"White Men Can't Jump," But Would You Bet On It?*

Deniz Igan† Marcelo Pinheiro‡ John Smith§

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****Comments Welcome****

Abstract

We identify an otherwise efficient market in which racial stereotypes affect market outcomes. In this market, there are well-defined prices, well-defined outcomes, a finite time horizon, and readily available information. The market appears to efficiently process the available information, with the exception of the race of the participants. We examine data on point spreads for NBA games over the 15 seasons from 1993-94 to 2007-08. We find evidence that the racial composition of the team is related to the size of the spread and their performance against the spread. Specifically, we find that a more black team tends to face a larger point spread and that these teams perform worse against the spread. It is possible that this effect is driven by the bookmakers setting a biased point spread or driven by excessive betting on the more black team. Using a different data set containing the movement of the spread, we do not find a relationship between the movement of the spread and the racial composition of the team. As a result, we favor the explanation that the bookmakers set a biased point spread.

Keywords: Stereotypes, Point spread, Market efficiency

JEL Classification: D03, G00, J15

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†International Monetary Fund, Research Department, 700 19th St, NW, Washington, DC 20431. Phone: 202-623-4743. Fax: 202-623-4740. E-mail: digan@imf.org.

‡George Mason University, School of Management, Email: marcelo@alumni.princeton.edu.

§Rutgers University-Camden, Department of Economics, Email: smithj@camden.rutgers.edu.

"Billy, listen to me, white men can't jump."

Sydney Deane

1 Introduction

Some of the most deeply held ideas about race and racial difference are expressed in our beliefs about sports and athletic ability, creating one of the most well-known stereotypes: the natural black athlete, and especially, the black basketball star. The common perception that black people are better at basketball than people of other races and/or ethnicities is so evident that "the black game" was coined as a phrase to refer to the sport (see, for instance, George, 1992, and Freeman, 2010). What makes it so difficult to counter the argument that blacks have an innate ability to play basketball is that there appears to be evidence to support it, especially on the playing field, based on casual observations such as the fact that only a fifth of National Basketball Association (NBA) players are white. As a result, the idea that blacks are better basketball players and the evidence that seemingly supports this idea can have far-reaching consequences affecting observed behavior. For instance, a self-reinforcing loop may emerge where black youngsters get encouraged by media images while the whites get discouraged to play the game creating a discrepancy in athletic participation (Hall, 2002; Ogden, 2004). For economists, a more interesting question arises when these observations become unwavering, subconscious attitudes that athletic ability is inextricably tied to race and these attitudes affect economic decision making in a predictable manner challenging the rationality tenet in its standard form.

This paper provides evidence that stereotypes have an impact on financial decisions by examining how the point spread and the performance against the spread in NBA betting markets vary with the racial composition of the teams. We ask whether the belief that black players are better than their white counterparts leads to a nudge in the point spread affecting the winning margin and the probability of beating the spread. In other words, do more black basketball teams look better than less black teams in the sense that, all things equal, bettors are more inclined to bet on the former? If this is the case, and bookmakers are aware of this bias, the spread on a "more black" team will be higher than it should be leading to a negative relationship between the fraction of black players and the performance against the spread.

We examine the outcomes of NBA games through the 1993-94 season to the 2007-08 season against the point spreads on these games in Las Vegas. We find that the point spreads are set higher for teams with a relatively higher fraction of black players (measured by the difference between the number of black players starting the game in the home and visiting teams). Consequently, the probability of beating the spread decreases as the fraction of black players increases. The results remain unaltered when the minutes played by black players and the racial discrepancy between the two teams based on full rosters are employed as alternative measures.

As an illustration of these findings, take two teams that are exactly as good as each other so that each team wins with a probability of exactly 0.5. But one team is "more black" than the other. Therefore, some people will have a bias that the black team is better and deem the probability of this team winning to be greater than 0.5, even though "the truth" is 0.5. To exploit this bias, rather than setting the spread as a "pick-em" (spread of 0), the bookmaker sets the spread in favor of the black team at a value different than 0. This means that (all things equal) the black team will cover the spread with a probability less than 0.5, making this a worse bet because of the bias induced by stereotypes. This reasoning still holds when the teams are not as good as each other. In that case, there is a "true spread" which each team will cover with probability 0.5. But the bookmakers do not set the spread at the true spread but rather the true spread minus a few points for the black team. Again, the black team covers with probability less than 0.5.

One important assumption in interpreting the finding that it is less likely for black teams to beat the spread concerns the efficiency of NBA betting markets. In other words, it is implicitly assumed that the bookmakers set the spread so that it incorporates all relevant and available information for the game outcome. We confirm that this is indeed the case with the spread being distributed normally around a mean of zero. Hence, unconditionally, any game has equal probability of ending up with a score on either side of the spread.

An alternative explanation could be that the beliefs are simply wrong: black teams are actually, on average, worse than white teams. Yet, performance measures for black and white teams are not different in a statistically significant way. Actually, white players tend to be taller and more efficient in the sense that they score almost the same points as black players despite playing less minutes, but there is no significant difference in terms of scoring ability between black players and their white counterparts. Hence, this explanation is unlikely to be driving our results.

In order to pin down the mechanism which could explain the relationship between race and performance against the spread, we use a second data set containing the fraction of money bet on each team, in addition to the opening and closing lines, for the 2003-04 through 2007-08 seasons. As a result, we can investigate the question of whether it is the bettors pushing the spread towards the black team or the bookmakers, already aware of the bias, setting the initial spread towards the black team. The results show that the opening line does not move *at all* a quarter of the time and the difference between the closing and opening lines is normally distributed around zero. Moreover, the moving of the line is not related to the racial composition of the teams in a statistically significant and robust manner. Hence, it appears to be the case that the bookmakers know of the bias towards more black teams and take that into account when they set the spread rather than the bets pushing the initially-unbiased line (set at the true spread) to the final line that reflects the uneven-ness in the money placed on both sides of the spread.

Stereotypes are a product of mental categorizing and are deemed to be inevitable by many psychologists and sociologists. Our results imply that stereotypes can influence behavior in financial settings. Hence, we contribute to the literature by providing evidence that economic decision making is altered by conscious or subconscious categorization based on observable characteristics, e.g. race and gender. Such biases appear more likely to stem from information-based motives than from taste-based motives. Because the bookmakers seem to incorporate these biases into prices and there is no reason to expect these particular agents to be of a different racial composition than the others. Also, if one presumes that bettors from a particular city would be more inclined to bet on the team based in their city and bettor racial profile resembles the demographics of the region, preference-based explanations would imply a negative relationship between the "black cities" and the probability of the more black home teams betting the odds. We do not, however, find any statistically significant relationship in that dimension.

The rest of the paper is organized as follows. Section 2 summarizes the main findings of the studies looking at sports betting markets and racial issues in sports in the context of our study. Section 3 gives the details on the data. Section 4 presents the results. Section 5 concludes.

