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Effects of crowd size on referee decisions: Analysis of the FA Cup

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Abstract

Data were collected on the number of first yellow cards awarded during 857 games, over six seasons (1996–2002), played in the Football Association (FA) Cup. Overall, a significantly higher number of yellow cards were awarded against the away team, while a non-linear relationship between crowd size and yellow cards was observed. In general, the probability of a yellow card being awarded against the home team decreased as crowd size increased, but was attenuated for the largest crowd sizes. Crowd size may be related to the probability of the home team receiving a yellow card in two potential ways. Crowd noise may be a decision-making heuristic whereby the likelihood that an incident is a foul is increased when accompanied by crowd noise. Alternatively, referees may seek to appease the crowd and are more likely to do so as crowd size increases. The present findings have implications for the training of match officials and for coaches and players as they prepare to play away from home.

Keywords: *Home advantage, game location, soccer, officials, yellow cards, football, audience, supporters*

Introduction

There is a growing literature exploring the dual concepts of home advantage and referee (official) bias in sports encounters. The former is concerned with the finding that sports teams tend to perform better (i.e. win more games, accumulate more points) when performing at home rather than away from home (Carron, Loughhead, & Bray, 2005). The latter is concerned with officials making discretionary decisions that favour the home team (Nevill, Balmer, & Williams, 2002). It would appear that one possible contributory factor to the home advantage phenomenon is officials' decision making.

Four game location factors are thought to contribute to the home advantage (Carron *et al.*, 2005; Courneya & Carron, 1992): the influence of the crowd, familiarity with the facilities, the impact of travel on performance, and rules within competition. Of these four factors, crowd factors have been proposed to be the most dominant cause of the home advantage (Nevill & Holder, 1999). Yet, teasing out the characteristics of the crowd that contribute most to the home advantage has been difficult. For example, an increased home advantage has been associated with increased crowd sizes in

some studies (Schwartz & Barsky, 1977; Nevill, Newell, & Gale, 1996) but not in others (Pollard, 1986; Pollard & Pollard, 2005). Similarly, an increased home advantage has been associated with increased crowd density in some studies (Agnew & Carron, 1994; Schwartz & Barsky, 1977) but not in others (Pollard, 1986). Crowd behaviour has also been examined, with normal crowd behaviour (e.g. cheering) having a positive impact on the performance of the home team (Greer, 1983; Thirer & Rampey, 1979) but antisocial behaviour (e.g. swearing, chanting obscenities) having a negative impact on the home team (Thirer & Rampey, 1979). Thus, to date there is no uniform research outlining the manner in which a crowd contributes to the home advantage phenomenon (Jones, Lavalley, & Bray, 2007).

Although it may vary in size, density, and behaviour, there is almost always an audience present during sport competition and while the relationship between the characteristics of the crowd and the home advantage phenomenon is equivocal, there is evidence to suggest that a crowd may affect factors that could potentially contribute to home advantage. Of relevance to the present study is research demonstrating that officials may be

influenced by a crowd to favour the home team. For example, research has shown that discretionary refereeing decisions, such as adding extra time, are biased in favour of the home team in Spanish (Garicano, Palacios, & Prendergast, 2001) and German football (Sutter & Kocher, 2004). Also, referees are more likely to treat the tackles made by the home team leniently when exposed to the effects of crowd noise (Nevill *et al.*, 2002). Interestingly, both Pollard (1986) and Clarke and Norman (1995) showed that in English football home advantage was reduced in the case of local derbies or games that only involved London's 13 clubs. The implication is that stadia that were more evenly populated in terms of support contributed to a reduced home advantage. Finally, it appears that small crowds do not appear to impact upon officials in the same way. In minor league cricket, which averages less than 50 spectators a game, there is no evidence of official bias (Jones, Bray, & Bolton, 2001).

