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Referee home bias due to social pressure. Evidence from Spanish football

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Abstract. This paper analyses referee home bias due to social pressure with data from the matches played in the First Division of the Spanish football league between the 2002/03 and 2009/10 seasons. The aim is to assess the behaviour of the referee in relation to two decisions, namely free kicks awarded and players booked. The variables used to explain referee behaviour are the number of spectators attending matches, the percentage occupation of the stadium and the existence or not of running tracks, all of which are intended to represent social pressure, in addition to referee experience. Furthermore, two control variables concerning ball possession and shots at goal are included. Regarding methodology, two random effects panel data regression models are estimated. The first model explains the difference in the number of home team fouls and away team fouls, while the second explains the difference in yellow and red cards shown to local and away teams. The results obtained cannot confirm, at least in the period under analysis, that Spanish football referees have been biased in favour of the home team when it comes to awarding free kicks. However, once a free kick has been awarded, there does appear to be a referee home bias in the punishment a player receives for committing a foul. These findings suggest that when there is a large crowd in the stadium, the referee tends to find it easier to book away team players than home players. A sensible hypothesis that could explain this result is that the time the referee has to make a decision does affect the final outcome. While referees are not biased when it comes to awarding a free kick, they are when given more time to make a decision, allowing social pressure to work in favour of the home time.

Keywords. Social pressure; crowd effect; referee home bias; sports economics.

INTRODUCTION

Most sports appear to share a home-advantage effect (Carron *et al.*, 2005). The home advantage ‘... implies that a team performs better at home against an opponent than playing away against that same opponent...’ (Stefani, 2008; 204), and this is mainly due to factors related to social psychology (Edwards & Archambault, 1989). In regard to such factors, it is worth high-

lighting crowd support, travel fatigue, familiarity with local conditions, territoriality, referee bias, special tactics, role factors and psychological status (Nevill & Holder, 1999; Pollard & Pollard, 2005; Pollard, 2008).

The existence of a home-advantage effect has been comprehensively tested in the literature, particularly in the case of team sports such as basketball (Gómez & Pollard, 2011), football (Carmichael & Thomas, 2005; Pollard & Gómez, 2009), baseball (Smith, 2003), rugby (Clarke, 2005) and hockey (Agnew & Carron, 1994). Furthermore, there is also evidence of this effect in individual sports such as gymnastics, wrestling, boxing and speed skating (Balmer *et al.*, 2003; Koning, 2005). Conversely, other studies find no empirical evidence of a home-advantage effect in sports such as tennis and golf (Holder & Nevill, 1997) or athletics (Bray & Martin, 2003). In any case, various studies reach the conclusion that the magnitude of the home-advantage effect differs depending on the sport, the sport registering the strongest effect being precisely football (Courneya & Carron, 1992; Pollard & Pollard, 2005; Jamieson, 2010).

In this research we focus on one of the causes of the home-advantage effect in football: referee bias. In general, researchers agree that referee bias constitutes an important part of the home-advantage effect in football. The majority of studies that have addressed this issue to date analyse the English case (Nevill *et al.*, 1996; Boyko *et al.*, 2007; Dawson *et al.*, 2007; Rickman and Witt, 2008; Buraimo *et al.*, 2010), although there is also evidence on the German league (Sutter & Kocher, 2004; Dohmen, 2008; Buraimo *et al.*, 2010), the Italian league (Scoppa, 2008; Pettersson-Lidbom & Priks, 2010) and the Spanish league (Garicano *et al.*, 2005). In addition, there have been studies based on data from European competitions (Dawson & Dobson, 2010) and also some that combine information from different competitions (Page & Page, 2010).

Examining the performance of referees to determine whether or not they are biased in favour of the home side is not an easy task. Some incidents during a match can be interpreted very differently. Occasionally, when a player falls to the ground after an incident, some interpret there has been a foul and others that the player did so intentionally to gain a free kick. As regards free kicks, the referee has a certain degree of discretionary power to decide whether or

not to book a player and, when applicable, whether the card shown is yellow or red. Further evidence of how difficult it is to interpret incidents that occur during the course of a match is that after repeating the incident several times on television, commentators and viewers alike discuss the referee's decision without, on many occasions, reaching agreement.