2 Background

Our paper relates primarily to two distinct strands of literature. The first such strand examines the efficiency in sports betting markets. Sports betting markets form an attractive test of market efficiency in general because unlike most financial markets, the sports betting markets contain well-defined prices, well-defined outcomes and a finite time horizon. Therefore, the findings related to the efficiency of the sports betting markets are of interest to economists to test market efficiency hypotheses in general. Similar to findings in financial markets, several studies have found inefficiencies in the sports betting market.[1] Several studies have found that bettors erroneously place bets for sentimental reasons (Avery and Chevalier, 1999; Braun and Kvasnicka, 2008; Forrest and Simmons, 2008) on teams which are deemed *hot* (Brown and Sauer, 1993; Camerer, 1989) and on teams which are favorites (Golec and Tamarkin, 1991; Grey and Grey, 1997). Levitt (2004) finds, using data on the wagers placed by bettors as part of a handicapping contest offered at an online sports book during the 2001-02 NFL season, that the money on both sides of the bet is not even and that the uneven-ness is predictable. Levitt finds that the casinos nudge the spread in order to exploit common biases: people like favorites and people do not sufficiently account for the home

[1] See Sauer (1998) for an overview.

field advantage.[2] Therefore, a home underdog is a "better bet" than a road favorite. Paul and Weinbach (2010) confirm this evidence using the percentage of bets actually placed on NFL games. Our analysis shows that the bets on NBA are also distorted by racial stereotypes.

The second strand of related literature involves the effect of race on outcomes in sports. Again, this literature is significant beyond the sports context because it involves decisions which exhibit large incentives for success or accuracy and that outcomes can be objectively measured. Price and Wolfers (forthcoming) show that more personal fouls are awarded against players when they are officiated by an opposite-race refereeing crew than when officiated by an own-race crew. Relatedly, Parsons, Sulaeman, Yates and Hamermesh (2011) find that the likelihood of a called strike in baseball is related to the agreement of the pitcher's and umpire's race. Although these judgments are made by well-trained and experienced professionals, they are also made under great duress and must be made almost instantaneously. Therefore, it is possible that these judgments, while obviously of great significance, would be attenuated if they were made under different circumstances. By contrast, the judgments which comprise the data which we provide are made by individuals who have the opportunity to reflect on the merits of their decision. Hence, our findings imply that racial stereotypes may affect decisions which are made under an extended period of deliberation.

There is also a literature involving an experimental investigation of the effects of stereotypes on judgments in sports.[3] Of particular relevance, Stone, Perry and Darley (1997) directed subjects to listen to an audio clip of a basketball game after viewing a picture of the player whom they were instructed to judge. The subjects who were shown a picture of a black player rated the performance as better than those subjects who were shown picture of a white player. While existing experiments are suggestive of biases in judgments involving race and athletic performance, since the accuracy of these judgments are not related to the material incentives of the subjects, these results cannot be taken at face value to draw further inferences regarding economic behavior. This also highlights the advantage of our paper because the judgment of whether to bet on a team based on its racial makeup is indeed related to a person's material incentives. In other words, even if economic agents hold the belief that "white men can't jump," they may be hesitant to act on this belief or it could be that acting on this belief may not pay off since it can be exploited by the bookmaker who sets the betting odds in favor of the less black team.

It should be noted from the start that our paper does not deal with discrimination per se. Actually, the phenomenon we study is a product of "positive stereotypes" and can be more accurately viewed as "reverse discrimination" since the group that is deemed to be superior faces odds that are harder to overcome. In other words, the belief that black basketball players are better creates

[2] Also see Kuypers (2000).

[3] For more on the stereotype of the athletic black man, see Biernat and Manis (1994), Sailes (1996), and Stone et. al. (1999).

a bias for betting for the more black team and, as the bookmakers take advantage of this bias, it becomes harder for the black team to beat the spread.[4] Still, one could think of this phenomenon in terms of the main theories of discrimination in the microeconomics literature. In the first of these theories, differential behavior towards a certain group of individuals is driven by the preference for not interacting with them (Becker, 1957; Arrow, 1973). In other words, individuals have a "taste" for their own kind or distaste for the other kind. In the second theory, agents take race to be a signal for unobserved or costly information about skill levels and mistaken beliefs can survive if they create self-fulfilling outcomes (Phelps, 1972). In our context, information-based explanations would be more relevant if bets reflected the prior belief that blacks are better at basketball while the findings would fit the taste-based explanations if white bettors bet against more black teams.[5]

To the best of our knowledge, the only other paper that comes close to the issues we have at hand and addresses the implications of racial biases in the NBA betting markets is Larsen, Price, and Wolfers (2008). These authors find that the racial composition of the referees interacts with the racial composition of the teams in a way which could predictably beat the spread. Specifically, the authors show that there is a negative relationship between the racial composition of referee crews and fouls called on players of the dominant race within that particular referee crew.[6] This effect is significant enough so that, given information about the race of the referees and the relative racial composition of the teams, one could improve their chances of winning. By contrast, we focus exclusively on the relationship between racial composition of the teams and success against the point spread. In addition, we take a step further by analyzing the opening and closing lines to show that the bookmakers probably know about the bias suggesting that the phenomenon is more likely to be driven by information-based motivations than by taste-based explanations. To put it more precisely, we provide evidence that the bettors may be taking the racial composition of teams as a signal to guide their betting decisions, but the bookmakers incorporate all relevant information that may not be reflected in the racial discrepancy between the teams and set the spread so that they can exploit the information-based bias of the bettors.

3 Data

Sports betting markets provide an almost ideal setting to test predictions of financial economic theory. These are simple financial markets but the advantage over other financial markets is that

[4] Cheryan and Bodenhausen (2000) provide evidence that stereotypes can lead to such a "choking effect" by looking at the performance of Asian-American women in math tests.

[5] Unfortunately, we do not have information on the race of the individual bettors but we use the demographic characteristics of the city that hosts the team to indirectly address this issue.

[6] Note that the race of the referee who actually called the foul is not available. The referee data only contains the racial composition of the crew and the race of the player and the racial composition of the team called for the foul.

the outcomes are realized within a short time frame, are observable by all market participants, and are unambiguous (no measurement error or uncertainty about the horizon over which outcomes should be measured). Also, these markets are less likely to have uninformed traders as the coverage of past performance and current information on starting line-ups, players' health, etc. are publicly accessible and often are free of charge.

Our dataset combines box score information on all regular season NBA games played from the 1993-94 season to the 2007-08 season. We exclude the playoff games since the outcomes for these tend to be rather path-dependent not only across games in the same series but also through rounds accentuating the survivorship bias in the sense that the number of observations a player or team appears in the final dataset would closely depend on their past performance. The box score information is obtained at the player-game level from www.basketball-reference.com, which also keeps track of draft picks and other background information, such as the height and weight, on players. The ultimate team-game level dataset is constructed based on these player-by-player observations.

One crucial variable, however, for our analysis that is missing from the www.basketball-reference.com website is the race of the players. In some cases (mostly for players that are still active), a picture of the player accompanies the statistics but this happens only at a small fraction of the overall player universe during our sample period. Hence, we conduct an extensive search to obtain information on the race of the players, navigating www.nba.com, www.hoopedia.nba.com, www.draftreview.com, and Google images search. This information enables us to characterize the racial composition of each team at a point in time. Admittedly, we use a rather coarse definition of race simply assigning players (and coaches) into two broad categories of black and white, where white includes Caucasians, Asians, and Latinos, relying on visual inspection alone. Yet, we use several measures to ensure robustness of the results to a variable as subjective as a player's race and also double-check our classification of racial composition against other studies. For instance, discrepancy between the race variable used in Price and Wolfers (forthcoming) and that used in our analysis exists for a mere 31 out of 1128 matched players across the two datasets, corresponding to only 2.5 percent of more than quarter of a million player-game observations.

