Behavior under Social Pressure: Empty Italian Stadiums and Referee Bias[•]

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Abstract

This paper studies how social pressure affects the behavior of soccer referees. We make use of an attractive source of exogenous variation in the number of spectators at matches. Due to recent hooligan violence, the Italian government has implemented a regulation that some soccer teams must temporarily play home matches in empty stadiums. We find that referees punish away players much more harshly and home players much more lightly when the games are played in front of spectators compared to when they are not. We find no evidence for the alternative hypothesis that home and away players are affected differently in these games along a number of different outcomes of players, such as the number of tackles. Our results therefore suggest that referees exhibit home bias caused by social pressure from the spectators.

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1. Introduction

People experience social pressure in one form or another. Particularly revealing examples are celebrity trials where the jurors are often dismissed, and where the trials may even have to change location, due to influence from the public and media.[1] There is a large theoretical literature in economics that deals with this type of behavior (see e.g. Akerlof 1980 and 1991, Bernheim 1994, and Becker and Murphy 2000) but there is surprisingly little empirical work given the prevalence of social pressure in the society.[2]

The contribution of this paper is to provide clear evidence of social pressure using data from the behavior of soccer referees in Italy. There are two features that makes Italian soccer referees a particularly attractive case study of social pressure. First, and most importantly, we use a unique exogenous source of variation in the number of spectators due to hooligan violence in Italy on February 2, 2007. In response to the incident, the Italian minister of interior declared that spectators would only be allowed into those arenas that fulfilled certain requirements. In total, 25 games have been played without spectators in the Italian soccer leagues Serie A and Serie B. Secondly, the Italian referees are highly skilled, highly paid, and closely monitored, professionals. If these individuals are sensitive to social pressure, then one might suspect that workers in other types of jobs are too.

We find surprisingly large and significant effects that the referees favor the home teams by giving them fewer fouls, yellow and red cards relative to the away teams in games with spectators compared to games without spectators. Depending on the type of punishment, the bias effects are in the order of 20 to 70 percent. On the other hand, we find no evidence for the alternative hypothesis that home and away players are affected differently in games with and without spectators. In none of six outcome variables for players (number of shots on target, number of shots off target, number of tackles, tackle success rate, passing accuracy rate, and ball possession) do we find an effect. Our results therefore suggest that social pressure from the spectators affects the referees' behavior.

This paper is also related to a literature on the behavior of referees. For example, Price and Wolfers (2007) find evidence of racial discrimination among NBA referees while Garicano et al. (2005) find that soccer referees systematically favor the home team by shortening close games where the home team is ahead, and lengthening close games where

[1] Recent examples include the trials against O.J. Simpson, Michael Jackson, Martha Stewart, Phil Spector, Kobe Bryant, Jayson Williams, Paris Hilton, and Robert Blake. Some jurors were for example dismissed in the O.J. Simpson trial while the criminal case against former NBA player Jayson Williams was moved to another county.
[2] Interesting recent exceptions are Falk and Ichino (2006) and Mas and Moretti (2006).

the home team is behind.[3] Garicano et al. (2005) argue that this behavior is due to social pressure from the crowd. However, whether a game is close or not is likely to be endogenous since it will be a function of the game itself. A close game might, for example, generate more conflict among players which, in turn, may affect stopping time. Moreover, the causal link between social pressure and referee bias cannot be convincingly addressed without an exogenous source of variation in social pressure, i.e., in the size of the crowd.

The rest of the paper is organized as follows. Section 2 describes the data, the source of exogenous variation, and the empirical strategy. The results are presented in Section 3 and Section 4 concludes.

2. Data and empirical framework

On February 2, 2007, supporters from the Italian football clubs Calcio Catania and Palermo Calcio clashed with each other and the police in Catania in serious acts of hooligan violence. Police officer Filippo Raciti was killed and around hundred people were injured. Following the riots, the Italian government announced that the enforcement of the current football stadia act, "Decreto Pisanu", enacted in 2005, would be radically changed. In its original form, it required Italian football clubs to meet specific safety standards in their stadiums. However, with the indulgence of the government, these standards have been ignored by most of the clubs in Series A and B, and virtually all games have been played in front of spectators. Following the events in Catania, the government altered its position and forced the clubs that had stadiums with deficient safety standards to play their home games without spectators.