Two potential explanations are proposed to account for why officials may favour the home team. The first and most common explanation offered is psychological and descriptive of the decision-making process. Nevill and Holder (1999) argued that crowd noise acts as a decision-making heuristic (Tversky & Kahneman, 1974), whereby the likelihood that an incident is representative of a foul is increased when accompanied by crowd noise. Crowd noise is likely to be substantially louder following a foul by a member of the away team than a foul by a member of the home team.

Sutter and Kocher (2004) have recently offered an alternative explanation. Adopting an economic rather than psychological perspective, they argue that Agency Theory predicts referee bias as the rational, optimizing response to the need of officials to balance appearing impartial to their "employers" (i.e. football governing body) with appeasing the crowd. In this case, the referees are fully informed agents when making a decision, and as the monitoring is less complete from their employers than the immediate crowd, there is a tendency to be biased in favour of the home team.

Thus, there is evidence to suggest that a crowd may affect the decisions of match officials, either by the noise they make or by the referee's perception that they are being monitored and this may be a potential contributory factor to the home advantage phenomenon. In the present study, we aimed to extend the literature in two related ways. First, data were taken from the premier football cup competition in England – the Football Association (FA) cup. Because teams in this competition play others from higher and lower divisions, the range of crowd sizes is likely to be wider. Having more variance in the data may help to tease out the effects of crowd size more

readily and in particular highlight possible non-linear relationships indicative of "threshold" effects of crowd sizes. In this regard, Nevill *et al.* (1996) acknowledge the possibilities of "peak" effects and Jones *et al.* (2001) "null" effects. Threshold effects are a feature of many decision-making models involving compensatory and non-compensatory heuristics (cf. Earl, 1996). Second, by exploring matches where a higher ranked team is playing away from home against a lower ranked team (and, of course, vice versa), this may help to control for one possible explanation of referee bias that the home team will tend to attack more because of a more attacking strategy employed by the coach (Dennis & Carron, 1999), as higher ranked teams playing away from home against lower-ranked teams may also be expected to employ an equally attacking strategy because of a positive expectation of success.

Three main hypotheses were tested in this paper. First, we hypothesized that the away team would receive significantly more yellow cards than the home team. Second, the relationship between yellow cards awarded to home and away players would change as crowd size changed. Finally, we hypothesized that there would be an increase in the probability of the yellow cards being awarded against the home team as a result of playing a better and possibly more attack-minded away team.

Methods

The Football Association supplied data on the referees' decisions from 857 games, over six seasons (1996–2002), in the premier football cup competition in England – the FA Cup. The focus was on the first yellow card awarded against a player. Straight red cards could be awarded for rash, aggressive, and unusual behaviour from players, while second yellow cards, although awarded for similar offences to the first yellow, have the added consequence of the player being dismissed from the field of play. Of the 2808 decisions recorded, 2622 were first yellow cards, 109 were second yellow cards, and 77 were straight red cards. The games included those from the first round until the quarter-finals, as the semi-finals and finals were played at neutral grounds. The range of crowds in this sample (871–67,029) enabled a detailed exploration of threshold crowd effects to be explored. Data on crowd size were taken from www.soccerbase.com.

To test the first hypothesis, the overall frequencies of first yellow cards awarded to home and away players were explored using a χ^2 test. Then a binary logistic regression model was used to test the second and third hypotheses simultaneously to control for possible interaction effects. In the binary logistic regression model, the dependent variable, *home* vs.

