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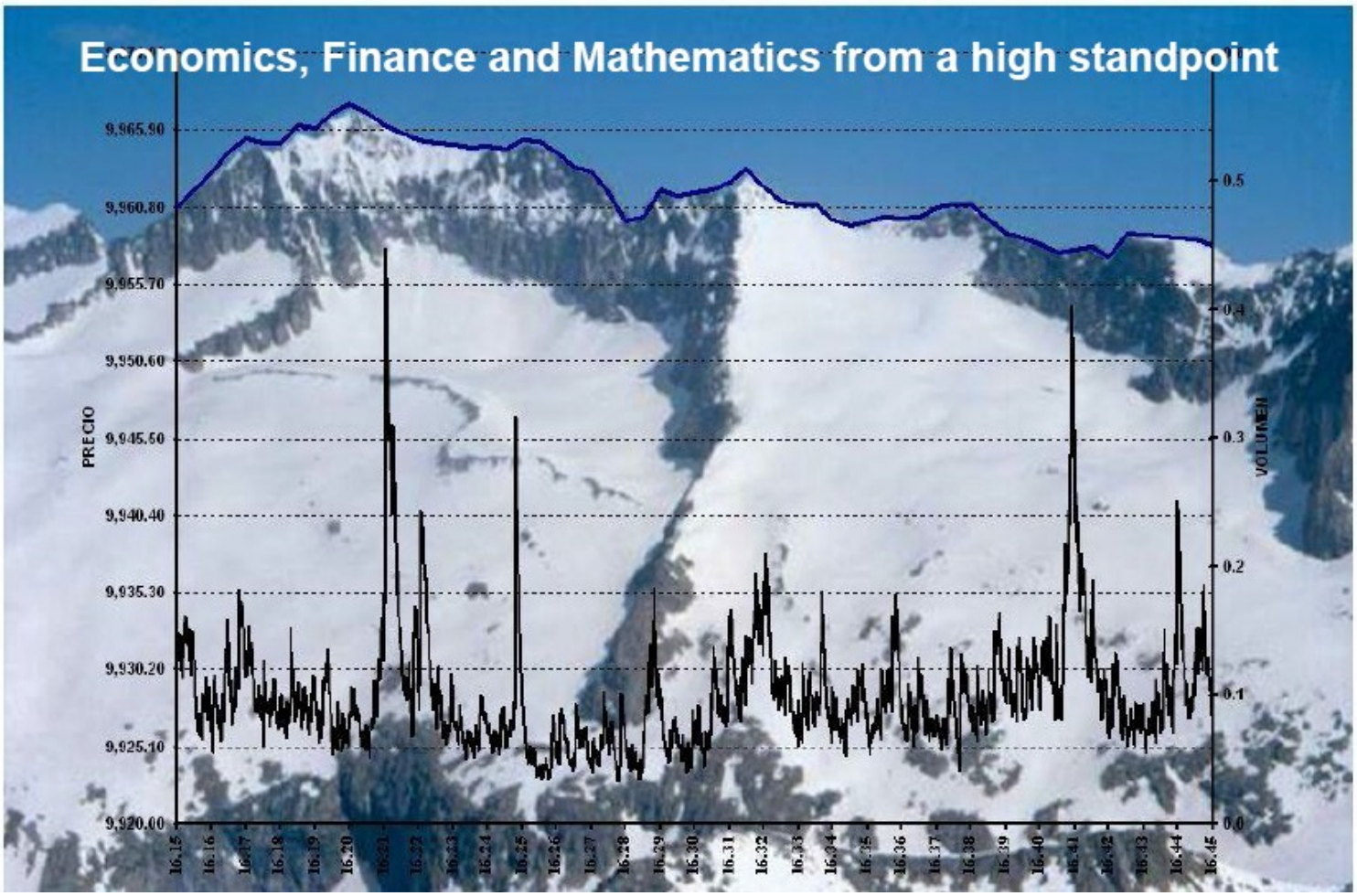

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Racial differences in the labor market: The case of expected performance and dismissals of head coaches in NBA

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ABSTRACT:

Professional basketball in the US provides an opportunity to test for racial differences in the labor market. In contrast to other economic sectors, black Americans are well-represented in influencing positions as head coaches in National Basketball Association (NBA). This paper investigates the influence of the race of the coach and performance (winning ratio and an efficiency index relative to expectations) on dismissal decisions. The data include coach-team information over a 20-year period in NBA and the analysis uses several probit models. The results show that black head coaches are more likely to be fired and less prone to quit.

Keywords: OR in sports, Productivity and competitiveness, Coaches dismissals, Race

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1. Introduction

In the words of Samuel Johnson, racial discrimination was a fact "too evident for detection and too gross for aggravation" in the American society of the first part of the 20th century (Arrow, 1998, p. 92). African Americans had a strictly limited access to certain jobs, which prevented them from creating a social network and reaching top positions (Ibarra, 1995). In recent years, although African Americans still face barriers to access leadership jobs in certain sectors, they have successfully reached top positions in professional sports, particularly in basketball. However, the question that still arises is: Are black and white Americans treated differently in the labor market?

Many authors have dedicated their research in different sectors to answer this question by analyzing, for example, rates of employment (Riach & Rich, 2002), wages (Charles & Guryan, 2008), or seniority (Altonji & Blank, 1999) of employees from minority groups. However, most of the contributions in economics do not examine racial differences in managerial positions due in part to the limited representation of racial groups. In this paper, we use data from professional basketball head coaches to analyze the influence of race on dismissal decisions. If racial preferences interfere in the assessment of the work of employees in influencing positions, both the social role of minorities (Arrow, 1988), and the wealth of firms and organizations (Becker, 1957) are at risk.

In order to analyze the dismissal decisions in professional basketball, we refer to the extensive body of literature that examines the determinants of team leaders' turnover in sports (e.g., Humphreys, Paul, & Weinbach, 2016) and business firms (e.g., Farrell & Whidbee, 2003). These studies analyze factors related to age, education, experience, and the performance of teams and firms. In sports, recent studies introduce the dimension of expected results as a benchmark to investigate the performance of coaches and its influence on dismissals (e.g., van Ours & van Tuijl, 2016). Hence, we examine the difference between expectations and actual results of black and white head coaches in NBA and the impact of this difference on the probability of being fired.

The analysis of racial differences in competitive sports, especially basketball, is relevant due to three main reasons: (1) the presence of African Americans in leadership positions as coaches; (2) the visibility/availability of the results of the teams; (3) the large salaries and compensations at stake.[1] The efforts of Kahn (2006), and Fort, Lee, and Berri (2008), who introduce efficiency to detect racial discrimination practices in the retention of NBA coaches, are two noted precedents. Both studies find no significant differences by race, but our results show otherwise.

[1] Hoopshype (2016) shows that the salaries of head coaches in NBA are far above the average salary in the US. Moreover, these coaches sign for several years. At the top of the list, we find Gregg Popovich ($55 million, 5 years in San Antonio Spurs) or Doc Rivers ($50 million, 5 years in LA Clippers).

The contribution of this study to the discrimination literature, which relates to the influence of race on dismissals in NBA, is twofold. On the one hand, the analysis incorporates the dimension of fans expectations to calculate the efficiency of coaches. Moreover, the database is larger with respect to previous studies and covers the period 1993-94 through 2016-17.

2. Literature review

Representatives of the international activist movement Black Lives Matter emphasise that the residue of discrimination affects several areas such as education, health care, or the economy in the US (Deruy, 2016). Research results from field experiments point towards this direction. Beginning with Bertrand and Mullainathan (2004), ethnic discrimination has been analyzed using correspondence studies featuring made-up resumés. For instance, Edelman, Luca, and Svirsky (2017) show that African Americans receive 16% less acceptance calls than White Americans in a short-term housing rental portal (Airbnb), *ceteris paribus*. Similarly, Pager, Bonikowski, and Western (2009) demonstrate that black applicants were half as likely as equally qualified whites to receive a callback from a job offer in the low-wage labor market of New York City.

Professional sports leagues offer the possibility to investigate the labor conditions of black Americans in the top positions of a very competitive labor setting. In US basketball, some African Americans have arrived at the most influential positions as coaches in professional (NBA) and college (NCAA) leagues. Still, it remains unclear whether African Americans suffer from double standards once they enter this labor market. The share of black coaches remains relatively low in comparison to the number of players, especially as coaches tend to be former players (Goodall, Kahn, & Oswald, 2011). In NBA, Lapchick and Balasundaram (2017) report that the number of players of color was close to 80%, while the number of coaches only represented a 30% share. Additionally, this percentage is even lower when we analyze the list of head coaches who had won the NBA championship.[2] Our paper uses measures of performance to assess the career records of coaches and investigate determinants of dismissals.