We will use the drastically tightened enforcement of the football stadia act as an exogenous variation in the number of spectators to evaluate the hypothesis that referees may be biased due to social pressure. We use data from Serie A and Serie B for the season 2006/2007 up to the point where all teams apart from Catania play in front of spectators again. The season consists of altogether 842 games.[4] Excluding the Catania games, 21 games have been played without spectators due to the inability to comply with the act.[5] Table 1 shows the games that have been played without spectators.

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[3] Dohmen (2005) and Scoppa (2007) also find support for this type of behavior. Nevill et al. (2002) found that English referees who watched video-taped tackles with the sound from the crowd called for 15.5 percent fewer fouls for the home team compared to those that did not hear the sound.

[4] The 20 teams in serie A and the 22 teams in serie B play each other twice per year.

[5] Because the hooligan event took place in Catania, and because the club has not complied with safety regulation earlier, Calcio Catania has to play all of its home fixtures at a neutral venue and most games without spectators. Due to this special regulation, and since the hooligan event may be correlated with the club's outcomes, we exclude this club's home games without spectators from our analysis. However, our results are not affected qualitatively by the inclusion of these games.

Referees control the games by having the possibility to adjudicate fouls, yellow cards, and red cards. Committing a foul implies that the opposing team gets possession of the ball.[6] If one player receives two yellow cards, or one instant red card, then he is send off the pitch. This implies that his team has to play one man short, which is a significant disadvantage.[7] 41 different individuals have refereed games in the two leagues. 36 referees are active in both Serie A and Serie B and five in Serie B only. The average number of games per referee in the data set is approximately 20. Referees are appointed on the Friday before the games are played. The salary is 70 000 euro per year or 35 000 per year depending on experience. They additionally receive 3 500 euro per game in Serie A and 2 000 euro per game in Serie B. The way to qualify for becoming a referee at this high level is to show extraordinary skills in the lower leagues. The performance of the referees in Series A and B is closely monitored by observers from the Italian National Referee's Commision (Commissione Arbitri Nazionale). Good performance is rewarded by the possibility to referee more Serie A, Serie B, and even international games. Poor performance may be punished by relegation to lower leagues. In sum, the referees we study are considerably above average in the society in terms of pay, specific skills, and the ability to work under scrutiny.

The data is obtained from the Italian newspaper La Gazzetta dello Sport's home page. Because the number of fouls per game differs across sources, we also use data on fouls from the home page of ESPN (the Entertainment and Sports Programming Network). Table 2 provides summary statistics for home and away teams regarding the number of fouls, the number of yellow cards, and the number of red cards.

To test whether referees are biased due to social pressure we construct the following specification. Let Y_{ij} denote referee *i*'s behavior in game *j* (fouls, yellow cards, and red cards) and let X be an indicator variable for if the game was played without spectators due to that home team was unable to comply with the stadia act. Then, the average change in the behavior of referees' toward the *home team* in games with and without spectators is

$$\beta^{Home}=\mathrm{E}[Y|X=0, \textit{Home team}] - \mathrm{E}[Y|X=1, \textit{Home team}],$$

while the average change in the behavior of referees' toward the away team in games with and without spectators is

[6] If the foul is committed close to the own team's penalty area, i.e., the own goal, then the free kick that follows gives the opposing team an excellent opportunity to score.

[7] He may also be suspended for games in the future. This, however, does not affect the number of players on the pitch.

$$\beta^{Away}=\mathrm{E}[Y\,|\,X=0, \textit{Away team}] - \mathrm{E}[Y\,|\,X=1, \textit{Away team}].$$

We now define the bias of a referee as $\beta^{Bias} = \beta^{Home} - \beta^{Away}$. Thus, we argue that one must take into account the behavioral response of a referee towards *both* the home team and the away team in games with and without spectators in order to test whether the referee is biased or not. An equivalent way of stating this identification strategy is to express it in the form of an regression model, i.e.,

$$Y_{ij}=\alpha + \theta Home_{ij} + \lambda X_{ij} + \beta X_{ij}\times Home_{ij} + v_{ij}, \tag{1}$$

