *APR* score is a weighted average over four prior seasons, the reported (and lagged) *APR* score has little connection to the practices of first- and second-year coaches. Our preferred specification is the one listed in Columns 3 and 6 of each table – excluding first-year and second-year coaches and including tenure/year dummy variables as independent variables.

We convert the lagged *APR* score into units of 100 points in order to ease the interpretation of the estimated effects of *APR* score on coaching outcomes. That is, the reported coefficients on the *APR* score in Tables 3 and 4 indicate the estimated effect of an increase of 100 points in the *APR* score on the dependent variable. For example, the coefficient of -.056 in Column 3 of

[19] A small number of observations are excluded from even this most basic specification, either because we exclude observations with a coaching change that is explained by extenuating circumstances or because a small number of *APR* scores (mostly in 2004-2005) are listed as missing on the NCAA website.

Table 3 indicates that a 100 point increase in (lagged) *APR* score is predicted to reduce the probability that the coach is fired after the next season by 5.6 percentage points.

As shown in Columns 1 to 3 of Table 3, the coefficient for *APR* score is negative in every specification with firing of basketball coaches as the dependent variable. That is, a higher *APR* score predicts a reduction in the probability that the coach is fired at the end of the season. Further, the coefficient is statistically significant in every specification except for the baseline specification reported in Column 1. We also find that an impending NCAA violation is a strong predictor of firing, but interestingly, we find little to no effect of an *APR* penalty beyond the direct effect of the *APR* score itself on the probability that the coach is fired.

As shown in Columns 4 to 6 of Table 3, we find broadly similar results for our analysis with "Firing" as the dependent variable for college football coaches. However, since there are fewer college football than college basketball teams, our sample size is smaller and thus the standard errors for the *APR* coefficient are higher for college football than for the comparable specifications reported for college basketball in Table 3. As a result, the estimated effect of *APR* score is only statistically significant for college football coaches in the final column of Table 3. Since this corresponds to our preferred specification, we are inclined to conclude that *APR* is a significant negative predictor of firing of college football coaches. Interestingly, the estimated effect of *APR* score on firing is more than twice as large for football than for basketball. From Columns 3 and 6 of Table 3, a 100 point increase in *APR* is estimated to reduce the probability that the coach at the end of the season is fired by 15.6 percentage points for football coaches and by 5.6 percentage points for basketball coaches.

As shown in Table 4, we find no statistically significant results of the *APR* when we repeat the same set of analyses using "Promotion" instead of "Firing" as the dependent variable. The coefficients on *APR* in Table 4 are small in magnitude, and are even negative in two of the specifications. (Note that when "Promotion" is the dependent variable, a positive effect of *APR* score on career prospects would correspond to a positive coefficient on the *APR* variable.) Thus, it is possible that there is simply no relationship between *APR* and promotion of college coaches.

Table 5 reports the results of analysis using our salary data for college football coaches, with change in salary and combinations of internal and external promotion as dependent variables. By comparison to the specifications for Table 4, these results have the virtue in including both internal promotion (renegotiation) and external promotion (change to a different college head as possible positive outcomes for the coach. However, given the restriction of the sample to the years for which we have detailed salary information for college football coaches, the tests reported in Table 5 have less statistical power than those reported in Table 4.

Consistent with prior evidence, we find that salary increases, external promotions, and renegotiations are positively related to the winning percentage. We do not find evidence of a significant relation between *APR* and changes in salary, external promotions, or renegotiations, though the estimated coefficients for the *APR* are reasonably large (though not precisely estimated) in some specifications reported in Table 4. We conclude that there is no evidence of an effect of *APR* score in predicting promotion of college coaches, though it might be interesting to revisit this question if/when it is possible to compile more systematic data on the combination of internal as well as external promotions of these coaches.

5. Sensitivity Analysis

We consider several sources of alternate explanations and critiques of the findings for our preferred specification in Table 3 with firing as the dependent variable. We divide these alternate explanations into four categories: (1) alternatives to the OLS model; (2) coding issues related to the variables included in the preferred specification; (3) the potential importance of additional explanatory variables; (4) alternative mechanisms that could explain the observed results. We report the full results for one alternative procedure in a separate table (Table 6), then show the effect of a series of adjustments to our preferred specification from Columns 3 and 5 in Table 3 in separate rows of Table 7.

Alternatives to the OLS Model

The OLS framework does not account for the explicit time series nature of the data, whereby the same coach is evaluated by the same college year after year. We account for the possibility of serial correlation that is implied by the structure of the data by repeating the analysis from Columns 3 and 6 of Tables 3 and 4 using Prais-Winsten estimation. As reported in Table 6, we find similar results for OLS and Prais-Winsten estimation of the effect of *APR* on both firing and promotion. Once again, the estimated effect of *APR* is negative and statistically significant in predicting "Firing", but small and insignificant in predicting "Promotion".

The OLS framework also does not account for the explicitly binary form of the dependent variable, whether "Firing" or "Promotion". Row 1 of Table 7 lists the coefficients when we repeat the analysis for our preferred specification using a Probit model instead of OLS. (To facilitate comparisons, Row 0 of Table 6 reports the coefficients from Columns 3 and 6 of Table

3.) *APR* remains negative and statistically significant in predicting "Firing" for both college basketball and football coaches with the Probit model.[20]

<u>Coding Issues</u>

Since *APR* is a continuous variable with most observations in the range between 900 and 1,000, it is potentially prone to outliers. There are five instances with *APR* below 800 in the basketball sample, including one dramatically low value of 489 for Southern University in 2012-2013.[21] However, the coaches (who were all relatively new) were retained in each of these instances, so removing them from the sample would only serve to strengthen the existing negative relationship between *APR* and "Firing". In addition, though *APR* is capped at 1,000, there does not seem to be a problem with truncation of the right tail of the distribution – for example, basketball teams with *APR*'s of 1,000 only fired the coach in 2 of the 69 instances observed in the sample.

On a related point, we also wanted to confirm that our coding decisions for ambiguously motivated coaching changes does not affect our results. So we constructed an expansive version of the "Firing" variable, including cases of "Health Issues", "Possible Promotion" and "Retirement" as negative outcomes. We report the estimated coefficients for *APR* with this expansive version of "Firing" as the dependent variable in Row 2 of Table 7, finding little effect of this change in coding.

[20] After converting Probit coefficients into marginal effects (i.e. probability units), the predicted effect of *APR* score on Firing is slightly smaller in magnitude for the Probit model than for OLS, but the standard errors on these coefficients are also smaller with Probit than for OLS. Thus, the significance levels for the *APR* coefficients are very similar with OLS and Probit for these specifications.