The referee must be impartial and make decisions by applying the rules. However, the interpretation of some situations during a match and the lack of precision of the human eye leave room for either conscious or unconscious referee bias in favour of the home team. Such referee bias is largely due to social pressure. The relationship between social pressure and referee home bias was studied using two main approaches, the first being the injury time added on by the referee (Dohmen, 2008; Rickman & Witt, 2008) and the second being the disciplinary measures taken by the referee (Boyko *et al.*, 2007; Dawson & Dobson, 2010). In the first case, the referee would tend to prolong injury time when the home team is losing by a short margin. In the second case, social pressure would be expected to tilt the balance of disciplinary measures taken in favour of the home team.

This article follows the second line of research and aims to study whether social pressure can explain referee bias in favour of the home side when it comes to awarding free kicks and booking players. Prior knowledge of systematic behaviour on behalf of referees in favour of home teams due to social pressure might be important, as it could condition a manager's strategy and also players' attitude on the pitch. This research employs data from the First Division matches of the Spanish Professional Football League played between the 2002/03 and 2009/10 seasons, both inclusive.

The first contribution this study makes to the existing literature in this field of research is the way in which referee home bias is analysed, distinguishing between the number of free kicks awarded and the cards players are shown. In the second place, new variables are incorporated to control for certain features of the style of play and quality of the teams that may influence the referee's decision to award a free kick. The results of this study indicate that there is no referee bias in favour of the home team when it comes to awarding free kicks, but that once

a free kick has been awarded, social pressure could influence referee decisions in favour of the local team when deciding to book a player with a yellow or red card.

BACKGROUND

Referee home bias can be due to social pressure in two different ways.¹ The first factor is psychological, in that the referee may be influenced unconsciously by home team supporters. Referee bias is influenced by home spectators' ability to intimidate and the different way that each referee reacts to social pressure (Boyko *et al.*, 2007; Page & Page, 2010). The psychological state of referees created by the actions of local team supporters can have an impact on their behaviour (Jamieson, 2010) and cause a state of anxiety and mental effort (Balmer *et al.*, 2007) that may lead referees to be more lenient where the home team is concerned.

Another argument related to psychology is the idea that referee decision making occurs as in a sequential model of information processing (Bless *et al.*, 2004). In such a sequential process, referees relate a stimulus perceived to prior knowledge in order to judge a certain incident during the course of a match and act accordingly. A wrong decision could be due to '*...smaller errors or incorrect information from different steps of information processing*' (Plessner and Haar, 2006; 557). If crowd noise is assumed to be one of the multiple cues that referees include in the sequential decision making process, then this factor could lead to biased judgement in favour of the local team (Neville *et al.* 2002; Plessner *et al.*, 2009; Unkelbach & Memmert, 2010).

Secondly, from an economic perspective, the Agency Theory explains that a referee could favour a home team consciously (Sutter & Koecher, 2004; Rickman & Witt, 2008) for two reasons. On the one hand, referees could seek to content their employer, the Football Association in each country. This body is responsible for appointing referees for matches, for taking decisions regarding the division referees should be in and, moreover, is authorised to take dis-

¹ Social pressure can also explain home advantage through its effect on players' behaviour. However, analysing this relationship is beyond the scope of this paper.

ciplinary action against referees. On the other hand, during the match the referee may try to please the crowd, which will exert pressure in order to obtain the best result for their team. In this scenario, permissive or imperfect monitoring on behalf of the Football Association can be an incentive for referees to take decisions that favour the home team.

In the literature, several variables have been employed to measure the home advantage effect, such as the difference in the fraction of games won (Stefani, 2008), the standard deviation of team winning percentages divided by an *ideal standard deviation* (Trandel & Maxcy, 2010), goal difference (Page & Page, 2010) or the probability of the local team winning (Forrest *et al.*, 2005). However, as the objective of this research is to explain referee bias, which is only one of the determinants of the home-advantage effect, it is necessary to find variables that represent the result of referee decisions more accurately. This point is discussed in detail later in the paper.