away, measured whether the first yellow card was awarded to a home-team or an away-team player. The independent variables crowd size and its squared term, *crowd* and *crowdsq* respectively, were included to test the second hypothesis, with the quadratic term, *crowdsq*, testing if the relationship between yellow cards awarded to home and away players changed as crowd size changed (i.e. a non-linear relationship). A divisional difference variable, *divdiff*, which was defined as the difference in divisions between the home team and the away team, was included to test the third hypothesis that the award of yellow cards would vary with the quality of opposition. This variable ranged in value from -4 to +4 because the data included Premiership clubs, clubs from the three divisions of the football Championship, and non-league teams. A value of "0" would indicate that the teams were playing in the same division. Subsequently, a plus or minus value would indicate how many divisions below or above the home team the opposing team was drawn from respectively. Finally, because the effects of the variables being used to test hypotheses 2 and 3 may operate in combination, an interaction term, *crowdiff*, was included to control for this. The full estimated model is reported below in equation (1), where the variables are as defined above, \ln is natural logarithm, P_i is the probability of receiving a first yellow card as home-team player rather than an away team player, the β_i s are coefficients to be estimated, and ε_i is a random error. The units of analysis, i , were a total of 2622 decisions to award a first yellow card.

$$\ln(P_i/1 - P_i) = \beta_1 + \beta_2 \text{crowd}_i + \beta_3 \text{crowdsq}_i + \beta_4 \text{divdiff}_i + \beta_5 \text{crowdiff}_i + \varepsilon_i \quad (1)$$

Results

The first hypothesis was tested using a χ^2 test to explore the frequency of first yellow cards awarded to home and away players. In support of the first hypothesis, significantly more first yellow cards [$\chi^2(1, N=2622)=36.18, P<0.001$] were awarded against the away team ($n=1465$) than the home team ($n=1157$).

To test the second and third hypotheses, the data were analysed using a binary logistic regression. Table I records the estimated regression coefficients (undertaken on STATA), their asymptotically normal z -scores, and the significance level with which the null hypothesis that a $\beta_i=0$ can be rejected. The lower part of the table reports the sample size, the pseudo R^2 for the regression, and the Wald statistic of the overall significance of the regression.

Table I. Logistic regression on home and away.

Independent variables	Coefficient	z -score	P
Crowd	-2.47×10^{-5}	-2.17	0.030
Crowdsq	5.75×10^{-10}	2.10	0.036
Divdiff	0.389	7.72	0.000
Crowdiff	-3.79×10^{-5}	-9.11	0.000
Constant	-0.0965	-1.21	0.226
n	2622		
Pseudo R^2	0.0310		
$\chi^2(4)$	111.63		
Prob. > χ^2	0.000		

The results indicate that controlling for divisional difference, the effects of crowd size do impact referee bias. In support of the second hypotheses, the negative coefficient reveals that the log-odds ratio for a home rather than away yellow card being awarded reduces as crowd sizes increase. The results, however, do not indicate a uniform effect. In part, this is implied by the non-linear relationship between the log-odds ratio and the underlying probabilities of receiving a card. However, more explicitly, the positive sign on the variable *crowdsq* suggests that the log-odds ratio for a home yellow card increases as larger incremental crowd sizes are experienced.

In support of the third hypothesis, the positive sign on the variable *divdiff* also reveals that the log-odds ratio of a home team rather than away team yellow card increases if the home team is of lower quality than the away team (and vice versa). This is consistent with the third hypothesis that teams of lower quality may receive more yellow cards when playing at home. The negative value on the interaction variable *crowdiff* suggests that this situation is attenuated for home teams if the opposition is better but crowd sizes increase.

Discussion

In this paper, we have explored the impact of crowd size on referees' decisions to award a first yellow card to players from the home and away teams. The data show that referees favoured the home team and awarded significantly more yellow cards against the away team.

The finding that referees awarded significantly more yellow cards against the away team is not surprising and supports previous literature suggesting that referees make more decisions that favour the home team (e.g. Garicano *et al.*, 2001; Nevill *et al.*, 2002; Sutter & Kocher, 2004). The crowd is thought to play an important role in the decision-making process of referees (Garicano *et al.*, 2001; Nevill *et al.*, 2002; Sutter & Kocher, 2004) and a major

finding from this study was that in general the bias in favour of the home team increased as crowd size increased. That is, the likelihood of the yellow card awarded being against the home team decreased as crowd size increased. However, the data suggest that this bias was attenuated for in games with the largest crowds. As the analysis controlled for divisional difference effects *per se*, this may have reflected the later rounds of cup competition and the corresponding growth of support for both teams, with the crowds becoming more balanced, and/or the appointment of referees of a higher standard to officiate at these fixtures. Collectively, these findings are interesting and the non-linear relationship between crowd size and yellow cards extends the literature by building on previous research that acknowledges the possibilities of “peak” (Nevill *et al.*, 1996) and “null” effects (Jones *et al.*, 2001).

