A NATURAL EXPERIMENT TESTING THE IMPORTANCE OF CROWDS FOR THE HOME ADVANTAGE IN SPORTS

Author:
Emily B. Garron

Faculty Sponsor:
John Ruscio
Department of Psychology

ABSTRACT

Players, coaches, and fans have long known that home teams win more than 50% of all games in most sports. A wide range of factors have been proposed to account for this home advantage (e.g., the effects of travel, familiarity with one's home venue, the energizing effects of a supportive crowd), and research suggests that many of these play a much smaller role, if any, than is widely believed. Consensus has emerged that referee bias may be the most significant factor favoring home teams. It is often suggested that this bias is amplified by the presence of a large, noisy crowd, which psychologically intimidates referees and influences their behavior even if only unconsciously. Testing the influence of crowds is challenging under normal circumstances, but the COVID-19 pandemic led to crowd restrictions that afford a unique natural experiment. If crowds are an important factor, one would expect that the baseline level of home advantage in a given sport would decrease when crowds are absent and then rebound when crowds return. An examination of trends for five major sports leagues in the United States before, during, and after the period of COVID-related crowd restrictions fails to support this prediction. Instead, the home advantage remained robust to the disappearance and reappearance of crowds. In two of five sports leagues, there has been a decline in home advantage, but this predated COVID-related crowd restrictions and persisted even after crowds returned. The legalization of sports gambling and officiating-relevant rule changes may explain the reduction in referee bias, and therefore in home advantage, and directions for future research to test these possibilities are discussed.

INTRODUCTION

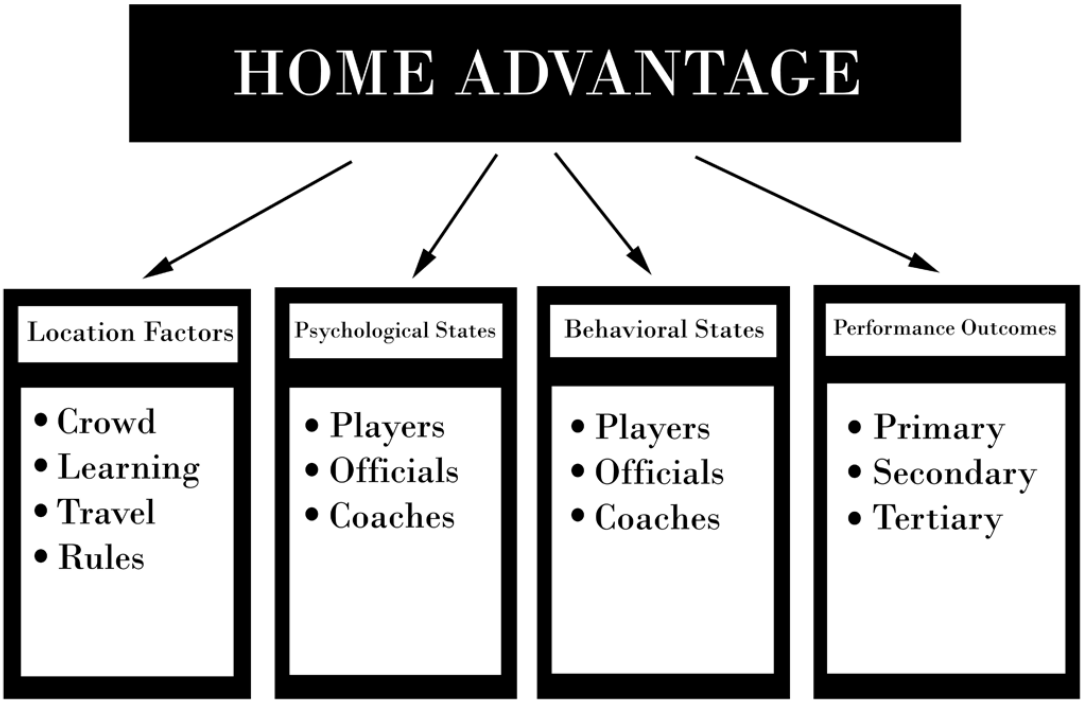
The home advantage in sports is observed when home teams win more than 50% of all games played (Courneya & Carron, 1992), and this occurs in most professional and collegiate sports leagues around the world (Jamieson, 2010; Moskowitz & Wertheim, 2011). The magnitude of home advantage, however, varies substantially across these leagues. In professional sports leagues in the U.S. over the last 12 seasons, for example, the average home-team winning percentage ranges from a high of 63.4% in Major League Soccer (MLS) to a low of 53.6% in Major League Baseball (MLB), with intermediate levels of 60.1% in the National Hockey League (NHL), 58.2% in the National Basketball Association (NBA), and 55.8% in the National Football League (NFL).

