FAVORITISM UNDER SOCIAL PRESSURE

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Abstract—This paper is concerned with the effect of nonmonetary incentives on behavior, in particular with the study of social pressure as a determinant of corruption. We offer empirical evidence that shows how professional soccer referees favor home teams in order to satisfy the crowds in the stadium. Referees have discretion over the addition of extra time at the end of a soccer game to compensate for lost time due to unusual stoppages. We find that referees systematically favor home teams by shortening close games where the home team is ahead, and lengthening close games where the home team is behind. They show no such bias for games that are not close. We further find that when the rewards for winning games increase, referees change their bias accordingly. Lastly, we identify that the mechanism through which bias operates is to satisfy the crowd, by documenting how the size and composition of the crowd affect referee favoritism.

I. Introduction

THE economics literature on corruption generally emphasizes the role played by monetary incentives on individuals to deviate from their prescribed behavior. These include bribes, promotions, and other forms of material incentives.[1] Economists have also studied theoretically and empirically how corruption may take place because individuals are inherently biased.[2] Less understood and studied, both theoretically and empirically, is the role that social forces may have in corrupting the behavior of individuals. That social environments can affect individual behavior has long been the focus of the literature on endogenous preference formation (for example, Akerlof, 1980; Bernheim, 1994; Becker and Murphy, 2000). The pursuit of social approval and other forms of social interdependences have been offered as an explanation of such diverse behavior as consumption patterns, social customs and cultural practices, parental influences on children's tastes, and a variety of other socioeconomic behavior. Unfortunately, however, convincing empirical tests of such social pressure are hard to find.[3] In particular, we are not aware of any evidence of the effects of such social pressure on corruption.

In this paper, we offer such an empirical test. We do this by analyzing the deviations from honest behavior in a sports context, an approach followed by Duggan and Levitt (2002) as well.[4] The empirical study addresses how the preferences of one group (namely, the crowd attending a soccer game) affects referee behavior. The games that we study can be attended by up to 100,000 spectators (the average is 28,000), often overwhelmingly supporting the home team, and it is this pressure which we posit affects individual behavior. To put it simply, we study whether referees internalize the preferences of the crowd in their decisions, by systematically favoring the home team.

It has long been suspected that referees may be biased in favor of home teams in many of the decisions they make. Unfortunately, however, it is typically impossible to assess whether the decisions in question are just or unjust. Yet, professional soccer games have the advantage that there is one decision that referees take that is suitable for empirical testing of favoritism: the amount of *injury time* that they add at the end of the game. This extra time is meant to compensate for lost time due to unusual stoppages, such as injuries and time wasting. On average, referees add 3 minutes to the end of a game. Using a unique data set on referees in professional soccer games in Spain, we test for systematic bias in favor of home teams in the choice of injury time. To do so, we show how the identity of the team leading in close games affects the amount of injury time that is allowed: when the home team is behind in a close game, more injury time is added than when the home team is ahead in an equally close game. When the game is not close, injury time is less likely to be pivotal and referees show no such bias. We also study the effects of an exogenous change in the rewards for winning a game, and find that when these rewards increase, referees become more biased. We further identify that the motive through which the bias operates is to satisfy the crowd in the stadium.

The empirical analysis proceeds in three steps. First, we document the existence and extent of referee favoritism. The amount of time added is subjectively chosen by the referee, though in doing so referees are guided by the official *Laws of the Game* (FIFA, 2000), which prescribe the reasons for such extra time. The premise of the paper is that the amount of additional time should *not* systematically depend on the identity of the team that is leading at the end of a game. Yet, we find that it does, but only for close contests. On average, the injury time is approximately 3 minutes. However, if the home team is behind by 1 goal, the injury time is 35% above average, whereas if it is ahead by

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[1] See Bardhan (1997) for the relevant literature.

[2] See, for instance, Prendergast and Topel (1996), Goldin and Rouse (2000), Knowles, Persico, and Todd (2001), and the *New York Times* (2000).

[3] See Brock and Durlauf (1999) for a review of the empirical work on interactions in economic and social contexts.

[4] Beyond corruption, the use of sports data to test different predictions about individual behavior has been quite successful in recent years. The areas of study include discrimination (Szymanski, 2000), the effects of police on crime (McCormick & Tollison, 1984), the Coase theorem, incentive contracts, supervision and performance, and others (see Kahn, 2000). Recent studies have also tested for Nash equilibrium behavior in strategic settings using sports data (for example, Walker & Wooders, 2001; Chiappori, Levitt, & Groseclose, 2002; Palacios-Huerta, 2003).

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1 goal, the injury time is 29% below average. Such differences only arise when the game is close: when either side is ahead by 2 goals or more, there is no change from the average. Thus, we argue, referees use their discretionary power to favor home teams, but only in close games, where the time added has a greater chance to have an effect on the ultimate outcome. Controlling for factors that directly predict the intensity of the game (such as the number of disciplinary sanctions, player substitutions, or the strength of the teams involved in the contest) makes no difference to this result. This is our primary evidence of bias.

