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DISCUSSION PAPER SERIES

IZA DP No. 12144

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ABSTRACT

Do Male Managers Increase Risk-Taking of Female Teams? Evidence from the NCAA*

We analyze the effect of the coach's gender on risk-taking in women sports teams using data taken from National Collegiate Athletic Association (NCAA) basketball games. We find that the coach's gender has a sizable and significant effect on risk-taking, a finding that is robust to several empirical strategies, including an instrumental variable approach. In particular, we find that risk-taking among teams with a male head coach is 5 percentage points greater than that in teams with a female head coach. This gap is persistent over time and across intermediate game standings. The fact that risk-taking has a significantly positive effect on game success suggests that female coaches should be more risk-taking.

JEL Classification: J16, J44

Keywords: corporate risk-taking, gender difference, success

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1 Introduction

Empirical evidence from surveys (Dohmen et al., 2011), laboratory experiments (Eckel and Grossman, 2008; Charness and Gneezy, 2012), and field data (Barber and Odean, 2001) indicate that women are more risk-averse than men. Such gender differences in risk-taking are frequently discussed as a potential source of the gender gap in labor market outcomes (Weichselbaumer and Winter-Ebmer, 2005; Blau and Kahn, 2017) and the underrepresentation of women in top corporate jobs (OECD, 2012), including in academia. Evidence from the field suggests that social norms play a key role in the formation of risk attitudes (Säve-Söderbergh and Sjögren Lindquist, 2017). Albanese et al. (2016) argue that parents transmit their values to their children and refer to this mechanism as 'parental coaching" (p. 590).

Researchers rarely know on which information risky decisions are based and a clear measure of corporate risk-taking is difficult to operationalize. Thus, studies found positive, negative, and no effects of female leadership on corporate risk-taking. We analyze risk-taking in semi-professional intercollegiate basketball competitions. In particular, we study the role of the head coach's gender in player risk-taking. Basketball coaches act as top-level managers who make influential decisions before and throughout each game. They decide on the general system of play, including the level of risk-taking and other game strategies. Basketball, among sports in general, provides an ideal environment in which to study risk-taking because its rewards and rules are clear, and the available data allow a precise identification of risk and measurement of performance.

The evidence on how female CEOs or board members influence firm risk-taking is ambiguous. Amore and Garofalo (2016) find that female leadership during periods of high competition increases the stability of banks, while lowering returns, whereas banks led by men increase both risk-taking and financial performance. Faccio et al. (2016) analyze data on companies from 21 countries covering 1999 through 2009 and find that companies where a male CEO is substituted with a female CEO display less corporate risk-taking. In general, they find that being led by a woman increases a firm's survival probability. Analyzing data on emerging markets in central and eastern Europe covering 2005 to 2012, Andries et al. (2017) find that female-led banks exhibited higher stability during the financial crisis, which they attribute to lower levels of risk. Examining Vietnamese banks from 2009 to 2016, Hoang and Nguyen (2018) find that the introduction of female board members reduced risk-taking.

To the contrary, Peltomäki et al. (2018) find that women-led S&P 1500 firms take more corporate risk. Using data from German banks covering 1994 to 2010, Berger et al. (2014) find that executive boards with more female members take more portfolio risk. Using data collected through surveys of companies in Sweden and the US, Adams and Funk (2012) find that female board members report themselves as more risk-taking than their male counterparts.

Several studies find that female leadership has no effect on corporate risk-taking. For example, Wu et al. (2018) find no evidence that female leadership affects risk taking among US banks. Analyzing large US companies, Sila et al. (2016) find no evidence that female representation on boards influences firms' equity risk. Similarly, Adams and Ragunathan (2017) find that US banks with a larger share of female directors did not operate less riskily than banks with fewer female directors during the 2008 financial crisis.

The selection of women in leadership roles may pose a problem for our analysis because it could arise from unobserved characteristics. For example, women may prefer to work at firms pursuing a low-risk corporate strategy. Consequently, conventional methods will lead to biased estimates of the effect of female leadership on risk-taking. Since this problem cannot be ruled out in the context of collegiate basketball, we use an instrumental variable (IV) approach to assess the robustness of our empirical analysis.

We find a significant and sizable effect of a male head-coach on the teams' risk-taking. This difference is persistent over the course of several games and across intermediate score differences. We use the number of female professors at a college as an instrument for the probability that the women's basketball team is coached by a female head coach. The results of this IV approach confirm our estimates and indicate that our results are robust.

We find that risk-taking during the first 10 minutes of a game increases scoring. Risk-taking benefits women's teams with female head coaches (as with men's teams). By contrast, more risk-taking does not increase the chances of victory among women's teams with male head coaches. We conclude that female teams coached by women take too few risks and could improve their performance by taking more.

2 Data and Empirical Approach

National Collegiate Athletic Association (NCAA) basketball is the second highest level of basketball competition in the US. Intercollegiate contests started in 1893, and the men's NCAA championship was inaugurated in 1939. The current championship format for women's college basketball was introduced in 1981. Currently, 351 men's teams and 349 women teams compete for the championships. During an initial round-robin stage, they play approximately 20 to 35 regular season games.[1] The 64 highest-ranked teams are selected for a 64-team seven-round championship tournament.

We use play-by-play data taken from men's and women's NCAA Division I collegiate basketball games from seasons 2008 through 2015.[2] The data cover 5,732 regular season games for women, as well as 368 games for women's teams in the NCAA championship tournaments. We restrict the data to teams that played in the NCAA tournament at least once during the period; this criterion restricts the data to teams that performed at the highest level of collegiate basketball. In addition, we collect data on 15,224 men's NCAA regular season games to compare success and risk-taking between female and male teams. There is no gender variation for the male teams, as all men's teams have male head coaches.

We observe 535,658 throwing attempts of female players and their outcomes. Teams are awarded two points if they score from within an area clearly marked by a line, resembling an arc at a distance of about 19 feet and 9 inches from the basket. In the 2008/9 season, the distance was extended to 20 feet and 9 inches for men. In 2011/12, the distance was also extended for women. A successful attempt from beyond this line-without a foot or any body part touching it-is rewarded with three points instead of two. In our data, slightly above 27.48% of all attempts made by women are three-point attempts. In addition to the potential yield and success rates, the data also provide detailed information about the scores of both teams as well as the exact timing of each attempt. Table 1 provides descriptive statistics for key variables in our empirical analysis.

[1] We include conference tournaments in the regular season sample. The exact number of regular season varies across competition levels and conferences.