Many factors have been identified to account for the home advantage and its variation across sports leagues. Courneya and Carron (1992) developed an organizational framework for theory and research that classifies factors into those dealing with location (e.g., crowds, learning effects, travel, game rules); psychological and behavioral states of competitors, officials, and coaches; and performance outcomes (e.g., primary outcomes such as fundamental skill execution, secondary outcomes such as scoring, tertiary outcomes such as winning vs. losing a game or point differential).

Research has suggested that the factor with the greatest impact on home advantage involves a type of referee bias and that this referee bias is in turn magnified by the presence of crowds (Moskowitz & Wertheim, 2011). Though there are a number of lines of evidence that are consistent with this explanation, the COVID-19 pandemic provided a unique opportunity to put this to the test because many sports leagues played the 2020 season with restrictions on crowds, often with no spectators at all in attendance. The present study tested the extent to which home advantage depends on crowds through a natural experiment that enabled comparisons with the presence vs. absence of crowds. The baseline level

of home advantage was calculated for seasons prior to COVID and then compared to the level of home advantage during a crowd-restricted season as well as a season in which crowds returned. These time series would support the importance of crowds as an explanatory factor to the extent that home advantage decreased from its baseline level in 2020 and then rebounded toward that baseline level in 2021.

Figure 1. Components of the home advantage in sports.



REFEREE BIAS

It is well established that referees are not always objective, making calls strictly based on the rules. There are some unwritten rules that guide referee judgment, too. For example, one unwritten rule of officiating appears to be trying to have as little influence on the game outcome as possible. In most circumstances, even-handedly enforcing the rules is consistent with this goal. However, there are times when the situation calls for tactfully doing otherwise. "Swallowing the whistle," or knowingly overlooking a minor rule infraction at a key moment in a game, is one way to avoid the appearance of having the outcome decided by officials. Moskowitz and Wertheim (2011) describe several instances where referees have been publicly shamed for strictly enforcing the rules such that a technically correct call ultimately decided the outcome of an otherwise exciting competition, enraging fans of the sport. Officials want to avoid the stress of making such a call, and the retribution from crowds that would likely follow (Nevill et al., 2002; Guérette et al., 2021). They understand that it is better to let players determine the outcome of the game instead of making what may be perceived as an overly intrusive call in a big moment.

Another way in which referees try to minimize their real or perceived influence on game outcomes is to make up for a bad call that benefits one team by later making another bad call that benefits the other team (Moskowitz & Wertheim, 2011). Mistakes are unavoidable when human judgment is involved, so there will always be some bad calls in sports that occur unintentionally. However, when a referee recognizes that a mistake has been made, they will feel compelled to try to balance the scales, to right their wrong. This can result in another bad call, but this time made intentionally. As much as this is unfair in the moment, it can be understood as serving the broader interest of fairness in the ultimate game outcome.