Another way in which referees may exercise favoritism is based on what happens *during* injury time. Accordingly, we test for home bias by studying how quickly referees decide to end the game when the home team scores during injury time, relative to the case in which the away team scores. We find that when visitors score, the injury time is 15% longer than when the home team scores. In other words, referees are more speedy in blowing the whistle for the end of game if the home team scores, thus giving the visitors less time to respond, than if the visitors score and vice versa.

Second, an implication of how social pressure affects referees is that they are more likely to exhibit this form of malfeasance when the returns to the crowd from doing so are larger. In our context, this means that when the home team has more to gain from a victory, the referee should become more biased. Accordingly, our second exercise is to show that referees show more favoritism when the returns to the crowd increase. To do so, we exploit an exogenous change in the rewards for winning. Before 1995, 2 points were awarded per win, 1 per tie, and 0 per loss. After 1995, the points per win were increased to 3. As predicted, we find that after 1995, referees became more biased where the home team was ahead by 1 goal in comparison with when it was behind by 1 goal.

Third, we study the mechanism that may underlie this behavior. Our hypothesis is that crowd size imposes pressure on referees: although millions of people may care about the outcome of the game, it is the (on average) 28,000 in the crowd who are influential. To test for this, we examine the connection between referee bias and crowd size and composition. We find that when crowds are larger, referees become more biased: a 1-standard-deviation increase in crowd size causes the home bias to rise by 20%. But crowds do not only support the home team. An additional test of social pressure examines the relationship between the composition of the crowd and the amount of bias. We show that in cases where the crowd is likely made up of a substantial number of fans supporting the visiting team, the referee's bias in favor of home teams is mitigated. In that situation, by reacting to the preferences of the representative supporter in the crowd, referees become more impartial.

These results are consistent with the argument that the immediate social environment plays an important role in shaping individual choices in the setting we study. Thus, the analysis supports the implications of models that allow for agents' preferences to conform in the presence of social pressure.

TABLE 1.—DESCRIPTIVE STATISTICS

Variable	Obs.	Mean	SD	Min.	Max.
Score Difference	750	0.58	1.71	−5	6
Score Home	750	1.57	1.32	0	7
Score Visitor	750	1.00	1.08	0	7
Goals in Extra Time, Home	750	0.04	0.21	0	1
Goals in Extra Time, Visitor	750	0.03	0.17	0	1
Minutes Extra Time, 2nd Half	750	2.93	1.11	0	7
Minutes Extra Time, 1st Half	750	0.79	0.73	0	3
Yellow Cards, Home	750	2.23	1.37	0	7
Yellow Cards, Visitor	750	2.55	1.39	0	8
Red Cards, Home	750	0.09	0.30	0	2
Red Cards, Visitor	750	0.08	0.31	0	3
Total Player Substitutions	750	4.49	1.06	0	6
Attendance (1000s)	750	27.84	17.78	5.17	98.00
Attendance/Capacity	750	0.74	0.17	0.19	1
Distance Home-Visitor (1,000 kilometers)	750	0.73	0.60	0	2.70

II. Data and Descriptive Statistics

The data come from one the main professional soccer leagues in Europe (the Primera División in Spain), where 20 teams play each other twice during the season, once as a home team and once as a visitor. A season lasts for approximately 9 months (September through May), and teams typically play one game per week. The games have two 45-minute halves, at the end of which the referee may, at his discretion, award injury time to make up for the time lost during the game. Time awarded ranges in our sample from 0 to 7 minutes.

In a league competition, the incentives of the teams in a match are determined by the points they receive. Three outcomes are possible: a win, a tie, and a loss. Until 1994–1995, these three outcomes yielded 2, 1, and 0 points respectively. After this season, the point structure was changed by increasing the returns per win from 2 to 3 points. We will examine the effects of this change in incentives on referee behavior using data from the 1994–1995 season (380 games), the last one with the 2-1-0 reward scheme, and from the 1998–1999 season (380 games) with the new 3-1-0 reward scheme.

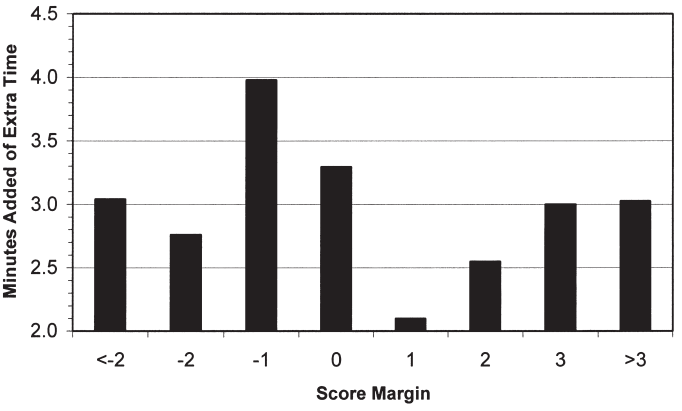
We first note in table 1 some descriptive statistics of the data set.