[21] It is not clear that this was a valid score, as the NCAA reported that the university had provided unusable data, but Southern still received numerous penalties related to its low *APR* score in that year. When it provided more appropriate data the following year, Southern's *APR* score for its basketball team improved, but only to 727.

Additional Explanatory Variables

We made a conscious decision to exclude two sets of explanatory variables in our earlier analysis. First, we excluded performance variables based on post-season play and we also excluded attendance variables, primarily because college football attendance figures are not readily available for every year of the sample. We repeat the OLS analysis from our preferred specification with the addition of four variables: (Avg Attendance) for last year and this year (to capture the possible effect of changes in attendance), plus dummy variables for "Bowl Game" and "Won Bowl Game" for college football and "NCAA Tournament" and "NIT Tournament" for college basketball. The estimated effects of the attendance variables are statistically significant, but the estimated effect of the post-season variables are both small and not statistically significant for either college basketball or college football. We report the estimated coefficients for *APR* given the expansion of the model to include additional performance variables in Row 3 of Table 7.

Second, we excluded measures of the academic quality of the colleges associated with each of these teams. To capture the possibility that (say) colleges with unusually high-performing students may put special weight on *APR*, we repeat the OLS specification from our preferred analysis with the addition of four academic variables: Median SAT score of entering students: four-year graduation rate, and a binary variable to identify public colleges.[22] We report the estimated coefficients for *APR* given the expansion of the model to include these college-level variables in Row 4 of Table 7.

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[22] These academic variables are compiled from IPEDS and are available for almost all of the colleges in the sample with the exception of the three military academies. To maintain comparability of the estimates across specifications, we define the interaction term between *APR* and Median SAT as the product of deviations from sample means: (*APR* Score – Mean(*APR*)) * (SAT – Mean(SAT)).

Comparing the coefficients reported in Rows 3 and 4 to the baseline coefficients in Row 0 of Table 7, each of these two sets of additional explanatory variables yields a coefficient on *APR* that is the same or larger in magnitude than the baseline coefficient. That is, these changes only strengthens the evidence that *APR* influences firing and retention decisions. In each case, the estimated effect of *APR* on "Firing" remains statistically significant and at the same significance level as in the baseline case (Column 4 of Tables 3a and 3b).

<u>Subsamples and Fixed Effects</u>

As we described in Section 2, it was much more common for the NCAA to impose penalties associated with below-threshold *APR* scores in the early years than in the later years of our sample. This suggests the possibility that any effects of *APR* on future coaching prospects might be confined to the first years of our sample – and thus not relevant in current practice. To account for this possibility, we divide our ten-year sample into two halves, and then repeat the analysis for our preferred specification with firing as the dependent variable with different variables for *APR* for the first-half and second-half of the sample, and report the results in Rows 5a and 5b of Table 7. The estimated effect of *APR* on "Firing" is very similar in each half of the sample for college basketball (though given the increase in standard error associated with this specialized analysis, the coefficient is only significant for the first part of the sample) and is much larger (i.e. more negative) for the second half of the sample for college football. Neither of these results provides support for the hypothesis that the effect of the *APR* on retention/firing has diminished over time.

We also consider the possibility that the effect of *APR* is limited to major (or non-major) conference teams, using separate versions of *APR* score for major and non-major conference teams in a single OLS specification. As shown in Rows 6a and 6b of Table 7, we find strongest effects of *APR* on "Firing" for major conference teams. The estimated effect of *APR* on "Firing" remains negative for non-major conference teams and is significant for college basketball though not significant for college football.

A more general version of these critiques is that each school may utilize differential criteria in evaluating its coaches. One, albeit limited, way to allow for this possibility in the analysis is to add team-level fixed effects to the specification, though this choice clearly reduces the statistical power of the analysis. As reported in Row 7 of Table 6, the introduction of these team fixed effects increases the magnitude of the *APR* coefficient from -6.7% to -9.1%, for basketball and reduces the magnitude of the *APR* coefficient from -15.1% to -13.0% for football. Here, the coefficient on *APR* score remains significant for college basketball, but (primarily because the use of fixed effects increases the standard error associated with the *APR* coefficient) is not significant for college football, even though the estimated coefficient for *APR* in predicting "Firing" remains larger in magnitude for football than for basketball.

6. Discussion of Results

The lack of a significant relation between *APR* and promotions or salary changes combined with the significant relation between *APR* and termination suggests that *APR* only influences bad outcomes for coaches of each sporting discipline. That is, there may be a threshold *APR* that is required to retain employment, while there is no incremental benefit for incremental *APR* above that threshold. These results are consistent with labor economic theories that predict the use of non-linear performance hurdles in the separate contexts of limited liability (e.g. Innes, 1990) and subjective performance measurement (e.g. Rajan and Reichelstein, 2009).

Explicit Incentives

Head coaches may be motivated by explicit contractual incentives related to the academic achievement of their players, whether or not *APR* is directly associated with coaching retention. To assess these explicit incentives, we coded all explicit academic performance-based bonuses from the 2010 employment contracts for 88 college football coaches. Three-quarters of these contracts contain some explicit bonus for academic performance of players. The most common performance measures used to determine these bonuses were *APR* (53.4%), Graduation Success Rate (*GSR*) (40.9%), and Grade Point Average (*GPA*) (20.4%).[23] But even if these coaches achieved all of these possible bonuses, they would increase their salaries by only an average of 3.7% of total annual salary. By contrast, these contracts typically included much larger possible bonuses related to measures of the team's athletic results – totalling an average of 39% of total annual salary. In sum, though many coaches do have explicit contractual incentives to promote

[23] See LaForge and Hodge, 2011 for detailed discussion of the methodology used to compute *GSR*.

the team's academic achievement, these explicit incentives pale by comparison to the contractual incentives to improvement the team's athletic record, as found by Cadman and Cassar (2016).[24]

Alternative Mechanisms to Explain Our Results

In addition to the possibility of a direct causal relationship, several alternative mechanisms could explain the observed relationship between *APR* and retention of the current coach. As we discuss below, however, some of these mechanisms can be (mostly) ruled out by our analysis above.

First, as we discussed in Section 5, teams could be solely motivated by the fear of NCAA penalties, which are triggered automatically by *APR* scores below 930. If so, we should expect to see the *APR* as particularly influential in the early part of our sample period, when *APR* scores were relatively low, many teams were penalized and even more teams were in danger of being penalized. Yet, we see the opposite, as shown in Table 7, with *APR* score estimated to have the same or greater importance in the most recent years of the sample, despite the fact that *APR* penalties are now quite rare.