The data for the betting lines come from www.goldsheet.com. We check the accuracy of the betting lines from this source against other sources commonly-used in the academic studies of sports betting, such as www.covers.com, and find no significant discrepancies. Actually, information on the ultimate outcomes of the games tends to be more accurate in www.goldsheet.com than it is in www.covers.com: of the 41 cases when a discrepancy between the two sources exists, the cross-check with www.espn.com confirms that the former has the correct information 80 percent of the time. We complement this information point spreads and closing lines with information on the opening lines and percent bets placed on each team.[7]

Betting on NBA basketball generally involves a point spread for a fixed dollar value wager ($11), where the bet wins if a team wins the game by a certain number of points. To illustrate, the Los Angeles Lakers visited the Washington Wizards on February 3, 2008. The spread was 3.5 for the home team, putting the Lakers as a road favorite and the Wizards as a home underdog. A bet on the Wizards would win if they won the game or lost by 3 points or less, giving back the bettor $21. In this setting, the point spread is a market-based estimate of the actual margin at the end of the game.[8]

A total of 18,450 regular-season games were played during the sample period. After excluding the games where there is missing data in terms of box score statistics and racial composition, which leaves us with 17,211 games and those with no betting information and where the betting outcome was a push leading to cancellation of all bets (which happens around 1.3 percent of the time), we end up with 16,402 games in the sample. Before we move on to the formal analysis, we present some descriptive statistics of this final dataset.

Of the 1021 players who were active in the NBA during our sample period, 71.8 percent are black. Black players are even more over-represented in the starting line-up of the teams: only one out of five starters is white. In a typical game, each team employs 9 to 11 players, 8 of which are, on average, black players. As a result, at the player-game level, 76.7 percent of the observations are identified as being associated with a black player. These statistics confirm the casual observations on the dominance of black players in the NBA, not only by sheer number but also by the visibility they get by playing more minutes in more games.

Tables 1a, 1b, and 2 give a summary of the data used in our analysis at the player-game and team-game levels, respectively. At the player-game level, there are some statistically significant differences between black and white players but it is not always the case that black players have "more desirable qualities" and the magnitudes of these differences are not very meaningful. For instance, while black players score two points more than their white counterparts on average, they are as efficient as demonstrated by their lower field goal percentages. These statistics are not altered drastically when the raw statistics are adjusted for playing time (Table 1b). According to these metrics, black players overall do not appear to be much better than their white peers. If one assumes that the team is a sum or reflection of the skill levels of individual players, there seems to be no obvious reason to deem more black teams to be of better quality.

At the team-game level, the level at which we conduct the empirical analysis, we summarize the information on betting spreads and the racial composition of the teams. Racial composition is

[7] These data are available, at a fee, from www.sportsbetting.com.

[8] The Lakers won the game scoring 103 points against the Wizards' 91, and hence, beat the spread.

measured by three alternative variables: number of black starters, number of black players in the team roster regardless of whether they actually play in a game, and the sum of minutes played by black players. To avoid duplication, all variables are expressed from the home team's perspective. Simple statistics point to a slight advantage for the home team as they win the game 60 percent of the time by an average margin of around 4 points and beat the spread 55 percent of the time by an average of 2 points. This, however, is against bets placing the home team as the favorite 70 percent of the time. A home favorite wins the game 72 percent of the time while a home underdog can do that only 34 percent of the time. Point spreads seem to take this into account at least partially: a home favorite beats the spread 59 percent of the time and a home underdog beats it 48 percent of the time.

4 Analysis

4.1 Accuracy of point spreads and the link between race and winning probability

In order to demonstrate the relationship between performance against the spread and the racial makeup of the teams, we estimate the following regression:

$$P(\text{home team beats the spread})_{it} = \alpha + \beta \Delta black_{it} + \gamma X_h + \varphi Y_s + \phi(X_h * Y_s) + \varepsilon_{it}$$

where the the dependent variable is a dummy variable that takes on the value 1 if the home team beats the spread on game i played at date t and 0 otherwise, $\Delta black_{it}$ is the difference between the "blackness" of the home team and the visiting team, X_h and Y_s are (home) team and season (during which date t is included) fixed effects, respectively. Blackness of a team is measured by various variables (number of black starters, number of black players in the team roster, and the sum of minutes played by black players) to ensure robustness.

Thus, our empirical approach rests on a baseline specification where the probability that the home team beats the spread is a function of the racial composition of the team relative to its opponent. This relies on two assumptions and, before moving on to presenting the analysis, we confirm that these assumptions hold.

The first assumption is that basketball betting markets are efficient. More precisely, any observable information should be reflected in the spread. So, we start our analysis by looking at the accuracy of point spreads in forecasting the game outcome. Figure 1 shows the distribution of "forecast errors," defined as the actual margin (or realized spread) minus the point spread on a game. Indeed, the errors closely resemble a normal distribution with zero mean. Figure 2 formally verifies this statement by plotting the quintiles of the forecast error against the quintiles from a normal distribution.[9] Basketball betting markets are, in general, efficient in the sense that the distribution of the difference between the winning margin and the point spread is not distinguishable from a normal distribution. In line with this, when plotted against the realized winning margins, one can see that the point spread is pretty accurate forecast of the actual game outcomes (Figure 3)

The second assumption is that the probability of winning a game does not increase with the differences in racial composition towards blackness. Table 3 presents the results of a regression analysis where the more black team in a match-up is shown not to have a systematically higher probability of winning a game. In fact, we find a negative relationship between the blackness of the team and winning.

With the two assumption verified, we now proceed to the regression analysis of the point spread and actual game outcomes.

4.2 Race and point spreads

Table 4 presents the main findings of our analysis. Roughly, it demonstrates that a more black team tends to face a higher spread, and that the team exhibits worse performance against the spread. Note that in each regression, team fixed effects and season fixed effects were employed.

In the upper panel, the dependent variable is the spread faced by the home team. According to our three measures of the racial differences between the teams, we see that there is a positive relationship between the spread and these measures. In the middle panel, the dependent variable is the realized margin minus the spread. In other words, what was the winning margin of the home team minus the spread. According to our three measures of the racial differences between the teams, we see that there is a negative relationship between the blackness of the team and the realized margin minus spread. In the lower panel, the dependent variable is the probability of beating the spread. Again, according to the three measures of the racial differences between the teams, we find a negative relationship between the blackness of the team and the probability that they cover the spread. To summarize, we find evidence that a more black team tends to face a larger point spread and that these teams perform worse against the spread.