Concerning the variables employed to measure social pressure and explain its influence on referee bias, some studies uphold that the larger the crowd, measured by the number of spectators at matches, the greater the social pressure on the referee (Scoppa, 2008; Page and Page, 2010). For other authors, however, the most relevant variable is crowd density, measured by the number of spectators in relation to the capacity of the stadium (Boyko *et al.*, 2007); in this case, the important aspect would be the psychological effect that empty seats could have (Smith, 2003). One extreme case analysed by Pettersson-Lidbom and Priks (2010) is when some Italian football teams had to temporarily play home matches in empty stadiums in 2007. Similarly, some studies have used crowd noise to measure social pressure, considering that this variable is a better indication of home team supporters' powers of intimidation (Nevill *et al.*, 2002). Finally, the closeness of spectators to the pitch, measured by the presence of an athletics track between the crowd and the pitch, has also been used to estimate social pressure (Dohmen, 2008; Buraimo *et al.*, 2010; Dawson & Dobson, 2010).

The papers that have analysed referee bias in terms of free kicks awarded have also included representative control variables, in the majority of cases to cater for the difference in the quality of the teams playing each other. The reason is that managers could ask players to commit

more fouls to stop opposing team attacks and reduce the amount of time the ball is in play, as higher quality teams normally enjoy more possession of the ball (Dawson *et al.*, 2007; Boyko *et al.*, 2007). In order to account for the difference in quality, most papers use historical data. One option is to construct a variable that compares goals scored and received by the rival teams (Boyko *et al.* 2007; Page & Page, 2010). However, Dawson *et al.* (2007) and Buraimo *et al.* (2010) opt for a measure of the probability of the home team winning, drawing or the away team winning. Furthermore, Dawson and Dobson (2010) build up an index that follows the UEFA seeding and drawing procedures in the two European competitions.

DATA AND MODEL SPECIFICATION

This study is based on a set of data obtained from the Football Year-book (*Guía de la Liga*) by *Marca*, the leading sports newspaper in Spain according to market share, published between 2003 and 2010.² The data refer to matches in the First Division of the Spanish Football League played between the 2002/03 and 2009/2010 seasons, both inclusive. During this period, 3,040 matches were played, although due to a lack of information, the sample used here only includes 2,651 matches. Furthermore, written permission to use the data has been obtained and the study has been approved by the Ethics Committee in Research of the University of Granada in Spain.

In order to analyse the possible existence of referee home bias due to social pressure, two variables are constructed, both representing the disciplinary measures taken by referees. It is important to clarify that, as in Boyko *et al.* (2007) and Page and Page (2010), both variables are expressed as the difference between the home and away teams in order to ascertain whether or not referees treat two teams in the same match differently. Other papers have studied the determinants of free kicks awarded to the home team separately, on the one hand, and those

² Concerning the reliability of this source of information, it must be said that the data are gathered in real time during each match by employees of *Marca* itself or by specialists contracted precisely for this job. Later, the information is checked using videos of the matches. Furthermore, the use of this data source is widespread in the empirical literature on Spanish football (Garicano *et al.*, 2005; Ascari & Gagnepain, 2007; García-Sánchez, 2007; Corral *et al.*, 2008; Carbonell-Nicolau & Comín, 2009; González-Gómez & Picazo-Tadeo, 2010; Picazo-Tadeo & González-Gómez, 2010; García-Rubio *et al.* 2011; González-Gómez *et al.*, 2011).

awarded to the away team, on the other. The drawback of this method is, however, that it fails to take into account the different attitude the referee has towards the two rival teams in the same match.

The first of the variables used to measure referee home bias in this research expresses the difference in the number of home team fouls and away team fouls in one same match. The variable is called *FOUL DIFFERENCE*. As far as the authors of this research are aware, only Pettersson-Lidbom and Priks (2010) have used this variable. The second variable is the *RATIO DISCIPLINARY POINTS DIFFERENCE*, which measures the difference between the ratio of disciplinary points of the home team and the away team. The ratio of disciplinary points is defined as:

$$\text{Ratio disciplinary points}_i = \frac{\text{Disciplinary points}_i}{\text{Fouls}_i},$$

whereby for a team i , the numerator is constructed by adding one point per yellow card received and two points per red card received (Dawson *et al.*, 2007 and Dawson & Dobson, 2010), while the denominator denotes the number of fouls committed by the team.