There are on average 2.57 goals per game, with the home team scoring approximately half a goal more than the away team. Attendance on average is 28,000, but can be as high as 98,000. Referees can discipline players for foul play in two easily observable ways: a yellow card, which allows the player to continue playing in the match unless he receives a second one, and a red card, which has as a consequence that the player is expelled from the game. On average 4.78

yellow cards are awarded per game (2.5 to the away team), and 0.17 red cards.[5]

As for the issue of direct interest to us, referees add on average 2.93 minutes of injury time in the second half of the game, and 0.79 minutes in the first half.[6] The discretion that referees have over the amount of injury time varies in our sample. Until the World Cup of 1998, referees simply added on as much injury time as they saw fit, and notified nobody about the amount they intend to add on. Beginning in the 1998–1999 season, the world governing body of professional soccer, the Fédération Internationale de Football Association (FIFA), ruled that referees have to announce publicly how long they intend to add at the end of normal play, that is, they requested referees to commit to injury time in a way that they did not before 1998.

FIGURE 1.—INJURY TIME AWARDED BY SCORE MARGIN



Number of minutes awarded by referees as a function of the margin in favor of the home team at the end of the match. Score margin = (goals scored by home team) − (goals scored by visiting team). Note: 3.3% of the matches ended with score differences smaller than −2; 5.2%, with score differences greater than 3.

III. Evidence of Favoritism

Our initial evidence of bias is given in figure 1, where we plot the average injury time played by the scoreline at the end of the second half of play, that is, before injury time begins. As indicated, the injury time in the second half averages 2.93 minutes. For games with a difference of 2 or more goals in the score, the referee adds roughly this amount of time regardless of whether it is the home or the visiting team that is ahead in the score. This is not the case for games where the difference is 1 goal. When the home team is ahead by 1 goal (+1 in the figure), the referee allows almost 30% less additional time than the average, whereas if the home team is behind by 1 goal (−1 in the figure), the referee allows 35% more time than the average. Both of these amounts are significantly different from the average.

This is our prima facie evidence of favoritism on the part of the referee. Injury time appears to systematically benefit the home team, but only in the cases of closer games, where the additional time is more likely to affect the result of the game. These observations lead us to suspect that referees systematically favor teams simply because they play at home. The remainder of the paper addresses the robustness of this initial finding, tests for different ways in which the bias may operate, and identifies as best we can the mechanisms through which this happens. We will find little to change this initial impression.

We are primarily interested in how referees act when the home team is ahead by 1 goal compared to when it is behind by 1 goal. This succinctly measures the way that the scoreline may affect referee behavior, and is more parsimonious than a complete nonparametric estimation. Accordingly, in our regression analysis, we restrict attention to games where the home team is ahead or behind by 1 goal. The strategy of restricting our attention to this margin is similar to that in Duggan and Levitt (2002).

Law 7 in the *Official Laws of the Game* states that "allowance for injury time is made in either period of play for all time lost through substitutions, assessment of injury to players, removal of injured players for treatment, wasting time, or any other cause. Allowance for time lost is at the discretion of the referee" (FIFA, 2000, p. 37). Thus, the first alternative to the hypothesis of favoritism that we consider is that "true" injury time is correlated with the identity of the team leading at the end of the game, but only in close games. To test this we first test whether allowing for variables correlated with the intensity of the game affects the results. Table 2 estimates how our measure of bias is affected by controlling for (i) the numbers of yellow and red cards, which are awarded to players that cause injuries and waste time, and (ii) the number of player substitutions.

Favoritism is captured by the coefficient on the *Score Difference* dummy variable, which equals 1 if the home team is ahead by 1 goal and 0 if the home team is behind by 1 goal. The univariate regression shows that on average the injury time is shorter by 1.88 minutes when the home team is ahead by 1 goal. The second specification includes controls for yellow and red cards, and the number of players replaced by a substitute. We find positive and significant effects of both yellow cards and the number of player substitutions on the amount of injury time. This means, not surprisingly, that injury time is affected by the intensity of the game. Interestingly, the effect of *Score Difference* remains stable and highly significant after including these variables.[7] This supports our identification strategy in that *Score Difference* is not capturing the effect of game intensity on "true" injury time.

The next specifications deal with the possibility that the identity of the teams playing is indicative of the "true"

[5] Data sources are described in the Appendix. For the description of disciplinary sanctions, see FIFA (2000).

[6] In total, 56 goals were scored in injury time, and there is no statistical difference between the likelihood of a goal in injury time and in normal time.

[7] Likewise, controlling for long-standing rivalries between the teams has no significant effect on the size and significance of the effect.

