ORIGINAL PAPER

Inside the NBA Bubble: how Black players performed better without fans

Mauro Caselli[1] · **Paolo Falco[2]** · **Babak Somekh[3]**

Abstract

In the NBA, predominantly Black players play in front of predominantly non-Black fans. Using the "NBA Bubble", a natural experiment induced by COVID-19, we show that the performance of Black players improved significantly with the absence of fans vis-à-vis White players. This is consistent with Black athletes being negatively affected by racial pressure from mostly non-Black audiences. We control for player, team, and game fixed effects, and dispel alternative mechanisms. Beyond hurting individual players, racial pressure causes significant economic damage to NBA teams by lowering the performance of top athletes and the quality of the game.

Keywords Discrimination · Harassment · Racism · Performance · Basketball · NBA · COVID-19

JEL Classification D91 · J15 · J71 · Z22

1 Introduction

The National Basketball Association (NBA) is one of the richest and most prestigious sports leagues in the world. It is also characterized by a unique feature. While the

✉ Mauro Caselli
mauro.caselli@unitn.it

Paolo Falco
paolo.falco@econ.ku.dk

Babak Somekh
babak.somekh@baruch.cuny.edu

1 University of Trento, Trento, Italy

2 University of Copenhagen, København, Denmark

3 Baruch College, New York, USA

 Springer

majority of players are Black,[1] most fans in the stands, a majority of coaches and front-office executives, as well as most team owners, are not Black. This has historically led to cleavages between players and supporters, as well as to episodes of open racism on the court. Vivid recent examples of racially motivated hostility include a New York Knicks fan spitting on the Atlanta Hawks star Trae Young in Madison Square Garden during the second game of a playoff series in 2021. Such episodes are far from isolated, as documented by numerous media accounts. They are but the most visible result of racial divides that run deep in the sport, as in US society more broadly (Pew Research Center 2016).

While such episodes have often made the headlines and fostered a heated debate, a careful analysis of how the pressure from predominantly non-Black fans affects predominantly Black players, and in turn the overall quality of the game, has never been conducted. We fill this knowledge gap using a natural experiment generated by the COVID-19 pandemic. Between July 30th and October 11th, 2020, NBA games were played behind closed doors without fans in the stands in an effort to curb the spread of the virus. This led to the creation of the so-called NBA Bubble, a controlled environment where players were isolated from the outside world and could avoid being infected. This provides a unique natural experiment to study the question of interest. To this end, we obtain data from August 17th to October 11th, 2020, when playoff games took place inside the Bubble, and compare the performance of Black vs. White players with the 2019 playoffs. Crucially, we have objective and comprehensive metrics of performance for every single NBA player in every game.

We find that the performance of Black players improved significantly in the Bubble relative to the performance of White players. Specifically, we estimate that the performance of Black players improved by 27% of the average performance in the pre-Bubble period relative to the performance of White players. We also find that the negative effect of playing with fans prior to the Bubble was strongest among top players (those in the top 50% of the pre-Bubble performance distribution), consistent with the hypothesis that top players are targeted the most by crowds. As these players contribute the most to the quality of the game and, in turn, to the profits of the league, this implies that racist pressures cause significant damage to the NBA.

This study makes an important contribution to the large literature documenting racial discrimination in the labor market (Bayer and Charles 2018; Lang and Spitzer 2020; Aizer et al. 2020; Caselli and Falco 2021; Blair and Chung 2022). We extend this body of knowledge by providing new evidence on the impact of negative encouragement in the form of racial pressure on worker performance. The existing literature in the fields of labor economics, behavioral economics, and management on the topic is still scant. While numerous studies document existing racial labor-market gaps in a range of contexts (e.g., Lang and Manove 2011; Kline et al. 2022), little is known about how racist pressures can *directly* affect performance and contribute to creating those gaps in the first place. The natural experiment we exploit offers a unique opportunity and, although the ideal test would have entailed shutting down racist behavior per se (as opposed to the presence of fans altogether), our evidence offers strong support for the hypothesis that racial pressures have large negative impacts on worker performance.

---

[1] For the purpose of our analysis, this includes both Black and mixed-race/Black players.

Indeed, while we acknowledge that the Bubble was a special environment for reasons other than the lack of fans (and we provide robustness checks to address this), it is hard to conceive of confounding mechanisms that may have affected Black and White players differently and driven the sizeable gap we uncover.

We also contribute to a growing literature documenting the impact of racial discrimination in sports.[2] Existing studies have investigated referee decisions (e.g., Price and Wolfers 2010; Parsons et al. 2011; Gallo et al. 2013; Magistro and Wack 2022), coach biases (Schroffel and Magee 2012), and racial preferences among fans (Kanazawa and Funk 2001; Foley and Smith 2007; Burdekin et al. 2005). Crucially, no study to date has offered evidence of how racial pressure affects athletes' performance in any major US sport. As one of the most prestigious leagues in the country and throughout the world, the NBA is an ideal context for this analysis. We build on existing work by Caselli et al. (2023), who use a similar natural experiment induced by COVID-19 to identify the impact of pressure from fans on soccer players of African origin playing in Italy. A key difference with respect to Caselli et al. (2023) is that Black players in the US are mostly American. This allows us to cleanly isolate the effect of race. By contrast, Black players in the Italian soccer league are predominantly from outside of Italy. Pure jingoism and nationalism on the part of fans may therefore contribute to their worse performance over and above sheer racism. In addition, by looking at the NBA — a league where Black players are in fact the majority while fans are predominantly non-Black — we show that racial pressure can have an impact even when the disadvantaged group is a prominent one. By contrast, Black football players in Italy are a small minority. Despite these differences, the strong similarities in the overall patterns of results between the NBA and the Italian football league lend further strength to our conclusions.

2 Racial divides in the NBA

The NBA is a racially diverse league with a defining feature: the majority of players are Black while the majority of fans are non-Black. In the period we analyze (2019–20), over 75% of players in NBA teams were Black, while only 27% of fans identified as Black according to the latest data available (Fig. 1). This stark divide does not represent a source of tension per se, but in a society where racial cleavages run deep, basketball games have often become an outlet for racist sentiments. Such tensions are further exacerbated by the fact that basketball courts are the smallest among major league sports (football, basketball, soccer, baseball, and ice hockey), allowing fans to be very close to players during games.