The performance of firms is an important determinant of dismissal in many sectors (Brickley, 2003). However, in several cases measuring performance is not straightforward, and the variables are not able to capture the managerial influence of leaders (Kulik & Metz, 2017). This is especially problematic in

[2] In particular, the first black American head coaches in this list are the former professional players, K.C. Jones and Bill Russell, who won 2 titles with the Boston Celtics (in the 1980s and the 1960s, respectively), in the 10th and 11th position. Then, Al Attles or Lenny Wilkens, who won the title with the Golden State Warriors and the Seattle Supersonics respectively, during the 1970s, in the 15th position. The recent isolated cases of Doc Rivers (2008 with the Boston Celtics) and Tyronn Lue (2016 with the Cleveland Cavaliers) complete the short list of black head coaches who have won the NBA championship.

organizations where teams are composed of a large number of members. In the literature of sports economics, it is easy to obtain accurate measures of team performance such as the winning percentage, which has been widely used in previous research (e.g., Dietl, Lang, & Werner, 2009; Idson & Kahane, 2000). [3]

Moreover, in sports competitions, we consider the perceived status, objectives and expectations of teams. The same winning percentage of two different teams can have different implications for performance, if they do not have similar objectives and resources. In NBA, Wangrow, Schepker, and Barker III (2018) include team expectations to analyze coaches' dismissals with a measure based on previous winning percentage, play-off performance, attendance percentage, and players' salary. Our study also controls for the expectations of teams, but the analysis uses information from betting odds. Specifically, we identify game outcome probabilities, and then calculate an efficiency index of coaches with the aim of investigating unfair race-based labor assessment.

Although some studies identify biases in the market such as bettor sentiment (Levitt, 2004), or specific teams' prior benefits (Paul & Weinbach, 2009), many empirical works confirm the possibility to use odds to accurately predict game outcomes since the paper of Sauer (1998).[4] The nature of the relationship between bookmakers and bettors makes this market efficient. While the former need to use all the information available to set accurate odds that prevent bettors from finding gaps to exploit, the latest place their bets on games with the aim of earning a profit. Thus, this market avoids unreal estimations of the game outcomes on both sides of the betting market, which allows research to obtain the embedded probabilities of winning.[5]

Previous studies also use information from betting odds to analyze team results, expectations, and coaches' dismissals. In college football, Humphreys et al. (2016) use the cumulative winning percentage (actual result) with respect to point spreads from the betting market (expected result) to assess the performance of coaches and the probabilities of turnover. With a similar application to European soccer leagues, van Ours and van Tuijl (2016) analyze the cumulative surprise (actual vs. expected points) of a team in a season. In this paper, we use a similar approach to calculate the efficiency of coaches

[3] Other commonly used measures in the literature of determinants of coach dismissal include the position in the ranking (Bachan, Reilly, & Witt, 2008), the changes in the position (d'Addona & Kind, 2014), results in prior games (Audas, Dobson, & Goddard, 1999), points (Frick, Barros, & Prinz, 2010), and managerial efficiency (Tena & Forrest, 2007).

[4] Wolfers and Zitzewitz (2006) also state "prediction market prices typically provide useful (albeit sometimes biased) estimates of average beliefs about the probability an event occurs".

[5] Measures of performance based on betting information are commonly used to understand the determinants of sports demand in recent contributions (Coates, Humphreys, & Zhou, 2014; Pawlowski, 2013), as they stand closer to the perspective of fans.

following the methodology proposed by del Corral, Maroto, and Gallardo (2017), in which efficiency is calculated as the inverse of the probability from betting odds of obtaining more victories than the actual ones.

Other studies that include the difference between expected (betting odds) and actual (game outcome) results to analyze the probabilities of firing the coach are: in professional soccer leagues Pieper, Nüesch, and Franck (2014) in Germany; Elaad, Jelnov, and Kantor (2018) in England; or Buraimo, Bryson, and Simmons (2017) in Italy, Germany, and Spain.[6] The results demonstrate that previous expectations play an important role in the dismissal of coaches.

The influence of race on coaches' dismissal is ambiguous in different college sports leagues. For example, in college football, Mixon and Treviño (2004) find that black coaches are less likely to be fired, Holmes (2011) reports that race has little effect, and Kopkin (2014) shows that black coaches have higher probabilities of dismissal. In college basketball, LaFave, Nelson, and Doherty (2018) advert that black head coaches' contracts are more likely to be terminated earlier. In professional leagues, the results also differ. In professional football, while Madden (2004) finds that black head coaches receive an unfavorable treatment, Foreman, Soebbing, and Seifried (2018), and Wangrow et al. (2018) find no statistically significant evidence of racial discrimination.

The results from our study control for the influence of team performance and expectations from betting odds to extend the former contributions of Fort et al. (2008) and Kahn (2006) on the determinants of dismissal by race in the NBA. Fort et al. (2008) use stochastic frontier models to calculate the technical efficiency of coaches, where the inputs are the contributions (statistics) of players for each team in specific positions (i.e., guard, small forward and big men). The authors find no evidence that suggests that racial preferences determine the dismissal of NBA coaches during the period 2001-2004. Similar to these results, Kahn (2006) finds an insignificant effect of race on the probability of being fired, using hazard models with information on the teams' winning percentage and the characteristics of coaches from 1996 to 2004.

The predicted results of this study are similar to the above-mentioned as race *per se* should not significantly influence turnover decisions in NBA. The high-competitive nature of the teams in this league and the visibility of their performance should diminish the prevalence of racial preferences.

3. Data description and methods

In this paper, we use data on NBA teams and coaches that cover the period 1993-94 through 2016-17 and come from different sources. On the one hand, the information on the actual and expected results of teams are extracted from: www.nba.com, www.covers.com and www.oddsportal.com, respectively.

[6] This methodology has not only been used in academic outlets but also in influential journals (Silver, 2014).

On the other hand, the characteristics of coaches and their contractual relationship with teams were gathered using the official websites of teams, www.nba.com and www.basketball-reference.com.

In order to obtain the expected results, we use betting data from two different sources. With regard to the oldest betting data (1993/1994-2011/2012), we use the website www.covers.com[7], which provides the point spreads.[8] Prior to use the information from the spreads, it is needed to extract the embedded probabilities. To do so, we follow the methodology of del Corral et al. (2016) that uses a probit model to predict the win probabilities, in which the dependent variable takes value 1 for a home win and the only independent variable is the point spread. After the estimation of this model for each season, it is straightforward to compute the predicted probabilities.[9]

With respect to the latest betting data, the website www.oddsportal.com provides betting odds as decimal odds (o_e). The inverse of these odds reveals the probability of the events happening, but they include the profit of bookmakers (over-round). We follow Franck, Verbeek, and Nüesch (2010) to obtain the embedded probabilities. Thus, the probability of event e occurring (P_e) is calculated as in equation (1). The inverse of the odds of event e is divided by the over-round. Then, the sum of the probability of the two possible outcomes in a basketball game: home win, or away win sum to one.[10]

$$P_e = \frac{1}{o_e} \frac{1}{\sum_e \frac{1}{o_e}} \quad (1)$$

Similar to Buraimo et al. (2017), this analysis distinguishes between coaches that decided to voluntarily leave the team and coaches that were fired. We collected the appropriate information from the official websites of teams, www.basketball-reference.com and the sport section of several

[7] We would like to acknowledge Leigh Herdman of Herdman-Highton Consultancy Ltd for providing us with this data.

[8] Spread betting is a type of bet in which the bettors anticipate whether the outcome will be above or below the spread. Specifically, the bookmaker ascribes an advantage to the underdog (handicap) and a disadvantage to the favorite (supremacy), which results in an implied probability of 50% for both sides of the wager. As only two possible outcomes are possible in the NBA (home and away win), betting odds of 1.90 are set to both teams in order to ensure the over-round for bookmakers. For example, Oklahoma City Thunder's supremacy over the Sacramento Kings in the last game of the 2011-2012 regular season was valued at 10. This implies that Oklahoma City Thunder was clearly the favorite in the game (del Corral, García-Unanue, & Herencia, 2016).

[9] Please, note that similar conversions of point spreads into probabilities can be found in Stern (1991) and Wolfers (2006) for NFL and NBA, respectively.

[10] For example, the closing odds for the game (H) LA Lakers vs. (A) LA Clippers on October 30, 2013 were the following: home win (4.93) away win (1.18). The probabilities from the odds as provided by Oddsportal ($1/O_e$) were: home win = 0.20 and away win = 0.85, while the final probabilities: home win = 0.19 and away win = 0.81.

newspapers. In this competitive setting, we find fewer in-season dismissals than in other leagues/sports such as soccer leagues in Germany (Frick et al., 2010), or Argentina (Flores, Forrest, & Tena, 2012). Specifically, the data shows that the average of teams without coach replacements within a season is over 86%. Other important fact about the NBA head coaching market is that very few head coaches sign for a better team (in terms of winning record) or a better contract (in another team), before terminating the contract in the current team (<3%).[11]

The racial gap between players and head coaches in NBA reported by Lapchick and Balasundaram (2017) finds support in our data. Figure 1 shows the number of games coached by black and white head coaches during the analyzed period. This evolution reveals that, although the number of games coached by black head coaches has increased over time, their representation is consistently lower. There are peaks and troughs in the number of games coached by African Americans over the last 15 seasons, with no apparent trend.