In addition to unwritten rules of officiating that are designed not to influence game outcomes, others are designed to give spectators more of what they want to see. For example, spectators prefer for there to be more action in a sports contest, so some forms of referee bias tend to steer a game in this direction. In a baseball game, spectators want to see batters either put the ball into play or strike out swinging, rather than having an umpire determine the outcome via a walk or a called third strike. Moskowitz and Wertheim (2011) show how this preference influences the home-plate umpire's calling of balls and strikes. Pitches near the edges of the strike zone are much more likely to be called a strike if the count is 3-0 and a ball if the count is 0-2. In each case, the effect is to prolong the at-bat, giving the batter further opportunities to hit the ball or strike out swinging. The fact that MLB chooses not to replace the umpires with technology that can more accurately call balls and strikes probably stems in part from the fact that spectators prefer a game with more balls being put into play and swinging strikeouts than at-bats ending in walks or called strikeouts.

Another way to give spectators more of what they want to see is to keep stars in play as much as possible. For example, in baseball an umpire can also massage the strike zone to keep a star from striking out, and in basketball the referees can look the other way when a star is at risk of fouling out of a game. Considerable research suggests that referees do indeed make calls more favorable to star players to keep them involved in the action (Caudill et al., 2014; Moskowitz & Wertheim, 2011; Nevill & Holder, 1999; Courneya & Carron, 1992).

Though there are many factors widely believed to contribute to the home advantage in sports (e.g., the rigors of travel vs. the comforts of home, familiarity with unique characteristics of a home stadium or arena, the energizing effects of having a crowd cheer for you rather than booing you), most of these ideas appear incapable of explaining much, if any, of the effect when submitted to empirical tests (Moscowitz & Wertheim, 2011). In fact, the home advantage appears to stem largely from another type of referee bias intended to give spectators more of what they want to see. Specifically, officials seem to make calls that favor the home team.

Not only do most of the fans in attendance usually support the home team, but also an entire sports league might prefer some degree of home advantage because this can increase revenues in the stadiums (e.g., happy fans will stay longer and buy more food, drinks, and merchandise). Officials are keenly aware of the crowd's attitudes, if not the more abstract and subtle preference of a league, and their behavior may be the largest causal factor giving rise to home advantage. Several studies show that home teams receive far fewer penalty calls against them than visiting teams (Boyko et al., 2007; Courneya & Carron, 1992; Fischer & Haucap, 2021; Guérette et al., 2021; Nevill & Holder, 1999; Nevill et al., 2002; Sors et al., 2020; Wunderlich et al., 2021), but that evidence alone is equivocal. For example, perhaps home teams commit fewer infractions. It might be that they are better rested because they did not have to travel as far from home to compete, or that they are performing better thanks to the support of the home crowd. The visiting team, in contrast, may find themselves at a relative disadvantage and try to make up for this with more aggressive play, thereby running afoul of the rules more often.

Moscowitz and Wertheim (2011) review what may be the most compelling lines of evidence suggesting that referee bias does in fact cause the lion's share of the home advantage in sports. To start with, they observe that referee bias becomes most influential at the end of close games. This is suggestive of discretion being exercised, as throwing some calls the home team's way is being reserved for situations when it is most likely to have an impact. To spread such calls throughout a game, particularly in a lopsided contest whose outcome will not depend on a few calls going one way or the other, would run the risk of appearing biased for no reason.

At least as important is the discrepancy between comparatively subjective vs. objective calls, as only the former affords much room for referee discretion. For example, in the NFL a delay of game penalty is quite objective in that anyone can see when the 40 second play clock has expired, whereas a pass interference call can be highly subjective because it can be difficult to determine whether an illegal form contact occurred and was sufficient to materially affect a receiver's chances of catching the ball. Each sport has rules that vary along this continuum of objective to subjective. What is striking is that when the game is on the line, officials tend to make fewer subjective calls against the home team even as the number of objective calls remains the same (Moscowitz & Wertheim, 2011). Random errors in referee

judgment would be distributed more evenly, with objective or subjective calls equally likely to favor either team at any point in a game. The observed deviations from random error all suggest that referees are exercising discretion in ways that favor the home team when it can make a difference.