Recent reports by Sports Illustrated, The Ringer, and the NBA itself, offer detailed accounts of racist episodes in NBA games (Selbe 2021; Tynes 2019; Reynolds 2019). There are also numerous reflections on the issue of racism in the league from major NBA players from different epochs. Bill Russell, one of the greatest players in NBA history, wrote the following in his memoirs as he reflected on the atmosphere in the city

---

[2] The literature has also highlighted the importance of diversity for team performance (Glennon et al. 2021) and the impact of supporters on sports results (Pettersson-Lidbom and Priks 2010; Ponzo and Scoppa 2018; Bryson et al. 2021; Colella et al. 2023).
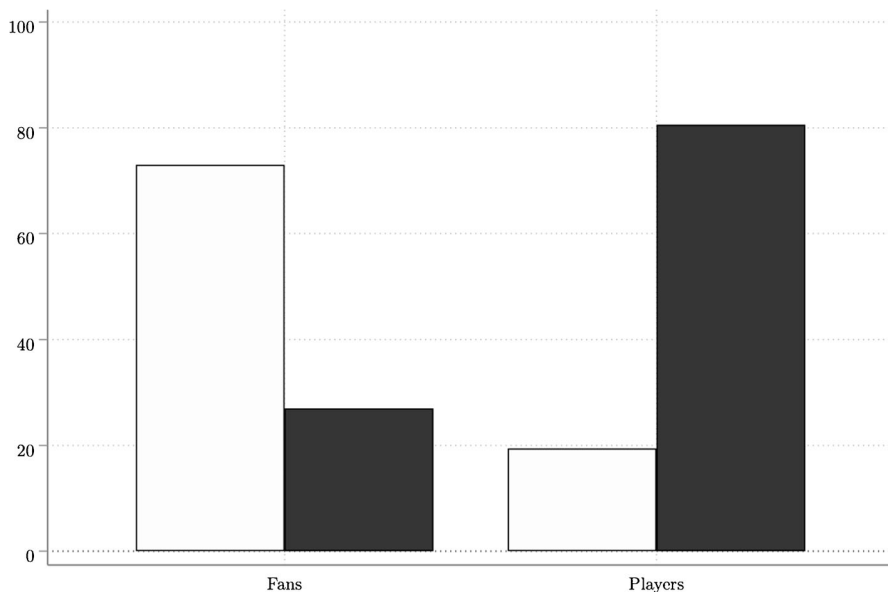
Notes: Percentage of Black (black bars) and non-Black (white bars), fans vs players. Own elaborations based on Silverman (2020) for data on fans and Interbasket (2020) for data on players.

Fig. 1 Black Players, non-Black Fans

of Boston, where he played in the 1950s: "The city had corrupt, city-hall-crony racists, send-em-back-to-Africa racist, and in university areas, phony radical-chic racists (long before they appeared in New York)" (Goldstein 2022). A similar view was expressed decades later by Lebron James, the elder statesman of the NBA, and its best player since Michael Jordan. When discussing fan behavior Lebron James called Boston fans "...racist as [expletive]", going on to explain "They will say anything. And it's fine. I mean, [expletive], it's my life. It's [expletive] I've been dealing with my whole life. I don't mind it. Like, I hear it. Like if I hear somebody close by, I'll check them real quick. I'll move on to the game. They're going to say whatever the [expletive] they want to say...I mean, I got a beer thrown on me leaving the game. Like, it's Boston." (Himmelsbach 2022). Russell Westbrook, a two-time NBA most valuable player, said this of Utah in 2019 when visiting as a player for the Oklahoma City Thunder: "Every time I come here, it's a lot of disrespectful things that's said." Going on to say that fans in Utah regularly call him "boy" during games and have yelled out insults such as "get down on your knees like you're used to" (Tynes 2019).[3] In the 2019 season, the Boston Celtics banned a fan for two years for shouting racist language towards an opposing player. After the game, one of the Celtics' starting players, Marcus Smart, told the Boston Globe: "I've dealt with a lot of things, here in my own city, and out of this city," Smart said. "I get it. I've seen it. I'm not surprised, and it has to be fixed, plain and simple" (Himmelsbach 2019). Another recent incident took place in May 2022. The

---

[3] The term "boy" has a racial history dating back to slavery. It has been deemed a racist term by US federal courts, and in certain contexts is legally considered to bear racial animus (Brinkerhoff 2007; Bright 2010).

Phoenix Suns' Chris Paul confronted Dallas fans in the stands for harassing his family and offering them unwanted hugs. Earlier in the same season, a Philadelphia 76ers fan was banned for life from the arena for calling Carmelo Anthony of the Los Angeles Lakers "boy", yelling "get in the corner boy" and "keep shooting boy" (Haynes 2022).

The pressures faced by Black players in the NBA are not limited to fan behavior. There have also been high-profile incidents involving White owners behaving in overtly racist ways. One example that took place in 2014 led to Donald Sterling, the owner of the Los Angeles Clippers, being banned for life by the NBA due to overtly racist comments caught on tape about Magic Johnson, one of the greatest players in NBA history. In 2022, Robert Sarver, the owner of the Phoenix Suns, was fined and banned from the NBA for a year due to racist and misogynist behavior that took place over the course of 18 years.

3 COVID-19 and the NBA Bubble

On March 11th, 2020, the NBA shut down all games in response to the global spread of COVID-19. As it became clear that the pandemic was not going to end quickly, the league faced the possibility of having to cancel the season, and so forgo enormous revenue from fan attendance and TV deals. The significant financial costs of a full shutdown led to the decision by the NBA, in agreement with the players, of finishing the season and conducting the post-season playoffs inside an isolated environment without fans in attendance, or "bubble".

At the end of July 2020, the NBA Bubble officially opened at the Walt Disney World resort in Lake Buena Vista, Florida. For the subsequent two-and-a-half months, all NBA games took place inside the Bubble without fans in the stands. To compensate for the lack of crowds, the NBA played music and fake crowd noise (biased towards the nominal home team) throughout the games. This primarily served the purpose of making the game sound more "natural" on TV. For the purpose of our study, the Bubble constituted a natural experiment that effectively turned off the presence of live crowds at NBA matches. A recent but consolidated literature has used the same approach in different contexts (Higgs and Stavness 2021; Scoppa 2021; Gong 2022; Steinfeldt et al. 2022; Cross and Uhrig 2022; Reade et al. 2022; Caselli et al. 2023).[4] The NBA Bubble ended with the last game of the playoffs on October 11th, 2020.

One possible concern with our approach is that the protests that followed the killing of George Floyd took place over the same summer as the NBA bubble. It may be reasonable to assume that these protests had a greater impact on Black players than White players that were playing inside the bubble, and this may be one of the explanations for our findings. For this to explain our results, however, the protests should have impacted the performance of Black players inside the Bubble positively, relative to White players. Statements from NBA players suggest the opposite. If anything, the

---

[4] A defining feature of the NBA Bubble was that players were isolated from the outside world. Despite the NBA investing substantial resources to make the Bubble as comfortable as possible, this may have taken a toll on players. Our results do indeed show a slight drop in average performance inside the Bubble across all players (see the next section). Since all players faced the same restrictions, however, this does not affect our analysis, which looks at the *differential* impact on Black and White players.

protests were a distraction for Black players and could have contributed negatively to their performance (Thompson 2021). Black players at the time explicitly expressed concerns about playing games when they would have preferred to be out protesting (Thompson 2021). There was also an incident within the Bubble when the entire Milwaukee Bucks team walked out of a game in protest at police violence in Wisconsin (Bontemps and Andrews 2020). As professional basketball is a game of focus as much as ability, it seems sensible to hypothesize that this type of distraction could have easily impaired the performance of Black players during the Bubble (Thompson 2021). This would work in the opposite direction to our findings rather than constituting a plausible explanation for the detected pattern. In light of these considerations, our estimated effect may be a lower-bound estimate of the actual effect of playing inside the Bubble, since the George Floyd protests may have biased the estimated coefficient downwards. We acknowledge, however, that one should be careful in drawing such a conclusion given the speculative nature of this discussion in the absence of solid evidence on the effects of the protests.