TABLE 2.—MINUTES OF INJURY TIME AT END OF MATCH IN CLOSE MATCHES

Statistic	[1]	[2]	[3]	[4]	[5]	[6]
Constant	3.98**	2.94**	3.23**	3.28**	3.01**	3.05**
	(0.09)	(0.17)	(0.33)	(0.60)	(0.44)	(0.70)
Score Difference	**−1.88****	**−1.86****	**−1.78****	**−1.77****	**−1.76****	**−1.80****
	(0.12)	**(0.11)**	**(0.11)**	**(0.12)**	**(0.12)**	**(0.13)**
Yellow Cards		0.08**	0.06**	0.05**	0.06*	0.06*
		(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Red Cards		−0.20	−0.19	−0.17	−0.16	−0.22
		(0.13)	(0.12)	(0.13)	(0.13)	(0.15)
Player Substitutions		0.14**	0.04	0.04	0.02	0.08
		(0.05)	(0.07)	(0.07)	(0.07)	(0.08)
Year Effect			0.11	−0.09	0.52	−0.10
			(0.19)	(0.37)	(0.37)	(0.43)
Budget Home			0.00	0.06	−0.01	0.04
			(0.02)	(0.1)	(0.02)	(0.11)
Budget Visitor			0.05**	0.05**	−0.02	0.06**
			(0.02)	(0.02)	(0.08)	(0.02)
Rank Home			0.02	0.01	0.02	0.02
			(0.01)	(0.03)	(0.01)	(0.04)
Difference in Ranks[a]			−0.03*	−0.03**	−0.02*	−0.03**
			(0.01)	(0.01)	(0.01)	(0.01)
Team Fixed Effects				Yes: home	Yes: visitor	Yes: home
Referee Fixed Effects						yes
R^2	0.48	0.52	0.56	0.60	0.61	0.64
(*N*)	(268)	(268)	(268)	(268)	(268)	(268)

The dependent variable is the length of injury time in matches that ended with a 1-goal difference. Controls are included for variables that may affect "true" stoppages in the match. *Score Difference* is 1 if home team is ahead by 1 goal before injury time begins, and 0 if it is behind by 1 goal.

Notes: Standard errors in parentheses. *Significant at 5% level; **significant at 1% level. [a]*Difference in Ranks:* absolute value of *Rank Home − Rank Visitor.*

(warranted) amount of injury time. Thus, we control for the relative strengths of home and visiting teams (as measured by their rank and operating budgets), the absolute value of the difference in ranks, and team fixed effects.[8] We also control for referee fixed effects.[9] The results show that when the intensity of the match increases, more injury time is added. In particular, when the visiting team is stronger (as indicated by a greater budget) and when the difference in rank between the visiting and the home team is smaller, the amount of injury time that is added is greater. Interestingly enough, though the percentage of the variation of injury time explained in the regressions increases substantially (from 48% explained simply by the difference in score at the end of the match to 64% in the most complete specification), the regression coefficient is not affected in any empirically significant way. Neither the size nor the significance of the effect of the *Score Difference* variable changes when these controls are introduced. These results strengthen our initial impression of referee bias.

Thus far, we have focused on injury time at the end of the second half of close games. In table 3 we offer two falsification tests by studying situations in which we would expect to find *no* evidence that the scoreline has an effect on the amount of injury time that is allowed. First we note that referees also have discretion to add injury time at the end of the first half of play. But because there are another 45 minutes to play in the second half, the marginal effect of adding one extra minute or two in the first half on the ultimate score is likely to be low. Accordingly, we would expect to see little or no evidence of favoritism in this case. In panel A we implement similar regressions to those in the previous table, where we predict injury time in the first half of play by the scoreline at that time.

Consistent with our premise, we find that the sign of the first-half *Score Difference* variable, though positive, is of small magnitude and statistically insignificant, again strengthening our hypothesis that these effects only arise when the additional time may be important to the outcome of the game.

In panel B we undertake a second test by studying another situation in which the marginal effect of adding extra time on the ultimate score is likely to be low, namely, when there is a 2-goal difference in the score at the end of the second period of play. We again find that *Score Difference* is of small magnitude and statistically insignificant.

The evidence from these two falsification tests confirms the idea that the form and extent of favoritism are dependent upon the identity of the leading team, but only when the marginal effect of injury time can conceivably affect the result.

We have also implemented other tests of favoritism that are worth discussing briefly. Another way in which referees can be biased is to respond to goals in extra time in ways that depend on who scores. For example, consider a game which is a draw. If the home team scores, a referee who is biased in favor of the home team has an incentive to quickly signal an end to the game, whereas if the away team scores,

[8] The rank of a team is given by its position in the final standings at the end of the season.

[9] Referees are assigned randomly to games. This means that we can rule out any hypotheses that involves referees being selectively allocated based on the identities of the teams or on expected scores.