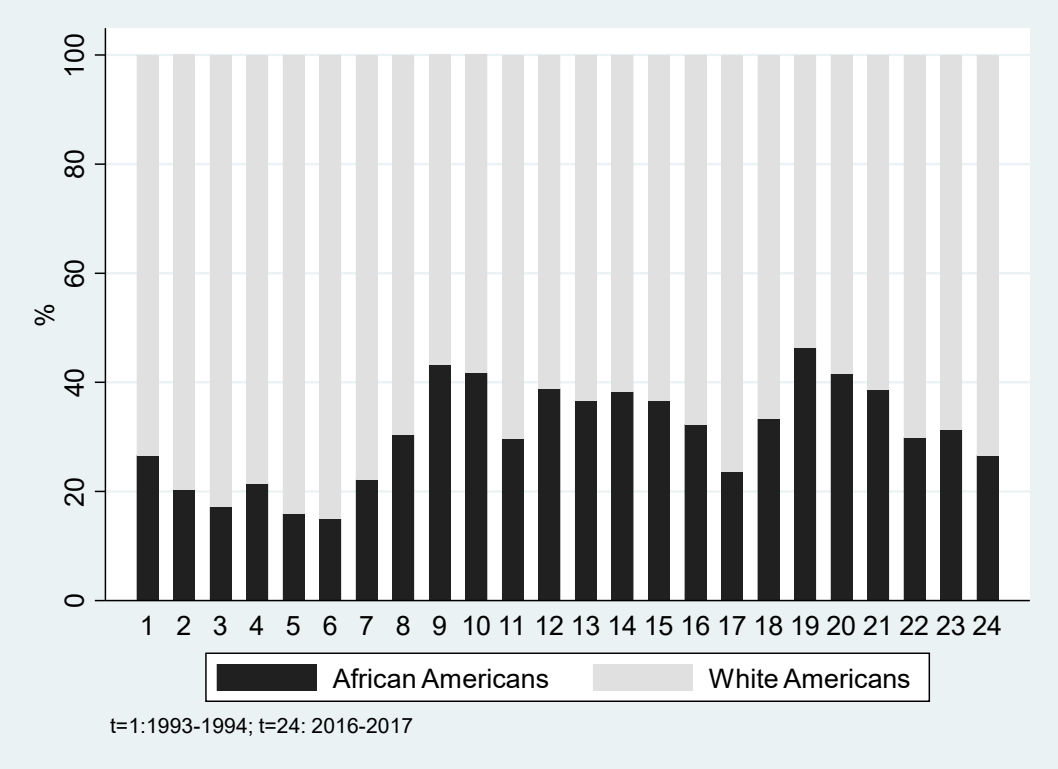

Fig. 1. Evolution of the percentage of games coached by race.

Beyond the racial composition of the teams' coaching positions, this study also provides insights about the background and previous experience of head coaches working in this competitive setting. For example, we investigate if head coaches are former players of this competition (Goodall et al., 2011),

[11] The low number of contract improvements in the sample preclude us from further analyzing the determinants of these changes.

and differences by race. Contingency tables are used to analyze the relationship between the race of the coach and previous experience.

Some papers have focused on the efficiency of coaches, as a determinant of dismissal, and race to detect unfair practices in NBA (Fort et al., 2008; Kahn, 2006). In this setting, we use the relationship between expected and actual results to calculate the efficiency of head coaches, as in del Corral et al. (2017). From basic probability theory, we know that the probability of two independent events equals the product of these probabilities (Stern, 1991).[12] In a basketball game, we know the probability of a team winning 2 consecutive games by multiplying the probabilities of these two events. By doing so with the probabilities of all possible game outcomes for a team in a season (from betting odds), we calculate the density function of victories.[13] Then, we provide a measure of coaching efficiency by subtracting the sum of the probabilities of achieving more victories than the actual ones from one. The most efficient coaches will obtain values close to 1, while inefficient coaches will tend to numbers close to 0.

Figure 2 shows two different coaches that are expected to obtain the same number of victories at the end of the season (41). While coach A obtains more victories than expected (51 – red line), coach B achieves fewer victories than expected (31 – red line). To calculate the efficiency of coaches, we subtract the sum of the probabilities of achieving the victories that belong to the blue area from one. Thus, coach A will report a value close to 1 (efficient), while coach B will report a value close to 0 (inefficient). This measure is relevant to our analysis because of two main reasons. First, we incorporate the expectations derived from the betting market to calculate the efficiency of coaches. Second, we analyze racial differences and control for actual and relative performance of coaches.

[12] The independence assumption in sports games is questionable as other factors such as winning streaks or hot hand can play a role (Waggoner, Wines, Soebbing, Seifried, & Martinez, 2014). Some papers compute the difference between the number of expected wins from betting odds and actual wins, which does not rely on the independence assumption (Pieper et al., 2014; Humphreys et al., 2016; van Ours & van Tujil, 2016). However, this method has the shortcoming that it cannot control the influence of being two victories ahead expectations at gameday 5 and at gameday 82, which has different implications. In our database, we have several observations with 82 games, but also with a lower number of games. Therefore, we think that it is more sensible to include the efficiency score, which relies on the independence assumption, rather than the difference between actual wins and expected wins in the probit models. Moreover, if the number of games is the same, the correlation between the efficiency index and the difference between expected and actual results is 0.99.

[13] Please, see Appendix 1 for further explanations about this methodology.

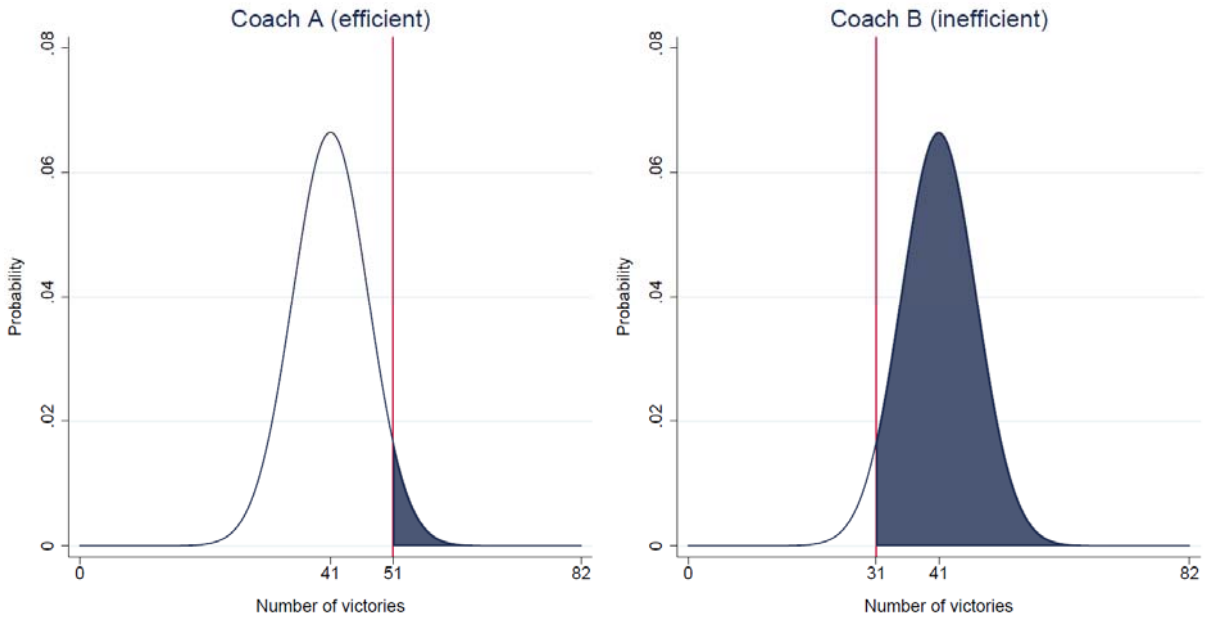

Fig. 2. Efficiency of coaches.

A first analysis to investigate the relationship between the efficiency of coaches and dismissals consists of a contingency table. Thus, we are able to examine the number of dismissals at different intervals of efficiency. According to previous results in the literature, we expect to observe a higher number of dismissals when the efficiency of coaches is low. Moreover, we also include the race of the coach in the analysis of efficiency and the probability of being fired in order to detect racial bias.

Finally, we estimate several probit models to investigate the influence of efficiency, performance and race on the contractual relationship between NBA teams and head coaches, using data from the seasons 1993-94 to 2016-17. In the model estimation, we use 809 coach observations.[14] Thus, the data set is larger and extends the previous efforts of Fort et al. (2008) and Kahn (2006). The dependent variables of our probit models are: (1) dismissals, (2) dismissals that exclude the interim coaches[15] who were fired from the sample, (3) resignations, and (4) all types of coach exits.

The analysis includes the following independent variables: *black* is a dummy variable that takes value one if the coach is African American and zero otherwise.[16] Then, following the idea of van Ours and

[14] The observation is defined as the coach within a team in a particular season. Therefore, if a coach worked for two different teams in the same season, the analysis would include two different observations.

[15] Interim coaches are those coaches already enrolled within an NBA team. These coaches are upgraded to head coach, but the team has no intention to maintain them in this position in the long term. In our sample, we find 33 interim coaches, who average less than 24 games per observation.