where *Home* is an indicator for the home team. Thus, this set up characterizes a referee's behavior through a home bias effect, θ, a direct effect from the absence of spectators, λ, while the bias of the referee is the interaction between X and *Home*, i.e., $\beta^{Bias}=\beta$. The identifying assumption is therefore that $\mathrm{E}[v|\, X\times Home]=0$.[8] One would expect that $\theta<0$ if the referee is favoring the home team for whatever reasons, and that $\lambda<0$ since players are typically playing less tough in games without spectators. Perhaps the largest threat to the identifying assumption is whether it is plausible to assume that players of the home and away team are similarly affected in games without spectators, i.e., the effect λ. If home players are differently affected in these games these would lead to biased estimates. The estimate of the referee bias would be underestimated if home players play tougher than away players in games with spectators than in games without spectators and overestimated if it is the other way around. Since each team consists of a large number of players (11 on the pitch plus 3 substitutes per game) we find it reasonable to think that they should respond more or less similarly in the presence or absence of spectators. In other words, it seems a priori likely that the team production functions would not differ much with respect to the size of the crowd. Nevertheless, if the team production functions would differ it also seems more likely that home teams play *more* intensively in front of their home crowds than away teams. Thus, if anything, our estimate of the size of the bias of the referee is likely to be underestimated.

One way of addressing this issue is to add a number of confounding factors and to see to what extend the estimated effect is affected. If it is insensitive, then this will lend more credibility to the identifying assumption.[9] We will include a full set of referee fixed effects (there are 41 referees) and a full set of team fixed effects (there are 20 teams in Serie A and

[8] See Meyer (1995) for a discussion of identifying assumptions in these types of difference-in-difference models.
[9] See, for example, Altonji et al. (2005) for a discussion of this approach.

22 teams in Serie B). The referee fixed effects and team fixed effects will also be allowed to differ between the home and away teams.[10] It is important to note that the parameter β is identified *only* by the within referee variation when we include fixed referee effects. In other words, we compare the behavior of the *same* referee when he is a referee in a game with no spectators compared to a game with many thousands of spectators.[11]

Another way of indirectly assessing the plausibility of the identifying assumption, $E[v|X\times Home]=0$, is to estimate the referee bias effect β on a variable that is known not to be affected by the treatment.[12] Since, we have assumed that the bias effect should not be affected by the players we could use outcomes of players (such as ball possession, number of shots on and off target, number tackles and tackle success rate) and estimate equation (1) to test whether home and away players are affected differently in games without spectators. If we cannot reject that $\beta=0$ is significantly different from zero, then this would lend credibility to the identifying assumption.

3. Results

In this section we provide evidence on the behavior of Italian referees. Before presenting the results from regression approach, Table 3 displays the averages for the three outcomes: number of fouls (panel A), number of yellow cards (panel B), and the number of red cards (panel C), in the games played *with* spectators (column 1) and in the games played *without* spectators (column 2). The outcomes are further divided into outcomes for home team (rows a, c and e) and away team (rows b, d and f), respectively. Table 3 shows some intriguing results. First**,** the home team is punished *less* harshly than the away team across all outcomes in games with spectators (e.g. compare row (a) and (b) in column 1). In contrast, the home team is punished *more* harshly than the away team across all outcomes in games without spectators (e.g. compare row (a) and (b) in column 2). Consequently, there is clear evidence that the referee is biased: the estimated for the number of fouls is 3.96 (i.e., $\hat{\beta}^{Bias} = \hat{\beta}^{Home} - \hat{\beta}^{Away}$=1.17-(-2.79)), the estimated for the number of yellow card is 0.63 (i.e., -0.5-(-1.13)), and the estimate for the number of red card is 0.086 (i.e., -0.041-(-0.127)). These effects are quite substantial: the estimated bias effect is 23 percent for fouls since the average number of fouls is 19 per team and game. Similarly, the estimated referee bias effect

[10] This is the same as running two separate regressions for the home and away team.
[11] The average number of spectators is 19,551 in Serie A and 8,250 in Serie B.
[12] See, for example, Heckman and Hotz (1989) and Imbens (2004) for a discussion of such specification tests.

is 26 percent effect for yellow cards, and 70 percent for red cards (i.e., the average number of yellow and red cards is 2.62 and 0.105, respectively).