TABLE 3.—FALSIFICATION TESTS

Statistic	Panel A: Half-Time Effect [1]	[2]	[3]	Panel B: 2-Goal Difference [1]	[2]	[3]
Constant	0.7**	0.78**	1.42**	2.76**	2.36**	1.42**
	(0.06)	(0.13)	(0.45)	(0.13)	(0.43)	(0.45)
Score Difference	0.13	0.11	0.08	−0.21	−0.15	−0.03
	(0.08)	(0.09)	(0.09)	(0.16)	(0.16)	(0.17)
Yellow Cards		−0.06*	−0.05		0.06	0.03
		(0.03)	(0.03)		(0.03)	(0.04)
Red Cards		−0.24	−0.18		0.12	0.15
		(0.26)	(0.27)		(0.15)	(0.15)
Player Substitutions		0.12	0.13		−0.04	−0.02
		(0.08)	(0.08)		(0.09)	(0.09)
Year Effect		−0.02	0.17		0.42	0.70
		(0.12)	(0.25)		(0.24)	(0.44)
Budget Home		0.01	−0.07		−0.03	−0.04
		(0.02)	(0.07)		(0.03)	(0.03)
Budget Visitor		0.01	0.01		0.03	−0.05
		(0.01)	(0.01)		(0.03)	(0.11)
Rank Home		0.00	−0.03		0.02	0.01
		(0.01)	(0.03)		(0.02)	(0.02)
Difference in Ranks[a]		0.00	0.00		−0.01	0.00
		(0.01)	(0.01)		(0.02)	(0.02)
Team Fixed Effects			Yes: home			Yes home
R^2	0.01	0.03	0.10	0.01	0.14	0.31
(*N*)	(332)	(290)	(290)	(161)	(161)	(161)

This table studies whether referee bias appears in situations where we could expect little or no bias. In panel A the dependent variable is the length of first-half injury time in matches in which the first half ended with a 1-goal difference. *Score difference* is 1 if the home team finished this half ahead by 1 goal, and 0 if it finished behind by 1 goal. In panel B, the dependent variable is injury time in matches with a 2-goal difference in the score at the end of the second half. *Score Difference* in this panel is 1 if the home team is ahead by 2 goals, 0 if it is behind by 2 goals.

Notes: Standard errors in parentheses. *Significant at 5% level; **significant at 1% level. [a]*Difference in Ranks:* absolute value of *Rank Home − Rank Visitor.* Cards and substitutions in panel A are those in the first half.

the referee will more likely extend the game in the hope that the home team can respond. We examined this hypothesis by studying those games where a goal was scored in injury time, and identifying whether the total amount of injury time depends on who scored. Our identification strategy here is simply that conditional on one team scoring, injury time added should not depend on who scored. Yet, it does. Table 4 shows that when the scorer is the visiting (home) team the amount of injury time that is allowed is significantly greater (less), by roughly 20% of the average injury time. Thus referees appear to signal the end of the game, again, in a way that favors the home team.[10]

TABLE 4.—EFFECT OF THE IDENTITY OF THE SCORER ON THE INJURY TIME

Statistic	[1]	[2]
Constant	2.55**	2.48**
	(0.38)	(0.44)
Scorer is Visiting Team	**0.57***	**0.56***
	(0.28)	(0.28)
Year Effect	0.81*	0.81*
	(0.33)	(0.33)
Yellow Cards	−0.05	−0.04
	(0.06)	(0.06)
Difference in Ranks[a]		0.01
		(0.03)
R^2	0.16	0.16
(*N*)	(53)	(53)

The table analyzes the effect of the identity of the scorer on the number of minutes of extra time added at the end of the match. It compares the matches in which the home team scored in extra time with those in which the visiting team scored in extra time. It controls for the most important variables affecting extra time (see table 2).

Notes: Standard errors in parentheses. *Significant at 5% level; **significant at 1% level. [a]*Difference in Ranks:* absolute value of *Rank Home − Rank Visitor.*

IV. Rewards for Winning and Social Pressure

The premise of this paper is not simply that referees favor home teams, but instead that they are more likely to do so when the returns to satisfying the crowd are greater. In this section we study two situations where the preferences of the crowd may induce changes in referee's behavior in predictable ways.

A. *Changes in the Rewards for Winning*

As mentioned earlier, after the 1994–1995 season professional leagues changed the reward schedule from 2 to 3 points per win. Consider then the case where the home team

[10] We also noted that in our later data period (1998–1999), referees must commit at the end of normal playing time to the amount of injury time that they intend to add. If this commitment is binding, referees can no longer react to goals in injury time by changing the amount of time they add. Accordingly, in the working-paper version of this paper (Garicano, Palacios-Huerta, and Prendergast, 2001) we estimate separate regressions for the two time periods. We find that only in the 1994–1995 does the identity of the scorer matter for the injury time, which we interpret as the referees' using their discretion to change the injury time based on a score. There is no such relationship in 1998–1999, illustrating their reduced discretion, though care must be take here, as our sample sizes are too small to allow us to say that the effects are statistically significantly different from each other.