[16] The complete list of coaches in our database and the attributed race can be found in Appendix 2 (Table A1). The race was attributed by the authors by looking at pictures of the face of the coaches. Some of them were considered

van Tuijl (2016), we include our measure of *efficiency* of the coach as a determinant of dismissal. The values of efficiency are between zero (highly inefficient) and one (highly efficient). As a traditional measure of actual performance, we include the *team winning percentage* (which ranges from zero to one)[17], the *age* (and *squared age*) of the coach, dummies that account for coaches' *bad previous seasons* -takes value 1 if the coach had an efficiency below 0.5 in the same team in the previous season-, *NBA winners,* or *former NBA players*, and the *coaching experience*, which is the number of years at their current position. Table 1 contains the descriptive statistics for the variables used in the analysis of dismissals of NBA head coaches.

Table 1
Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Black (dummy)	809	0.33	0.47	0	1
Efficiency	809	0.53	0.29	0	1
Team winning percentage	809	0.48	0.17	0	1
Bad previous season (dummy)	809	0.21	0.41	0	1
Age	809	50.08	7.92	32	71
Coach NBA winner (dummy)	809	0.13	0.34	0	1
Former NBA player (dummy)	809	0.61	0.49	0	1
Tenure	809	2.90	2.72	1	21

In detail, our database[18] is composed of 809 observations. This sample includes 211 dismissals, from which 120 belong to white coaches and 91 to black coaches (see Table 2). The ratio firings-observations is larger for black coaches than it is for white coaches. Moreover, there are 44 quits, and only 8 of them involve black coaches. Finally, the data has 33 interim coaches (18 white and 15 black).

Table 2
Contingency table of fired, quit and interims by race.

	Fired		Quit		Interims	
	No	Yes	No	Yes	No	Yes
White	426	120	510	36	528	18
Black	172	91	255	8	248	15

4. Results

The contingency tables that firstly explore the relationship between the race of the coach and their professional background provide interesting results. Table 3 shows that in our sample, while the majority

mixed-race. However, the number of mixed-race was too small in order to make any statistical analysis. Hence, the analysis only distinguishes between black Americans and white Americans.

[17] In our sample, the correlation between the team winning percentage and efficiency is positive as expected, i.e., 0.622. Although the correlation is positive, it is not so high. Therefore, in order to fully consider the performance of teams, the analysis includes both measures.

[18] The database can be downloaded using this link.

of black head coaches previously played professional basketball, the 60% of white head coaches took other career paths. The result, which is significant at the 1% level, is relevant for students or athletes that want to pursue a career in professional basketball coaching. African Americans seem to be required to prove themselves as players prior to becoming head coaches in NBA.

Table 3
Contingency table between former NBA players and head coach by race.

NBA player	White coach	Black coach	Total
No	62 (60%)	13 (20%)	75 (45%)
Yes	41 (40%)	51 (80%)	92 (55%)
Total	103 (100%)	64 (100%)	167 (100%)

Pearson $\chi^2 = 25.376$; p-value= 0.000; Cramer's V = 0.389

This study also analyzes the relationship between dismissals and the efficiency of coaches. Table 4 shows the number of dismissals at different intervals of efficiency. As expected, we find that the higher the efficiency of NBA head coaches, the lower the number of dismissals, and vice versa.

Table 4
Contingency table between coach efficiency and dismissal.

Efficiency	Dismissal		Total
	No	Yes	
[0-0.1)	34 (45%)	42 (55%)	76 (100%)
[0.1-0.2)	42 (56%)	33 (44%)	75 (100%)
[0.2-0.3)	44 (67%)	22 (33%)	66 (100%)
[0.3-0.4)	41 (61%)	26 (39%)	67 (100%)
[0.4-0.5)	54 (68%)	25 (32%)	79 (100%)
[0.5-0.6)	67 (82%)	15 (18%)	82 (100%)
[0.6-0.7)	77 (80%)	19 (20%)	96 (100%)
[0.7-0.8)	61 (81%)	14 (19%)	75 (100%)
[0.8-0.9)	94 (90%)	10 (10%)	104 (100%)
[0.9-1]	84 (94%)	5 (6%)	89 (100%)
Total	598 (100%)	211 (100%)	809 (100%)

Pearson $\chi^2 = 95.403$; p-value = 0.000; Cramer's V = 0.343

Our contingency table helps to test for differences in dismissals by race. Table 5 shows that the percentage of black coaches that are fired is always higher than this of white coaches at all intervals of efficiency. We find the most substantial difference in the interval that goes from 0.3 to 0.4. The percentage of black coaches that were fired at this interval of efficiency in NBA (60%) doubles the percentage of dismissals of white coaches (30%). These results suggest the possible existence of double standards when it comes to assess the performance of black and white head coaches in NBA. To further test this hypothesis, we follow previous analyses in the literature and estimate probit models of the determinants of sports head coach dismissals.

Table 5
Relationship between dismissals and efficiency by race.

Efficiency	White coaches		Black coaches	
	% of fired coaches	N	% of fired coaches	N
[0-0.1)	51	47	62	29
[0.1-0.2)	43	42	45	33
[0.2-0.3)	30	46	40	20
[0.3-0.4)	30	47	60	20
[0.4-0.5)	26	46	39	33
[0.5-0.6)	13	60	32	22
[0.6-0.7)	19	69	22	27
[0.7-0.8)	15	54	29	21
[0.8-0.9)	8	71	12	33
[0.9-1]	5	64	8	25
Total	-	546	-	263

Table 6 contains the results of four probit models results. While the first model analyzes the dismissals of all coaches, the second one excludes caretaker coaches. The third one examines the quits, and the fourth includes all exit types.[19] The results show that the better the performance the less likely the exit. The coefficient of the two present performance variables, i.e., efficiency and team winning percentage, are negative and significant in the models of dismissals (1 and 2) and all exits (4). These results suggest that teams consider both the efficiency and the victories when judging the performance of coaches. The case of Sam Vincent is illustrative. This coach was fired from the Charlotte Hornets after the season 2007-2008, in which the team obtained 32 victories out of 82 games. Thus, although the team had an efficiency score of 0.76, the team managers still decided to fire Sam Vincent.

With respect to the coefficient of the main variable (black dummy), the analysis shows two interesting results. First, the variable is positive and significant in the models of dismissals (1 and 2), which indicates discriminatory practices in the firing process. Second, the black dummy is negative and significant in the model of quits (3), which demonstrates that black head coaches in NBA are less likely to quit than their white counterparts (at a 1% level).

[19] The Pseudo-R^2 of the different models range between 0.110 and 0.174. These are reported in Table 6. Moreover, in order to further analyze the goodness-of-fit of the models, we use the sum of the fraction of zeros correctly predicted plus the fraction of ones correctly predicted as proposed in Kennedy (2008, p. 249). The values equal and exceed the unit in all models: (1. Dismissal) = 1.22, (2. Dismissal –no interims) = 1.18, (3. Quit) = 1, (4. All exits) = 1.31. The tables of values correctly predicted are calculated using the command *estat class* in the package Stata and are available upon request.

Table 6
Probit regression results.

Variables	(1) Dismissal		(2) Dismissal^{+}		(3) Quit		(4) All exits	
	Coef.	**ME**	**Coef.**	**ME**	**Coef.**	**ME**	**Coef.**	**ME**
Black (dummy)	0.306***	0.081	0.250**	0.064	-0.420**	-0.042	0.179	0.054
	(2.599)		(2.036)		(-2.055)		(1.575)	
Efficiency (0-1)	-1.126***	-0.299	-1.112***	-0.284	-0.507	-0.050	-1.165***	-0.350
	(-4.806)		(-4.632)		(-1.439)		(-5.267)	
Team winning percentage (0-1)	-1.674***	-0.445	-1.783***	-0.455	-0.512	-0.051	-1.826***	-0.549
	(-3.945)		(-3.885)		(-0.813)		(-4.5)	
Bad previous season (dummy)	0.077	0.020	0.126	0.032	0.344*	0.034	0.203*	0.061
	(0.588)		(0.957)		(1.941)		(1.651)	
Age	0.031	0.008	0.076	0.019	-0.268***	-0.027	-0.073	-0.022
	(0.43)		(0.965)		(-2.843)		(-1.076)	
Squared age	0	0.000	-0.001	-0.000	0.003***	0.000	0.001	0.000
	(-0.289)		(-0.906)		(3.048)		(1.313)	
NBA winner (dummy)	-1.156***	-0.307	-1.069***	-0.273	0.436**	0.043	-0.415**	-0.125
	(-4.348)		(-4.09)		(2.058)		(-2.309)	
Coaching experience	0.029	0.008	0.049*	0.012	0.005	0.000	0.025	0.008
	(1.12)		(1.89)		(0.188)		(1.185)	
NBA player (dummy)	-0.118	-0.031	-0.077	-0.020	0.168	0.017	-0.052	-0.016
	(-1.042)		(-0.657)		(0.99)		(-0.48)	
Constant	-0.417		-1.483		5.030**		2.285	
	(-0.228)		(-0.746)		(2.073)		(1.322)	
Pseudo-R^2	0.174		0.165		0.110		0.157	
Log-L	-383.378		-354.849		-152.076		-429.361	
N. of observations	809		776		809		809	
Number of 1 in dependent	211		184		44		262	

Notes: ***Significant at 1% level; **significant at 5% level; *significant at 10% level. a. In (2) Dismissal^{+} interim coaches are not considered.
b. The z-value is shown in parenthesis. c. ME are the average marginal effects.