4 Data and empirical model

4.1 Data

For the purpose of our analysis, we construct a rich dataset combining several sources of information. The main challenge is to obtain a reliable and *objective* metric of players' performance that is not subject to potential bias in measurement.[5] In addition, our analysis requires detailed information on players' characteristics and positions (that is, center, forward, and guard, and combinations thereof), in order to test for potential confounding factors.

To overcome these challenges, we rely on rich data from Stathead (2022), which is itself based on data provided by *SportRadar*, the official statistics partner of the NBA. This data uses the modern box score to provide information on all players' main characteristics and statistics, e.g., age, position, points, minutes played, field goals, free throws, offensive and defensive rebounds, assists, steals, blocks, personal fouls, and turnovers. Based on this very rich data, Stathead (2022) calculates the Game Score (GS), which is our objective metric of players' performance.[6] In sum, GS gives

---

[5] Principe and van Ours (2022), for instance, note that newspaper ratings of professional football players can be subject to racial bias in the context of Italy.

[6] GS was created by John Hollinger, the former Vice President of Basketball Operations for the Memphis Grizzlies of the NBA, former columnist at ESPN, and current Senior NBA columnist at The Athletic. The exact formula for GS is: $GS = PTS + 0.4 \times FG - 0.7 * FGA - 0.4 \times (FTA - FT) + 0.7 \times ORB + 0.3 \times DRB + STL + 0.7 \times AST + 0.7 \times BLK - 0.4 \times PF - TOV$, where PTS is points, FG is field goals, FGA is field goal attempts, FT is free throws, FTA is free throw attempts, ORB is offensive rebounds, DRB is defensive rebounds, STL is steals, AST is assists, BLK is blocks, PF is personal fouls and TOV is turnovers. The weights assigned to the different dimensions are routinely used (see, for instance, Berri et al. 2011). While they may appear arbitrary, they do not influence our analysis which holds them constant throughout and compares the same players before and after the creation of the Bubble. In addition, the results are robust to an alternative formula for GS that does not include FG and FGA. This implies that the results are not simply driven by the fact that Black players take more shots. These additional results are available upon request.

a measure of a player's productivity over an entire game by aggregating a player's positive accomplishments and subtracting the negative accomplishments. It is worth noting that the scale of the variable is comparable to that of points scored during a game, that is, 40 tends to be an outstanding performance, while 10 is an average performance. The variable can also take negative values for very poor performances. This is not the first study using this performance metric (Berri et al. 2011). We are the first, however, to use GS for the purpose of investigating racial discrimination in the NBA.[7]

In addition to players' performance, Stathead (2022) provides general information on the game: home team, score by quarter, whether the game is part of the regular season or the playoffs, and the date of the game. We use the date of games to construct *Bubble*, a dummy variable equal to one if the game was played during the NBA Bubble. Finally, we obtain data on players' race and nationality from Interbasket (2020), based on information provided by the NBA.

In the interest of full comparability, we focus on the post-season playoff games, which took place entirely inside the bubble, and compare them with playoff games from the previous year.[8] Since playoff games are the most important games of the year, this has the added advantage of focusing on higher-stake settings, where pressure from fans is most likely to play a role.[9]

Our dataset spans 165 games over two playoff seasons (2019 and 2020). Overall, 19 teams take part in the two playoffs (but only 13 teams play in both playoffs) and 101 players appear in at least two games of each year analyzed. We drop players who appear in only one or no games in one of the two seasons as such cases do not lend themselves to a robust within-player analysis that controls effectively for individual fixed effects.[10] Table 1 shows the characteristics of the sample. Black players constitute about 80% of all the observations in our sample (the share is very similar in the pre-Bubble and

---

[7] John Hollinger has also created an alternative measure of players' productivity on the field, the Player Efficiency Rating (PER). That measure also takes into account three-point field goals and attempts, and normalizes players' performance within team and season (Sports Reference 2022). The empirical analysis will show that our results are robust to using this alternative measure.

[8] The alternative would have been to compare a mix of (relatively few) regular season and (all) playoff games that took place inside the Bubble with the entire previous season (regular plus playoffs). This would have been a much more imprecise comparison since the NBA Bubble started at a time when teams had a different number of regular season games left to play before the playoffs. Given the very different stakes of regular season and playoff games, this imbalance would have caused major problems of comparability (Teramoto and Cross 2010; Fromal 2017).

[9] One concern with using data from the playoffs is that, by construction, some teams are exiting the data every round and the persistence of some teams relative to others may not be random. One possible way to correct for this issue is to restrict the sample to the first round, but this would trim the sample significantly, thus affecting the statistical significance of our estimates. Indeed, when we restrict the sample to the first round of the playoffs, we find that our results are qualitatively unchanged but the number of observations drops by half and our statistical power is significantly impaired, preventing us from detecting a significant effect. These additional results are available upon request.

[10] When we include players who appear in only one season or play only a single game in either season, our conclusions are qualitatively unchanged but they become less precise, as a result of lowering the degree of comparability between the pre-Bubble and the Bubble sample (the additional estimations are available upon request).

Table 1 Descriptive statistics

	Pre-Bubble (2019)		Bubble (2020)	
	Mean	Std Dev	Mean	Std Dev
Game Score (GS)	9.408	8.148	9.185	8.476
Black	0.783	0.412	0.807	0.395
Starting 5	0.575	0.495	0.587	0.493
Personal fouls	2.370	1.553	2.318	1.527
Age	28.106	3.665	29.059	3.914
Observations	927		943	

Notes: The table shows the mean and standard deviation (Std Dev) in the sample of observations pre-Bubble (2019 playoffs) and during the Bubble (2020 playoffs). Game Score is a continuous variable representing a metric for a player's performance. Black is a dummy equal to 1 for Black players. Starting 5 is a dummy equal to 1 if a player is in the starting lineup in a game. Personal fouls is the number of personal fouls called against a player in a given game. Age is the age in years on the day when a game is played

in the Bubble period).[11] The average player in our sample is 28 years old during the 2019 playoffs. Average performance, as captured by the player Game Score (GS) was 9.4 before the Bubble and declined to 9.2 inside the Bubble. This slight drop is consistent with the fact that being in the Bubble was challenging for players. Through an econometric model, we will show that this minor average decline conceals very different effects for Black and White players.