TABLE 5.—MARGINAL EFFECT OF INCENTIVES ON INJURY TIME

Statistic	[1]	[2]	[3]	[4]
Constant	3.50**	3.11**	2.93**	2.42**
	(0.14)	(0.32)	(0.34)	(0.39)
Score Difference	**−1.53****	**−1.56****	**−1.47****	**−0.64***
	(0.18)	**(0.18)**	**(0.17)**	**(0.28)**
Year Effect	0.81**	0.7**	0.49	0.55*
	(0.18)	(0.21)	(0.25)	(0.27)
Year × Score Difference	**−0.58***	**−0.52***	**−0.51***	**−0.55***
	(0.23)	**(0.23)**	**(0.23)**	**(0.23)**
Yellow Cards		0.07**	0.06*	0.06*
		(0.02)	(0.02)	(0.02)
Red Cards		−0.2	−0.19	−0.09
		(0.13)	(0.12)	(0.12)
Player Substitutions		0.03	0.05	0.04
		(0.07)	(0.07)	(0.07)
Budget Home			−0.01	−0.02
			(0.02)	(0.02)
Budget Visitor			0.05**	0.04*
			(0.02)	(0.02)
Rank Home			0.01	0.01
			(0.01)	(0.01)
Difference in Ranks[a]			−0.03**	−0.04**
			(0.01)	(0.01)
Game Number			0.01	0.02**
			(0.01)	(0.01)
Game Number × Score Difference				**−0.02****
				(0.01)
R^2	0.5263	0.5415	0.5773	0.5989
(*N*)	(268)	(268)	(268)	(255)

The table analyzes the effect of the change in points awarded per win on the number of minutes of second-half injury time allowed by the referee in games with a 1-goal difference. It controls for variables that may affect "true" stoppages in the match. *Year × Score Difference* is the interaction between the dummy variable *Score Difference* and the year (0 if before change, 1 if after change).

Notes: Standard errors in parentheses. *Significant at 5% level; **significant at 1% level. [a]*Difference in Ranks:* absolute value of *Rank Home − Rank Visitor.*

is behind by 1 goal. If the home team scores, it gains 1 point under both regimes. But if the home team is ahead by 1 goal, the marginal return to finishing the game for the home team increases from 1 point to 2 points (if they concede a goal, they previously went from 2 points to 1; now they go from 3 points to 1). This exogenous variation in rewards, therefore, represents a valuable opportunity for testing whether referees respond to the desires of the home team. In table 5 we test for this effect by including interaction terms between the year of observation and the *Score Difference* dummy, where we predict that the size of the coefficient on *Score Difference* increases after the points change.

We find that the interaction is negative and significant. This implies that, as predicted, the bias is stronger after the increase in the rewards for winning. In numerical terms, the 1994–1995 season saw a difference of 1 minute and 30 seconds, which increased to almost 2 minutes by the 1998–1999 season.[11]

One caveat is necessary here. In 1998–1999, not only were games characterized by a different reward scheme than in 1994–1995, but also referees had to commit publicly to the amount of injury time, as they did not before 1998. Specifically, they are now required to announce to the crowd at the beginning of injury time the amount of time they will add. It is possible that the results obtained above are also partially generated by this change in regulation in addition to the change in point spread.[12]

A second source of potential variation in the perceived importance of a game comes from differences in the stage of the season. Teams typically care about their final position in the league table. Given this, it should be obvious that games at the end of the season may have different importance than those at the beginning, both because the end of the season is more imminent, and because teams have a better idea of their likely finishing position. Although it is theoretically ambiguous whether games are more or less important at the end of the season, it is often claimed that fans are more likely to be vocal in their support as the ultimate prizes of winning competitions and not being relegated to the lower

[11] The rule change also carries an implication for drawn outcomes. If the home team scored, it gained 1 point in the 1994–1995 and 2 points in the 1998–1999 season. If it conceded a goal, it lost 1 point in either season. As a result, referees should exhibit more bias in drawn games relative to −1 games in 1998–1999 than in 1994–1995. We studied this margin and found that though the effect goes in that direction, it is not statistically significant. Following a suggestion by a referee, we also studied whether tied games played after the rule change lasted significantly longer than before the change. The basic idea is that there is now a net benefit to extending such games (before, the expected benefit was low, but perhaps not 0 given that the home team is typically more likely to score). We found that although it appears that tied games may last longer, the effect is not statistically significant at conventional levels.

[12] Unfortunately, we were not granted access to the 1996–1997 data to disentangle the possible effects.