A natural question is then, what is causing the relationship between the racial composition of the teams and the performance against the spread. There are two possibilities. First, bookmakers are aware of the bias of bettors and they set the spread in such a way to exploit the bias of bettors,

[9] Kolmogorov-Smirnov equality-of-distributions test as well as skewness and kurtosis test for normality further verify that forecast errors are normally distributed. Results of these tests are available from the authors upon request.

ala Levitt (2004). Second, the bookmakers are unaware of the bias of bettors and set the spread to be the expected final score of the game. The relationship found above is caused by bettors who systematically bet on the more black team, thus moving the spread. Therefore, we investigate whether there is a relationship between the movement of the spread and the racial composition of the teams. Figure 4 demonstrates that the movement of the spread is normally distributed with a mean of zero.

Table 5 presents the results of our regressions involving the movement of the spread. In our first specification, in which we do not account for team-specific, season-specific, or team-season interaction, we find a significant relationship between race and the movement of the spread. However, for the three specifications in which we do account for these effects, we do not find a significant relationship between the race of the teams and movement of the spread. As a result of these regressions, we favor the explanation that bookmakers are aware of the bias of bettors and set the spread to exploit this bias.

How robust are our results? We perform two sets of robustness checks: controlling for the race of the referees and controlling for the racial composition of the location of the home team. First, it is possible that our results no longer hold when one accounts for the race of the referee crew. For instance, Larsen et. al. (2008) finds that the racial composition of the referee crew interacts with the racial composition of the teams. Specifically, the authors find that teams can become disadvantaged when the racial composition of the referee crew differs from the racial composition of the team. We perform a series of probits with the dependent variable as the probability of beating the spread, however we restrict attention to for the following categories: an all white crew, a crew with at least one black referee, a crew with at least one white referee, and an all black crew. Table 6a presents the results of the probits. Even when accounting for the racial composition of the referee crew, our results remain significant in each case with the exception of an all black crew. Also note that an all black crew is an extremely rare occurrence as it accounts for only 152 games out of 16186 in our sample.

Perhaps the biases found above are related to the racial composition of the bettor or the racial composition of the location of the basketball team. While we cannot account for the race of the bettors, we can control for the racial composition of the location of the teams. Therefore, to the extent that a person living in the location of the team is more likely to bet on the team, we can test whether our results are driven by the characteristics of the populations of the location of the teams. We run a series of probits with probability of beating the spread as the dependent variable. We include the difference in black starters as a independent variable, while accounting for the racial composition of the location of the teams. In particular we account for the difference in the proportion of blacks in the city and difference in the proportion of blacks in the state. In

Table 6b we present the results of these probits. In each of the four specifications, the difference in black starters remains significant, and none of the terms accounting for the racial composition of the location are significant. As a result, we do not find evidence that the racial composition of the locations are related to the bias found above.

Finally, we examine the outcome of a simple betting strategy using data from the 2007-08 season. We employ the strategy of only betting on the home team when it has 1, 2, 3, or 4 more white players than the visiting team. Table 7 presents the summary of the results of the strategy. As a result of this simple betting strategy, we observe the probability of a winning bet to be as high as 77.8%.

5 Conclusion

This paper looks at the impact of the positive stereotype of the black basketball star on financial decisions using evidence from sports betting markets. In summary, the analysis presented here demonstrates the existence of a bias in NBA betting markets based on race and suggests that this bias is exploited by the bookmakers. This finding can be explained by bettors taking race as a signal of skill level in deciding on which team to bet but bookmakers, having more at stake, gathering more information on skill levels and setting the point spreads higher for more black teams to take advantage of the bias towards them. An interesting implication of the findings is that stereotypes may affect even well-thought financial decisions.

What do these findings mean for basketball markets in general and for other economic markets? There are various inferences that can be drawn from these findings. Most straightforwardly, if the basketball betting market harbors overestimation of skill conditional on race, does this also apply to coaches and scouts or other basketball experts? Or, do presumptions about intellectual or athletic ability based on stereotypes increase or decrease the odds of success for certain groups in certain fields? Another, perhaps a socially and politically uncomfortable question which may arise from this analysis is, if people are prone to making suboptimal sports betting decisions due to racial stereotypes, do people make similar costly judgment errors in other economic decisions? For instance, do employers hire engineers with a background from a particular region presuming that they have an innate ability for quantitative tasks? Or, is provision of health, education, and other social services affected by subconscious attitudes towards some groups? These and other interesting questions are left for further research.

In order to demonstrate the complex nature of the effects of race and racial attitudes in professional basketball, consider that our paper provides evidence that a team which is more white is perceived to be worse at basketball. And presumably spectators go to games or watch basketball on television in order to see "good basketball". Given these two conjectures, one would imagine that there would exist a negative relationship between the white composition of the teams and television ratings for that game. However, Kanazawa and Funk (2001) find precisely the opposite. The authors find that television ratings of games are positively related to the fraction of white players on the teams. This finding could be explained if one considers another factor: that the majority of NBA fans are white (or that white fans are more likely to create revenue). Hence, while these white fans think that black players are better they still prefer to watch the white guys, leading to a "premium" for white players. This is in line with the own-race preference, which would predict that white audiences choose to watch white players as they derive utility from associating with them even if they perceive the overall quality of the basketball played by these players to be inferior. We do not, however, find an analogous relationship between betting on the more black home teams in cities with a higher proportion of black population.

References

[1] Arrow, Kenneth J., 1973, "The Theory of Discrimination." in Orley Ashenfelter and Albert Rees, eds. *Discrimination in Labor Markets*. Princeton, N.J.: Princeton University Press, pp. 3-33.

[2] Avery, Christopher and Judith Chevalier, 1999, "Identifying Investor Sentiment from Price Paths: The Case of Football Betting", *Journal of Business*, Vol. 72, No. 4, pp. 493-521.

[3] Becker, Gary, 1957, *The Economics of Discrimination*. Chicago: University of Chicago Press.

[4] Biernat, Monica and Manis, Melvin, 1994, "Shifting Standards and Stereotype-Based Judgments," *Journal of Personality and Social Psychology*, Vol. 66, No. 1, pp. 5-20.

[5] Braun, Sebastian and Kvasnicka, Michael, 2008, "Against All Odds? – National Sentiment and Wagering on European Football", working paper, Ruhr-Universitat Bochum #42.

[6] Brown, William O. and Raymond D. Sauer, 1993, "Fundamentals or Noise? Evidence from the Professional Basketball Betting Market", *Journal of Finance*, Vol. 48, No. 4 (Sep., 1993), pp. 1193-1209.

[7] Camerer, Colin F., 1989, "Does the Basketball Market Believe in the 'Hot Hand'?", *American Economic Review*, Vol. 79, No. 5 (Dec., 1989), pp. 1257-1261.

[8] Cheryan, S. and G. V. Bodenhausen, 2000, "When Positive Stereotypes Threaten Intellectual Performance: The Psychological Hazards of Model Minority Status", *Psychological Science*, Vol. 11, No. 5, pp. 399-402.

[9] Entine, Jon, 2000, *Taboo: Why Black Atheletes Dominate Sports And Why We Are Afraid To Talk About It*, Public Affairs, New York.