[2] All play-by-play data were collected from ESPN.com. A substantial share of our data comprise observations of all actions, including throwing attempts from the field or free-throw line.

Table 1: Descriptive statistics of main variables for women's games.

	regular season		*NCAA tournament*	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
three-point attempt[a]	0.274	-	0.279	-
attempt successful[b]	0.413	-	0.408	-
home game[c]	0.498	-	-	-
score difference[d]	2.012	13.459	-1.063	13.010
minutes remaining[d]	19.896	11.459	19.945	11.518
N	495,371		40,287	

[a] Binary indicators equal to 1 if observed attempt is a three-point attempt, 0 else. [b] Binary indicators equal to 1 if observed attempt is successful, 0 else. [c] Binary indicators equal to 1 if throwing attempt is observed for the home team. All NCAA tournament games are staged on neutral ground. [d] Continuous variables measuring score difference and time remaining (in mins.) before the observed attempt.

The share of three-point attempts, especially in critical situations, is an established indicator of risk-taking in basketball (Grund et al., 2013; Böheim et al., 2016). Figure 2 illustrates the distribution of three-point attempts over the duration of games for both men's and women's teams. These figures demonstrate that women's teams coached by a male head coach behave similarly to men's teams, whereas women coached by women make markedly fewer three-point attempts. The difference in risk-taking is small in regular season games and non-existent in NCAA tournament games. For women's teams, the average yield of three-point attempts is 0.97, with a standard deviation of 1.40, while the average yield for two-point attempts is 0.89 with a standard deviation of 0.99.

Using three-point attempts as a risk measure may pose a concern because teams may actively seek to be awarded free throws. For example, teams with a more physical style of play could forgo the risky three-point attempt and focus instead on being fouled close to the basket while attempting a two-point shot. Being fouled will result in an additional free throw. A successful result can produce a gain of three points. If a physical style of play were associated with a male style of either play or coaching, our risk measure would indicate a certain style of play rather than risk-taking propensity.

Figure 1 plots the average absolute number of attempted free throws by team and coach gender for all regular season games.[3] The average number of free throws awarded to teams with female coaches is slightly higher for women's teams with female coaches than for teams with male coaches. We can thus safely ignore this concern in our analysis.

[3] We can use only regular season games for this descriptive analysis, as we do not observe free throws in the NCAA tournament data.

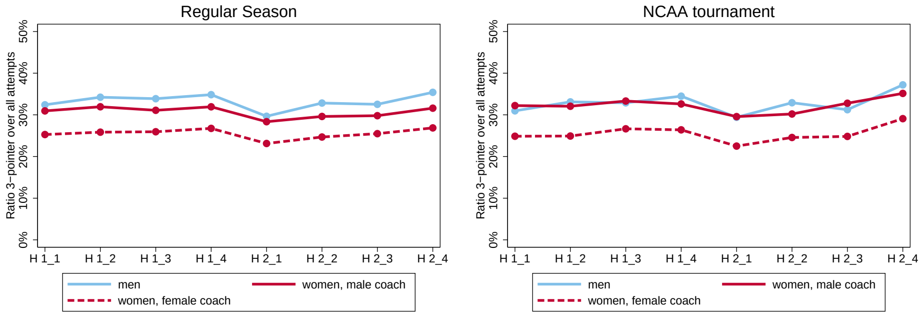
Figure 1: Average number of free-throws by team and coach gender

Three-point attempt as a share of all scoring attempts from the field by team and coach gender.

Women's teams with male coaches have two-point attempt success rates that are almost identical to those of women's teams with female coaches: Both types of teams score at a rate of 44.7% when attempting a two-point attempt. Women's teams with a female coach have a success rate of 32.4%, and women's teams led by a male coach score on 32.2% of their three-point attempts. Figure 3 illustrates the three-point success rates of male and female teams in the regular season and NCAA tournament.

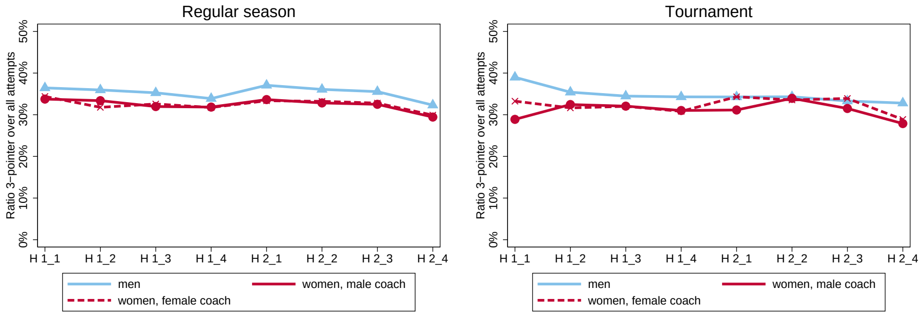
In the regular season, male teams are slightly better at three-point attempts during the game, while there is no difference for female teams according to coach gender. In the NCAA tournament, male and female teams have equal success rates for three-point attempts. For tournaments games, teams with a female coach appear to be slightly more successful than those with a male coach, but this difference is not statistically significant. Teams with a female coach convert 32.4% of their attempts, while teams with a male coach convert 30.9% during NCAA tournament contests.

Figure 2: Ratio of three-point attempts over all scoring attempts.



Notes: Three-point attempt as a share of all scoring attempts from the field by team and coach gender.

Figure 3: Three-point success by team and coach gender



Notes: Success ratio of three-point attempts by team and coach gender.

Different players have different abilities, which could affect teams' risk-taking behavior. At the end of the regular season, the NCAA selection committee creates a "seed list", a consensual ranking of the teams by region in descending order in which a team's seed reflects its relative qualitative assessment.

Figure 2 illustrates the average NCAA tournament seeding for all women's teams. The average seed for teams with female coaches is lower than that for teams with male coaches. This suggests that the average ability of teams coached by women (based on regular season success) is greater than that of teams coached by men. This suggests that female coaches do not select themselves to low-ability teams.

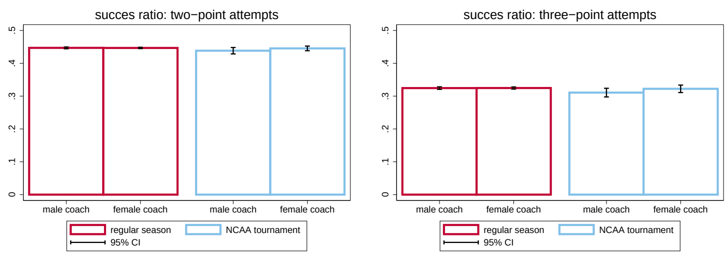
The average seed for teams with female coaches is lower than the average seed for team with male coaches. This suggests that the average ability of teams coached by women (based on success in the regular seasons) is greater than for teams coached by men. We interpret this as evidence that female coaches do not select themselves to low-ability teams.