4.2 Empirical model

Our main results are based on the estimation of the following empirical model:

$$GS_{itg} = \alpha + \beta Bubble_g + \gamma Bubble_g \times Black_{it} + \zeta X_{itg} + \delta_i + \eta_{tg} + u_{itg}, \quad (1)$$

where GS is the Game Score of player i in team t for match g; $Bubble_g$ is a dummy equal to 1 if game g takes place during the Bubble without fans in the stands;[12] $Black_{it}$ is a dummy equal to 1 if player i in team t is Black; X_{itg} is a vector of controls, including a dummy for whether a player is in the starting lineup of a game; δ_i is a player fixed effect that allows us to control for ability, productivity, and any other individual traits that may play a role in the analysis (e.g., age, salary level); η_{tg} is a combined team-game fixed effect that captures game-specific characteristics, such as home games and overall characteristics and performance of a player's team as well as

---

[11] Black players include mixed-race Black players. White players include one player who is mixed/ Polynesian.

[12] The coefficient on this variable is not identified on its own when we include $team \times game$ fixed effects because it is a game-specific characteristic that is absorbed by the team-game fixed effects. In this case, only its interaction with $Black_{it}$ is identified.

those of the opponent team.[13] u_{itg} is an idiosyncratic error term. The inclusion of all these fixed effects implies that our coefficient of interest, γ, identifies the change in the performance of Black players relative to the White players who play in the same team and in the same games. This amounts to controlling for any factors that may vary across teams and games between the two periods, such as referees. Standard errors are clustered at the team-game level to take into account potential correlation in the error terms between players who play in the same team and in the same game.[14]

5 Results

In this section, we discuss our core results and present a set of robustness tests to investigate alternatives to racist pressure as potential mechanisms.

5.1 Playing without fans improves the performance of Black players relative to White players

Our key result is that playing without fans improved the performance of Black players relative to White players. The estimates are presented in Table 2. As explained above, the Bubble period captures all the 2020 playoff games, which took place behind closed doors, while the pre-Bubble period captures the 2019 playoffs when fans could attend the games. In the first specification (Col. 1), we estimate a model with player fixed effects but no *team* nor *team* × *game* fixed effects. In this case, we find that inside the Bubble the performance of Black players improves by 1.3 Game Score points with respect to the pre-Bubble period relative to White players. This is a large effect, which corresponds to 13.4% of the average score players obtained in the pre-Bubble period. When we include *team* fixed effects in the specification (Col. 2), the estimated impact grows to 1.9 GS points (20.1% of the pre-Bubble average performance), and its statistical significance increases to the 1% level. When we include *team* × *game* fixed effects, the estimated impact of the Bubble on the performance of Black players relative to White players grows further (2.5 points, or 26.6% of the pre-Bubble average), and it is statistically significant at the 1% level. Reassuringly, all the specifications

---

[13] Team-game fixed effects also capture spillover effects related to, e.g., the number of Black players in the player's team or the opponent team. Assuming that differences in the number of Black players between teams are random and, more generally, players are equally influenced by all the other team members (i.e., the interaction across players is constant in each team-game combination), the inclusion of team-game fixed effects implies that our analysis does not violate the assumption of Stable Unit Treatment Value Assumption (SUTVA) (Imbens and Rubin 2015) even in the presence of peer effects, and our estimates can be interpreted in a causal way. However, under more general interaction structures (as in Horrace et al. 2022), the magnitude of peer effects can vary across players and including team-game fixed effects is not sufficient to control for such effects. In this case, our estimates should be interpreted as "reduced form" and would include both direct and indirect effects of racial pressure.

[14] We further test robustness to the use of two-way clustered standard errors at the level of player-season and team-game.

Table 2 Effect of Bubble (no fans) on players' performance

| Dep. var.: Game Score. Pre-Bubble mean: 9.408 | | | |
	(1)	(2)	(3)
Bubble	−0.709	−1.076*	
	(0.539)	(0.604)	
Bubble × Black	1.264*	1.895**	2.503***
	(0.666)	(0.738)	(0.777)
Individual controls	Yes	Yes	Yes
Player FE	Yes	Yes	Yes
Team FE	No	Yes	No
Team-Game FE	No	No	Yes
Observations	1,870	1,870	1,870
R-squared	0.478	0.483	0.559

Notes: The dependent variable is players' Game Score. Bubble is a dummy equal to 1 for all games played inside the NBA Bubble (without fans). Black is a dummy equal to 1 for Black players. Individual controls include a dummy equal to 1 if a player is in the starting lineup of a game. Standard errors are clustered at the team-game level. $*p < 0.10$; $**p < 0.05$; $***p < 0.01$

we estimate deliver results in a tight range.[15] We also run a placebo test where we estimate the change in the performance of Black players relative to White players in regular season games that took place before the Bubble (2019–20) compared to regular season games the previous year (2018–19). We find no change (Appendix Table A2), which lends further credibility to the conclusion that our estimated impact is indeed due to playing inside the Bubble. In a similar vein, we analyze the playoffs the year after the Bubble (2020–21), when fans were back in the stands (Appendix Table A3). Consistent with the hypothesis that the Bubble drove our main result, we do not find a significant difference between the performance of Black and White players in the 2020–21 playoffs (the post-Bubble year) relative to the 2018–19 playoffs (the pre-Bubble year). This also corroborates the conclusion that racial protests following the killing of George Floyd are unlikely to explain our results, as discussed in Section 3, since the issue of police brutality continued to be salient after the end of the Bubble.

To offer some insight into the monetary value of the productivity loss induced by racial pressure among Black players, we estimate the relationship between player

---

[15] The results are robust to the use of two-way clustered standard errors at the level of player-season and team-game (Col. 1 of Appendix Table A1). They are also robust to including players who only play a single game in either year (Col. 2 of Appendix Table A1), and to using Player Efficiency Rating (PER) and Value over Replacement Player (VORP) rating, alternative measures of performance based on the same data as the dependent variable (Col. 3 and Col. 4 of Appendix Table A1). PER is calculated in several steps. The first step is to sum up all of a player's positive accomplishments and to subtract the negative accomplishments in order to obtain an overall rating of a player's performance. Then, in the second step a player's performance is normalized within team and season. The full formula for PER can be found at Sports Reference (2022). On the other hand, VORP is calculated as *(BPM + 2) * share of possessions of each player in a game* where BPM is box plus minus per 100 possessions.

salaries and productivity as captured by the Game Score we use in the analysis.[16] The results, not shown for conciseness, indicate that the negative effect of playing with fans on Black players relative to White players is associated with an earning loss per player of 2.58 million US dollars a year on average.[17] This is a descriptive exercise, but the sheer magnitude of the monetary values involved is sufficient to underscore the economic implications of the problem, as discussed further in the next section.