[10] Freeman, Mike, 2010,

http://www.cbsnews.com/stories/2010/03/25/sportsline/main6332033.shtml

[11] Forrest, David and Simmons, Robert, 2005, "Efficiency of the Odds in English Professional Football Matches", in L. Vaughan Williams (ed.) Information Efficiency in Financial and Betting Markets. Cambridge: Cambridge University Press.

[12] Forrest, David and Simmons, Robert, 2008, "Sentiment in the Betting Market on Spanish Football", *Applied Economics*, Vol. 40, pp. 119-126.

[13] Gandar, John M., William H. Dare, Craig R. Brown, and Richard A. Zuber, 1998, "Informed Traders and Price Variations in the Betting Market for Professional Basketball Games", *Journal of Finance*, Vol. 53, No. 1 (Feb., 1998), pp. 385-401.

[14] George, Nelson, 1992, *Elevating the Game*, HarperCollins Publishers.

[15] Golec, Joseph and Tamarkin, Maurry, 1991, "The Degree of Inefficiency in the Football Betting Market," *Journal of Financial Economics*, Vol. 30, pp. 311-323.

[16] Grey, Philip K. and Grey, Stephen F., 1997, "Testing Market Efficiency: Evidence From The NFL Sports Betting Market, *Journal of Finance*, Vol. 52, No. 4, pp. 1725-1737.

[17] Hall, Ronald E., 2002, "The bell curve: Implications for the performance of black/white athletes," *Social Science Journal*, Vol. 39, No. 1, pp. 113-118.

[18] Kahn, Lawrence M., 2004, "Race, Performance, Pay and Retention among National Basketball Association Head Coaches", working paper, National Bureau of Economic Research.

[19] Kanazawa, Mark T. and Funk Jonas P., 2001, "Racial Discrimination in Professional Basketball: Evidence from Nielsen Ratings", *Economic Inquiry*, Vol. 39, No. 4, pp. 599-608.

[20] Kuypers, T., 2000, "Information Efficiency: An Empirical Study of a Fixed Odds Betting Market," *Applied Economics*, Vol. 32, pp. 1353-1363.

[21] Larsen, Tim, Joe Price, and Justin Wolfers, 2008, "Racial Bias in the NBA: Implications in Betting Markets", *Journal of Quantitative Analysis in Sports*, Vol. 4, No. 2, pp. 1-19.

[22] Levitt, Steven D., 2004, "Why are Gambling Markets Organised so Differently from Financial Markets?" *Economic Journal*, Vol. 114, No. 495, pp. 223-246.

[23] Ogden, David C., 2004, "The Welcome Theory: An approach to studying African American Youth Interest and Involvement in Baseball," *NINE: A Journal of Baseball History and Culture*, Vol. 12, No. 2, pp. 114-122.

[24] Parsons, Christopher A., Sulaeman, Johan, Yates, Michael C. and Hamermesh, Daniel S., 2011, "Strike Three: Discrimination, Incentives and Evaluation,", forthcoming *American Economic Review*.

[25] Paul, Rodney J. and Weinbach, Andrew P., 2010, "NFL Bettor Biases and Price Setting: Further Tests of the Levitt Hypothesis of Sportsbook Behavior", forthcoming in Applied Economics Letters.

[26] Phelps, Edmund S., 1972, "The Statistical Theory of Racism and Sexism," *American Economic Review*, Vol. 62, pp. 659-61.

[27] Price, Joseph and Justin Wolfers, forthcoming, "Racial Discrimination among NBA Referees", *Quarterly Journal of Economics*.

[28] Price, Joseph, Lefgren, Lars and Tappen, Henry, 2009, "Interracial Workplace Cooperation: Evidence from the NBA", working paper, National Bureau of Economic Research.

[29] Sailes, G., 1996, "An Investigation of Campus Stereotypes: The Myth of the Black Athletic Superiority and the Dumb Jock Stereotype." In R. E. Lapchick (Ed.) *Sport in Society: Equal Opportunity or Business as Usual?* Sage, Thousand Oaks CA, pp. 193-202.

[30] Sauer, Raymond D., 1998, "The Economics of Wagering Markets", *Journal of Economic Literature*, Vol. 36, No. 4, pp. 2021-2064.

[31] Sauer, Raymond D., Brajer, Vic, Ferris, Stephen P., and Marr, M. Wayne, 1988, "Hold Your Bets: Another Look at the Efficiency of the Gambling Market for National Football League Games", *Journal of Political Economy*, Vol. 96, pp. 206–13.

[32] Schollaert, Paul T., and Smith Donald H., 1987, "Team Racial Composition and Sports Attendance", *Sociological Quarterly*, Vol. 28, pp.71-87.

[33] Snowberg, Erik and Wolfers, Justin, 2009, "Explaining the Favorite-Longshot Bias: Is it Risk-Love or Misperceptions?" working paper Wharton School, University of Pennsylvania.

[34] Stone, Jeff, Perry, Zachary W., and Darley, John M., 1997, "'White Men Can't Jump': Evidence for the Perceptual Confirmation of Racial Stereotypes Following a Basketball Game," *Basic and Applied Social Psychology*, Vol. 19, No. 3, pp. 291-306.

[35] Stone, Jeff, Lynch, Christian I., Sjomeling, Mike and Darley, John M., 1999, "Stereotype Threat Effects on Black and White Athletic Performance," *Journal of Personality and Social Psychology*, Vol. 77, No. 6, pp. 1213-1227.

[36] Wolfers, Justin, 2006a, "Diagnosing Discrimination: Stock Returns and CEO Gender", *Journal of the European Economic Association*, Vol. 4, No. 2-3, pp. 531-541.

[37] Wolfers, Justin, 2006b, "Point Shaving: Corruption in NCAA Basketball", *American Economic Review*, Vol. 96, No. 2 (May, 2006), pp. 279-283.