In our sample of 136 women's teams, 14 changed from a male to female head coach and 16 changed from a female to a male coach. For this subset of teams, we investigate risk-taking, three-point attempt success, and wins in the two seasons before a change of coach and in the four years after the change. The first panel in 6 illustrates the percentage of three-point attempts out of all throwing attempts. On average, we see no marked difference in attempts before the change.[4] After the change, however, teams that switch from a male coach to a female coach have significantly fewer three-point attempts than those that switch from a female to a male coach.

A change in risk-taking could be a consequence of the event that triggered the coaching change. For example, coaches might have been willing to take excessive risk to save their job before the change occurred, while new coaches might be induced to take a more conservative approach. In seasons 3 and 4 post-change, however, risk-taking increases for teams that changed from a female to a male coach. For teams that switched from a male to a female coach, we see a decline in risk-taking for all post-change years.

Regarding success rates, the middle panel of Figure 6 illustrates that a change in coach gender is associated with an almost unchanged success rate for three-point attempts. Consequently, we conclude that the increase in risk-taking that might have been induced by a change in coach is not due to differences in ability. The third panel of Figure 6 illustrates that the coach changes are not associated with differences in win rates.

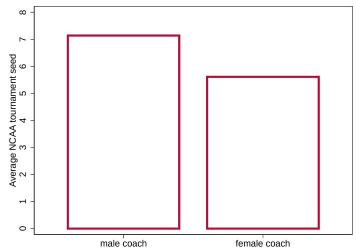
Figure 4: Women's teams: three-point and two-point attempt success coach gender



Notes: Success ratio of three-point attempts by team and coach gender.

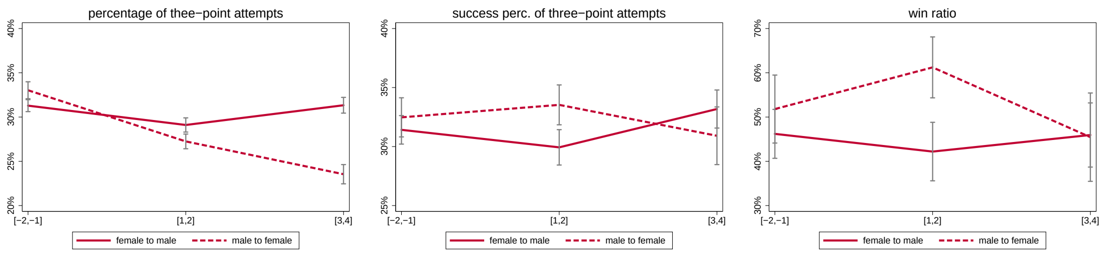
[4]Our data include five teams that changed their head coach twice in the sample period. We do not include these in the analysis presented in 6

Figure 5: Women's teams: average NCAA tournament seed by coach gender



Notes: Average NCAA tournament seed by coach gender for women's teams in season 2008–2015.

Figure 6: Risk-taking and success before and after coach change by type of change



Notes: Average percentage of three-point attempts of all attempts from the field (top panel), average success percentage of three-point attempts (middle panel) and win percentage (lower panel) by timing of change and change type. [-2,-1] indicates two years before the change, [1,2] indicates the first two years after the change, while [3,4] denotes years 3 and 4 after the change of the coach. Regular season and NCAA tournament, only team who change coach gender in years 2008 through 2015.

At each point in time t during a game, any player with the ball has to decide whether to make a two- or three-point attempt. We analyze the effect of coach gender on risk-taking by estimating the following model:

$$three - point_{it} = \beta_0 + \beta_1 coachfemale_i + \phi' \mathbf{X}_{it} + \epsilon_{it}, \tag{1}$$

where $three - point_{it}$ is a binary variable equal to 1 if the observed throwing attempt by a player of team-season i at time t during a game is a three-point attempt, and 0 if it is a two-point attempt. β_1 is the coefficient of interest, as it reports the effect of the coach's gender on the probability of a three-point attempt. $\mathbf{X}_{it}$ is a vector of control variables, which are the score difference, time remaining in the game, academic year and month, as well as (for the regular season sample) if the observed team plays at home or away. In addition, in an attempt to control for a team ability, we include the win-percentage of the previous season. Obviously, the strength of the opposing team will affect a team's willingness to take risks. Consequently, we include indicators for the opposing-team.

For the NCAA tournament sample, we use tournament seed indicators to control for unobserved differences in ability.

We cannot rule out the possibility that our results suffer from an omitted variable bias-for example, if we fail to control for team-specific differences in playing styles. Consequently, we also include team fixed effects in the model. These results indicate the effect of head-coach gender on risk-taking via the subsample comprised of teams that experienced a change in head-coach gender during the observed sample period.

Table 2 tabulates the results for the pooled regular season and NCAA tournament samples. We estimate that the probability of a three-point attempt is 5 percentage points lower if the team is coached by a woman. Qualitatively, this result is confirmed by a model that includes team-season fixed effects; however, the effect is smaller, at 2.4 percentage points. Using observations from the NCAA tournament sample only, we estimate that female teams with a female coach are almost 6.5 percentage points less likely to make a three-point attempt than female teams with a male coach. This result is robust to the inclusion of tournament seed in the list of covariates.

Table 2: Estimated effect of coach gender on risk-taking — pooled sample.

	regular season		*NCAA tournament*	
	(1)	(2)	(3)	(4)
coach female	-0.0542***	-0.0233***	-0.0745***	-0.0646***
	(0.0023)	(0.0051)	(0.0087)	(0.0090)
minutes left	-0.0000	-0.0000	-0.0003*	-0.0004*
	(0.0001)	(0.0001)	(0.0002)	(0.0002)
score difference	-0.0008***	-0.0007***	-0.0017***	-0.0013***
	(0.0001)	(0.0001)	(0.0003)	(0.0003)
win percentage previous season	-0.0300***	-0.0174**	-0.1283***	-0.0802**
	(0.0067)	(0.0079)	(0.0285)	(0.0360)
Team FE	*No*	*Yes*	-	-
Seed FE	-	-	*No*	*Yes*
Opponent-season FE	*Yes*	*Yes*	*Yes*	*Yes*
N	495,371		40,287	
R^2	0.020	0.029	0.038	0.039

The Dependent variable is equal to 1 if the observed throwing attempt is a three-point attempt. All specifications include month and home field dummies. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Standard errors, clustered by team-year, in round parentheses.