THE ROLE OF CROWDS

In addition to showing that referee bias does appear to favor the home team, research has explored possible moderators or mediators of referee bias. The influence of crowds has emerged as a leading contender to help explain what motivates officials to favor the home team. It is sometimes suggested, for example, that a large, noisy crowd can be psychologically intimidating for officials, causing them to exhibit a bias favoring the home team that may or may not be intentional (e.g., Moscowitz & Wertheim, 2011). Both absolute crowd size (the total number of spectators in attendance) and relative crowd size (the percentage of a venue's capacity that is filled) have been examined for their impact on home advantage (Boyko et al., 2007; Goumas, 2013; Goumas, 2014; Courneya & Carron, 1992; Nevill & Holder, 1999; Fischer & Haucap, 2021; Wunderlich et al., 2021), as have crowd noise and crowd support (Nevill et al., 2002; Sors et al., 2020; Waters & Lovell, 2002). The results have been mixed, but it remains possible that officials may feel more pressure to decide subjective calls, at critical moments, in favor of the home teams in the presence of large, noisy crowds.

A NATURAL EXPERIMENT

The extent to which crowds induce or amplify a referee bias favoring home teams has been somewhat challenging to test because it is impossible to experimentally manipulate this variable. Crowd sizes and noise levels naturally differ from one game to another, but this variation is confounded by differences in the size of a local population or fan base, the strength of a team, and other variables. This makes it challenging to draw conclusions from correlational evidence on the importance of crowds. In 2020, a unique research opportunity emerged to help untangle the influence of crowds on the home advantage in sports.

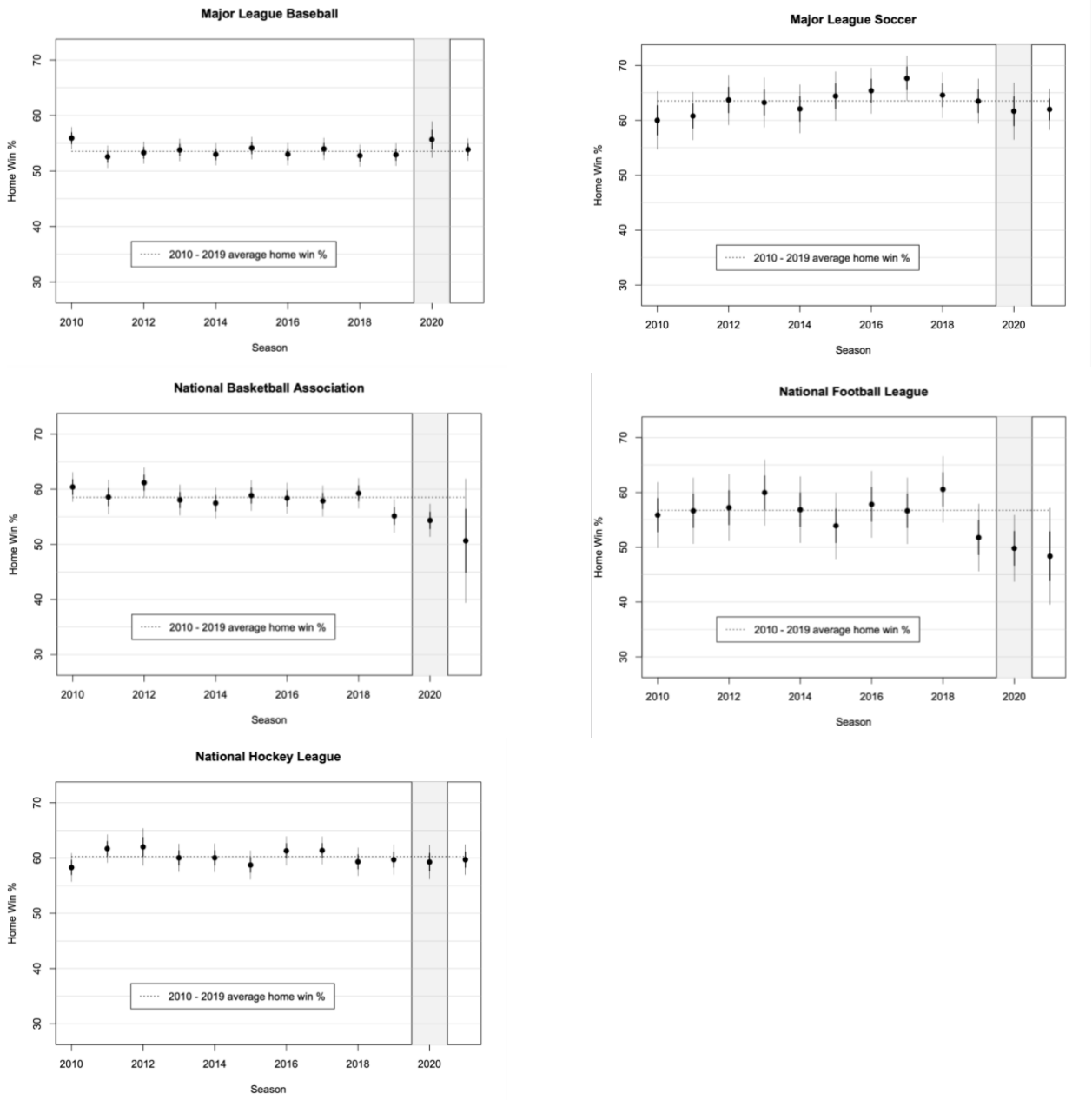
As the COVID-19 pandemic spread around the world and social distancing was a driving force in policy-making, many sports leagues implemented restrictions that either eliminated crowds altogether or severely reduced the number of spectators present. Thus, despite the horrific toll it was taking on humanity, the pandemic offered an unprecedented research opportunity to examine the impact of crowds on the home advantage in sports. For the present study, data were retrieved from five professional sports leagues in the United States (MLB, MLS, NBA, NFL, and NHL) to track changes in home advantage before, during, and after COVID-related crowd restrictions.