TABLE 6.—EFFECT OF THE SIZE AND COMPOSITION OF THE CROWD ON REFEREE BIAS

Statistic	[1]	[2]	[3]	[4]
Constant	3.23**	2.94**	2.65**	4.09**
	(0.18)	(0.20)	(0.26)	(0.44)
Score Difference	**−0.93****	**−0.96****	**−0.88****	**−2.92****
	(0.20)	**(0.21)**	**(0.20)**	(0.47)
Year Effect	0.36**	0.33**	0.12	0.12
	(0.11)	(0.11)	(0.18)	(0.18)
Attendance	0.00	0.00	0.01	0.01
	(0.00)	(0.00)	(0.01)	(0.01)
Attendance × Score Difference	**−0.02****	**−0.02****	**−0.02****	**−0.02****
	(0.00)	**(0.00)**	**(0.00)**	**(0.00)**
Yellow Cards		0.07**	0.05*	0.05*
		(0.02)	(0.02)	(0.02)
Budget Home			0.00	0.00
			(0.04)	(0.04)
Budget Visitor			0.05*	0.05**
			(0.02)	(0.02)
Rank Home			0.02*	0.02
			(0.01)	(0.01)
Difference in Ranks[a]			−0.03*	−0.02
			(0.01)	(0.01)
Game Number			0.01	0.01
			(0.00)	(0.00)
Ratio of Attendance to Capacity				−0.51
				(0.37)
Ratio of Attendance to Capacity × Score Difference				**1.51****
				(0.32)
R^2	0.5678	0.5802	0.6107	0.6438
(*N*)	(255)	(255)	(255)	(255)

The dependent variable is the injury time granted in the second half by the referee. The effect of the crowd on bias is given by the interaction between *Attendance* and *Score Difference,* and by the interaction between the *Ratio of Attendance to Capacity* and *Score Difference.*

Notes: Standard errors in parentheses. *Significant at 5% level; **significant at 1% level.

[a]*Difference in Ranks:* Absolute value of *Rank Home − Rank Visitor.*

division get nearer.[13] To test for this, and to ensure that our earlier results are not generated by an end-of-season effect, we include in table 5 two specifications in which we study how the amount of bias depends on *Game Number.* This variable runs from 1 (the first game of the season) to 38 (the final game of the season). We find, first, that the coefficient on *Score Difference* remains unchanged when we control for the stage of the season (column 3). Second, when we also interact *Game Number* with *Score Difference* (column 4), we find that the referee bias increases as the season advances. From the beginning to the end of the season, the referee bias increases by approximately 40 seconds for −1 relative to +1 matches.

B. Social Pressure: Crowd Size and Composition

We believe that the incentive to favor the home team likely arises from the crowd supporting that team. Anyone who has attended a sports event with a large crowd can attest to the volume that may be created. Crowds in professional soccer games in Europe are not slow to vent their anger at referees for decisions that do not favor their preferred team. In order to test for the direct effect of the crowd on the behavior of the referee, we carry out two exercises. First, we consider, how higher attendance affects referee behavior. Second, we address how changes in the likely mix between home and away fans affects bias. In particular, when (our estimate of) the fraction of visiting fans increases, the extent of favoritism should fall if in fact the crowd is the mechanism by which referees are affected. We test for these effects in table 6.

First, we examine how attendance and injury time are related. On average, attendance does not seem to affect significantly the amount of injury time that is allowed. Instead, the only effect is the interaction between attendance and the scoreline. Specifically, when attendance rises, the bias exhibited by the referee, as measured by the difference between the +1 and −1 scorelines, also rises. A 1-standard-deviation increase in attendance increases the amount of bias by approximately 20%. This effect is predominantly caused by the larger stadiums in which the more popular teams play: econometrically, we cannot distinguish between attendance and home-team fixed effects. But another test of the effect of attendance at games is to consider the effect of *unusually* large attendances on the bias shown by the referee. To do so, we compute the ratio of attendance to stadium capacity. Crowds tend to be unusually large relative to capacity when either popular visiting teams play or the teams are geographically close. In either case, this would suggest that large crowds relative to average are indicative of more fans (than usual) supporting the away team. In

[13] In Primera División, the bottom four teams are relegated to the lower Segunda División, and the top seven teams qualify to play various European competitions next season. During the seasons in our sample, basically all teams in the league had much at stake in the latter part of the season, especially in the last few games, and for the majority of the teams even in the last game.

Garicano et al. (2001) we study whether the deviation of the attendance-to-capacity ratio from its mean can be explained by (i) visiting-team dummies and (ii) the geographical proximity of the teams. We find that visiting-team dummies that significantly predict unusually high attendance are those which have the greatest support all over Spain (Barcelona and Real Madrid), and that matches between teams from cities separated by small distances have significantly higher attendance as well.[14] Either of these scenarios reflects a greater fraction of the crowd supporting the visiting team. The hypothesis that we would then like to study is whether referees are likely to be less biased in favor of the home team when attendance is unusually high. This is considered in the last specification in table 6. Consistent with the hypothesis, we find that unusually high attendance interacted with the *Score Difference* is highly significant and results, as predicted, in less bias.

One possible interpretation of these results is that individual referees are exhibiting this bias, rather than social pressure affecting most referees. To deal with this, we also investigated the extent of the heterogeneity in referees' susceptibility to social pressure. Interacting referee fixed effects with the score difference, we found that most referees appear to be equally biased. Only 3 of the 35 referees in the sample show statistically significant individual effects at the 10% level.

V. Concluding Remarks

This paper has studied the effect of nonmonetary incentives on behavior, in particular the role of social pressure as a determinant of corruption. The analysis differs from previous work in the literature on corruption both in the origin of the incentives to deviate from honest behavior and in the agent whose behavior we study. It also contributes to the literature on how social environments may influence individual behavior, an important aspect which has long been the focus of the literature on endogenous preference formation but where convincing empirical tests are difficult to find.