Figure 1: Distribution of Forecast Errors

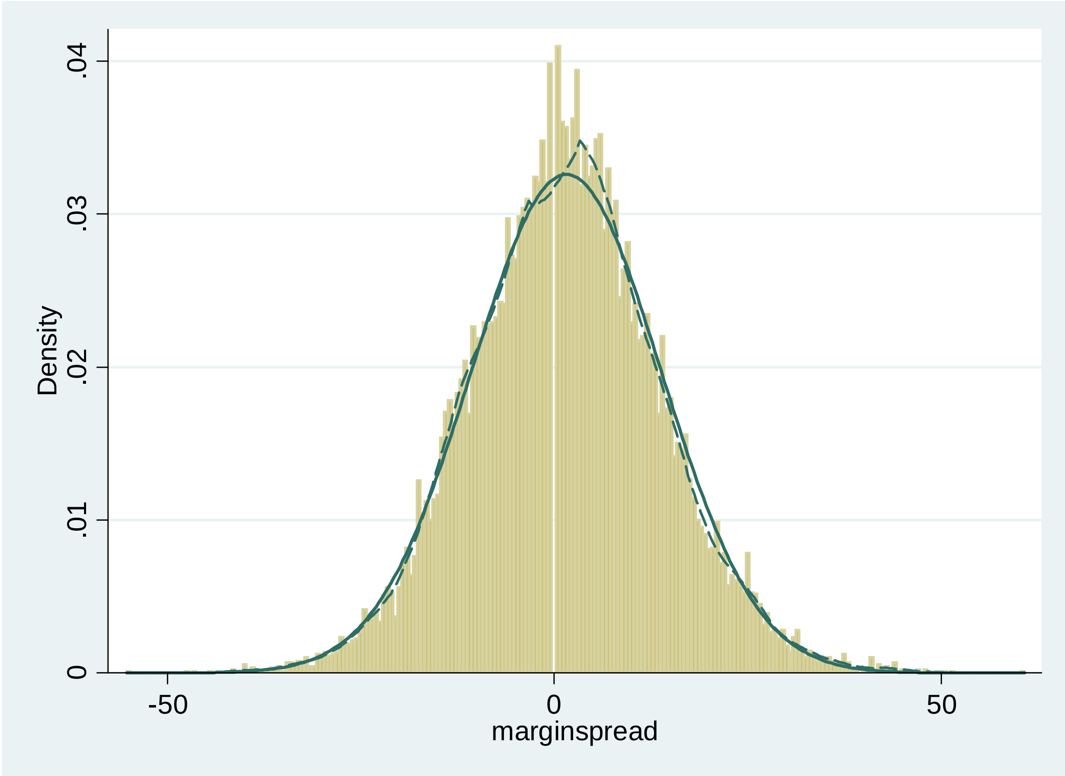

Figure 2: Margin-Spread against Normal Distribution

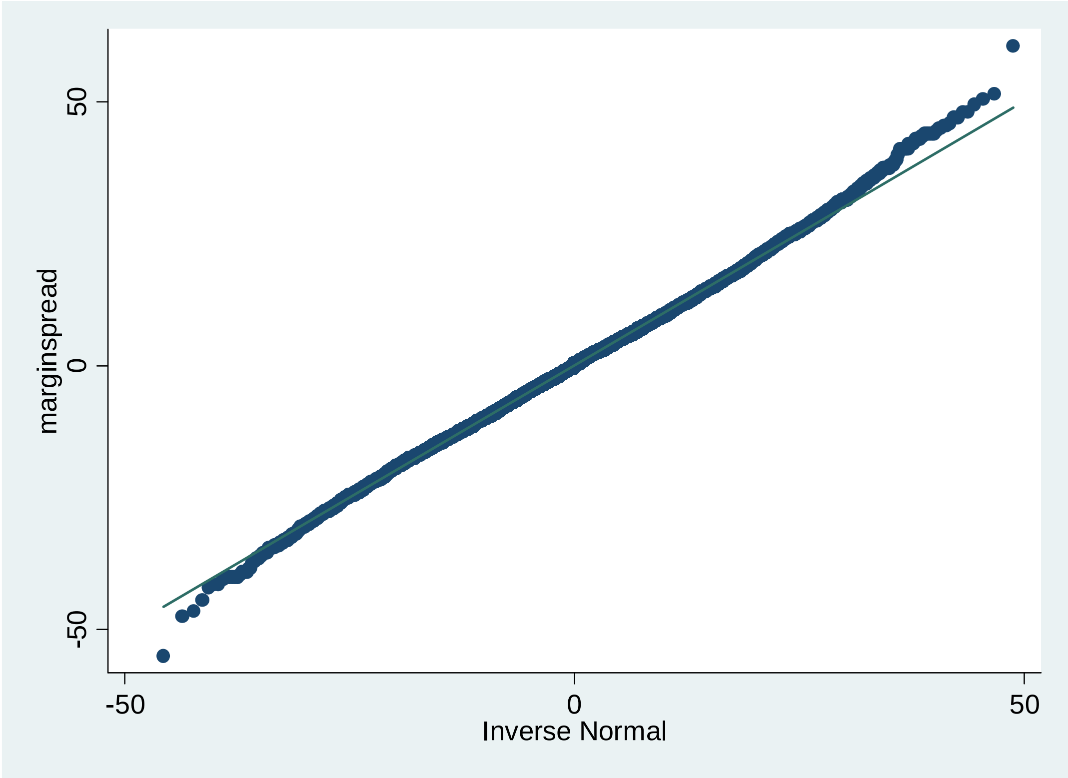

Figure 3: Accuracy of Point Spreads

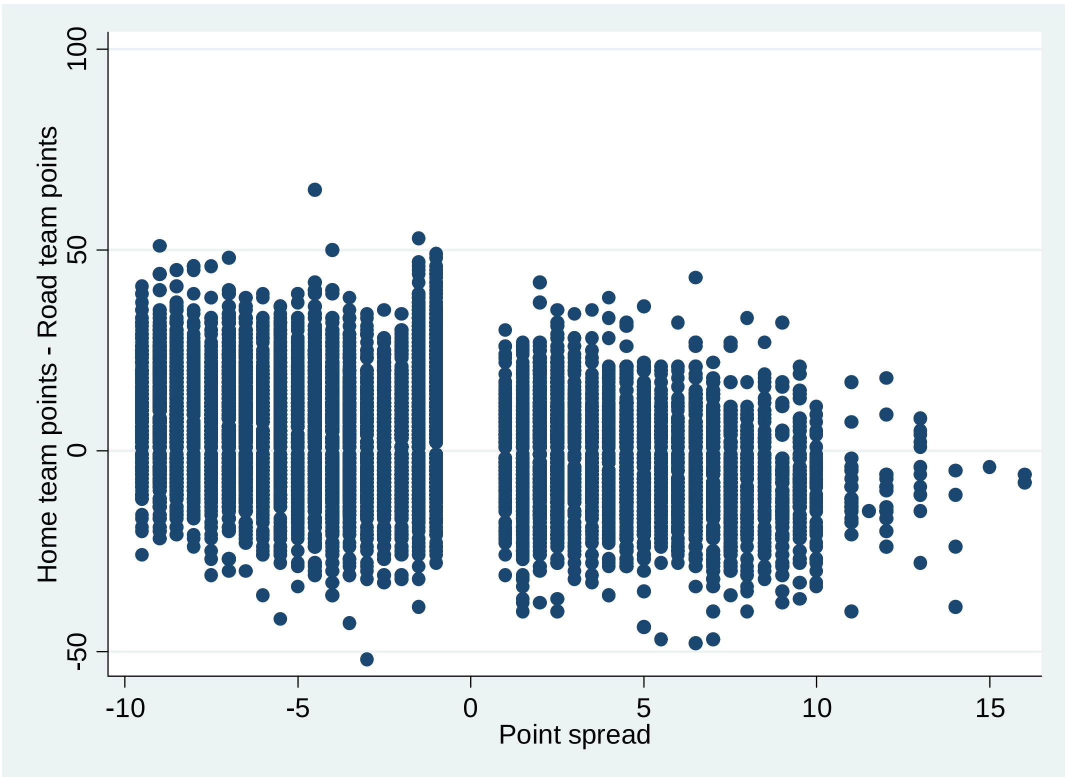

Figure 4: Distribution of Moves in the Betting Line

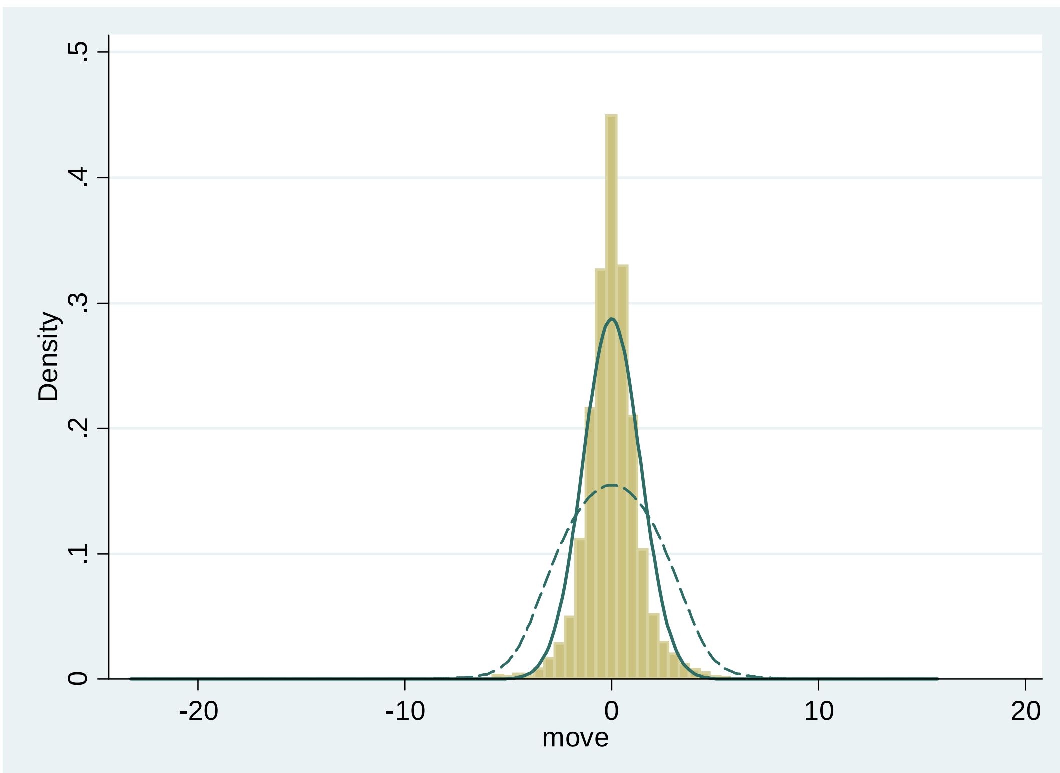

Table 1a. Summary Statistics at Player-Game Level: Raw

	Black players			White players			Significance
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	of difference
Age	323705	27.80	4.21	98200	27.56	3.85	0.00
Height (inches)	323705	78.47	3.60	98202	80.37	3.85	1.00
Weight (pounds)	323705	213.42	27.07	98202	224.40	27.91	1.00
Games started	323705	0.52	0.50	98200	0.45	0.50	0.00
Minutes played	323705	24.77	11.99	98200	22.09	11.85	0.00
Personal fouls	323704	2.23	1.55	98200	2.16	1.57	0.00
Points	323702	10.18	8.29	98200	8.65	7.45	0.00
Free throws attempted	323705	2.69	3.14	98200	2.15	2.73	0.00
Free throws made	323705	2.00	2.52	98200	1.64	2.24	0.00
Free throw percentage	206297	0.73	0.28	55808	0.75	0.29	1.00
Field goals attempted	323705	8.45	5.98	98200	7.04	5.22	0.00
Field goals made	323705	3.83	3.18	98200	3.24	2.85	0.00
Field goal percentage	308737	0.44	0.23	91852	0.44	0.25	1.00
Two point shots attempted	323705	6.98	5.27	98200	5.61	4.59	0.00
Two point shots made	323705	3.32	2.93	98200	2.72	2.61	0.00
Two point shot percentage	303843	0.46	0.25	89369	0.47	0.28	1.00
Three point shots attempted	323705	1.46	2.15	98200	1.43	2.07	0.00
Three point shots made	323705	0.51	1.01	98200	0.53	1.01	1.00
Three point shot percentage	155425	0.31	0.32	46555	0.34	0.33	1.00
Offensive rebounds	323705	1.25	1.55	98200	1.16	1.48	0.00
Defensive rebounds	323705	2.99	2.71	98200	2.92	2.70	0.00
Total rebounds	323705	4.23	3.66	98200	4.09	3.58	0.00
Assists	323705	2.27	2.58	98200	2.04	2.65	0.00
Steals	323705	0.83	1.06	98200	0.66	0.96	0.00