As discussed in section 3, the referee effect can be estimated via a regression including an indicator for being in the home team, an indicator for games without spectators, and the interaction between those two indicator variables (equation 1). Tables 4 to 6 show the results from this regression approach. Table 4 shows the results for the number of fouls, Table 5 shows the results for the number of yellow cards, and Table 6 shows the results for the numbers of red cards. Column 1 shows the results without any additional control variables except for the two indicator variables, which makes these results identical to those displayed in Table 3. As can bee seen in all three tables, the estimated bias effect is statistically significant for all the outcomes.

To test whether these point estimates are sensitive to the inclusion of confounding factors we add referee fixed effects interacted with the indicator variable for being the home team in Column 2. In Column 3, we also include a full set of controls for individual teams, both when playing home and away. These fixed team effects are also interacted with the indicator for being a home team. As can be seen from columns 2 and 3 in these tables, the point estimates of the bias effect are strikingly unaffected (the standard errors are of course becoming larger when adding more control variables). Thus, this lends credibility to that estimated effect is caused by the behavior of the referee rather than the behavior of individual teams.

Another robustness check is to look at Serie A and Serie B separately. These results are displayed in Table 7. We find referee bias effects in both Serie A and Serie B, although they are less precisely measured. The effect is typically larger in Serie A, which is consistent with the fact that there are more spectators in Serie A (19,551) than in Serie B (8,250).

Finally, we test whether home and away players are affected differently in games with and without spectators by estimating equation (1) on a number of outcomes of players. We expect that the estimated bias effect should be zero unless players are differently affected as noted previously. Table 8 shows the results from the following six outcomes: number of shots on target (Column 1), number of shots off target (Column 2), number of tackles (Column 3), tackle success rate (Column 4), passing accuracy rate (Column 5), and ball possession (Column 6).[13] As can be seen from the table, there is no indication that the players are

[13] The data on the number of shots on and off target is taken from the Italian newspaper La Gazzetta dello Sport's home page and the other players' outcomes are taken from Eurosport's home page. La Gazzetta dello Sport has data both from Serie A and Serie B while Eurosport only reports data from Serie A.

differently affected in games with and without spectators. In other words**,** we cannot reject that the bias coefficient is significantly different from zero for any of the six outcomes. Hence, this lends strong support to that the referees, rather then the players, are affected by social pressure.

4. Conclusions

Soccer referees are supposed to be neutral. Yet, we find evidence that Italian referees change their behavior significantly in games played without spectators. The evidence we provide is consistent with the idea that individuals are likely to change their behavior under influence of social pressure. Home players and away players may also be affected differently by the presence or absence of spectators. We test a number of outcomes of players and find no evidence in support for this argument. This strongly suggests that it is the referee that changes his behavior in games without spectators rather than the players.

Our results may have further implications outside the world of sports. For example, courts and politicians could be affected by pressure from media, which may affect their decisions. More empirical work on this topic would complement the findings in this study. To the extent the results on soccer referees can be extrapolated to jurors, our paper suggests that one would have to take into account that they may make biased decisions in trials with a large public interest. To reduce the social pressure, trials behind closed doors may then be a sensible policy.

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Table 1. Games without spectators

Date	Home team	Away team
	Serie A	
February 17	Ascoli	Udinese
February 11	Atalanta	Lazio
February 25	Catania	Internazionale
March 04	Catania	Siena
March 13	Catania	Reggina
February 17	Catania	Fiorentina
February 11	Chievo	Internazionale
February 17	Empoli	AS Roma
February 11	Fiorentina	Udinese
February 18	Livorno	Messina
February 11	Messina	Catania
	Serie B	
February 17	Albinoleffe	Triestina
March 17	Brescia	Rimini
February 24	Brescia	Verona
February 10	Brescia	Bari
February 10	Lecce	Verona
February 17	Mantova	Lecce
February 10	Modena	Albinoleffe
December 16	Napoli[14]	Mantova
February 10	Napoli	Piacenza
February 18	Napoli	Arezzo
February 10	Pescara	Mantova
February 24	Piacenza	Genoa
February 10	Triestina	Treviso
February 17	Verona	Spezia

[14] This game was played without spectators in Perugia due to previous Napoli-related hooliganism.