The location of a game can also influence risk-taking. Games played on the home court could lead to a home field advantage or, alternatively, a friendly home crowd could lead to increased pressure to perform, causing a 'home-choke' (Harb-Wu et al., 2017; Böheim et al., 2018).

Column (1) of Table 3 tabulates the estimated coefficients from regressions where we stratify the sample according to whether the game was played at home or away.[5] Our results indicate that risk-taking during home games, for which we can assume increased pressure to perform, does not differ from risk-taking during away games.

Analyzing the risk-taking of professional chess players, Gerdes and Gränsmark (2010) find that both men and women increase risk-taking when they compete against women rather than men. We therefore also stratify the sample according to the gender of the opposing team's head coach. Columns (4) to (7) of Table 3 tabulate the results for these subsamples. We find that teams with a female head coach have a 5 percentage points lower probability to attempt a three-point attempt regardless of the opposing head coach's gender. The same is true for the NCAA tournament sample.

Table 3: Estimated effect of coach gender on risk-taking - sample splits

	regular season				***NCAA tournament***	
	game location		*opp.coach gender*			
	home	**away**	**male**	**female**	**male**	**female**
coach female	-0.0483***	-0.0587***	-0.0606***	-0.0506***	-0.0700***	-0.0645***
	(0.0035)	(0.0034)	(0.0040)	(0.0029)	(0.0194)	(0.0097)
N	224416	270955	181475	313896	14845	25442
R^2	0.022	0.025	0.022	0.018	0.041	0.040

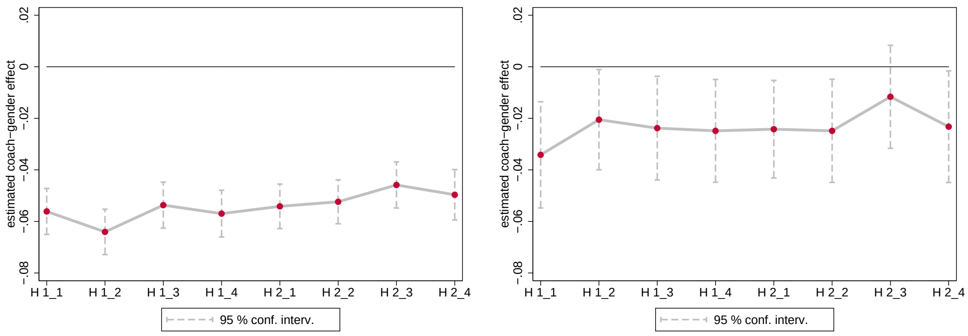
The Dependent variable is equal to 1 if the observed throwing attempt is a three-point attempt. All specifications include month and home field dummies. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Standard errors, clustered by team-year, in round parentheses.

[5] All NCAA tournament games are played on a neutral field. Consequently, tournament data are not available for this analysis.

We provide further estimates of risk-taking for additional subsamples. First, we stratify the sample according to the time when the attempt was observed. We split the sample into eight time periods of eight minutes each, ignoring attempts made during overtime. The results are illustrated in Figure 7. We find a three-point attempt probability that is 5 percentage points lower for women's teams coached by a female head coach regardless of the time of the attempt.

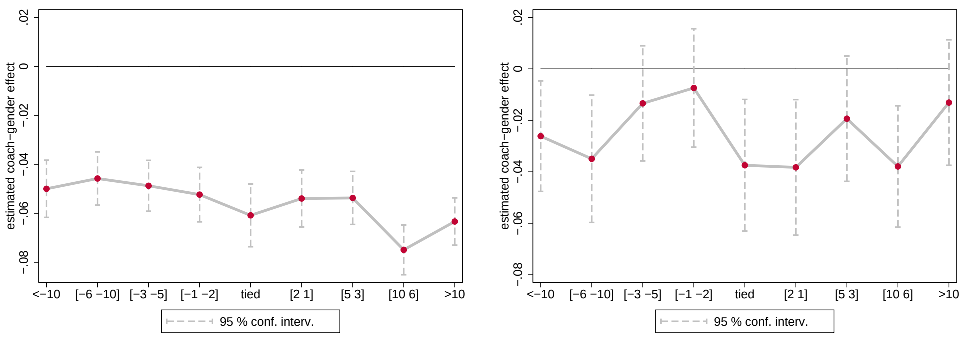
We also analyze risk-taking separately for various score differences and stratify the sample according to whether the team was trailing or leading when the attempt was made. The results for several score difference intervals are plotted in Figures 8. Again, the coach-gender effect is found for all intermediate score differences.

Figure 7: Estimated coach gender effect on risk taking—timing of the game.



Notes: Each point illustrates a result from estimating model 1 for a particular time interval sample, $N = 495{,}371$. Left panel illustrates results from model without team fixed-effects, right panel incorporates team fixed-effects.

Figure 8: Estimated coach gender effect on risk taking—intermediate standing.



Notes: Each point illustrates a result from estimating model 1 for a particular score-difference interval sample, $N = 495{,}371$. Left panel illustrates results from model without team fixed-effects, right panel incorporates team fixed-effects.

To analyze the interaction between the timing and intermediate score of a game, we split the sample into three score-difference categories: trailing by more than four points, a close score at the interval (-4, 4), and a decisive lead of more than four points. We estimate model 1 for all eight five-minute time periods of regulation time in the observed games. The estimated coefficients for the female head-coach dummy are presented in appendix Figure 14. Again, we find a remarkably persistent coach-gender gap in team risk-taking over time and across intermediate scores.

3 Instrumental variable approach

A collegiate basketball program might base its decision to hire a male of female coach on the general ability and risk-attitude of the team. For example, a women's team with many risk-loving players who are highly successful in converting attempts from beyond the three-point line could actively pursue a male coach. We cannot directly observe the risk preferences and season-specific characteristics of teams directly, which may result in an omitted variable bias. In order to account for this potential bias, we further analyze risk-taking using an instrumental variable approach. This approach rests on the assumption that, conditional on our instrument, hiring a male or female coach is random – in other words, that the hiring of female coaches is not related to a team's willingness to take risks.