By considering this variable to explain referee home bias, this paper contributes to the literature, making it possible to implicitly consider that there are two stages in the process of showing a card. Firstly, the referee must indicate a foul and then, secondly, decide whether or not to book the player who committed it. The variable *RATIO DISCIPLINARY POINTS DIFFERENCE* is not intended to analyse the direct relationship between social pressure and cards shown, but rather the influence of social pressure when, after a free kick has been awarded, the referee must decide whether or not the foul warrants a card. Directly analysing the relationship between social pressure and bookings could lead to incorrect results due to ignoring that the number of bookings and fouls might be correlated. In other words, the fact that a referee books more players from the away team than the home team could be due to the former committing more fouls rather than to referee home bias.

In order to capture the possible influence of social pressure on referee decisions, three variables were included. The number of spectators at the stadium, variable *CROWD*, the percentage

of the stadium that is occupied, variable *OCCUPANCY*, and the variable *ATHLETICS TRACK*, which is a dummy variable equal to 1 if there is an athletics track between the crowd and the pitch and 0 otherwise. Initially, a larger crowd, a higher stadium occupancy rate and less distance between the spectators and the pitch could be expected to increase the social pressure on the referee. Likewise, in order to capture how easily influenced the referee is by social pressure, the model includes a variable that represents referee experience, variable *EXPERIENCE*. As in Boyko *et al.* (2007), referee experience is measured by the number of matches refereed in the First Division of Spanish football. A more experienced referee should be less submissive to social pressure (Pollard & Gómez, 2009).

Furthermore, other factors apart from the possible difference in referee criteria for the home and away team could influence referee decisions in a match. This paper further contributes to the literature by including a series of control variables that, as far as the authors are aware, have not been used in previous studies. Instead of the variables based on historical data used in other studies, a couple of variables are included representing how the match unfolds, so as to capture the type of football the teams play and their quality.

In the first place, the variable *POSSESSION SCORE DIFFERENCE*, which represents the difference in the percentage of ball possession between the home team and the away team. It is reasonable to assume that the more time a team has the ball, the less fouls it will commit and, more than likely, the more fouls the players from the opposing team will commit. In the second place, the variable *SHOTS SCORE DIFFERENCE* represents the difference in shots at goal between the home team and the away team and aims to capture the differing attacking tendencies of both teams. Occasionally, a more attacking mentality is not reflected by having greater ball possession, but can also explain why that team commits less fouls.

These variables are also intended to account for the difference in quality between home and away teams. Recent studies have pointed out the importance of quality in home advantage and final outcome (Gómez & Pollard, 2011). Team quality has mostly been measured, as noted previously, using historical data. However, as this research analyses referee bias with match-by-match data, it was decided to use variables that reflect the different behaviour of teams in

each match. In fact, possession score is significantly correlated with two of the most habitual variables used to proxy quality, namely the difference between goals scored and received and the points gained at the end of the season.³ Furthermore, recent studies by Lago & Martín (2007) and Lago (2009) show, with data from professional Spanish football teams, that the worse the opponent, the greater the possession of the ball.

Table 1 presents the descriptive statistics of the variables. The average difference in fouls does not initially suggest the existence of a home effect due to referee bias. In contrast, there does appear to be referee home bias where bookings are concerned. In other words, after a foul is given, the referee seems to penalise the away team more severely.

METHODOLOGICAL NOTE, RESULTS AND DISCUSSION

Methodological note and results

In order to analyse the possible existence of referee home bias in Spanish professional football two random effects panel data regressions were estimated for the determinants of *FOUL DIFFERENCE* and *RATIO DISCIPLINARY POINTS DIFFERENCE*, respectively. In both cases we consider a model with home team effects and another model with referee effects (see Cameron & Trivedi, 2009 for technical details about these models). The estimations were performed with Stata 11 software and the results are presented in Tables 2 and 3.