Finally, we acknowledge that the ideal test of our hypothesis would have been to "turn off" racist behavior per se as opposed to the presence of fans altogether. That source of exogenous variation is not available and would be hard to induce. In the absence of such a test, we can check whether our results are consistent with recorded patterns of racist behavior among fans prior to the pandemic. Specifically, we can test whether the results are stronger when Black players inside the Bubble play against teams whose supporters have been more frequently associated with episodes of racial abuse in the past, relative to playing against those teams before the Bubble. Since a complete record of racial abuse in the NBA is not available, we must rely on evidence of racist behavior in the general population and in the literature.[18] Namely, we rely on recent work by Stephens-Davidowitz (2014), who use large-scale data from Google searches to rank US states by the prevalence of racist attitudes. Their results are compelling and have attracted the attention of the public (e.g., Ingraham 2015 on The Washington Post), but should be treated as suggestive. They show that racist attitudes are most prevalent in the Northeast and in the South of the United States. In line with this, our analysis shows that the performance of Black players inside the Bubble improves the most when they play against teams from the Northeast and the South (Appendix Table A4). The Northeast is also a region where anecdotal evidence suggests that episodes of abuse in NBA games have been more prominent (Himmelsbach 2019, 2022; Haynes 2022).[19]

To probe these findings further, we identify additional proxies for the racist attitudes of a team's fan base and use them to create a triple interaction between Black, Bubble and the attitudes of the opponent's team fan base. If our proposed mechanism is truly at play, we should find that the estimated effect of the Bubble on the performance of Black players is stronger when playing away matches against teams whose fan base

---

[16] We run a cross-sectional regression of salaries in the 2018–2019 season as the dependent variable on players' average GS across the entire 2018–2019 season using salary data from ESPN (2022). The regression also includes year of birth, position dummies, and team fixed effects among the controls. The sample includes all players who played in the 2018–2019 season, that is 389. The coefficient on average GS is 1.01 million, which implies that an increase by one unit of GS is associated with an increase in salary by 1.01 million US dollars per year.

[17] The value of 2.58 million US dollars per year is the product of the estimate of *gamma* in Col. 3 of Table 2 (2.552) and the coefficient obtained from regressing 2018–2019 salaries on average GS (1.01 million US dollars per year, see footnote 16).

[18] Even if an official record did exist, it would be at best partial since racial abuse is difficult to record when it largely consists of slurs from a loud crowd comprising thousands of people who are difficult to monitor individually.

[19] A related hypothesis is that our results may be partly driven by White players performing worse in the absence of fans (assuming White players receive stronger support from crowds than Black players, especially in certain cities). This possibility deserves further scrutiny, but it is consistent with the idea that fan pressure affects players' performance differently on the basis of race.

has more racist attitudes.[20] As the first proxy of racist attitudes, we use the above data on Google searches by Stephens-Davidowitz (2014) at the state level and we define a dummy equal to one if the opponent team is from a state with a high prevalence of racist attitudes (top 25%). Second, we use data on the percentage of non-Black fans (Silverman 2020) and we define a dummy equal to one if the opponent team has a high share of non-Black fans (top 25%).[21] Third, we use historical data based on the 1820 Missouri Compromise and we define a dummy variable equal to one if the opponent team is from a slave state (Forbes 2007). In line with our hypothesis, the results show that the positive effect of playing in the Bubble for Black players is stronger when looking at away games played against opponent teams (i) from states with a high incidence of racist Google searchers (top 25%), (ii) whose fan base is less Black (top 25%), or (iii) from slave states according to the 1820 Missouri Compromise (Appendix Table A5).

5.2 Top players are the most affected by racial pressure

Our second main result is that the average effects described above are driven by top Black players, who are the ones who benefit the most from playing without fans. To rank players, we use wins above replacement (WAR), a statistic that evaluates each athlete relative to a replacement-level player while holding constant the value of the other players (Silver 2019).[22] This is a known metric of performance in the NBA. When we split the sample in half by players' WAR in the pre-Bubble season (Appendix Table A6), we find that Black players in the top 50% of the pre-Bubble performance distribution are the ones whose performance improves the most inside the Bubble relative to White players.[23] Since top players are the ones who generate the most revenue for the league (they are the ones who attract most fans and sponsors) and receive the highest salaries (NBA players with above-median performance are paid 17.5 million US dollars a year, on average, which is almost three times as much as players below the median), this implies that racist pressures are not only detrimental to the performance and well-being of individual players but *they also cause major economic damage to NBA teams by hurting the performance of their most valuable*

---

[20] For completeness, we use both actual away games played outside the bubble and nominal away games played within the bubble, during which piped-in fan noise biased in favor of the nominal home team was played.

[21] It is important to note that with the data at our disposal we can only characterize the racial composition of a team's fan base using TV viewership information. In-person attendance is likely to have an even lower share of Black fans who are on average less wealthy.

[22] Following Silver (2019), players are considered at the replacement level if they are on two-way contracts, that is, they are on the fringe between the NBA and the G League, NBA's minor league.

[23] Black players are represented in similar proportions among top and bottom performers. These results are robust to ranking players based on *average* WAR over the previous two (2017–2019) or three (2016–2019) seasons before the Bubble. They are also robust to using an alternative metric of performance called PREDATOR (Silver 2019), which is a predictive statistic that measures the number of points a player is expected to contribute to his team's offense and defense per 100 possessions, relative to a league-average player. Finally, they are robust to simply ranking players based on average Game Score (the outcome variable we use throughout the analysis) over the season prior to the Bubble. The additional estimates are available upon request.

players. Furthermore, the fact that top players are the ones most negatively affected by fans suggests that the effects we uncover are unlikely to be the result of sheer faltering under pressure (as further discussed below). Top players should be, if anything, the ones who are best equipped to withstand sheer tension from playing before large crowds. On the contrary, the evidence is consistent with an explanation based on racist pressure, whereby top players are targeted most heavily by racist fans seeking to inflict the most damage by affecting the most productive players.

5.3 Competing mechanisms

In this section, we explore a number of mechanisms other than racist pressure that could theoretically lead to the detected change in the performance of Black players vis-à-vis White players inside the Bubble. The results are presented in Table 3.

First, recent studies have shown that Black players may be subject to adverse bias in the judgment of referees (Price and Wolfers 2010, 2012). Coupled with evidence that referees can be affected by crowd pressure (Reade et al. 2022), this may in principle lead Black players to perform better inside the Bubble as a result of fairer referee judgment. To shed light on this mechanism, we separately add the number of personal fouls, and the interaction between referee fixed effects and the dummy for playing inside the Bubble.[24] In particular, since foul calls depend directly on the judgment of referees, investigating whether the inclusion of this variable changes the results is an indirect test of referee bias.[25] When we do this, our results are unchanged (Table 3, Col. 1 and Col. 2).

Second, one may hypothesize that the effect we detect is in fact due to Black players being more likely to play in positions where average performance improved inside the Bubble relative to performance in other positions for reasons that were not connected to the absence of fans. For example, since the Bubble started after a prolonged break in the season due to the initial COVID-19 shutdown, players' training routines were disrupted and one could theorize that such disruption affected players in different positions differently (e.g., centers may take longer to get back in shape due

---

[24] While referees represent a fixed game characteristic, we can still interact this trait with being/not being in the Bubble and analyze how it relates to *changes* in performance. This is to say that we can look at the differential impact of referees outside/inside the bubble over and above other characteristics that are absorbed by the fixed effects. We do this to test whether referees changing behavior inside the bubble may have contributed to our results, but we do not find evidence of that.