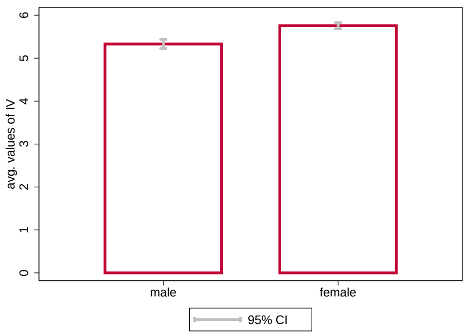
To ensure that we obtain a valid instrument, we use information on the size of the academic staff of all the colleges in our data.[6] The instrumental variable is constructed as the log of the absolute number of academic staff members at each observed university on the professor level.[7] As pointed out before, female coaches are on average coaching more successful women's NCAA teams. Consequently, we should expect that hiring top-level female coaches will demand higher financial commitment than employing a male coach. The larger a university's academic staff, the greater its overall financial resources should be; thus, they should be able to hire more female coaches. We are confident that we can

[6] Data on academic employment and total student enrollment were collected from the Integrated Post-secondary Education Data System (IPEDS), which is provided by the National Center for Education Statistics (NCES). It is available at https://nces.ed.gov/datatools/ and described in the data appendix A.

[7] As an alternative, we also use relative female representation on the professorial level (i.e. the ratio of female to male professors). This alternative instrument yields quantitatively and qualitatively comparable results. All results are available upon request.

rule out any direct effect of academic staff size on female basketball players' decisions concerning three-point attempts. Figure 9 plots the mean of our instrumental variable according to the gender of the women's basketball teams' head coach. Colleges with a large academic staff, and thus probably wealthier, are more likely to have a female head coach for their women's basketball team.

Figure 9: Number of professors by gender of women's basketball head-coach.



Notes: Mean value of instrumental variable (log of absolute number of professors) by head-coach gender of women's NCAA basketball programs.

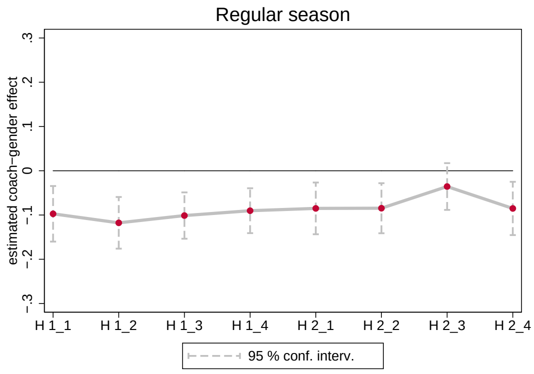
Table 4 presents the results of estimating the effect of the coach's gender on risk-taking via 2SLS. The estimations use the same set of covariates as are used in our OLS regressions. The coefficients from the first-stage regressions indicate a strong positive relation between the instrument and the probability of having a female head coach. We estimate that a female head coach reduces a team's risk-taking probability by about 9 percentage points. Again, we find no differences between home and away teams. The coach-gender effect for the NCAA tournament sample is estimated to be larger, at about 17 percentage points. Figure 10 illustrates the estimated coefficients β_1 for sample stratification according to elapsed game time. The negative effect on risk-taking of a female head coach is constant over the course of the game. We find a similar result for stratification across score differences, plotted in Figure 11. We estimate that teams with a female head coach have a consistently negative effect over the range of score differences, with the exception of large negative and very s mall positive score differences, where we find no statistically significant results. Overall, the IV approach confirms the results of the earlier OLS and fixed-effects estimations. Thus, we conclude that the selection of coaches to teams does not systematically bias our OLS results.

Table 4: IV Estimated effect of coach gender on risk-taking.

	regular season			
	pooled	**home**	**away**	*NCAA tournament*
coach female	-0.0905***	-0.106***	-0.0759***	-0.172***
	(0.021)	(0.023)	(0.022)	(0.035)
first stage coefficient	0.205***	0.206***	0.206***	0.281***
	(0.030)	(0.030)	(0.030)	(0.037)
F-statistics[a]	45.68	45.88	45.76	59.15
N	495,371	253,267	242,104	40,287
mean dep. variable	0.274	0.280	0.268	0.279

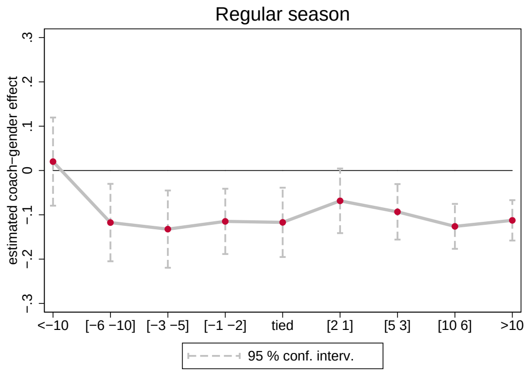
The dependent variable is equal to 1 if the observed throwing attempt is a three-point attempt. All specifications include month dummies, and opponent fixed-effects. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Standard errors, clustered by team-year, in round parentheses. [a] Kleibergen and Paap (2006) statistics on the instrument in the first stage.

Figure 10: IV estimates: coach gender effect on risk taking - timing of the game



Notes: 2SLS estimates for coach gender effect on the probability of a three-point attempt. Each point indicates a point estimate derived from 2SLS estimation for a sub-sample at a particular time interval during a game.

Figure 11: IV estimates: coach gender effect on risk taking - intermediate score



Notes: 2SLS estimates for coach gender effect on the probability of a three-point attempt. Each point indicates a point estimate derived from 2SLS estimation for a sub-sample at a particular score-difference interval.

4 Risk-taking and success

We show that the presence of female head coaches on women's NCAA basketball teams significantly lowers the probability of three-point attempts. This coach-gender effect is constant across game locations, in-game timing, score differences, and opposing team's head-coach gender. However, we have not confirmed if this difference in risk-taking is related to success.

Attempt-level success. We consider a three-point attempt successful if it results in a three-point score. Table 5 presents the results of a linear probability model where the dependent variable is equal to 1 if the observed attempt was successful and 0 if it was not. We cannot reject the null hypothesis of no effect, as we find no statistically significant different success rates between teams with a female head coach and those with a male head coach. Consequently, we conclude that the coach's gender does not affect throwing attempt success.