The results also imply that the awarding of yellow cards could be related to the quality of the competing teams and not just game location. Specifically, the probability of any yellow card being awarded against the home team was greater when they played against an opponent of higher standing. This may be a result of the home team having to defend more because the away team has employed a more attacking strategy and/or the away team simply has greater possession of the ball because the players have more ability. Interestingly, the probability of the yellow card awarded being against the home team when playing opponents of higher quality was attenuated as crowd size increased.

Unfortunately, determining why the crowd impacts referees' decisions is less clear. These results may reflect an increased likelihood of referees penalizing the away team. In this case, crowd noise can be considered as a decision-making heuristic where the likelihood that an incident is representative of a foul is increased when it is accompanied by crowd noise (Nevill & Holder, 1999). As the noise is likely to be substantially greater from the home crowd when a member of the home team is fouled, this could explain the greater frequency of yellow cards awarded against the away team. However, previous research suggests that crowd noise results in a reluctance to penalize the home team (Nevill *et al.*, 2002). In this regard, it may be the absence of crowd noise (when a member of the home team fouls a member of the away team) that indicates to the referee that no serious offence has been committed, and thus the referee is less likely to penalize the home team. Equally, adopting an economic rather than psychological perspective, the referees, in line with Agency Theory, may be balancing the need to appear impartial to their “employers” (i.e. football governing body) by

appeasing the crowd. As the crowd increases, the monitoring increases from the immediate crowd and there is a tendency to be biased in favour of the home team (Sutter & Kocher, 2004). Clearly, a limitation of the present paper is that it is not possible to determine why referees appear to be biased in favour of the home team. While both psychological and economic theories suggest that crowd effects may be the cause, other possible explanations for the effects cannot be ruled out. For example, there may be some particular characteristic of the games played with smaller crowds (e.g. less important games) that mean the impact of the crowd on referees is less marked.

It is also possible that these results could be explained if players in the away team simply transgressed more frequently. That is, the differences are the result of players', and not officials', behaviour. While it is not possible to rule this explanation out from the current data set, some research evidence would caution against the interpretation. In general, home and away players demonstrate similar levels of aggression, although differences may be observed as a function of game outcome (Jones, Bray, & Olivier, 2005; McGuire, Courneya, Widmeyer, & Carron, 1992). It is possible that yellow cards awarded could be a consequence of poorer performance by the away player (e.g. mistimed challenges) resulting from a less appropriate psychological state for performance than that experienced when playing at home (e.g. Bray, Jones, & Owen, 2002; Terry, Walrond, & Carron, 1998).

Nevertheless, the present study is the first to demonstrate that crowd size is associated in a non-linear manner with the bias displayed by referees. In the future, researchers should build on the work of Nevill and colleagues (2002) and explore the direction of this effect (i.e. increased likelihood of penalizing the away team, or decreased likelihood of penalizing the home team), which may shed some light on why this effect is observed and how the nature of the crowd (e.g. noise, density) might moderate this effect. The findings of this study have implications for players and coaches as they prepare to play away from home. They may reasonably be expected to be penalized more frequently and strategies that help address this (e.g. simulation training where players are penalized frequently by referees in a practice match) may be useful preparation. The findings also have implications for the training of match officials and suggest that psychological techniques, such as desensitization training, may be usefully employed. In addition, the potential to use video referees deployed outside the ground, and therefore away from the influence of the crowd, for crucial match-changing decisions is a strategy worth considering.

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