[25] It should be noted that we do not include the number of personal fouls in the main specification because it could be considered a "bad" control. Indeed, since the treatment in our analysis is the presence of fans, which has been shown to impact referee behavior, one could view the number of personal fouls as an outcome rather than a control variable. When we use fouls as a dependent variable in our empirical model, we do not find a statistically significant effect of the interaction between Black and Bubble. There is, therefore, no strong evidence in this context that fewer fouls are called against Black players inside the Bubble compared to outside of the Bubble. Despite this evidence, one may still be concerned that our measure of player performance may be affected by referee behavior. To investigate this further, one could measure player performance using the percentage of successful free throws, which one would not expect to be influenced by referees. Unfortunately, this alternative approach is practically impaired by the fact that only a share of all players ever attempt free throws. Within this highly selected sample, we do not find a statistically significant effect of the interaction between Black and Bubble. These additional results are available upon request.

Table 3 Effect of Bubble (no fans) on players' performance, mechanisms

	Referee Bias		Position/Athleticism		Age	Origin	Away	Sheer Pressure		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bubble × Black	2.552***	2.713***	2.442***	1.740**	2.046***	2.998***		2.527***	3.364***	3.505**
	(0.779)	(1.035)	(0.794)	(0.791)	(0.766)	(0.999)		(0.768)	(0.749)	(1.402)
Personal fouls	−0.331***									
	(0.124)									
Bubble × Center-Forward			−3.038*							
			(1.601)							
Bubble × Forward			−3.743***							
			(1.349)							
Bubble × Forward-Center			−0.483							
			(2.643)							
Bubble × Forward-Guard			−0.539							
			(1.570)							
Bubble × Guard			−0.240							
			(1.421)							
Bubble × Guard-Forward			−2.229							
			(1.715)							
Bubble × ΔGS RS20/RS19				0.445**						
				(0.180)						
Bubble × Age					−0.385***					
					(0.099)					
Bubble × Europe/C. Asia						0.546				
						(1.161)				
Bubble × Latin America						−5.366*				
						(3.173)				

Table 3 continued

	Referee Bias		Position/Athleticism		Age	Origin	Away	Sheer Pressure		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bubble × Africa						−2.873*				
						(1.513)				
Bubble × Others						1.089				
						(2.627)				
Black × Away game							0.074			
							(0.921)			
Black × High attendance								0.353		
								(0.779)		
Bubble × ΔGS PO19/RS19									−0.787***	
									(0.142)	
Bubble × Refs	No	Yes	No	No	No	No	No	No	No	No
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Player FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Team-Game FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,870	1,870	1,870	1,870	1,870	1,870	927	1,870	1,870	350
R-squared	0.561	0.567	0.564	0.561	0.564	0.560	0.565	0.559	0.570	0.656

Notes: The dependent variable is players' Game Score. Bubble is a dummy equal to 1 for all games played inside the NBA Bubble without fans. Black is a dummy equal to 1 for Black players. Individual controls include a dummy equal to 1 if a player is in the starting lineup in a game. Column (1) includes the number of personal fouls called against a player in a game. Column (2) includes interactions of Bubble and referee dummies (42). These coefficients are not reported. Column (3) includes interactions between Bubble and players' position. The baseline position is center. Column (4) includes the interaction between Bubble and ΔGS RS20/RS19, the difference in a player's average performance (ΔGS) between the regular season of 2020 (RS20) and the regular season of 2019 (RS19). Column (5) includes the interaction between Bubble and players' age. Column (6) includes interactions between Bubble and players' country group of origin. The baseline country group is USA/Canada. Column (7) includes the interaction between Black and Away game, a dummy equal to one if a team plays an away game. Column (8) includes the interaction between Black and High attendance, a dummy equal to one if a team plays in an arena with above-median fan attendance. Column (9) includes the interaction between Black and ΔGS PO19/RS19, the difference in a player's average performance (ΔGS) between the playoffs of 2019 (PO19) and the regular season of 2019 (RS19). Column (10) only includes games with an absolute margin of victory larger than 20 points. Standard errors are clustered at the team-game level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

to typically larger body size). It may also have affected players differently depending on their prior level of fitness and athleticism. While we have no reason to believe that such traits correlate with race, we can test this hypothesis for completeness. We begin by testing the effect of adding to the model an interaction between the Bubble dummy and a player's position (Table 3, Col. 3). Next, we test the effect of including the difference between a player's average performance in the 2019–20 regular season and the 2018–19 regular season as a measure of the degree to which a player was in shape just before the Bubble relative to the previous year. In both cases, our results are unchanged (Table 3, Col. 4).

A related hypothesis is that age may play a role insofar as players' performance falls with aging and given that the Bubble occurred a year after the previous playoff season. If Black players are younger, on average, this may generate the result we observe.[26] When we control for the interaction between the Bubble and the age of a player in our regressions, we find no evidence in support of this hypothesis (Table 3, Col. 5).

Fourth, COVID-19 was a major source of stress for people throughout the world and NBA players were no exception. Among relatively young athletes who faced limited personal health risks from contracting COVID-19, the biggest worries may have been about the health of their relatives back home. To test whether such worries affected players' performance, we exploit the fact that many NBA players are not from the United States (21% of all players in 2019–20) and COVID-19 did not spread evenly across the world. Some areas were affected earlier and more heavily. Adding players' country of origin to the estimation constitutes an indirect test of the role that COVID-19 worries may have played in driving our results. When we add controls for players' country of origin aggregated by macro-regions, the results do not change (Table 3, Col. 6).

Fifth, playing inside the Bubble entailed playing in a controlled environment with a set routine and, most notably, without the disruptions that traveling for away games normally entails. While there are no a priori reasons to believe that Black and White players would be differently affected by such disruptions, we can test for this possibility by investigating whether Black players performed worse in away games relative to White players before the Bubble. We find no evidence supporting this hypothesis (Table 3, Col. 7). We analyze performance in the 2019 (pre-Bubble) playoffs and we do not find a difference between Black and White players in away games.[27] If the Bubble impacted performance by increasing concentration and reducing the distractions players encounter on the road, there is no evidence that such an effect should have been more prominent among Black players.

Finally, a prominent hypothesis based on a large literature on the pressure effects of crowds (so-called choking effects) is that players from different backgrounds may be differently able to withstand pressures from large audiences, regardless of racist behavior. While we have no reason to believe that Black basketball players should be less able to deal with pressure, this is a theoretical possibility since life experiences that may affect one's susceptibility to crowd pressure and in turn athletic performance may

---

[26] On average, Black players are indeed slightly younger (28.5) than White players (28.8).