Home advantage was calculated for 10 seasons prior to COVID crowd restrictions (2010 to 2019) to serve as a baseline measure of the average and year-to-year fluctuations. This was then compared to home advantage during the 2020 crowd-restricted season and the 2021 season in which crowds returned. Sports leagues were limited to those in the United States because they all experienced similar COVID-19 crowd restrictions, and data were obtained only from professional sports leagues because (a) collegiate sports often involve smaller crowds, which could weaken tests of the influence of crowds, and (b) prior research suggests that, within a sport, the home advantage is equally strong at the professional and collegiate levels (Jamieson, 2010).

It was predicted that if crowds had an impact on the referee bias, then the home advantage would decrease during the COVID-19 crowd restrictions of 2020 and rebound when crowds returned to the stands in 2021. Home advantage for each year was calculated as the winning percentage for home teams, with tied games given half credit (i.e., a tie is counted halfway between a win and a loss). Each data point is accompanied by an estimated standard error that takes into account the size of the sample (i.e., the number of games played in a season). For the 2021 season, home advantage was calculated for complete seasons of play in MLB and MLS and all games played by the end of October in the ongoing seasons of the NBA, NFL, and NHL. The graphs for each sport are shown in Figure 2. In each graph, the average for the 10 seasons prior to COVID crowd restrictions (2010 to 2019) is plotted as a dotted line that extends through the 2020 and 2021 seasons to facilitate the examination of trends.

If crowds are an important factor in generating home advantage, this predicts that the advantage would decrease in 2020 and rebound in 2021. This prediction was not supported by the data. Several sports leagues (MLB, MLS, and NHL) maintained relatively stable home advantages since 2010, with no significant changes during 2020 or 2021. Apparent changes during these seasons are well within the normal range of year-to-year fluctuations and the effects of normal sampling error, as displayed using vertical error bars. The other two leagues (NBA and NFL) did exhibit a significant decline in home advantage in recent years, but this downward trend (a) began the year prior to COVID crowd restrictions and (b) continued even after fans returned to sporting venues. Thus, the lower-than-usual home advantage observed in the NBA and the NFL during 2020 cannot be attributed solely, or even largely, to the absence of crowds.