Table 5: Effect of coach gender on success of risk-taking — individual throwing attempt

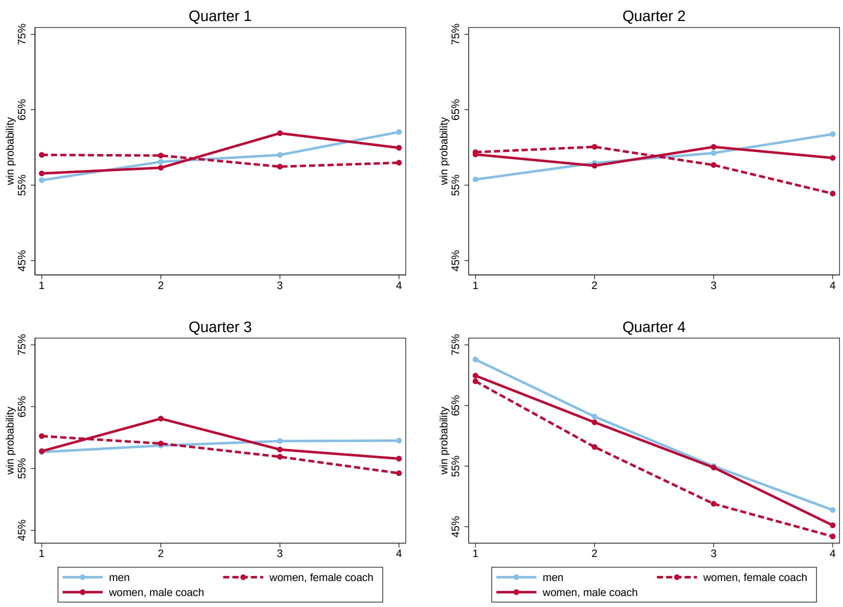
	regular season		*NCAA tournament*	
	(1)	(2)	(3)	(4)
coach female	0.0018	0.0023	-0.0004	-0.0110
	(0.0029)	(0.0072)	(0.0117)	(0.0113)
minutes left	0.0006***	0.0005***	0.0002	0.0002
	(0.0001)	(0.0001)	(0.0004)	(0.0004)
score difference	-0.0002	-0.0006***	-0.0008*	-0.0017***
	(0.0001)	(0.0001)	(0.0005)	(0.0005)
win percentage previous season	0.0575***	0.0262**	0.2378***	0.0639
	(0.0091)	(0.0123)	(0.0412)	(0.0527)
Team FE	*No*	*Yes*	-	-
Seed FE	-	-	*No*	*Yes*
Opponent-season FE	*Yes*	*Yes*	*Yes*	*Yes*
N	135,685		11,238	
R^2	0.017	0.019	0.041	0.044

The Dependent variable is equal to 1 if the observed throwing attempt is a three-point attempt.All specifications include month and home field dummies. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level, respectively. Standard errors, clustered by team-year, in round parentheses.

Quarter-level success. Success is the outcome of multiple periods involving a series of risk-taking decisions. To control for the relative strength of the matched teams, we divide the play time into intervals of 10 minutes.[8] This allows us to control for the initial score difference at the beginning of these sub-periods. We analyze the intermediate outcomes of 5,109 women's games and 12,699 men's games in the NCAA regular season.

Figure 12 plots the average win probabilities by quarter and quartiles of the risk-taking distribution. The indicator of risk is the share of three-point attempts in all attempts, excluding free throws. Except for the fourth quarter, the win probability for men's teams increases with risk-taking. For women's teams, this is not the case. For women's teams with female coaches, we see, in each sub-quarter, a lower win probability when risk-taking is greater. In the fourth quarter, higher levels of risk-taking are associated with lower win probabilities for all three types of team. Teams that are trailing heavily close to the end of games increase risk-taking as a measure of last resort, by "gambling for resurrection" (Downs and Rocke, 1994).

Figure 12: Success and risk-taking: correlation of wins and risk-taking.



Probability of a win over distribution of three-point shares in quartiles, by quarter of the game.

[8]All NCAA games are staged in two halves of 20 minutes each, without overtime.

We estimate the following OLS model to investigate the relationship between risk-taking and quarter-level success:

$$Y_{ioq} = \beta_0 + \beta_1 risk_{ioq} + \phi' X_{ioq} + \xi_i + \pi_o + \epsilon_{ioq}, \tag{2}$$

where Y_{ioq} measures productivity at the sub-quarter level using different indicators for team i playing opponent o in sub-quarter $q = 1, 2, 3$.[9] We therefore restrict the analysis to sub-quarters 1 to 3. We use three proxies for productivity or success in the observed quarter. First, we use a binary variable equal to 1 if the observed team wins the game and 0 otherwise. We also use the total points scored and the difference between the teams' scores in a sub-quarter (net points scored) as dependent variables. The model uses team-season, opponent-season, and sub-quarter fixed effects. The variable $risk_{iqo}$ measures the share of three-point attempts in all throwing attempts, excluding free throws. Since the relationship between risk-taking and success might be nonlinear, we also estimate a specification where we use indicators of the quartiles of the three-point attempt ratio distribution. The vector X_{iqo} contains control variables, including the total number of throwing attempts from the field, the initial score difference and the number of points score at the beginning of the sub-quarter, and a home-game indicator.

The estimation results are tabulated in Table 6. We estimate that a higher level of risk-taking (i.e. a higher three point ratio) is associated with more points scored and more net points scored for all three types of teams. For men's teams and women's teams with a female coach, we also estimate a positive relationship between risk-taking and the probability to win the sub-quarter. We do not estimate such a significant association for women's teams with a male coach.

A nonlinear relationship is illustrated in Figure 13, where we present the estimated coefficients on the indicators for the quartiles of the risk distribution (the omitted category is the first quartile, comprising the teams that take the least risk). The results indicate that teams that take more risk score more points (see panel A). In panel B of Figure 13,

[9] As a robustness check, we restrict the sample of sub-quarters to those that are initially close in terms of the overall score. We use sub-quarters where teams are initially only four points apart (a one-score game), meaning that the score differences are restricted to the interval (-4, 4). The results of these restricted-sample regressions confirm our results.

we see that teams that take more risk have a better score differences in the sub-quarters. Panel C indicates that teams that take more risk are more likely to win a sub-quarter.

Overall, we find few differences between men's teams, women's teams coached by men, and women's teams coached by women. However, women's teams coached by men appear to benefit less than the other two types of team.[10]

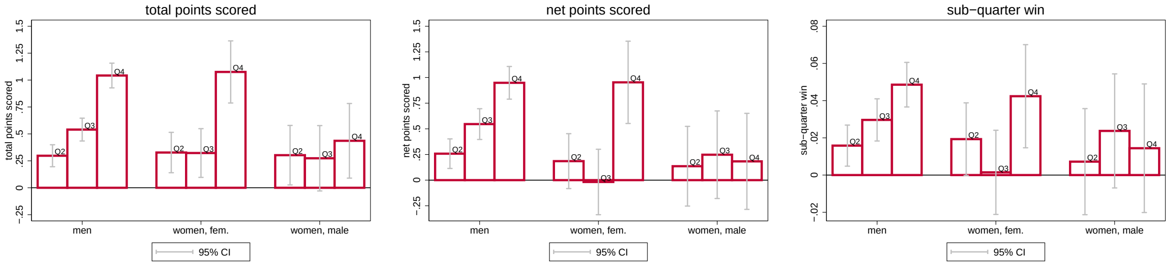
Table 6: Estimated effect of risk-taking on success: sub-quarter level.