[27] We reach the same conclusion if we analyze the 2018–2019 and 2019–2020 regular seasons. Since we use pre-Bubble games, the coefficient on the interaction between the Bubble and the dummy for Black players cannot be identified.

correlate with one's upbringing and family background (Kocher et al. 2012; Moore et al. 2018). We conduct several tests to investigate this hypothesis. First, we attempt to capture high-pressure situations by controlling for whether a match takes place in an arena that had above-median fan attendance prior to the COVID-19 lockdown (Table 3, Col. 8). Second, we introduce a control for the difference between a player's average performance in playoff and regular season games in the 2018–19 (pre-Bubble) season. This difference interacted with the Bubble dummy serves as a control for a player's ability to perform in high-stake situations (the playoffs) relative to low-stake situations (regular season) in normal circumstances before COVID-19 (Table 3, Col. 9). None of these control variables affects the results. Third, we restrict our sample to games in which there should be lower pressure on individual players because the final point difference between the two teams is larger than 20 (and a player's individual actions are unlikely to be pivotal in changing the outcome of the game). We find that the performance of Black players relative to White players improves inside the Bubble even when we focus on games when pressure is lower (Table 3, Col. 10).[28]

6 Conclusions

This paper shows that playing in the absence of fans as a result of the COVID-19 pandemic significantly improved the performance of Black NBA players relative to White players. The result is particularly compelling because Black players are the majority in the NBA. They play, however, in front of predominantly non-Black audiences and they are employed by predominantly non-Black team owners. Mounting evidence of racist behavior among NBA fans and owners is a clear sign of the presence of cleavages reflecting broader societal tensions. Our analysis provides evidence of the impact of these racial divides on player performance, and it strongly resonates with similar evidence from other sports (Caselli et al. 2023).

We also show that the presence of fans is most detrimental for top players, who receive the highest salaries and generate the most revenue for the NBA. This leads to an important conclusion: by lowering players' performance, racist pressures lower the quality of the game and cause economic damage to the NBA. Further work will be necessary to produce precise estimates of these costs, but in a league where the average player has a multi-million dollar yearly salary, the loss of productivity we estimate deserves close attention from NBA executives, who may realize that fighting racism is not only a moral imperative, it is also good for business.

---

[28] Since our analysis focuses on playoff games, one may worry that pressure is always high during such games independently of the point difference and that certain players may be particularly prone to faltering in those circumstances. To the contrary, existing work by Cao et al. (2011) shows that NBA players do not exhibit more faltering under pressure during games with higher stakes. This work also shows that performance under pressure is not affected by attendance, which supports our claim that sheer pressure from crowds is unlikely to explain our results and corroborates our conclusion that racist pressure is the most likely mechanism at play.

Data availability The data used in this article are publicly available (Basketball Reference/Stathead, Inter-Basket, ESPN, FiveThirtyEight).

Declarations

Conflict of interest The authors declare no competing interests.

Disclaimer All errors are our own.

References

Aizer, A., R. Boone, A. Lleras-Muney, and J. Vogel (2020). Discrimination and Racial Disparities in Labor Market Outcomes: Evidence from WWII. NBER Working Paper 27689, National Bureau of Economic Research

Bayer P, Charles KK (2018) Divergent Paths: A New Perspective on Earnings Differences Between Black and White Men Since 1940. The Quarterly Journal of Economics 133(3):1459–1501

Berri DJ, Brook SL, Fenn AJ (2011) From college to the pros: predicting the NBA amateur player draft. Journal of Productivity Analysis 35:25–35

Blair, P. Q. and B. W. Chung (2022). Job Market Signaling through Occupational Licensing. The Review of Economics and Statistics, 1–45

Bontemps, T. and M. Andrews (2020). Three Game 5s set for Wednesday postponed after Bucks' decision to not take floor. https://www.espn.com/nba/story/_/id/29747523/three-game-5s-set-wednesday-postponed-bucks-decision-boycott. Accessed 24 Nov 2023

Bright, S. (2010). Term 'boy' is proof of racial animus. https://library.law.yale.edu/sites/default/files/term_boy.pdf. Accessed 13 Sept 2022

Brinkerhoff DC (2007) A More Employee Friendly Standard for Pretext Claims After Ash v. Tyson. Nevada Law Journal 8(1):474–497

Bryson A, Dolton P, Reade JJ, Schreyer D, Singleton C (2021) Causal effects of an absent crowd on performances and refereeing decisions during Covid-19. Economics Letters 198:109664

Burdekin RCK, Hossfeld RT, Smith JK (2005) Are NBA Fans Becoming Indifferent to Race? Evidence From the 1990s. Journal of Sports Economics 6(2):144–159

Cao Z, Price J, Stone DF (2011) Performance Under Pressure in the NBA. Journal of Sports Economics 12(3):231–252

Caselli, M. and P. Falco (2021). As Long as They Are Cheap: Experimental Evidence on the Demand for Migrant Workers. University of Copenhagen, mimeo

Caselli M, Falco P, Mattera G (2023) When the Stadium Goes Silent: How Crowds Affect the Performance of Discriminated Groups. Journal of Labor Economics 41(2):431–451

Colella, F., P. Dalton, and G. Giusti (2023). Moral Support and Performance. Management Science forthcoming

Cross, J. and R. Uhrig (2022). Do fans impact sports outcomes? a covid-19 natural experiment. Journal of Sports Economics forthcoming, 15270025221100204

ESPN (2022). NBA Player Salaries – 2018-2019. http://www.espn.com/nba/salaries/_/year/2019/seasontype/1. Accessed 13 Sept 2022

Foley M, Smith FH (2007) Consumer discrimination in professional sports: new evidence from major league baseball. Applied Economics Letters 14(13):951–955

Forbes RP (2007) The Missouri Compromise and Its Aftermath: Slavery & the Meaning of America. University of North Carolina Press, Chapel Hill

Fromal, A. (2017). NBA Metrics 101: Which NBA Playoff Myths Are Actually True?, Bleacher Report. https://bleacherreport.com/articles/2708178-nba-metrics-101-which-nba-playoff-myths-are-actually-true. Accessed 13 Sept 2022

Gallo E, Grund T, Reade J (2013) Punishing the Foreigner: Implicit Discrimination in the Premier League Based on Oppositional Identity. Oxford Bulletin of Economics and Statistics 75(1):136–156

Glennon, B., F. Morales, S. Carnahan, and E. Hernandez (2021). Does Employing Skilled Immigrants Enhance Competitive Performance? Evidence from European Football Clubs. NBER Working Papers 29446, National Bureau of Economic Research, Inc

Goldstein, R. (2022). Bill Russell, Who Transformed Pro Basketball, Dies at 88, The New York Times. https://www.nytimes.com/2022/07/31/sports/basketball/bill-russell-dead.html. Accessed 13 Sept 2022

Gong H (2022) The Effect of the Crowd on Home Bias: Evidence from NBA Games During the COVID-19 Pandemic. Journal of Sports Economics 23(7):950–975