Second, it is possible that some colleges responded to the introduction of the *APR* by developing systematic methods of grade inflation - so that their *APR* scores increased without any change in the true academic progress of the basketball and football players. But, there were many incentives for grade inflation for recruited athletes prior to the introduction of the *APR*. As Harry Edwards wrote in 1985, "educationally high-risk athletes must be kept academically

[24] Wilson et al. (2011) reach a similar conclusion in the analysis of the contracts of (60 of 65) college basketball head coaches whose teams were invited to the 2009 NCAA tournament.

eligible, so phony transcripts, fixed grades, Mickey Mouse curriculums and low graduation rates have become commonplace."[25]

Even if grade inflation practices for recruited athletes increased in response to the penalties associated with low *APR* scores, it is not obvious that these practices would influence the results of our analysis above. Perhaps the most likely way that grade inflation could induce a statistical link between *APR* score and retention of the coach is through regulatory capture. If a coach has unusually strong influence at his college, he might be able to both promote grade inflation for his players and also to keep his job even after a year with a win-loss record that would put coaches at other colleges in jeopardy of being fired. But the inclusion of team/college-level fixed effects, as reported in Row 7 of Table 6 accounts for this possibility. Since the introduction of these fixed effects does not change our results very much (and yields an increase in magnitude of the estimated APR coefficient for basketball, which is likely to be more prone to the effects of grade inflation than football given the smaller number of players on the team), we can discount the possible influence of unobserved grade inflation in our analysis.

A final alternative explanation for our results goes beyond the observable variables in the data. In particular, we have no measures of off-court behavior of the coach and the players, positive or negative, except to the degree that they influence the academic standing of the players (and ultimately the *APR* score) and the record of the team on the court. So, for example, "Team Culture" might be an important omitted variable whereby "Positive Culture" solidifies a coach's

[25] "A Symposium: What's Wrong with College Sports?" New York Times, May 9, 1985. Oriard (2009) provides many specific examples of practices along these lines used by particular colleges and teams prior to the introduction of the *APR*.

position and simultaneously promotes academic engagement and the *APR.* [26] But from a policy perspective, the distinction between a causal relationship between *APR* and retention of the coach vs. an indirect relationship mediated by the link between "Positive Team Culture" and retention of the coach may not be that important. Either way, coaches who do not promote academic achievement will tend to be replaced, providing positive career incentives for the coaches with regard to the academic progress of their players.

[26] Florida A&M coach Mike Gillespie made a strong case for the importance of positive team culture in a 2007 National Public Radio interview, saying "If you're a very selfish person in a marriage or in a family, your family is going to be dysfunctional … If you have that type of atmosphere in a game of basketball, you're going to have a dysfunctional team. … I know exactly how many hours each guy needs to graduate. I know the curriculum that they're in. I could tell you how many hours they passed, what their *GPA* is. (I) make sure they're going to class, doing all the right things. And (if) I can stay on top of it as the head coach, I think the greater opportunity we have to graduate our kids" (http://www.npr.org/templates/story/story.php?storyId=7750391). Yet despite leading the team to the NCAA tournament in 2007, Gillespie was fired before the start of the next season after being charged with a criminal offense.

7. Conclusion

NCAA Division I head coaching positions are both scarce and lucrative. Further, relatively low-paying positions usually include a large option value; coaches that succeed at lower paying institutions often move to higher paying institutions.. Cadman and Cassar (2016) find evidence that that labor market incentives associated with career concerns for Division I football coaches are much greater than the explicit incentives present in most contracts.

In this study, we investigate a complimentary measure of performance that is of strong importance to the NCAA, *APR*. We find that coaches can solidify their existing positions if their teams achieve strong *APR* scores. That is, higher *APR* scores predict retention but not promotion of head coaches. The combination of these results is consistent with labor market theories based on limited liability (Innes, 1990) or subjective performance measurement (Rajan and Reichelstein, 2009), which predict that a threshold performance level is required to retain employment but that there no reward for increases in performance beyond that threshold.

We find that coaches face simultaneous career incentives to win games and to improve academic performance of their players as measured by *APR* score. In particular, we estimate that an increase in team *APR* of 50 points, which would move a team from near the bottom to near the top in most major conferences, increases the probability of retention by 2-3 percentage points per year for college basketball coaches and by 7-8 percentage points per year for college football coaches. These effects seem sufficiently large to motivate coaches to take steps to improve *APR* scores in order to solidify their coaching position. Our results in Table 3 indicate that a 50 point increase in team *APR* has approximately the same effect on the probability of retention as two additional wins per season in basketball and one additional win per season in football. To put this another way, given our estimates, Division I head coaches still stand to enhance their future career prospects much more by improving the team's athletic standing from last place to first place in the conference than by increasing the team's *APR*.

Our results suggest that the introduction of the *APR* and associated penalties may have helped the NCAA to accomplish some of its goals. There has been a clear and conspicuous increase in *APR* scores over the past decade, and we find that labor market incentives for coaches provide incentives to produce further increases in these scores. Nevertheless, we emphasize that the *APR*, which only measures athletic eligibility and continuing college enrollment, is at best a proxy for long-run outcomes of genuine interest, such as college graduation and career success. Indeed, some critics argue that these recent trends may represent only cosmetic and not substantive improvement of academic achievement by recruited athletes (see for example, Gurney and Southall (2012), Oriard (2009)). For this reason, we do not view this paper as an evaluation of the effects of introduction of the *APR*.