To conclude, we address some alternative hypotheses. First, the results do not support the idea that the "true" injury time is correlated with the identity of the team leading, but only for close games. We tested for this by including variables such as substitutions, disciplinary sanctions, and others, which (though correlated with injury time) are uncorrelated with our bias measure. This left our results unchanged. An alternative hypothesis to the idea that social pressure generates the referee's incentives is that instead they take bribes. We are unconvinced by this hypothesis because there is no reason to belive that the ability to bribe depends on whether a team is playing at home or away.[15]

One hypothesis that we cannot rule out is the possibility that the governing body, the Real Federación Española de Fútbol (RFEF), condones this form of favoritism. Ultimately our tests show that crowd pressure affects the behavior of referees. They do not necessarily show that these behaviors are not condoned by the RFEF. For example, a model where the RFEF simply tells the referee to (partially) satisfy the crowd would give similar results. All that we can truthfully show is that referees show favoritism, not that such favoritism does not correlate with the objectives of the principal.[16] Although the argument has some appeal, we see little reason to think the authorities systematically favor home versus away teams, for a number of reasons. First, FIFA has acted on its distaste for such referee behavior by changing the rules in 1998 to make them commit ex ante to the amount of injury time.[17] Second, though it is plausible that the RFEF favors some teams over others, we see little reason to think that it systematically favors home over away teams. Finally, one could imagine that the RFEF would like close games to continue longer (as these are most exciting), but why then are games shorter when the home team is ahead?

We should also note that the number of matches whose results were affected by this form of referee bias is small, even though the baying crowd in injury time would give another impression. Our estimates suggest that this bias changed the result of approximately seven games, or 2.5% of all the games in our sample.[18] But it is important to point

[14] In fact, Barcelona and Real Madrid are the only teams in the league with official clubs of supporters (so called Peñas) in every province in Spain.

[15] If teams have connections with referees and can bribe them, we think that they are as likely to do so for a home game as for an away game. Because our results arise only in comparisons between home games and away games, we do not find the bribery hypothesis persuasive. It is also highly unlikely that these results are the outcome of referees being afraid of physical violence from the crowd. Physical violence has become exceedingly rare, to the point that the fences that were erected in Spanish stadiums in the 1970s as a precaution against violence were taken away in the early 1990s.

[16] We attempted to address this by examining the turnover of referees during our sample. If the RFEF does not condone biased behavior, we would expected those referees who have shown more bias to be replaced, whereas if it does condone such behavior, these referees should not be replaced more often than others. Unfortunately, turnover in our sample was too low to empirically identify any relationship between likelihood of replacement and average bias.

[17] What happens now is that at the end of 90 minutes, the referee publicly reveals the amount of time that will be added. In justifying the new rule concerning the public announcement of extra time, the Spanish football authorities argued that "this measure would help referees make more efficient decisions, as it would reduce the amount of pressure they receive at the end of games." (Mr. Ortiz de Mendibil, member of the Comité Español de Disciplina Deportiva, *El Mundo Deportivo,* Edición Vizcaya, September 17, 1998.)

[18] When the home team is behind by 1 goal, the referee adds 1 minute of length. Home teams score with probability 0.015 per minute of extra time, which translates to 4.25 results which were changed among the 284 close games in our sample. Similar analysis shows that when the home team is in front, the referee shortens the game by 0.82 minutes. Away teams score with probability 0.01 per minute of injury time, which translates to an additional 2.33 games which would have changed results had the referee not shown favoritism.

out that this is unlikely to be the only form of bias exercised by referees: it is just the only form that we can verify. Others may include the subjective interpretation in favor of the home team of fouls, offsides, penalties, and other rules. As a result, we see the estimates we have obtained as a lower bound on the favoritism shown by referees.

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APPENDIX

Data Sources

Data on the identity of the teams, the number of goals scored by each team, the timing of the goals, whether the team played at home or as a visitor, attendance at the games, stadium capacities, the operating budgets of the teams, and the sanctions in the form of yellow and red cards received by the players were collected from the records of *Marca,* the best-selling newspaper in Spain, and www.sportec.es.

Data on the names of the referees and on the extra time added in the first and second halves by the referees were obtained from *Marca* and from the Comité de Disciplina Deportiva of the Real Federación Española de Fútbol (RFEF), which collects the actual referees' records of the games. Twenty-two referees are selected at the beginning of the season by the RFEF. Typically the set consists of the referees they selected the previous season except those who, according to the RFEF, performed worst during that season. The number of referees being replaced varies, but it is typically not more than three. They are replaced by the top referees in Segunda División, a lower-quality professional division, who are promoted to the top division. The referee's performance in every game is evaluated by the Asociación Española de Árbitros de Fútbol of the RFEF. These evaluations are not known to the referees. A given referee on average is involved in approximately 18 games every season. Nine of the referees in the 1994–1995 season remained in the 1998–1999 season.