Figure 3 displays the evolution of the marginal effect of the black dummy at different values of the two performance variables. The results show that the marginal effect is positive, but it decreases with higher values of the efficiency and the winning ratio. Therefore, the probability of firing a black coach or a white coach is closer when the performance of teams increases.

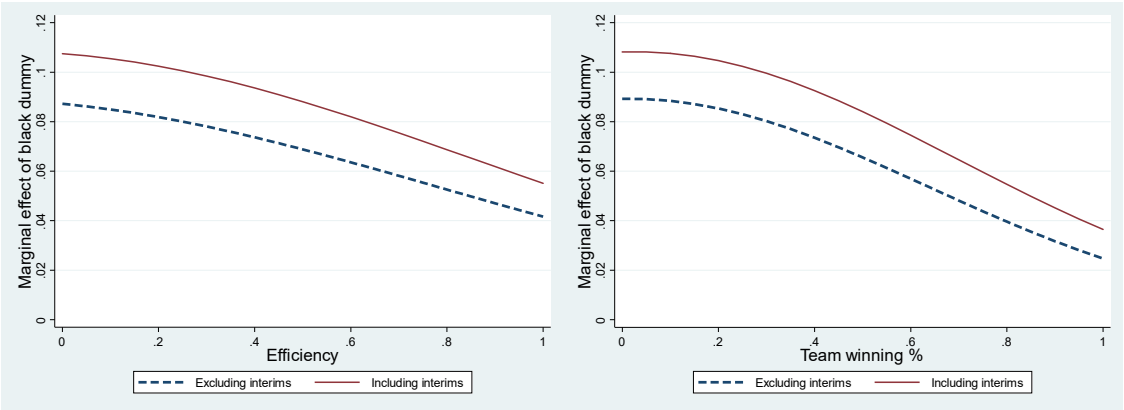

Fig. 3. Marginal effects of the probability of dismissal for black head coaches.

Notes: The marginal effects associated to the black dummy have been calculated with the Stata command *margins* asking for the average marginal effects for each increase of 0.05 in the *efficiency* and *team winning percenatge* variables.

4.1. Further Analyses

As some of the variables included in the previous probit models can be related to some extent with the black dummy variable, for example, *age, NBA winner, coaching experience, or NBA player*, it is important to check the robustness of the results. Hence, Table 7 provides probit estimates for the four dependent variables previously analyzed, i.e., dismissals, dismissal with no interims, quits and all exits, with two different sets of independent variables. First, the models only include the black dummy as covariate. Then, the models incorporate the rest of the variables related to performance (efficiency, team winning percentage and the bad previous season dummy).

Moreover, as the analysis includes two important variables of performance, i.e., winning percentage and efficiency, which could be highly correlated, we want to perform the analyses excluding one of them from the models. Table 8 reports the estimates of the four models including only one of the variables of performance. The results show that when we include only one of them, there is a decrease in the Pseudo-R^2. Moreover, among these two variables, we find that the efficiency index has a stronger influence on the probability of dismissal. This in line with the argument that is not only important to win, but to beat Vegas (Silver, 2014).

Table 7
Robustness checks probit regression results.

Variables	**(1) Dismissal**		**(2) Dismissal^{+}**		**(3) Quit**		**(4) All exits**	
	Coef.	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**
Black (dummy)	0.377***	0.247**	0.338***	0.209*	-0.368**	-0.416**	0.260***	0.111
	(3.785)	(2.319)	(3.254)	(1.880)	(-2.105)	(-2.285)	(2.683)	(1.069)
Efficiency (0-1)		-1.006***		-1.033***		-0.610*		-1.128***
		(-4.496)		(-4.490)		(-1.849)		(-5.259)
Team winning percentage (0-1)		-1.913***		-1.886***		-0.045		-1.855***
		(-4.966)		(-4.544)		(-0.081)		(-4.992)
Bad previous season (dummy)		0.092		0.167		0.369**		0.216*
		(0.737)		(1.322)		(2.230)		(1.811)
Constant	-0.773***	0.604***	-0.832***	0.545***	-1.507***	-1.269***	-0.545***	0.876***
	(-12.907)	(3.815)	(-13.424)	(3.116)	(-18.189)	(-5.562)	(-9.616)	-5.547
Pseudo-R^2	0.015	0.145	0.012	0.136	0.014	0.045	0.007	0.145
Log-L	-457.159	-396.969	-419.775	-367.220	-168.493	-163.220	-505.872	-435.536
N. of observations	809	809	776	776	809	809	809	809
Number of 1 in dependent variable	211	211	184	184	44	44	262	262

Notes: ***Significant at 1% level; **significant at 5% level; *significant at 10% level. a. In (2) Dismissal^{+} interim coaches are not considered.
b. The z-value is shown in parenthesis.

Table 8

Robustness checks probit regression results.

Variables	(1) Dismissal		(2) Dismissal^{+}		(3) Quit		(4) All exits	
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Black (dummy)	0.359***	0.279**	0.306**	0.228*	-0.394**	-0.433**	0.244**	0.151
	(3.096)	(2.407)	(2.533)	(1.887)	(-1.96)	(-2.133)	(2.194)	(1.35)
Efficiency (0-1)	-1.701***		-1.670***		-0.690**		-1.776***	
	(-9.181)		(-8.608)		(-2.547)		(-10.076)	
Team winning percentage (0-1)		-2.950***		-3.056***		-1.098**		-9.665***
		(-8.792)		(-8.24)		(-2.274)		(-9.665)
Bad previous season (dummy)	0.148	-0.002	0.206	0.047	0.362**	0.315*	0.269**	0.128
	(1.148)	(-0.012)	(1.593)	(0.367)	(2.065)	(1.803)	(2.228)	(1.063)
Age	0.026	0.04	0.063	0.086	-0.274***	-0.273***	-0.08	-0.057
	(0.358)	(0.559)	(0.817)	(1.103)	(-2.909)	(-2.772)	(-1.178)	(-0.86)
Squared age	0.000	0.000	-0.001	-0.001	0.003***	0.003***	0.001	0.001
	(-0.191)	(-0.427)	(-0.728)	(-1.044)	(3.122)	(2.977)	(1.448)	(1.087)
NBA winner (dummy)	-1.238***	-1.067***	-1.153***	-0.984***	0.398*	0.457**	-0.544***	-0.360**
	(-4.778)	(-4.134)	(-4.551)	(-3.86)	(1.934)	(2.171)	(-3.103)	(-2.03)
Coaching experience	-0.002	0.042*	0.018	0.061**	-0.001	0.01	-0.003	0.039*
	(-0.085)	(1.716)	(0.71)	(2.455)	(-0.05)	(0.373)	(-0.121)	(1.864)
NBA player (dummy)	-0.145	-0.069	-0.1	-0.032	0.145	0.203	-0.09	0.007
	(-1.296)	(-0.62)	(-0.865)	(-0.276)	(0.873)	(1.213)	(-0.852)	(0.066)
Constant	-0.733	-0.623	-1.698	-1.713	5.025**	4.821**	1.925	1.891
	(-0.404)	(-0.346)	(-0.866)	(-0.876)	(2.075)	(1.998)	(1.127)	(1.117)
Pseudo-R^2	0.157	0.149	0.147	0.139	0.108	0.104	0.137	0.129
Log-L	-391.31	-395.181	-362.555	-365.819	-152.408	-153.119	-439.711	-443.511
N. of observations	809		776		809		809	
Number of 1 in dependent variable	211		184		44		262	

Notes: ***Significant at 1% level; **significant at 5% level; *significant at 10% level. a. In (2) Dismissal^{+} interim coaches are not considered.
b. The z-value is shown in parenthesis.

Still, the results of these robustness checks are similar to the ones from Table 6. The performance variables have the same coefficient signs, similar marginal effects, and the levels of significance are almost the same. Most importantly for our research question, the coefficients of the black dummy also have the same signs and similar significance levels.

5. Discussion

Professional sports leagues are often used as a laboratory to test general topics of interest in behavioral economics (Kahn, 2000). Namely, this paper investigates the influence of the race on the dismissals of NBA head coaches over 24 years. Moreover, this analysis follows recent contributions that analyze performance of sports coaches and turnover (Humphreys et al., 2016; van Ours & van Tuijl, 2016), and calculates an efficiency index of coaches using expectations from betting data. Thus, the results provide the literature on racial biases in competitive settings with a new dimension to examine the performance and efficiency of team leaders.

The main findings of this paper demonstrate the role of race in dismissal decisions. The probit results confirm that there is a significant relationship between the race of the coach and the probability of being fired. Specifically, a black head coach is 8.1% more likely (6.4% if excluding the interim coaches) to be fired than a white coach after controlling for several factors such as performance.

The result contrasts with the findings of Mixon and Treviño (2004), which show that black coaches have 9.6% less probabilities of being fired than white coaches (*ceteris paribus*) in college football. Moreover, our results also differ from previous studies that analyze efficiency and racial differences in NBA. Neither Fort et al. (2008) nor Kahn (2006) find significant differences in the probability of being fired between black and white head coaches in the NBA.