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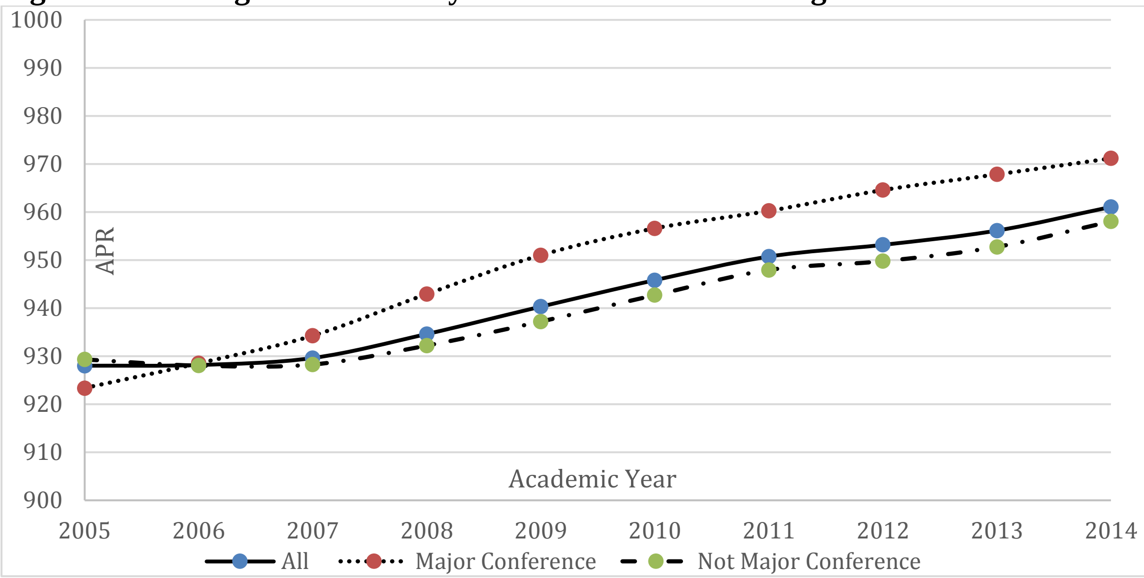
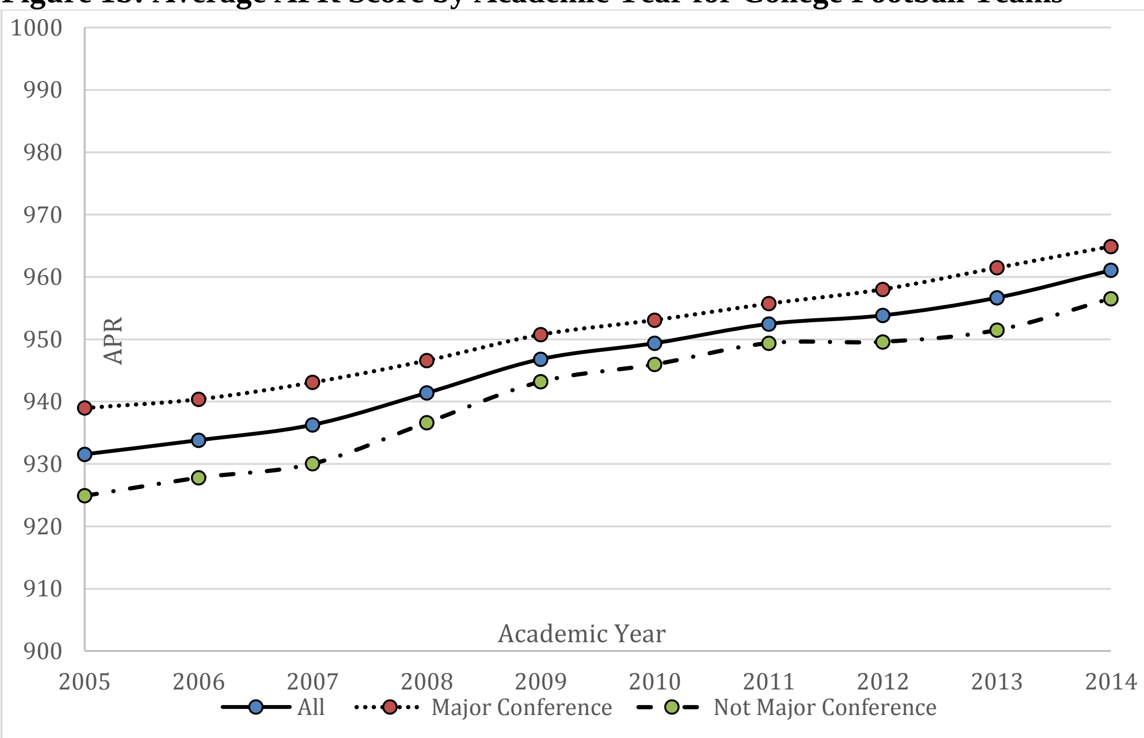
Figure 1a: Average APR Score by Academic Year for College Basketball Teams



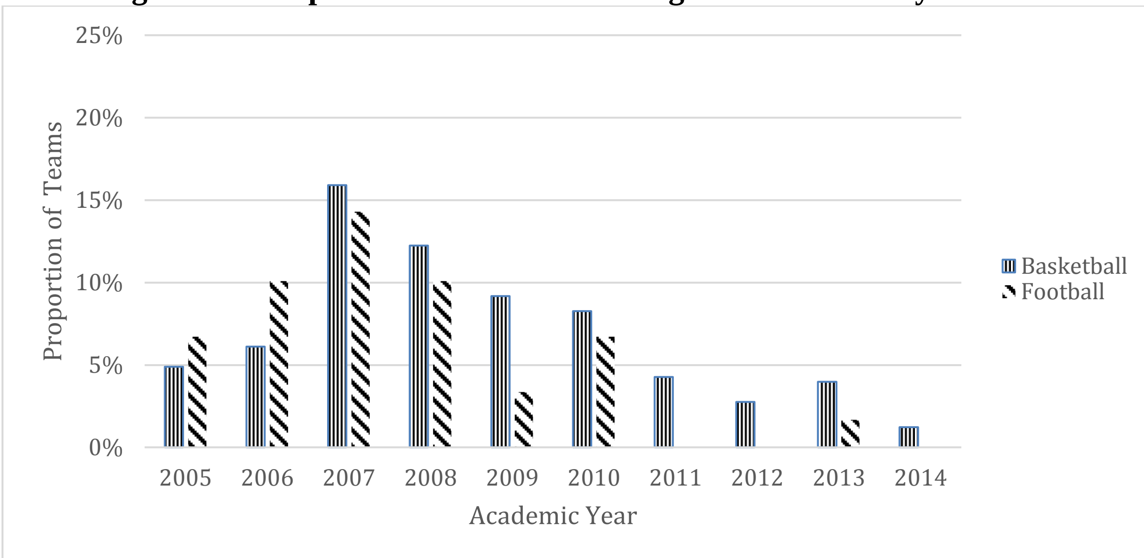
* Source: Authors' computations using data available from the NCAA website.