		Women	
	Men	female coach	male coach
Dep. var.: total points scored			
three point ratio	2.7923*** (0.1418)	2.3793*** (0.3325)	1.3121*** (0.4263)
Dep. var.: net points scored			
three point ratio	2.6496*** (0.1948)	1.6273*** (0.4692)	0.8435 (0.5716)
Dep. var.: sub-quarter win (binary)			
three point ratio	0.0451*** (0.0113)	0.0603*** (0.0225)	0.0309 (0.0263)
N	65,136	16,020	9,480

Only sub-quarters 1 through 3 are included. Each coefficient is derived from a separate regression. All specifications include month, team-season, and opponent-season dummies. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level. Standard errors, clustered by team-year, in parentheses.

[10]The results for the fourth sub-quarter only indicate a negative association between risk-taking and sub- quarter outcomes. However, this result is likely to be affected by reverse causality, as teams that are performing badly may resort to more risky strategies to have any chance to win the game. Figure 16 in the appendix B presents estimates for the fourth quarter only.

Figure 13: Success and risk-taking: sub-quarter outcomes.



Estimated coefficients for risk-taking quartile dummies dummies by team- and coach-gender. Reference group is the first quartile of three-point share. All estimations include team-season dummies, opponent-season dummies, as well as sub-quarter dummies. Only sub-quarters 1 through 3 are included.

Game-level success. We analyze the effect of risk-taking on the overall likelihood of winning a game. Similar to our analysis of sub-quarter outcomes, we use only three-point attempts from the first, second, and third game sub-quarters to calculate our measure of risk-taking. We estimate OLS regressions where we use a binary indicator for winning for each team-game observation. We estimate the regression separately for the three team types using the overall ratio of three-point attempts to all attempts, excluding free throws, as a proxy for risk-taking. We also estimate specifications where we use the quartiles of this distribution as explanatory variables. We also include month, team-season, and opponent-season fixed effects.

The estimation results are tabulated in Table 6. The results suggest that men's teams and women's teams coached by women benefit from risk-taking. For these two team types, we find that attempting 10 percentage points more three-point attempts leads to an approximately 1 percentage point greater chance of winning the game. Women's teams coached by men take as much risk as men's teams, on aver age; the means of risk-taking are 0.31 and 0.34. While men's teams that take more risk are more likely to win the game, we cannot reject the null hypothesis for women's teams. The estimated coefficient is not statistically significant at conventional levels.

When we use the set of indicator variables to describe the distribution of the risk-taking indicator, we find for men's teams a clearly positive gradient for risk-taking. For women's teams coached by women, we find a positive association between risk-taking and winning a game only for teams in the fourth quartile of the risk-taking distribution.

By contrast, women's teams coached by men do not appear to increase their chances of winning a game when they take more risk.

Table 7: Estimated effect of risk-taking on success: game level.

			Women			
	Men		female coach		male coach	
three point ratio	0.1326*** (0.0223)		0.1199*** (0.0463)		0.0837 (0.0562)	
quartile 2		0.0234*** (0.0088)		-0.0005 (0.0130)		0.0001 (0.0207)
quartile 3		0.0292*** (0.0091)		0.0281 (0.0172)		0.0227 (0.0232)
quartile 4		0.0499*** (0.0092)		0.0472** (0.0210)		0.0304 (0.0236)
mean dep. var.	0.5903		0.5899		0.6013	
mean risk-taking	0.3404		0.2610		0.3162	
N	21,712		5,340		3,160	
R^2	0.350	0.350	0.508	0.508	0.532	0.532

Only quarters 1 through 3 are included. The dependent variable is equal to 1 if the observed team wins the game, 0 if it loses. All specifications include month, team-season, as well as opponent-season dummies, as well as the total number of attempts from the field as a continuous control variable. *, ** and *** indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level. Standard errors, clustered by team-year, in round parentheses.

5 Conclusion

We analyze the effect of female leadership on risk-taking using data from NCAA basketball games. We estimate the effect of the head-coach's gender on risk-taking for women's teams. We consider three-point attempts, relative to the safer option of two-point attempts, as a risk-taking indicator. We find a significant and sizable negative effect of a female head-coach on risk-taking; this varies little depending on whether the game is played at home or away. This effect of the coach's gender on risk-taking is persistent over the course of games and across intermediate score differences. The effect is slightly stronger for NCAA tournament games, where teams are selected based on past performance and where stakes are greater than during the regular season. We find that the gender of the opposing team's head coach has no effect on risk-taking.

We use an IV approach to establish a causal link between the head coach's gender and risk-taking. We use the absolute size of professorial academic staff as an instrument for the probability that the women's basketball team is coached by a woman. The results confirm our OLS estimates.

Moreover, we find that coach gender has no effect on success at the individual throw level, while sub-quarter success in the first three sub-quarters is positively associated with risk-taking. At the game level, we find that men's teams and women's teams coached by women are more likely to win a game when their risk-taking is high. We do not find this association for women's teams coached by men.

Overall, we find a clear effect of coach gender on team risk-taking behavior for women's teams. This appears to be a manifestation of the coach's risk preferences rather than of gender-specific differences in the physical style of basketball play. Most male coaches are former professional players, who could incorporate the more physical play of men's basketball into their style of coaching. However, playing more physically could lead to more two-point attempts being thrown closer to the basket and being fouled more often. We find no evidence for this.

Moreover, over recent years, three-point attempts have become a dominant strategy in US (male) professional basketball. Figure 15 in the appendix illustrates, however, that the share of three-point attempts in all attempts from the field has remained almost constant for men's and women's teams with male coaches. Consequently, we argue that differences in coaches' risk preferences are the most likely explanation for our empirical results.

Our findings offer important implications for leadership structures and the representation of women in top management positions and boards. We contribute to the ongoing discussion by providing field evidence for a significant effect of female leadership on risk-taking. In particular, we confirm earlier findings of a risk-decreasing effect of female leadership in companies and banks (Faccio et al., 2016; Andries et al., 2017; Hoang and Nguyen, 2018). One particular advantage of our data is that they offer the opportunity to closely investigate the link between success and risk-taking. Our results suggest that female-led women's teams benefit from increased risk-taking similarly to men's teams. By contrast, women's teams coached by men do not benefit significantly from increasing the level of risk.