This paper mainly differs from the above-mentioned studies in the use of a larger data set and the approach to measure performance. This analysis includes two complementary measures, i.e., win rate and an efficiency index derived from betting odds, in line with Buraimo et al. (2017). While Fort et al. (2008) use players' statistics as inputs in a stochastic frontier model to calculate the efficiency of coaches, Kahn (2006) considers actual game results and controls by team payroll to calculate efficiency and builds hazard models. In our study, both performance measures are significant. Therefore, future papers that aim to analyze dismissals of coaches in sports teams should consider including not only measures of team performance such as win rates or average points per game, but also efficiency indices.

This paper uses the probabilities of obtaining victories from betting odds to calculate the efficiency of coaches and examine racial differences, which we consider informative in several ways. First, a weak form of efficiency characterizes this betting market, in which bookmakers are motivated to prevent loses and bettors want to make a profit. Moreover, the agents use all public information available, what

ensures the access to accurate expectations on team performance (Sauer, 1998). Second, the owners of teams use wins to create value to fans (Fort et al., 2008), so using expected outcomes from betting odds, which are close to the perceptions of the public opinion (Bowman, Ashman, and Lambrinos 2013), can help to assess the performance of coaches.

Finally, given the similarities between the remit of CEOs in corporations and head coaches in professional team sports, the use of a market-based measure of expected results is useful for the literature interested in team leaders' turnover. Humphreys et al. (2016) argue that these measures have the potential to assess the performance of leaders and avoid some of the biases that exist in the corporate setting. For example, CEOs that use the media to manage and influence the analysists' expectations and forecasts (Farrell & Whidbee, 2003). Moreover, the limited representation of black Americans in the highest ranks of top companies in other sectors makes professional sports leagues an important setting to examine racial disparities in the labor market.[20]

In this sense, we would not expect that the race significantly affects the contractual relationship between employees in influencing positions and clubs/corporations, mainly because of two reasons. On the one hand, the dismissals of team leaders' in any organization is a risky decision because, first, they do not ensure an improvement in performance as the new coach needs to adjust to the team (Frick et al., 2010); and second, they often have an implicit direct cost in form of large compensation payments (Tena & Forrest, 2007). On the other hand, following the idea of Szymanski (2000), high-competitive settings such as professional basketball, in which the performance of coaches and characteristics of players are highly visible, should lessen the influence of racial preferences. Still, we find that black Americans head coaches are more likely to be fired and less prone to quit than white Americans in similar positions.

Historical discrimination and negative stereotypes towards blacks are difficult to dismiss in any society after such a short period of time. Thus, previous contributions to the literature on this specific competitive setting that analyze the implications of the racial composition of NBA teams can help to explain this unexpected result. Kanazawa and Funk (2001) found evidence that fans tend to watch more local non-cable NBA games when the number of white players in the team rosters is higher. Similarly, Burdekin, Hossfeld, and Smith (2005) discovered that a match between the racial composition of teams and this of the market area increases home attendance, which led to the most skilled white players to areas with a larger white population during the 90s. These racial preferences might have been embedded in the American society and encourage some NBA team owners to fire black Americans head coaches when their efficiency is on the edge.

[20] For instance, the percentage of black CEOs in Fortune 500 companies is below 1% (White, 2017).

Beyond the significant influence of race on NBA head coaches' dismissals, the probit results demonstrate that the performance of teams and the efficiency relative to expectations of coaches are the most important determinants of dismissal in this sport setting. These papers show a significant influence of the win rate of head coaches on the probability of being fired. This is line with previous empirical findings in several contexts. Independently of the measures of performance, there is consensus in the literature since early contributions in different US corporate settings (e.g., Brickley, 2003), or professional sports leagues (e.g., Audas, Dobson, & Goddard, 1997).

Finally, the results support recent findings that confirm the significant influence of the performance of the team leaders relative to team expectations (also called "surprise" measures) on dismissals in college football (Holmes, 2011; Humphreys et al., 2016), European soccer leagues (Buraimo et al., 2017; van Ours & van Tuijl, 2016), or US firms (Engel, Hayes, & Wang, 2003). This study provides new evidence with a market-based measure (expected number of victories) to calculate the efficiency of coaches, which plays a significant role on turnover decisions in NBA. Future studies can explore other alternatives to account for performance relative to expectations.

The use of odds from the betting market to create the index of efficiency is a limitation to external validity, as other sports leagues with lower interest and media impact do not provide this information. Similar limitations are found in corporate finance studies that use the forecasts of firm performance as indicators of expectations (Farrell & Whidbee, 2003). Although the implications of discriminating in highly competitive and visible settings are more relevant from the economic perspective (larger salaries and compensations), minor sports leagues and small enterprises can report different insights on racial discrimination.

In line with this study, future research on performance and turnover in managerial positions by race can include other moderators such as the racial composition of teams, and especially the race of the star players, or geographical differences. Studies that analyze sports leagues with play-offs can further explore the influence of the results at this stage on dismissal decisions. For example, NBA is divided into two stages: regular-season and play-offs. Nonetheless, the performance of teams in the play-offs are not considered in our analysis. It is difficult to find objective variables that show the performance of teams in the play-offs due to the limited number of games. This setting increases the levels of uncertainty and multiply the importance of external factors such as injuries or sanctions that can influence the outcome. Thus, previous literature has omitted this analysis, and there is the notion that play-offs are not for science but for fan (Berri, 2013).

Still, subsequent papers can incorporate measures that account for racial differences in performance under pressure (play-offs). NBA playoffs are a best-of-seven elimination series, in which teams play home and away games with the pressure that generates the possibility of being eliminated from the

competition. These results can provide insights about leadership characteristics and behaviors of black and white managers in these situations, which is not possible in other settings due to the limited number of black leaders.

6. Conclusions

The main aim of the paper is to analyze whether black head coaches have to cope with discriminatory practices in a highly competitive labor setting such as the NBA, in which, moreover, the majority of players are black Americans. The analysis includes information from the seasons 1993-94 to 2016-17. A first difference in the labor conditions by race relates to the fact that the majority of black head coaches have a professional playing career in the NBA, while white head coaches do not.

To build on this finding and further examine the differences by race, several probit models were estimated. The results show that black head coaches are more likely to be fired than white head coaches, *ceteris paribus*. The analysis includes two measures of performance 1. an efficiency index based on expectation from betting odds; 2. team winning percentage, that shows the expected results. The better the performance of teams, the lower the probabilities of coaches of being fired. Other variables control for the influence of coach characteristics. The most interesting finding is that coaches that were successful before (NBA winners) are less likely to be dismissed and more prone to quit.

These findings contribute to extend the knowledge of team efficiency and racial differences in dismissals that first generated the works of Kahn (2006), and Fort et al. (2008). Moreover, this study incorporates the dimension of performance relative to expectations, which has been used in recent contributions on labor decisions and managerial positions (Humphreys et al., 2016; van Ours & van Tuijl, 2016).

References

Altonji, J. G., & Blank, R. M. (1999). Race and gender in the labor market. In O. Ashenfelter and D. Card (Eds.), *Handbook of Labor Economics, Vol. 3*. (pp. 3143–3259). Amsterdam: Elsevier.

Arrow, K. J. (1998). What has economics to say about racial discrimination? *Journal of Economic Perspectives, 12*(2), 91-100.

Audas, R., Dobson, S., & Goddard, J. (1997). Team performance and managerial change in the English Football League. *Economic Affairs, 17*(3), 30-36.

Audas, R., Dobson, S., & Goddard, J. (1999). Organizational performance and managerial turnover. *Managerial and Decision Economics, 20*(6), 305-318.

Bachan, R., Reilly, B., & Witt, R. (2008). The hazard of being an English football league manager: Empirical estimates for three recent league seasons. *Journal of the Operational Research Society, 59*(7), 884-891.

Becker, G. (1957). *The economics of discrimination*. Chicago: University of Chicago Press.

Berri, D. (2013, May 20). The playoffs are for fun, not science. *The Wages of Wins Journal*. Retrieved from: http://wagesofwins.com/2013/05/20/the-playoffs-are-for-fun-not-science/.

Bertrand, M., & Mullainathan, S. (2004). Are Emily and Greg more employable than Lakisha and Jamal? A field experiment on labor market discrimination. *American Economic Review, 94*(4), 991-1013.

Bowman, R. A., Ashman, T., & Lambrinos, J. (2013). Prospective measures of competitive balance: Application to money lines in major league baseball. *Applied Economics, 45*(29), 4071-4081.

Brickley, J. A. (2003). Empirical research on CEO turnover and firm-performance: A discussion. *Journal of Accounting and Economics, 36*(1), 227-233.

Buraimo, B., Bryson, A., & Simmons, R. (2017). *Time to go? Head coach quits and dismissals in professional football.* Working Paper No. 10600, Institute for the Study of Labor (IZA).

Burdekin, R. C., Hossfeld, R. T., & Smith, J. K. (2005). Are NBA fans becoming indifferent to race? Evidence from the 1990s. *Journal of Sports Economics, 6*(2), 144-159.

Charles, K. K., & Guryan, J. (2008). Prejudice and wages: An empirical assessment of Becker's The Economics of Discrimination. *Journal of Political Economy, 116*(5), 773-809.