Figure 1b: Average APR Score by Academic Year for College Football Teams



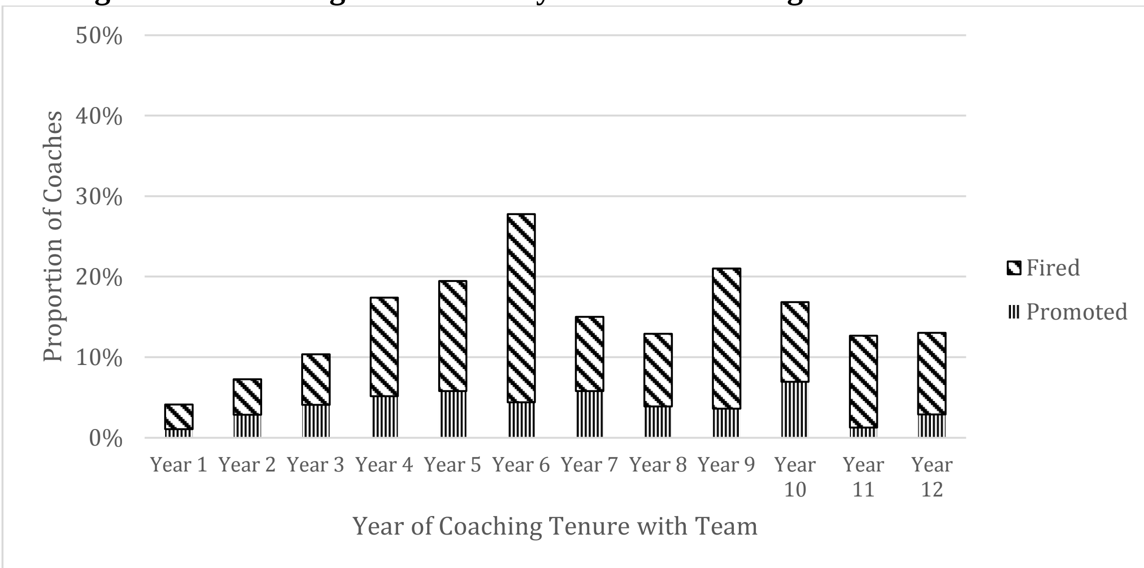
* Source: Authors' computations using data available from the NCAA website

Figure 1c: Proportion of Teams Receiving APR Penalties by Academic Year



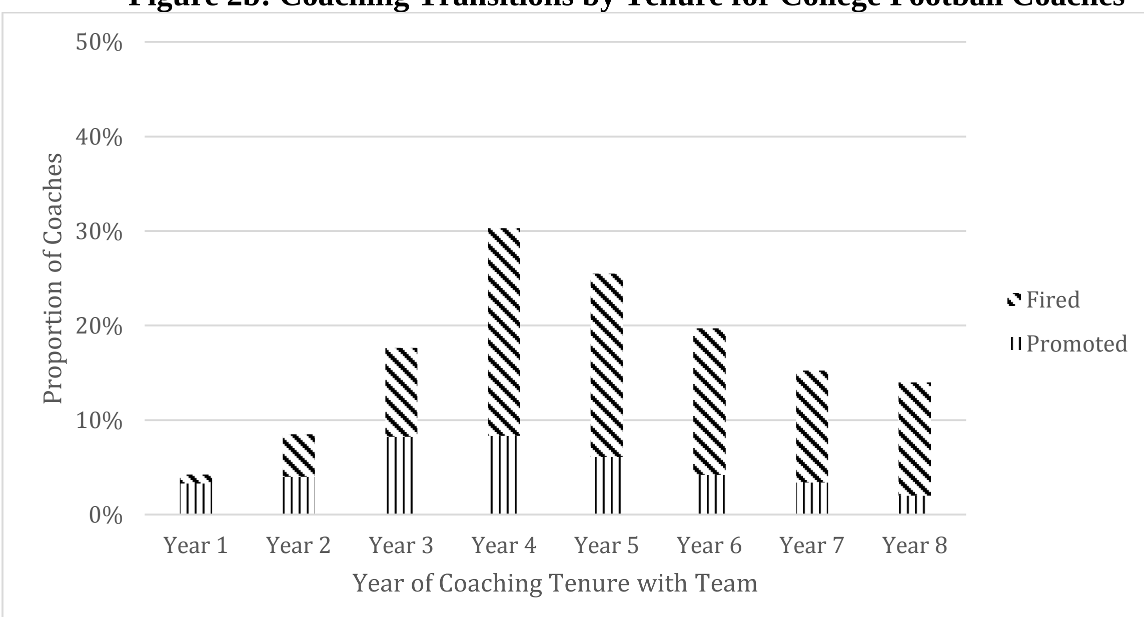
* Source: Authors' computations using data available from the NCAA website

Figure 2a: Coaching Transitions by Tenure for College Basketball Coaches



* **Source**: Authors' computations based on coding of coaching transitions, as described in Section 3.

Figure 2b: Coaching Transitions by Tenure for College Football Coaches



* **Source**: Authors' computations based on coding of coaching transitions, as described in Section 3.

Table 1a: Distribution of Coach Outcomes by Sport

Coach Outcome	Basketball	Football
Retained	2,794 (85.4%)	979 (82.3%)
Fired	310 (9.5%)	124 (10.4%)
Promoted	121 (3.7%)	59 (5.0%)
Left Job Due To Health Issue	8 (0.2%)	2 (0.2%)
Possible Promotion Took Job as Asst. Coach	15 (0.5%)	5 (0.4%)
Retired	18 (0.6%)	17 (1.4%)
Interim Coach	4 (0.1%)	4 (0.3%)
TOTAL	3,270	1,190

* **Source**: Authors' computations based on coding of coaching transitions, as described in Section 3.

Table 1b: Distribution of Coaching Changes by Sport

Coach Outcome	Basketball	Football
Fired	310 (65.1%)	124 (58.7%)
Promotion	121 (25.4%)	59 (27.8%)
Left Job Due To Health Issue	8 (1.7%)	2 (0.9%)
Possible Promotion Took Job as Asst. Coach	15 (3.2%)	5 (2.4%)
Retired	18 (3.8%)	17 (8.1%)
Interim Coach	4 (0.8%)	4 (1.9%)
TOTAL	476	211

* **Source**: Authors' computations based on coding of coaching transitions, as described in Section 3.

Table 2a: Descriptive Statistics by Basketball "Coach Outcome"

Variables	All Teams	"Promoted"	"Retained"	"Fired"
Win Pct	.513 (.173)	.655 (.119)	.522 (.169)	.379 (.146)
NCAA Bid	.201 (.401)	.405 (.493)	.209 (.407)	.055 (.228)
NIT Tournament	.099 (.299)	.215 (.412)	.101 (.301)	.042 (.201)
Conference Pctile	50.38 (31.64)	75.53 (23.33)	52.14 (31.12)	25.41 (23.86)
National Pctile	51.38 (28.65)	70.20 (21.36)	52.41 (28.41)	35.14 (26.17)
Arena Capacity	8,233 (4,822)	8,921 (4,614)	8,221 (4,805)	8,088 (4,388)
Avg Attendance	4,732 (4,415)	5,798 (4,513)	4,804 (4,483)	3,672 (3,557)
Major Conference	.225 (.417)	.207 (.407)	.227 (.419)	.213 (.410)
NCAA Violation Next Year	.013 (.111)	0	.011 (.103)	.032 (.177)
Penalty Lag 1	.069 (.254)	.050 (.218)	.065 (.247)	.104 (.306)
APR Lag 1	942.82 (37.01)	945.37 (34.94)	943.75 (36.95)	934.33 (37.02)
Coach Tenure	5.76 (5.07)	5.83 (3.66)	5.59 (5.09)	6.71 (4.44)
OBSERVATIONS	3,270	121	2,794	310

NOTES: The Data Appendix provides formal definitions and sources of all variables. The number of observations in Column 1 is greater than the sum of the observations in the other three columns because coaching transitions where the motivation for the change is ambiguous are not counted at any of "Promoted", "Retained" or "Fired". The Conference and National Percentiles in Column 1 do not average to 50 because we exclude teams that were not in Division 1 for the entirety of 2004-2005 to 2013-2014.