The results in terms of possible referee home bias where the number of fouls are concerned reveal that none of the variables representing social pressure exert a statistically significant influence on the number of free kicks a referee awards the home and away team (Table 2). Referee experience does not appear to influence the number of free kicks awarded either. Only the control variables *POSSESSION SCORE DIFFERENCE* and *SHOTS SCORE DIFFERENCE* are statisti-

³ The correlation between the variable *POSSESSION SCORE DIFFERENCE*, on the one hand, and the difference between goals scored and received and the difference in points gained at the end of the season between the local team and the away team, on the other, is 0.40 and 0.43 respectively. Furthermore, they are statistically significant at standard confidence levels. Correlation with *SHOTS SCORE DIFFERENCE* is slightly lower, but also statistically significant.

cally significant and display the expected sign. Therefore, having more possession of the ball and being more attacking on the pitch results in a team incurring in less fouls than its rival. Consequently, there does not appear to be referee bias in favour of the home team in terms of free kicks awarded.

However, after indicating a foul, the referee must decide whether or not the player warrants a card and, where applicable, whether the card is yellow or red. Table 3 presents the results of the estimations performed to analyse the possible existence of referee home bias in bookings per free kick (variable *RATIO DISCIPLINARY POINTS DIFFERENCE*). It is worth clarifying that in this case, the explanatory variables *POSSESSION SCORE DIFFERENCE* and *SHOTS SCORE DIFFERENCE* were excluded as ball possession and an attacking strategy can influence the number of free kicks awarded, but never how a player is penalised once a foul has been indicated.

These results show that the variable *CROWD*, which reflects the number of people at a match, is statistically significant and has the expected sign. In other words, this result suggests that once the referee has indicated a free kick, referee bias in favour of the home side does exist and a referee is therefore more likely to book a player from the away team. None of the remaining variables considered in the model is statistically significant at the standard confidence levels.

Discussion

The results of this research cannot confirm, at least in the period under analysis, that Spanish football referees have been biased, due to social pressure, in favour of the home team when it comes to awarding free kicks. However, once a free kick has been awarded, there does appear to be referee home bias in the punishment a player receives for committing a foul. The findings in this paper suggest that when there is a large crowd in the stadium, the referee tends to find it easier to book away team players than home players.

Evidence of referee home bias where bookings are concerned had already been found by Boyko *et al.* (2007), Dawson *et al.* (2007), Downward and Jones (2007), Dawson and Dobson (2010) and Unkelbach & Memmert (2010). However, the results of this research go one step further. At least in the Spanish case, referee bias towards booking away team players is not

brought about by bias in the number of free kicks awarded, but occurs after a foul is indicated. What happens during the moments after a free-kick is awarded and particularly, the pressure the crowd is capable of exerting, can have a significant effect on referees' decisions in favour of the home side.

According to Plessner *et al.*, (2009), referee decisions can be described in the first place as a primarily automatic (or intuitive) process rather than the result of deliberation and, in the second place, as decisions based on multiple rather than single cues. In this framework, one reasonable hypothesis that could explain the results of this study is that the crowd is a cue that would influence the process of indicating a foul differently to the decision to book a player. While referee reaction time when indicating a foul is insufficient to be influenced by the crowd, once the foul has been awarded, the crowd could have a significant impact on the decision regarding whether or not to book a player. This reasoning would be logical if it is assumed that referees have learned to use crowd noise as a decision cue because in general it would serve as a useful indicator of the severity of a foul. Due to the fact that the reaction of a crowd is usually biased against the away team, the use of this knowledge would be inappropriate and would generate referee home bias.

The aforementioned arguments provide, in the opinion of the authors of this paper, quite a sensible framework to explain the results obtained in regard to the existence of referee home bias when booking players. Notwithstanding, the possibility of the results of this research also being influenced by other circumstances apart from referee home bias cannot be discarded. Such circumstances could include the away team committing more serious fouls, in which case the away team would have more players booked as a consequence of playing *more physical* football.