One potential shortcoming of our analysis is that we cannot distinguish between risk-taking and aggressive play. In essence, male coaches could simply choose the most aggressive-and, in this case, more risky-strategy in an aggressive attempt to win. In this case, higher risk-taking by female coaches would not originate from differences in risk preferences, but differences in competitiveness.

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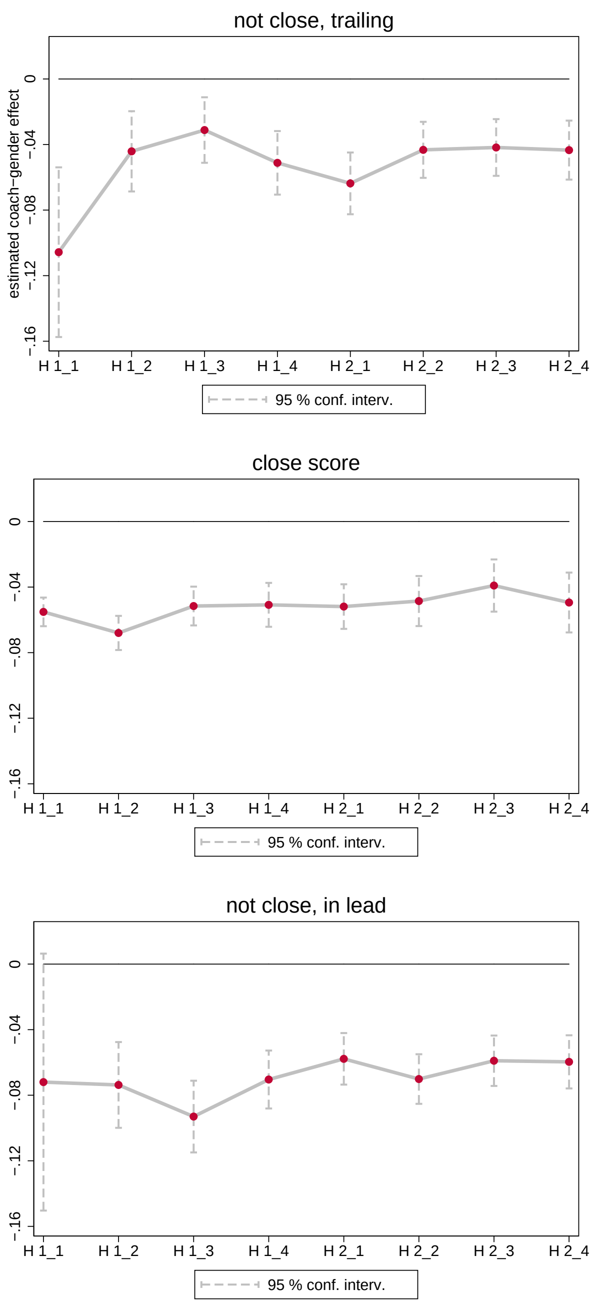
A DATA APPENDIX

The data was gathered from the Integrated Postsecondary Education Data System (IPEDS), which is provided by the National Center for Education Statistics (NCES). For the enrollment data, the subcategory *Gender, attendance status, and level of student* in the category *Fall Enrollment* was chosen.

For the years 2012-2015 the absolute numbers (as well as relative shares) of professors was calculated with the data obtained in the category *Human Resources*, and the respective subcategories *Full-time instructional staff by academic rank, faculty and tenure status, race/ethnicity and gender* and *New classifications for faculty and tenure status*. There, only *Professors* were selected in the *Instructional staff category*. To gather the data for the years 2008 through 2011, the subcategory *Full-time instruction/research/public service staff, by tenure status, academic rank, race/ethnicity, and gender (Degree-granting institutions with 15 or more full-time employees): Fall 1993 to 2011* was chosen in the section *Human Resources*. The *Tenured total* (in the *Total full-time instruction/research/public service* category) was used, limited on *Professors* (in the *Select all academic ranks* category).

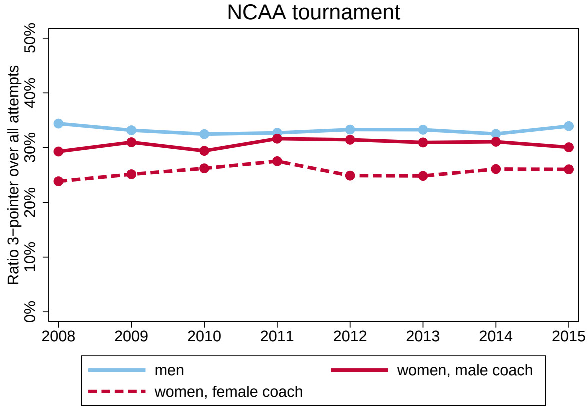
B TABLE AND GRAPHICAL APPENDIX

Figure 14: Estimated coach gender effect on risk taking - intermediate standing



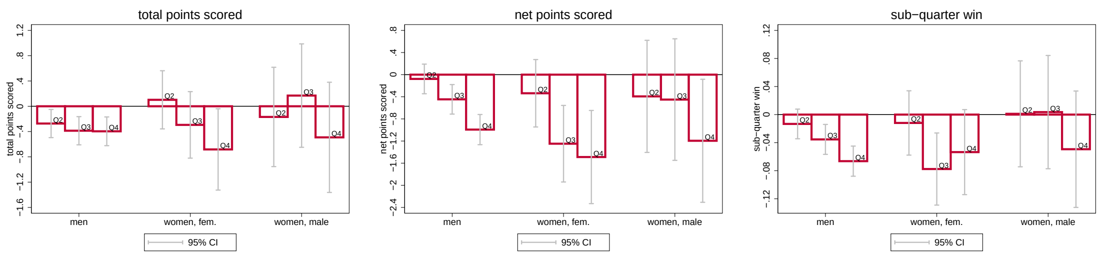
Estimated effect of coach gender on risk-taking for different intermediate scores over game sub-quarters. Each data point corresponds to an estimated coefficient for *female coach* by estimating model 1 for stratified sub-samples.

Figure 15: Percentage of three-point attempts of all attempts from the field, by academic year, team- and coach-gender



Notes: $N = 1{,}675{,}192$

Figure 16: Success and risk-taking: outcomes for fourth quarter only.



Estimated coefficients for risk-taking quartile dummies dummies by team- and coach-gender. Reference group is the first quartile of three-point share. All estimations include team-season dummies as well as opponent-season dummies. Only sub-quarter 4 is included.