Table 2b: Descriptive Statistics by Football "Coach Outcome"

Variables	All Teams	"Promoted"	"Retained"	"Fired"
Win Pct	.519 (.221)	.685 (.169)	.534 (.215)	.349 (.191)
Bowl Game	.566 (.496)	.847 (.363)	.590 (.492)	.274 (.448)
Won Bowl Game	.284 (.453)	.492 (.504)	.297 (.460)	.105 (.308)
Conference Pctile	50.16 (31.85)	73.50 (23.42)	51.70 (31.26)	30.39 (26.62)
National Pctile	50.58 (29.01)	63.33 (22.42)	52.14 (28.95)	34.84 (25.83)
Stadium Capacity	53,424 (22,348)	47,572 (20,094)	53,745 (22,264)	53,267 (23,074)
Avg Attendance	44,107 (25,625)	36,665 (20,722)	44,927 (25,656)	41,306 (26.244)
Major Conference	.492 (.500)	.254 (.439)	.505 (.500)	.508 (.502)
NCAA Violation Next Year	.029 (.167)	0	.030 (.170)	.040 (.198)
Penalty Lag 1	.053 (.225)	.017 (.130)	.053 (.225)	.073 (.261)
APR Lag 1	946.41 (22.89)	951.58 (18.94)	946.63 (23.01)	943.40 (23.50)
Coach Tenure	4.98 (5.16)	4.25 (2.76)	4.76 (5.16)	6.19 (4.98)
Observations	1,190	59	979	124

NOTES: The Data Appendix provides formal definitions and sources for all variables. The number of observations in Column 1 is greater than the sum of the observations in the other three columns because coaching transitions where the motivation for the change is ambiguous are not counted at any of "Promoted", "Retained" or "Fired". The Conference and National Percentiles in Column 1 do not average to 50 because we exclude teams that were not in Division 1 for the entirety of 2004-2005 to 2013-2014.

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Table 3: Results of OLS Regressions to Predict "Firing" of Coaches

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Wins	-.009** (.002)	-.010** (.002)	-.012** (.002)	-.032** (.005)	-.037** (.005)	-.059** (.007)
Wins^2	.00024* (.00011)	.00024* (.00011)	.00033* (.00014)	.0027* (.0010)	.0030** (.0010)	.0057** (.0014)
Conf_Pctile	-.0011** (.0003)	-.0012** (.0003)	-.0020** (.0004)	.0001 (.0005)	-.0000 (.0005)	-.0004 (.0007)
Conf_Pctile^2	.00002* (.00001)	.00002** (.00001)	.00004** (.00001)	-.00000 (.00001)	.00001 (.00001)	.00002 (.00002)
Ln(Capacity) (Arena/Stadum)	.034** (.009)	.042** (.009)	.058** (.012)	.060* (.028)	.067* (.027)	.131** (.040)
Major Conference	-.001 (.016)	-.002 (.015)	-.001 (.019)	.014 (.024)	.010 (.023)	.010 (.033)
NCAA Violation Next Year	.162** (.046)	.171** (.045)	.145** (.055)	.056 (.053)	.042 (.051)	.060 (.067)
APR Penalty	-.003 (.023)	.012 (.022)	.056 (.032)	.015 (.045)	-.007 (.043)	-.003 (.063)
APR (Lag 1) /100	-.015 (.016)	-.038* (.017)	-.056** (.022)	.019 (.045)	-.040 (.048)	-.146* (.067)
Constant	.099 (.181)	.258 (.187)	.390 (.236)	-.547 (.527)	-.044 (.533)	.490 (.767)
Sport	Basketball	Basketball	Basketball	Football	Football	Football
Coach Tenure	ALL	ALL	Year 3+	ALL	ALL	Year 3+
Seasons Included	ALL	ALL	ALL	ALL	ALL	ALL
Coach Tenure Dummy Vars	NO	YES	YES	NO	YES	YES
Year Dummy Variables	NO	YES	YES	NO	YES	YES
R-Squared	.085	.161	.209	.087	.217	.279
Observations	3,205	3,198	2,290	1,155	1,149	739

NOTES: * = significant at 5% level; ** = significant at 1% level.
This table reports the results of OLS estimations with "Firing" of the coach as the dependent variable and the variables listed in Column 1 included as independent variables. The unit of observation is Team*Year. The Data Appendix provides formal definitions and sources for all variables.

Table 4: Results of OLS Regressions to Predict "Promotion" of Coaches

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Wins	.004** (.001)	.003* (.001)	.004* (.002)	.015** (.004)	.015** (.004)	.016** (.005)
Wins^2	-.00013 (.00008)	-.00010 (.00008)	-.00019 (.00010)	-.0005 (.0007)	-.0007 (.0007)	-.0010 (.0010)
Conf_Pctile	.0004 (.0002)	.0004 (.0002)	.0003 (.0003)	.0000 (.00034)	.0001 (.0037)	.0005 (.0005)
Conf_Pctile^2	.00001** ($5x10^{-6}$)	.00001** (.000005)	.00001* (.000006)	.00002** (.00001)	.00003** (.00001)	.00003** (.00001)
Ln(Capacity) (Arena/Stadium)	.005 (.007)	.0006 (.007)	.011 (.009)	-.040* (.020)	-.038 (.021)	-.060* (.029)
Major Conference	-.022* (.010)	-.020 (.011)	-.022 (.014)	-.049* (.017)	-.045* (.018)	-.045 (.024)
NCAA Violation Next Year	-.039 (.030)	-.042 (.031)	-.039 (.039)	-.046 (.038)	-.054 (.039)	-.069 (.049)
APR Penalty	-.006 (.015)	.001 (.016)	.007 (.022)	-.045 (.032)	-.040 (.033)	-.038 (.046)
APR (Lag 1) /100	-.010 (.011)	-.006 (.011)	.003 (.015)	.012 (.033)	.001 (.037)	.002 (.049)
Constant	.006 (.121)	-.049 (.129)	-.173 (.166)	.268 (.379)	.353 (.410)	.567 (.558)
Sport	Basketball	Basketball	Basketball	Football	Football	Football
Coach Tenure	ALL	ALL	Year 3+	ALL	ALL	Year 3+
Seasons Included	ALL	ALL	ALL	ALL	ALL	ALL
Coach Tenure Dummy Vars	NO	YES	YES	NO	YES	YES
Year Dummy Variables	NO	YES	YES	NO	YES	YES
R-Squared	.031	.040	.038	.069	.094	.122
Observations	3,205	3,198	2,290	1,155	1,149	739

NOTES: * = significant at 5% level; ** = significant at 1% level.
This table reports results of OLS estimations with "Promotion" of the coach as the dependent variable and the variables listed in Column 1 included as independent variables. The unit of observation is Team*Year. The Data Appendix provides formal definitions and sources for all variables.