Figure 2. Home advantage in professional sports leagues in the United States.



This natural experiment strongly suggests that crowds play little role in inducing or magnifying the referee bias that accounts for much of the home advantage in sports. This is a fairly powerful test because COVID crowd restrictions were often so extreme that games were being played in otherwise empty stadiums or arenas, and these restrictions were in place for an entire season in these sports. Wunderlich et al. (2021) reached the same conclusion in a study of European football (soccer) matches played during the COVID era. These findings are also consistent with the fact that home advantage appears to be equally strong, with a sport, for collegiate and professional sports leagues despite the sometimes large differences in crowd size across these leagues.

DIRECTIONS FOR FUTURE RESEARCH

As discussed earlier, research has long suggested that referee bias is a leading contributor to home advantage, and some have speculated that this bias is induced or amplified by the crowd (e.g., Moscowitz & Wertheim, 2011). The present findings do not challenge the influence of referee bias on home advantage, but they do suggest that crowds may play very little, if any, part in this process, as home advantage remains robust even when crowds are highly restricted or entirely absent.

Though not the focus of this study, the recent decline in home advantage in the NBA and the NFL is an interesting phenomenon in its own right. Is this decline merely a fluke, or has something changed within these leagues and caused a sustained reduction in home advantage? There are at least two possible explanations.

First, perhaps the legalization of sports betting in the United States has affected home advantage via a reduction in referee bias. After the U. S. Supreme Court struck down the ban on sports gambling in May, 2018, many states passed laws to allow and regulate sports gambling. With so much money now flowing through sports betting markets, it is possible that executives at the NBA and NFL worried that outsiders might question the integrity of their league if referee bias continued to be detectable in game outcomes. Thus, these leagues may be working harder to improve officiating to avoid accusations of foul play. The fact that home advantage began to decline in the season following the legalization of sports gambling is consistent with this possibility, but if this explanation has merit, it would seem to predict a reduction not only in referee bias favoring home teams, but also other types of referee bias as well as random errors in judgment that do not systematically favor anyone. Future research could investigate this possibility by tracking trends in officiating error and bias before and after the legalization of sports gambling.

Second, recent rule changes aimed to improve officiating may be reducing the home advantage. For example, in the NFL there have been changes regarding the use of instant replay technology, plays that qualify for a coach's challenge or automatic review, and the ability of off-field officials to provide input on calls. These rule changes are designed to enhance fairness by reducing the number of bad calls. To the extent that they have succeeded, this would also predict a reduction in many types of referee bias as well as random errors in judgment. Future research could examine this possibility by tracking changes in officiating error and bias before and after various types of rule changes in specific sports.

CONCLUSIONS

Decades of research has firmly established the primacy of referee bias among an array of factors giving rise to the home advantage in sports, and the present study is entirely consistent with this premise. Likewise, there is no denying that crowds have real effects on athletes, psychologically (e.g., feeling energized by the support of a home crowd) and behaviorally (e.g., crowd noise can interfere with communication for visiting teams). What these findings do call into question, however, is that crowds provide much explanatory power with regard to the home advantage through their influence on athletes or referees. An examination of the home advantage across several professional sports leagues in the United States reveals that severe crowd restrictions had little influence on the size of the home advantage. The decline in home advantage in the NBA and NFL observed in recent years cannot be explained by the influence of crowds, but it does warrant further research to determine whether the legalization of sports gambling, rule changes designed to reduce officiating mistakes, or other mechanisms can account for this

decline. As much as crowds love to see their home teams win, the reduction of home advantage implies that high-stakes sporting events are being officiated more fairly.

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