Finally, it is worth highlighting that referee experience is not a significant variable when explaining referee home bias in either of the two relationships studied. This result could be interpreted as a sign of good referee selection and promotion policy on behalf of the Spanish Football Association. When a decision is made to promote a referee to the First Division of Spanish

football, referees have gained enough experience not to be influenced by social pressure to a greater extent than their more experienced colleagues.

CONCLUSIONS

This paper seeks to analyse referee home bias due to social pressure in Spanish football. The main result is that the time a referee has to take a decision could be an important factor when explaining referee home bias. While no empirical evidence was found to support referee bias where the number of free kicks awarded is concerned, after a foul is indicated there does appear to be referee home bias in terms of penalising the players that have committed fouls by booking them. The pressure that local supporters exert moments after a foul has been indicated can be a relevant factor in a referee's final decision.

One recommendation for supporters is that they should exert more social pressure, e.g. crowd noise, during the time after a referee indicates the away team has committed a foul. For those in charge of organising referees, it would be advisable for the decision to book a player to be taken by a referee far from the place where the pressure is being exerted. New technologies make it possible for this type of solution to be applied in practice. Alternatively, training programs focused on referee acquisition of correlations between multiple cues and criteria via automatic learning processes could be promoted. Acquiring the skills necessary to steer clear of the undesired influence of irrelevant cues, such as crowd noise, would be important when it comes to avoiding referee home bias.

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Table 1. Sample description

Variable	Mean	Standard deviation	Maximum	Minimum
<i>FOULS DIFFERENCE</i>	0.167	6.469	26.000	-24.000
<i>RATIO DISCIPLINARY POINTS DIFFERENCE</i>	-0.029	0.139	0.916	-0.700
<i>CROWD (thousand)</i>	28.2	17.9	98.0	5.0
<i>OCCUPANCY (%)</i>	0.742	0.184	1.000	0.167
<i>RUNNING TRACK (dummy)</i>	0.150	0.357	1.000	0.000
<i>EXPERIENCE (games)</i>	99.6	65.2	262.0	0.0
<i>POSSESSION SCORE DIFFERENCE (%)</i>	3.267	16.498	58.600	-62.500
<i>SHOTS SCORE DIFFERENCE (%)</i>	2.920	6.873	31.000	-21.000

Table 2. Referee home bias in fouls indicated (the dependent variable is *FOUL DIFFERENCE*)

Variable	Home team effects	Referee effects
<i>CROWD</i>	0.00252 (0.02215)	0.01340 (0.00778)
<i>OCCUPANCY</i>	-0.18524 (1.15055)	-0.09562 (0.76408)
<i>RUNNING TRACK</i>	0.12978 (0.92223)	0.05868 (0.36034)
<i>EXPERIENCE</i>	0.00189 (0.00181)	0.00181 (0.00186)
<i>POSSESSION SCORE DIFFERENCE</i>	-0.08772*** (0.00834)	-0.09328*** (0.00841)
<i>SHOTS SCORE DIFFERENCE</i>	-0.05009** (0.01964)	-0.05665*** (0.02003)
<i>CONSTANT</i>	0.32161 (0.79147)	0.13976 (0.57907)
Wald χ^2	169.72***	199.70***
R ²	0.099	0.180
Observations	2,651	2,651

*** Significant at 1%; ** Significant at 2.5%; * Significant at 5%.

Standard errors are in brackets.

Table 3. Referee home bias in bookings (the dependent variable is
RATIO DISCIPLINARY POINTS DIFFERENCE)

Variable	Home team effects	Referee effects
<i>CROWD</i>	-0.00047*** (0.00017)	-0.00047*** (0.00017)
<i>OCCUPANCY</i>	0.00856 (0.01695)	0.00811 (0.01672)
<i>RUNNING TRACK</i>	-0.01341 (0.00823)	-0.01294 (0.00799)
<i>EXPERIENCE</i>	-0.00001 (0.00004)	-0.00001 (0.00004)
<i>CONSTANT</i>	-0.01858 (0.01288)	-0.01820 (0.01273)
Wald χ^2	10.3*	9.70*
R ²	0.211	0.042
Observations	2,651	2,651

*** Significant at 1%; ** Significant at 2.5%; * Significant at 5%.

Standard errors are in brackets.