Table 5: Results of OLS Regressions using Football Coach Salary Data

Variables	(1)	(2)	(3)	(4)
Wins	.019 (.035)	.022 (.008)	.034* (.011)	.056** (.012)
Wins^2	-.001 (.007)	.001 (.002)	.003 (.002)	.004 (.002)
Conf_Pctile	.006* (.003)	-.000 (.001)	.000 (.001)	-.000 (.001)
Conf_Pctile^2	.00007 (.00008)	.00001 (.00002)	-.00000 (.0003)	.00000 (.00003)
Ln(Capacity) (Arena/Stadium)	-.497** (.181)	-.038 (.047)	-.115 (.068)	-.153* (.076)
Major Conference	.040 (.144)	-.086* (.038)	.112* (.056)	.026 (.062)
NCAA Violation Next Year	-.340 (.348)	-.063 (.065)	-.106 (.095)	-.170 (.104)
APR Penalty	-.208 (.239)	-044 (.049)	.028 (.072)	-.015 (.079)
APR (Lag 1) /100	.201 (.311)	-.018 (.081)	.095 (.118)	.077 (.130)
Constant	3.32 (3.42)	.490 (.853)	.216 (1.24)	.706 (1.37)
Dependent Variable	% Change Total Comp	Promoted	Renegotiated	Promoted or Renegotiated
Coach Tenure	Year 3+	Year 3+	Year 3+	Year 3+
Seasons Included	2007, 2009, 2010	2006, 2007, 2009, 2010	2006, 2007, 2009, 2010	2006, 2007, 2009, 2010
Coach Tenure Dummy Vars	YES	YES	YES	YES
Year Dummy Variables	YES	YES	YES	YES
R-Squared	.231	.142	.237	.289
Observations	169	311	311	311

NOTES: * = significant at 5% level; ** = significant at 1% level.
This table reports results of OLS estimations with the dependent variable as listed in each column and the variables listed in Column 1 included as independent variables. The unit of observation is Team*Year. The Data Appendix provides formal definitions and sources for all variables.

Table 6: Results using Prais-Winsten Specification

Variables	(1)	(2)	(3)	(4)
Wins	-.011** (.002)	.004** (.001)	-.057** (.007)	.013** (.005)
Wins^2	.00028* (.00012)	-.0002* (.0001)	.0057** (.0013)	-.0021* (.0009)
Conf_Pctile	-.0018** (.0004)	.0002 (.0002)	-.0002 (.0006)	.0004 (.0004)
Conf_Pctile^2	.00004** (.00001)	.00001** ($5x10^{-6}$)	.0002 (.0002)	.00000 (.00001)
Ln(Capacity) (Arena/Stadium)	.051** (.010)	.006 (.007)	.117** (.034)	-.028 (.020)
Major Conference	.000 (.015)	-.020 (.010)	.015 (.028)	-.035* (.016)
NCAA Violation	.156** (.053)	-.037 (.036)	.055 (.065)	-.043 (.042)
APR Penalty	.031 (.029)	.014 (.020)	-.030 (.058)	-.007 (.036)
APR Lag 1/100	-.039* (.018)	-.002 (.012)	-.141* (.058)	-.002 (.035)
Constant	.145 (.368)	-.109 (.262)	1.485* (.757)	.229 (.490)
Sport	Basketball	Basketball	Football	Football
Outcome	Fired	Promoted	Fired	Promoted
Coaches Included	Tenure 3+	Tenure 3+	Tenure 3+	Tenure 3+
Years Included	ALL	ALL	ALL	ALL
Coach Tenure Dummy Vars	YES	YES	YES	YES
Rho	-.374	-.464	-.266	-.601
R-Squared	.223	.0450	.287	.127
Observations	2,290	2,290	739	739

NOTES: * = significant at 5% level; ** = significant at 1% level.
This table reports results of Prais-Winsten estimations with dependent variable as listed in each column, and the variables listed in Column 1 included as independent variables. The unit of observation is Team*Year. The Data Appendix provides formal definitions and sources for all variables.

Table 7: Results of Sensitivity Analysis:
Fitted Coefficients for (APR Lag 1)/100 in Various Specifications

Row	Description	Basketball	Football
0	**Base Model** **Column 4 in Tables 3a, 3b**	-.056** (.022)	-.146* (.067)
1	**Base Model** **With Probit Specification**	-.037** (.015)	-.133* (.054)
2	**Base Model with** **Expansive Definition of Firing**	-.058** (.022)	-.148* (.069)
3	**Base Model plus Additional** **Performance Variables**	-.060** (.023)	-.175* (.078)
4	**Base Model plus** **College Academic Variables**	-.059* (.025)	-.166* (.080)
5a	**Base Model** **APR*(Year 2006 to Year 2010)**	-.055* (.027)	-.078 (.086)
5b	**Base Model** **APR*(Year 2011 to Year 2015)**	-.057 (.029)	-.233* (.097)
6a	**Base Model** **APR*Major Conference Team**	-.086* (.044)	-.223* (.093)
6b	**Base Model** **APR*Non-Major Conf. Team**	-.049* (.023)	-.086 (.083)
7	**Base Model plus** **Team Fixed Effects**	-.091** (.031)	-.130 (.110)

NOTES: * = significant at 5% level; ** = significant at 1% level.
This table reports results of OLS estimations (except as indicated) with "Firing" as the dependent variable, the same specifications as listed in Columns 3 and 6 of Table 3, and additional independent variables according to the "Description" in each row. The unit of observation is Team*Year. The Data Appendix provides formal definitions and sources for all variables.

DATA APPENDIX

I. SOURCES

1. NCAA: (www.ncaa.org)

We compiled year-by-year *APR* scores and penalties associated with them from the NCAA website: https://web1.ncaa.org/maps/aprRelease.jsp

We compiled the list of NCAA violations by team (and sport) from the NCAA Legislative Services database of Major Infractions: https://web1.ncaa.org/LSDBi/exec/misearch

We compiled average attendance figures by team and year from the NCAA website:
http://www.ncaa.org/championships/statistics/ncaa-mens-basketball-attendance
http://www.ncaa.org/championships/statistics/ncaa-football-attendance

2. Sports-Reference (www.sports-reference.com)

We compiled team records (including bowl game records for college football teams and NCAA Tournament participation for college basketball teams), conference affiliations, and coaching histories from Sports-Reference.