Coates, D., Humphreys, B. R., & Zhou, L. (2014). Reference-dependent preferences, loss aversion, and live game attendance. *Economic Inquiry, 52*(3), 959-973.

del Corral, J., García-Unanue, J., & Herencia-Quintanar, F. (2016). Are NBA policies that promote long-term competitive balance effective? What is the price? *The Open Sports Sciences Journal*, *9*(1), 81-93.

del Corral, J., Maroto, A., & Gallardo, A. (2017). Are former professional athletes and native better coaches? Evidence from Spanish basketball. *Journal of Sports Economics, 18*(7), 698-719.

d'Addona, S., & Kind, A. (2014). Forced manager turnovers in English soccer leagues: A long-term perspective. *Journal of Sports Economics, 15*(2), 150-179.

Deruy, E. (2016, August 5). How black lives matter activists plan to fix schools. *The Atlantic*. Retrieved from: https://www.theatlantic.com/education/archive/2016/08/the-ambitious-education-plan-of-the-black-lives-matter-movement/494711/.

Dietl, H. M., Lang, M., & Werner, S. (2009). Social welfare in sports leagues with profit-maximizing and/or win-maximizing clubs. *Southern Economic Journal, 76*(2), 375-396.

Edelman, B., Luca, M., & Svirsky, D. (2017). Racial discrimination in the sharing economy: Evidence from a field experiment. *American Economic Journal: Applied Economics, 9*(2), 1-22.

Elaad, G., Jelnov, A., & Kantor, J. (2018). You do not have to succeed, just do not fail: When do soccer coaches get fired? *Managerial and Decision Economics, 39*(3), 269-274.

Engel, E., Hayes, R. M., & Wang, X. (2003). CEO turnover and properties of accounting information. *Journal of Accounting and Economics, 36*(1-3), 197-226.

Farrell, K. A., & Whidbee, D. A. (2003). Impact of firm performance expectations on CEO turnover and replacement decisions. *Journal of Accounting and Economics, 36*(1), 165-196.

Flores, R., Forrest, D., & Tena, J. D. (2012). Decision taking under pressure: Evidence on football manager dismissals in Argentina and their consequences. *European Journal of Operational Research, 222*(3), 653-662.

Foreman, J. J., Soebbing, B. P., & Seifried, C. S. (2018). The impact of deviance on head coach dismissals and implications of a personal conduct policy. *Sport Management Review. In press.*

Fort, R., Lee, Y. H., & Berri, D. (2008). Race, technical efficiency, and retention: The case of NBA coaches. *International Journal of Sport Finance, 3*(2), 84-97.

Franck, E., Verbeek, E., & Nüesch, S. (2010). Prediction accuracy of different market structures-bookmakers versus a betting exchange. *International Journal of Forecasting*, *26*(3), 448-459.

Frick, B., Barros, C. P., & Prinz, J. (2010). Analysing head coach dismissals in the German "Bundesliga" with a mixed logit approach. *European Journal of Operational Research, 200*(1), 151-159.

Goodall, A. H., Kahn, L. M., & Oswald, A. J. (2011). Why do leaders matter? A study of expert knowledge in a superstar setting. *Journal of Economic Behavior and Organization, 77*(3), 265-284.

Holmes, P. (2011). Win or go home: Why college football coaches get fired. *Journal of Sports Economics, 12*(2), 157-178.

Hoopshype (2016). *The salaries of NBA head coaches*. Retrieved from: http://hoopshype.com/2016/06/15/the-salaries-of-nba-head-coaches/.

Humphreys, B. R., Paul, R. J., & Weinbach, A. P. (2016). Performance expectations and the tenure of head coaches: Evidence from NCAA football. *Research in Economics, 70*(3), 482-492.

Idson, T. L., & Kahane, L. H. (2000). Team effects on compensation: An application to salary determination in the National Hockey League. *Economic Inquiry, 38*(2), 345-357.

Ibarra, H. (1995). Race, opportunity, and diversity of social circles in managerial networks. *Academy of Management Journal, 38*(3), 673-703.

Kahn, L. M. (2000). The sports business as a labor market laboratory. *Journal of Economic Perspectives, 14*(3), 75-94.

Kahn, L. M. (2006). Race, performance, pay, and retention among National Basketball Association head coaches. *Journal of Sports Economics, 7*(2), 119-149.

Kanazawa, M. T., & Funk, J. P. (2001). Racial discrimination in professional basketball: Evidence from Nielsen ratings. *Economic Inquiry, 39*(4), 599-608.

Kennedy, P. (2008). *A Guide to Econometrics. 6th. ed*. Malden, MA: Blackwell Publishing.

Kopkin, N. A. (2014). You're fired!: The impact of race on the firing of black head coaches in major college football. *The Review of Black Political Economy, 41*(4), 373-392.

Kulik, C. T., & Metz, I. (2017). Women at the top: Will more women in senior roles impact organizational outcomes? In Hitt, M. A., Jackson, S. E., Carmona, S., Bierman, L., Shalley, C. E., & Wright, M. (Eds). *The oxford handbook of strategy implementation*. Oxford: Oxford University Press.

LaFave, D., Nelson, R., & Doherty, M. (2018). Race and retention in a competitive labor market: The role of historically black colleges and universities in NCAA Basketball. *Journal of Sports Economics, 19*(3), 417-451.

Lapchick, R., & Balasundaram, B. (2017). *The 2017 racial and gender report card: National Basketball Association*. Official Report. Orlando, FL: The Institute for Diversity and Ethics in Sport. Retrieved from: http://www.tidesport.org/racial-and-gender-report-cards.html.

Levitt, S. D. (2004). Why are gambling markets organised so differently from financial markets? *The Economic Journal, 114*(495), 223-246.

Madden, J. F. (2004). Differences in the success of NFL coaches by race, 1990-2002: Evidence of last hire, first fire. *Journal of Sports Economics, 5*(1), 6-19.

Mixon, F. G., & Treviño, L. J. (2004). How race affects dismissals of college football coaches. *Journal of Labor Research, 25*(4), 645-656.

Pager, D., Bonikowski, B., & Western, B. (2009). Discrimination in a low-wage labor market: A field experiment. *American Sociological Review, 74*(5), 777-799.

Pawlowski, T. (2013). Testing the uncertainty of outcome hypothesis in European professional football: A stated preference approach. *Journal of Sports Economics, 14*(4), 341-367.

Paul, R. J., & Weinbach, A. P. (2009). Sportsbook behavior in the NCAA football betting market: Tests of the traditional and Levitt models of sportsbook behavior. *Journal of Prediction Markets, 3*(2), 21-37.

Pieper, J., Nüesch, S., & Franck, E. (2014). How performance expectations affect managerial change. *Schmalenbach Business Review,* 66(1), 5-23.

Riach, P. A., & Rich, J. (2002). Field experiments of discrimination in the market place. *The Economic Journal, 112*(483), 480-518.

Sauer, R. D. (1998). The economics of wagering markets. *Journal of Economic Literature, 36*(4), 2021-2064.

Silver, N. (2014, April 22). In the NBA it's not whether you win or lose, it's whether you beat Vegas. *FiveThirtyEight.* Retrieved from: https://fivethirtyeight.com/features/in-the-nba-its-not-whether-you-win-or-lose-its-whether-you-beat-vegas/.

Stern, H. (1991). On the probability of winning a football game. *The American Statistician, 45*(3), 179-183.

Szymanski, S. (2000). A market test for discrimination in the English professional soccer leagues. *Journal of Political Economy, 108*(3), 590-603.

Tena, J. D., & Forrest, D. (2007). Within-season dismissal of football coaches: Statistical analysis of causes and consequences. *European Journal of Operational Research, 181*(1), 362-373.

van Ours, J. C., & van Tuijl, M. A. (2016). In-season head-coach dismissals and the performance of professional football teams. *Economic Inquiry, 54*(1), 591-604.

Waggoner, B., Wines, D., Soebbing, B. P., Seifried, C. S., & Martinez, J. M. (2014). "Hot hand" in the National Basketball Association point spread betting market: A 34-year analysis. *International Journal of Financial Studies*, *2*(4), 359-370.

Wangrow, D. B., Schepker, D. J., & Barker III, V. L. (2018). Power, performance, and expectations in the dismissal of NBA coaches: A survival analysis study. *Sport Management Review, 21*(4), 333-346.

White, G. B. (2017, October 26). There are currently 4 black CEOs in the Fortune 500. *The Atlantic*. Retrieved from: https://www.theatlantic.com/business/archive/2017/10/black-ceos-fortune-500/543960/.

Wolfers, J. (2006). Point shaving: Corruption in NCAA basketball. *American Economic Review, 96*(2), 279-283.

Wolfers, J., & Zitzewitz, E. (2006). *Interpreting prediction market prices as probabilities* (No. w12200). National Bureau of Economic Research.