Blocks	323705	0.50	0.95	98200	0.50	0.96	0.38
Turnovers	323705	1.49	1.47	98200	1.30	1.40	0.00
Win score	323702	4.23	5.51	98200	4.18	5.33	0.99

The last column shows the p-values from t-tests with the null hypothesis that the statistic for black players is greater than the statistic for white players.

Table 1b. Summary Statistics at Player-Game Level: Adjusted

	Black players			White players			Significance
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	of difference
Personal fouls	323178	4.99	5.07	98028	5.61	6.14	1.00
Points	323176	18.04	12.07	98028	17.13	12.79	0.00
Free throws attempted	323179	4.89	6.32	98028	4.38	6.69	0.00
Free throws made	323179	3.55	4.85	98028	3.24	5.14	0.00
Free throw percentage	206288	1.53	1.86	55807	1.76	2.33	1.00
Field goals attempted	323179	15.61	8.07	98028	14.71	8.39	0.00
Field goals made	323179	6.80	4.90	98028	6.44	5.16	0.00
Field goal percentage	308710	1.15	2.27	91836	1.35	2.73	1.00
Two point shots attempted	323179	12.94	7.62	98028	11.78	7.99	0.00
Two point shots made	323179	5.92	4.70	98028	5.43	4.92	0.00
Two point shot percentage	303829	1.18	2.25	89363	1.37	2.67	1.00
Three point shots attempted	323179	2.67	4.04	98028	2.92	4.52	1.00
Three point shots made	323179	0.88	1.89	98028	1.01	2.22	1.00
Three point shot percentage	155412	0.64	1.39	46544	0.80	1.83	1.00
Offensive rebounds	323179	2.48	3.55	98028	2.66	3.95	1.00
Defensive rebounds	323179	5.66	4.93	98028	6.20	5.52	1.00
Total rebounds	323179	8.15	6.52	98028	8.85	7.17	1.00
Assists	323179	4.09	4.46	98028	3.92	4.77	0.00
Steals	323179	1.57	2.38	98028	1.39	2.44	0.00
Blocks	323179	0.98	2.14	98028	1.09	2.40	1.00
Turnovers	323179	2.99	3.56	98028	2.90	3.87	0.00
Win score	323176	6.74	11.70	98028	7.28	12.88	1.00

The last column shows the p-values from t-tests with the null hypothesis that the statistic for black players is greater than the statistic for white players.