3. Wikipedia

We compiled yearly lists of college basketball teams participating in the NIT Tournament as well as arena/stadium capacities from Wikipedia.

4. Ken Pomeroy (kenpom.com)

We compiled Ken Pomeroy's yearly statistical rankings for college basketball teams from his website.

5. Football Outsiders (www.footballoutsiders.com)

We compiled the Football Outsiders yearly statistical rankings for college football teams from the Football Outsiders website. http://www.footballoutsiders.com/stats/fplus

6. College Football Head Coach Contracts

We compiled details of coaching contracts from the USA Today database.

7. Chronicle of Higher Education (collegecompletion.chronicle.com)

We compiled data (originally from the "Integrated Post-Secondary Education Data System" (IPEDS), including median SAT scores and graduation rates for Division 1 colleges from the "College Completion Project" at the Chronicle of Higher Education website.

II. VARIABLE DEFINITIONS

A. Dependent Variables

FIRED = Binary variable with value 1 if the coach at the start of a given season leaves that position (involuntarily) before the start of the next season, was not reported to be resigning the position to take a different position as head coach, and there is no ambiguity ("Health Issue", "Retirement" or "Possible Promotion"), and 0 otherwise except that this variable is coded as missing for "Interim Coaches" as well as in cases of "Health Issue", "Retirement" or "Possible Promotion".

FIRED (Expansive Version) = Binary variable with value 1 if the coach at the start of a given season leaves that position (involuntarily) before the start of the next season and was not reported to be resigning the position to take a different position as head coach, and 0 otherwise, except that this variable is coded as missing for "Interim Coaches".

PROMOTED = Binary variable with value 1 if the coach at the start of a given season leaves that position before the start of the next season to take a different position as head coach and 0 otherwise, except that this variable is coded as missing for "Interim Coaches" as well as for cases of "Health Issue", "Retirement" or "Possible Promotion".

RENEGOTIATED = Binary variable with value 1 if the football coach at the start of a given season continues in that position for the next season with a new contract with increased compensation of more than 10% per year than the previous contract. Given the problem of missing data for contracts in 2008, we code renegotiation as taking place between 2007 and 2009 if for coaches whose compensation increased by more than 15% per year between these two years. We code this variable as missing in all cases where we did not have access to the contract of the coach.

RENEGOTIATED/PROMOTED: Binary variable with value 1 if the football coach for a given Team*Year is coded as having been PROMOTED or having RENEGOTIATED his contract and 0 otherwise, except that this variable is coded as missing for each case where either PROMOTED or RENEGOTIATED is coded as missing.

% CHANGE TOTAL COMP: Percentage change in coach's compensation from the given season to the next season. This variable is coded as missing in cases where we do not have access to the coach's contract in both the current season and the next season.

B. Independent Variables Used in Tables 3 and 4

WINS – Count of team wins for the given season, including post-season play.

WINS^2 – Squared deviation of team wins for the given season from the average number of wins observed in the sample =(WINS – Mean(Wins))^2.

CONFERENCE PERCENTILE: Ordinal team ranking within conference, according to the Pomeroy rankings for basketball and the Football Outsiders rankings for football, converted to a scale of 0 to 100:

100 * (Ordinal Conference Ranking – 1) / (Number of Teams in Conference)

CONFERENCE PERCENTILE^2: Squared deviation of CONFERENCE PERCENTILE from the constructed mean of 50 = (CONFERENCE PERCENTILE – 50)^2.

LN(CAPACITY): Natural log of football stadium or basketball arena used for this team's home games.

MAJOR CONFERENCE: Binary variable with value 1 for teams affiliated with a major conference ("Atlantic Coast Conference", "Big 10", "Big 12", "Pac 10/12", "SEC" for either sport and also "Big East" for basketball), and 0 otherwise.

VIOLATION NEXT YEAR: Binary variable with value 1 for teams listed as being penalized by the NCAA for a major infraction in the subsequent academic year (meaning that the NCAA considers the violation to be associated with this team and coach as well as possibly with other teams at the same college) and 0 otherwise.

APR PENALTY: Binary variable with value 1 for teams listed as being penalized by the NCAA for low APR score in the preceding academic year and 0 otherwise.

APR LAG 1 / 100: Lagged APR score (i.e. based on academic results through the prior academic year) rescaled so that 0 is the minimum value and 10 is the maximum value.

COACH TENURE: Years of continuing experience for the coach as head coach of this team, where a new coach is coded as 1 and a coach coded as **n** has completed **n-1** prior seasons and is now in season **n** as head coach of this team. We code this variable as missing for three coaches who returned to a former team during the sample period.

C. Additional Independent Variables Used in Table 7

ROW 3 of TABLE 7: Additional Performance Variables:

LN(AVG_ATTENDANCE) and LN(AVG_ATTENDANCE LAG 1): Natural logarithm of the average attendance at this team's home games for the given season and separately for the past season. This variable is coded as missing in cases where we cannot compile attendance figures for both seasons.

NATIONAL PERCENTILE: Ordinal team ranking among all teams, according to the Pomeroy rankings for basketball and the Football Outsiders rankings for football, converted to a scale of 0 to 100:

100 * (Ordinal Ranking – 1) / (Number of Division I Teams)

NATIONAL PERCENTILE^2: Squared deviation of NATIONAL PERCENTILE from the constructed mean of 50 = $(\text{NATIONAL PERCENTILE} - 50)^2$.

NCAA BID: Binary variable for college basketball teams with value 1 for teams participating in the NCAA tournament and 0 otherwise.

NIT TOURNAMENT: Binary variable for college basketball teams with value 1 for teams participating in the NIT tournament and 0 otherwise.

BOWL GAME: Binary variable for college football teams with value 1 for teams participating in a post-season bowl game and 0 otherwise.

WON BOWL GAME: Binary variable for college football teams with value 1 for teams that won a post-season bowl game and 0 otherwise. (In one case, we use a value of 2 for this variable for a team that won 2 post-season games to win the BCS Championship for the 2014-2015 season.)

ROW 4 of TABLE 7: College Academic Variables:

MEDIAN SAT: Median SAT (combined Verbal plus Math) for full-time first year students at this college.

4-YEAR GRAD RATE: Proportion of full-time first-year students at this college who complete BA degrees within four years of initial college enrollment.

PUBLIC COLLEGE: Binary variable with value 1 for public colleges and 0 otherwise.

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