Appendix 1

This appendix explains in detail the calculations that are necessary to build the measure of efficiency as in del Corral et al. (2017). We use the specific example of Los Angeles Lakers during the season 2013-2014:

1. The efficiency measure uses information from density functions, which are calculated using the probabilities of the two possible outcomes (win or loss) of each individual team extracted from betting odds. See below the example for the first three games:

Game 1	Game 2	Game 3
LA Lakers (H) win: 0.19	GS Warriors (H) win: 0.87	LA Lakers (H) win: 0.26
LA Clippers (A) win: 0.81	LA Lakers (A) win: 0.13	SA Spurs (A) win: 0.74

2. By multiplying the probabilities of the two possible outcomes in Games 1 and 2, we obtain the probabilities that LA Lakers achieve a given number of victories (0, 1, or 2):

Possibilities of wins (2 games)	Probability
0 wins (1. loss - 2. loss)	0.81 * 0.87 = 0.70
1 win (1. win - 2. loss)	0.19 * 0.87 = 0.17
1 win (1. loss - 2. win)	0.81 * 0.13 = 0.11
2 wins (1. win - 2. win)	0.19 * 0.13 = 0.02

Number of wins (2 games)	Final probability
0 wins	0.70
1 win	0.28
2 wins	0.02

3. In order to calculate the probabilities of a given number of victories after three games, the final probabilities of wins (2) are multiplied by the probabilities of outcome in Game 3 and, then, added[21].

Possibilities of wins (3 games)	Probability
0 wins (1. loss - 2. loss -3. loss)	0.70 * 0.74 = 0.52
1 win (1. win - 2. loss -3. loss)	0.17 * 0.74 = 0.12
1 win (1. loss - 2. win -3. loss)	0.11 * 0.74 = 0.08
1 win (1. loss - 2. loss -3. win)	0.70 * 0.26 = 0.18
2 wins …	…
3 wins …	…

Number of wins (3 games)	Final probability
0 wins	0.52
1 win	0.38
2 wins	0.09
3 wins	0.01

4. Figure A1 charts the probabilities of the number of victories of LA Lakers after 3 games (1) and the end of the season (2).

[21] Please, note that the final probabilities might have small variations due to the decimals.

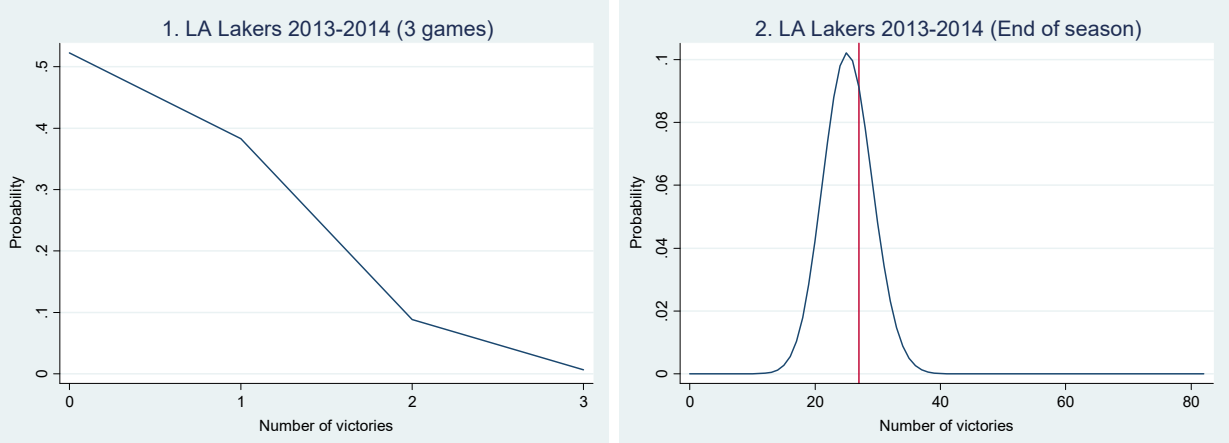

Fig. A1. Probabilities of win LA Lakers 2013-2014: 3 games (1) and end of season (2).

5. Finally, we calculate the inverse of the probabilities of achieving more victories than the actual ones (red line) at the end of the season and subtract it from one:

- expected victories = 25
- actual victories (red line) = 27
- efficiency index [1 - the sum of the probabilities of achieving 28 to 82 victories] = 0.72.

Appendix 2

Table A1

Coaches, race and number of games.

Coach	*Race*	*Games*	*Coach*	*Race*	*Games*	*Coach*	*Race*	*Games*
Rick Adelman	White	1,428	Jeff Bzdelik	White	192	Mike Dunlap	White	82
Richie Adubato	White	33	John Calipari	White	184	Mike Dunleavy	White	1,083
Danny Ainge	White	226	Kaleb Canales	White	23	Mike Evans	Black	56
Kenny Atkinson	White	82	PJ Carlesimo	White	554	Derek Fisher	Black	136
Randy Ayers	Black	52	Rick Carlisle	White	1,214	Bill Fitch	White	328
Tony Barone	White	52	Michael L. Carr	Black	164	Cotton Fitzsimmons	White	57
Tom Barrise	White	2	John Carroll	White	36	David Fizdale	Black	82
Butch Beard	Black	164	Butch Carter	Black	165	Tim Floyd	White	321
Bill Berry	Black	2	Fred Carter	Black	82	Chris Ford	White	453
Bill Bertka	White	2	Bill Cartwright	Black	151	Lawrence Frank	White	614
Bernie Bickerstaff	Black	527	Don Casey	White	112	Mike Fratello	White	638
JB Bickerstaff	Black	71	Dwane Casey	Black	598	Alvin Gentry	Black	869
Larry Bird	White	214	Don Chaney	Black	348	Frank Hamblen	White	39
Bill Blair	White	102	Maurice Cheeks	Black	620	Leonard Hamilton	Black	82
David Blatt	White	123	Jim Cleamons	Black	98	Bill Hanzlik	White	82
James Borrego	White	30	Steve Clifford	White	328	Del Harris	White	340
Jeff Bower	White	73	Doug Collins	White	603	Gar Heard	Black	44
Jim Boylan	White	106	Michael Cooper	Black	14	Bob Hill	White	316
Allan Bristow	White	246	Tyrone Corbin	Black	286	Brian Hill	White	613
Scott Brooks	White	627	Dave Cowens	White	284	Fred Hoiberg	White	164
Jim Brovelli	White	18	Michael Curry	Black	82	Lionel Hollins	Black	534
Brett Brown	White	328	Chuck Daly	White	214	Jeff Hornacek	White	295
Hubie Brown	White	168	Mike D'Antoni	White	963	Kim Hughes	White	33
Larry Brown	White	1,226	Johnny Davis	Black	219	Melvin Hunt	Black	23
Mike Brown	Black	563	Vinny del Negro	White	394	Lindsey Hunter	Black	41
Tony Brown	Black	45	Tony Dileo	White	59	Marc Iavaroni	White	123
Quinn Buckner	Black	82	Billy Donovan	White	164	George Irvine	White	106
M. Budenholzer	White	328	Larry Drew	Black	312	Dan Issel	White	306

Mark Jackson	Black	230	Mike Montgomery	White	164	Ed Tapscott	Black	71
Phil Jackson	White	1,312	Dick Motta	White	233	Reggie Theus	White	106
Stu Jackson	Black	39	Eric Musselman	White	246	Tom Thibodeau	White	476
Chris Jent	White	18	Pete Myers	Black	3	Isiah Thomas	Black	410
David Joerger	White	328	Kenny Natt	Black	58	Jim Todd	White	37
Avery Johnson	Black	440	Don Nelson	White	1,104	Rudy Tomjanovich	White	831
Dennis Johnson	Black	24	Jim O'brien	White	630	Jay Triano	White	229
Frank Johnson	Black	134	Kevin O'neill	White	82	Wes Unseld	Black	82
Magic Johnson	Black	16	Randy Pfund	White	64	Jeff van Gundy	White	748
Eddie Jordan	Black	600	Rick Pitino	White	248	Stan van Gundy	White	825
George Karl	White	1,580	Greg Popovich	White	1,656	Kiki Vandeweghe	White	64
Steve Kerr	White	246	Terry Porter	Black	215	Jacque Vaughn	Black	216
Jason Kidd	Black	328	Kevin Pritchard	White	27	Sam Vincent	Black	82
Lon Kruger	White	191	Kurt Rambis	White	230	Frank Vogel	White	513
Larry Krystkowiak	White	100	Pat Riley	White	1,013	Darrell Walker	Black	169
John Kuester	White	164	Doc Rivers	Black	1,388	Luke Walton	White	82
Bob Lanier	Black	37	Flip Saunders	White	1,246	Earl Watson	Black	115
Gene Littles	Black	16	Byron Scott	Black	1,101	Bob Weiss	White	112
Kevin Loughery	White	128	Brian Shaw	Black	141	Paul Westphal	White	515
Sidney Lowe	Black	254	Paul Silas	Black	629	Lenny Wilkens	Black	869
John Loyer	White	32	Scott Skiles	White	958	Herb Williams	Black	44
John Lucas	Black	370	Jerry Sloan	White	1,416	Monty Williams	Black	394
Tyronn Lue	Black	123	Keith Smart	Black	263	Brian Winters	White	184
Jim Lynam	White	210	Quin Snyder	White	246	Randy Wittman	White	684
Nate Macmillan	Black	1,012	Erik Spoelstra	White	722	Mike Woodson	Black	680
Brendan Malone	White	100	Garry St Jean	White	368			
Michael Malone	White	270	Bob Staak	White	1			
Kevin Mchale	White	417	Brad Stevens	White	328			
Sam Mitchell	Black	427	Terry Stotts	White	693			