Table 2. Summary Statistics at Team-Game Level

	Obs	Mean	St. Dev.
All			
Point spread	16402	-1.79	4.90
Winning margin	12252	2.35	12.98
Winning margin - spread	16402	1.59	12.25
Probability of beating the spread	16402	0.56	0.50
Black starters	17211	3.90	1.05
Difference in black starters	17210	0.01	1.41
Black players in the roster	17211	7.60	1.63
Difference in black players in the roster	17210	-0.01	2.12
Black minutes	17211	187.49	41.09
Difference in black minutes	17210	0.26	53.26
Home underdog			
Point spread	4875	4.52	2.56
Winning margin	4115	-3.27	11.98
Winning margin - spread	4875	0.38	11.64
Probability of beating the spread	4875	0.48	0.50
Black starters	5684	3.99	0.97
Difference in black starters	5684	0.20	1.41
Black players in the roster	5684	7.66	1.57
Difference in black players in the roster	5684	0.16	2.11
Black minutes	5684	191.44	37.64
Difference in black minutes	5684	7.53	53.04
Home favorite			
Point spread	11527	-4.46	2.74
Winning margin	8137	6.69	12.15
Winning margin - spread	11527	2.11	12.47
Probability of beating the spread	11527	0.59	0.49
Black starters	11527	3.85	1.08
Difference in black starters	11526	-0.08	1.41
Black players in the roster	11527	7.58	1.66
Difference in black players in the roster	11526	-0.10	2.12
Black minutes	11527	185.55	42.55
Difference in black minutes	11526	-3.33	53.00

Table 3. Winning the Game

	Realized margin					
Difference in black starters	-0.732***	-0.565***				
Diff. in black players in the roster			-0.424***	-0.380***		
Difference in black minutes					-0.019***	-0.014***
Team fixed effects	yes	yes	yes	yes	yes	yes
Season fixed effects	yes	yes	yes	yes	yes	yes
Team-season interactions	no	yes	no	yes	no	yes
Observations	12252	12252	12252	12252	12252	12252
R-squared	0.06	0.17	0.06	0.17	0.06	0.17
	Probability of winning					
Difference in black starters	-0.070***	-0.068***				
Diff. in black players in the roster			-0.047***	-0.052***		
Difference in black minutes					-0.002***	-0.002***
Team fixed effects	yes	yes	yes	yes	yes	yes
Season fixed effects	yes	yes	yes	yes	yes	yes
Team-season interactions	no	yes	no	yes	no	yes
Observations	12263	12263	12263	12263	12263	12263

Notes: The dependent variable in the upper panel is the realized margin in the game, computed as the home team score minus the visiting team score. The dependent variable in the lower panel is the probability of winning, which is a dummy that is 1 if the home team won the game. The regressions are estimated using ordinary least squares for the winning margin, and using probit for the probability of winning. Difference in black starters is calculated as the number of black players (black players in the roster, black minutes) in the home team minus the number of black players (black players in the roster, black minutes) in the visiting team. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 4. Beating the Spread

	Point spread					
Difference in black starters	0.269***	0.341***				
Diff. in black players in the roster			0.092***	0.132***		
Difference in black minutes					0.007***	0.009***
Team fixed effects	yes	yes	yes	yes	yes	yes
Season fixed effects	yes	yes	yes	yes	yes	yes
Team-season interactions	no	yes	no	yes	no	yes
Observations	16401	16401	16401	16401	16401	16401
R-squared	0.09	0.31	0.08	0.30	0.09	0.31
	Realized margin - spread					
Difference in black starters	-0.294***	-0.230***				
Diff. in black players in the roster			-0.210***	-0.240***		
Difference in black minutes					-0.006***	-0.004***
Team fixed effects	yes	yes	yes	yes	yes	yes
Season fixed effects	yes	yes	yes	yes	yes	yes
Team-season interactions	no	yes	no	yes	no	yes
Observations	16403	16403	16403	16403	16403	16403
R-squared	0.02	0.07	0.02	0.07	0.02	0.07
	Probability of beating the spread					
Difference in black starters	-0.023***	-0.023**				
Diff. in black players in the roster			-0.022***	-0.030***		
Difference in black minutes					-0.001**	-0.001*
Team fixed effects	yes	yes	yes	yes	yes	yes
Season fixed effects	yes	yes	yes	yes	yes	yes
Team-season interactions	no	yes	no	yes	no	yes
Observations	16401	16401	16401	16401	16401	16401

Notes: The dependent variable in the upper panel is the point spread on the game, expressed from the home team perspective. The dependent variable in the middle panel is the difference between the realized margin (the actual outcome of the game) and the point spread. The dependent variable in the lower panel is the probability of beating the spread, which is a dummy that is 1 if a bet on the home team wins. The regressions are estimated using ordinary least squares for the point spread and the difference between the winning margin and the spread, and using probit for the probability of beating the spread. Difference in black starters is calculated as the number of black players (black players in the roster, black minutes) in the home team minus the number of black players (black players in the roster, black minutes) in the visiting team. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 5. Moving the Line

	Closing line - Opening line			
Difference in black starters	0.014**	0.007	0.008	0.006
Team fixed effects	no	yes	yes	yes
Season fixed effects	no	no	yes	yes
Team-season interactions	no	no	no	yes
Observations	8011	8011	8011	8011
R-squared	0.00	0.01	0.01	0.05

Notes: The dependent variable is the difference between the closing and opening values of the line on the game, showing how much the point spread moves from the start of betting until all bets close. The regressions are estimated using ordinary least squares. Difference in black starters is calculated as the number of black players in the home team minus the number of black players in the visiting team. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 6a. Robustness: Referees

	Probability of beating the spread			
	All white crew	At least one black	At least one white	All black crew
Difference in black starters	-0.041*	-0.019*	-0.024***	-0.092
Team fixed effects	yes	yes	yes	yes
Season fixed effects	yes	yes	yes	yes
Team-season interactions	yes	yes	yes	yes
Observations	2918	13438	16034	152

Table 6b. Robustness: Black Population in Home Team Location

	Probability of beating the spread			
Difference in black starters	-0.022**	-0.021**	-0.021**	-0.021**
Diff. in proportion of blacks in the city	-0.0001	-0.0001		
Interaction term		-0.0003		
Diff. in proportion of blacks in the state			-0.001	-0.001
Interaction term				-0.0003
Team fixed effects	yes	yes	yes	yes
Season fixed effects	yes	yes	yes	yes
Team-season interactions	yes	yes	yes	yes
Observations	16319	16319	16319	16319

Notes: The regressions are estimated using probit. Difference in black starters is calculated as the number of black players in the home team minus the number of black players in the visiting team. In Table 6a, information on the race composition of referee crews are from Larsen and Wolfers (forthcoming). In Table 6b, difference in proportion of blacks in the city (state) is computed by subtracting the percent of black population, as of 2000, in the visiting team's host city (state) from the percent of black population in the home team's host city (state). The interaction term is the multiplication of the difference in black starters and the difference in proportion of blacks in the city (state). ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 7. Chances of Winning with a Simple Strategy

	Games	Bets	Wins	Win %	Return %
Bet on the home team only when it has X more white players than the visiting ...					
1	1211	253	147	58.10	10.92
2	1211	143	83	58.04	10.81
3	1211	44	27	61.36	17.15
4	1211	9	7	77.78	48.48

Notes: Games, bets, and wins are expressed in units; win % and return % are in percent terms.