Haynes, C. (2022). Sixers fan that was ejected for taunting Los Angeles Lakers star Carmelo Anthony kept calling him a "boy" and yelling "get in the corner boy" and "keeping shooting boy," league sources tell @YahooSports, [Tweet], Twitter. https://twitter.com/ChrisBHaynes/status/1486895378297278470. Accessed 13 Sept 2022

Higgs N, Stavness I (2021) Bayesian analysis of home advantage in North American professional sports before and during COVID-19. Scientific Reports 11:14521

Himmelsbach, A. (2019). Why a fan got just a 2-year ban after allegedly calling DeMarcus Cousins the n-word, The Boston Globe. https://www.bostonglobe.com/sports/celtics/2019/03/29/garden-fan-was-banned-for-racial-slur-directed-demarcus-cousins/Jn9RVg8SMgdhbIbigq3WkJ/story.html. Accessed 13 Sept 2022

Himmelsbach, A. (2022). LeBron James takes a shot at Celtics fans: 'They racist as [expletive]', The Boston Globe. https://www.bostonglobe.com/2022/07/16/sports/lebron-james-takes-shot-celtics-fans-they-racist-expletive/. Accessed 13 Sept 2022

Horrace WC, Jung H, Sanders S (2022) Network Competition and Team Chemistry in the NBA. Journal of Business & Economic Statistics 40(1):35–49

Imbens, G. W. and D. B. Rubin (2015). Causal Inference for Statistics, Social, and Biomedical Sciences. Number 9780521885881 in Cambridge Books. Cambridge University Press

Ingraham, C. (2015). The most racist places in America, according to Google, The Washington Post. https://www.washingtonpost.com/news/wonk/wp/2015/04/28/the-most-racist-places-in-america-according-to-google/. Accessed 13 Sept 2022

Interbasket (2020). What percentage of NBA players are Black and how many players are white? https://www.interbasket.net/news/what-percentage-of-nba-players-are-black-how-many-are-white/31018/. Accessed 13 Sept 2022

Kanazawa MT, Funk JP (2001) Racial Discrimination in Professional Basketball: Evidence from Nielsen Ratings. Economic Inquiry 39(4):599–608

Kline, P., E. K. Rose, and C. R. Walters (2022). Systemic Discrimination Among Large U.S. Employers. The Quarterly Journal of Economics 137(4), 1963–2036

Kocher MG, Lenz MV, Sutter M (2012) Psychological Pressure in Competitive Environments: New Evidence from Randomized Natural Experiments. Management Science 58(8):1585–1591

Lang K, Manove M (2011) Education and Labor Market Discrimination. American Economic Review 101(4):1467–1496

Lang K, Spitzer AKL (2020) Race discrimination: An economic perspective. Journal of Economic Perspectives 34(2):68–89

Magistro, B. and M. Wack (2022). Racial Bias in Fans and Officials: Evidence from the Italian Serie A. Sociology forthcoming

Moore LJ, Young T, Freeman P, Sarkar M (2018) Adverse life events, cardiovascular responses, and sports performance under pressure. Scandinavian Journal of Medicine & Science in Sports 28(1):340–347

Parsons CA, Sulaeman J, Yates MC, Hamermesh DS (2011) Strike three: Discrimination, incentives, and evaluation. American Economic Review 101(4):1410–1435

Pettersson-Lidbom P, Priks M (2010) Behavior under social pressure: Empty Italian stadiums and referee bias. Economics Letters 108(2):212–214

Pew Research Center (2016). On Views of Race and Inequality, Blacks and Whites Are Worlds Apart. https://www.pewresearch.org/social-trends/2016/06/27/on-views-of-race-and-inequality-blacks-and-whites-are-worlds-apart/. Accessed 13 Sept 2022

Ponzo M, Scoppa V (2018) Does the Home Advantage Depend on Crowd Support? Evidence From Same-Stadium Derbies. Journal of Sports Economics 19(4):562–582

Price J, Wolfers J (2010) Racial Discrimination Among NBA Referees. The Quarterly Journal of Economics 125(4):1859–1887

Price J, Wolfers J (2012) Biased referees?: Reconciling results with the nba's analysis. Contemporary Economic Policy 30(3):320–328

Principe F, van Ours JC (2022) Racial bias in newspaper ratings of professional football players. European Economic Review 141:103980

Reade JJ, Schreyer D, Singleton C (2022) Eliminating supportive crowds reduces referee bias. Economic Inquiry 60(3):1416–1436

Reynolds, T. (2019). NBA Enacting Zero-Tolerance Rules for Abusive, Hateful Fan Behavior. https://www.nba.com/news/nba-enacting-zero-tolerance-rules-fan-behavior. Accessed 13 Sept 2022

Schroffel JL, Magee CSP (2012) Own-Race Bias Among NBA Coaches. Journal of Sports Economics 13(2):130–151

Scoppa V (2021) Social Pressure in the Stadiums: Do Agents Change Behavior without Crowd Support? Journal of Economic Psychology 82:102344

Selbe, N. (2021). Marcus Smart on Hearing Racist Comments From Fans: 'Sad and Sickening', Sports Illustrated. https://www.si.com/nba/2021/05/27/marcus-smart-kyrie-irving-boston-celtics-fans-racist-comments. Accessed 13 Sept 2022

Silver, N. (2019). How Our RAPTOR Metric Works, FiveThirtyEight. https://fivethirtyeight.com/features/how-our-raptor-metric-works/. Accessed 13 Sept 2022

Silverman, A. (2020). Demographic Data Shows Which Major Sports Fan Bases Are Most Likely to Support or Reject Social Justice Advocacy, Morning Consult. https://morningconsult.com/2020/09/10/sports-fan-base-demographic-data/. Accessed 13 Sept 2022

Sports Reference (2022). Calculating PER. https://www.basketball-reference.com/about/per.html. Accessed 13 Sept 2022

Stathead (2022). Stathead Basketball. https://stathead.com/basketball/. Accessed 13 Sept 2022

Steinfeldt H, Dallmeyer S, Breuer C (2022) The Silence of the Fans: The Impact of Restricted Crowds on the Margin of Victory in the NBA. International Journal of Sport Finance 17:165–177

Stephens-Davidowitz S (2014) The cost of racial animus on a black candidate: Evidence using Google search data. Journal of Public Economics 118:26–40

Teramoto M, Cross CL (2010) Relative Importance of Performance Factors in Winning NBA Games in Regular Season versus Playoffs. Journal of Quantitative Analysis in Sports 6(3):1–17

Thompson, K. (2021). 'Something's about to go down': Revisiting the NBA protests a year later. https://www.boston.com/sports/nba/2021/09/07/boston-reporter-celtics-executive-nba-bubble-protest/. Accessed 24 Nov 2023

Tynes, T. (2019). Foul Fans: NBA Players Speak Out Against Verbal Abuse in Arenas, The Ringer. https://www.theringer.com/nba/2019/4/19/18485810/nba-fan-abuse-russell-westbrook-utah-jazz. Accessed 13 Sept 2022