Table 2. Summary Statistics

	Mean	St. Dev.	Min	Max
		Home Team		
Fouls	19.27	5.15	7	46
Yellow Card	2.44	1.28	0	7
Red Card	0.089	0.296	0	2
		Away Team		
Fouls	19.33	5.23	7	49
Yellow Card	2.79	1.47	0	9
Red Card	0.121	0.342	0	2

Note: The information about yellow cards and the red cards is taken from Italian newspaper La Gazzetta dello Sport's home page. The information about fouls is taken from both the Italian newspaper La Gazzetta dello Sport's home page and from the home page of ESPN (the Entertainment and Sports Programming Network).

Table 3. The behavior of referees in games with and without spectators

	Games with spectators (1)	Games without spectators (2)	Difference (2)-(1)
	Panel A: Number of fouls		
Home team (a)	19.26	20.43	1.17
	(0.26)	(0.87)	(0.85)
Away team (b)	19.41	16.62	-2.79
	(0.26)	(0.88)	(0.81)
Difference (a)-(b)	-0.15	3.81	3.96
	(0.26)	(1.10)	(0.99)
	Panel B: Number of yellow cards		
Home team (c)	2.45	1.95	-0.50
	(0.61)	(0.17)	(0.23)
Away team (d)	2.84	1.71	-1.13
	(0.69)	(0.21)	(0.17)
Difference (c)-(d)	-0.39	0.24	0.63
	(0.08)	(0.31)	(0.31)
	Panel B: Number of red cards		
Home team (e)	0.089	0.048	-0.041
	(0.012)	(0.048)	(0.048)
Away team (f)	0.127	0	-0.127
	(0.015)	(0)	(0.015)
Difference (e)-(f)	-0.038	0.048	0.086
	(0.019)	(0.05)	(0.048)

Note. Standard errors are in parentheses.

Table 4. Number of fouls

	(1)	(2)	(3)
Referee bias	3.96***	4.36***	4.56***
	(0.99)	(1.01)	(1.12)
Home	-0.15	4.10***	1.66
	(0.26)	(0.06)	(2.02)
No spectators	-2.78***	-2.61***	-2.27***
	(0.81)	(0.83)	(0.96)
Referee fixed effects	No	Yes	Yes
Team fixed effects	No	No	Yes
R^2	0.0060	0.1098	0.3778
Number of observations	1,156	1,156	1,156

Note: Standard errors clustered at the level of referee.* Significant at the 10 percent level, ** Significant at the 5 percent level, *** Significant at the 1 percent level.

Table 5. Number of yellow cards

	(1)	(2)	(3)
Referee bias	0.63**	.68**	0.61
	(0.31)	(0.32)	(0.39)
Home	-0.39***	-0.57***	-1.24*
	(0.08)	(0.02)	(0.68)
No spectators	-1.13***	-1.16***	-1.13***
	(0.17)	(0.16)	(0.25)
Referee fixed effects	No	Yes	Yes
Team fixed effects	No	No	Yes
R^2	0.031	0.1187	0.3254
Number of observations	1,164	1,164	1,164

Note: Standard errors clustered at the level of referee. * Significant at the 10 percent level, ** Significant at the 5 percent level, *** Significant at the 1 percent level.

Table 6. Number of red cards

	(1)	(2)	(3)
Referee bias	0.085*	0.068	0.078
	(0.049)	(0.064)	(0.092)
Home	-0.037*	-0.063***	-0.070
	(0.020)	(0.004)	(0.244)
No spectators	-.126***	-0.128***	-0.142**
	(0.015)	(0.035)	(0.061)
Referee fixed effects	No	Yes	Yes
Team fixed effects	No	No	Yes
R^2	0.0059	0.0787	0.2132
Number of observations	1,164	1,164	1,164

Note: Standard errors clustered at the level of referee. * Significant at the 10 percent level, ** Significant at the 5 percent level, *** Significant at the 1 percent level.

Table 7. Separate results from Series A and B.

	Number of fouls		Number of yellow cards		Number of red cards	
	Serie A	Serie B	Serie A	Serie B	Serie A	Serie B
Referee bias	6.12***	2.96***	1.00	.49	0.052**	0.095
	(2.22)	(1.04)	(0.62)	(0.34)	(0.025)	(0.074)
Home	0.02	-0.31	-0.29***	-0.49***	-0.052**	-0.024
	(0.33)	(0.38)	(0.13)	(0.10)	(0.025)	(0.031)
No spectators	-3.44***	-2.57***	-1.13***	-1.19***	-0.122***	-0.131***
	(1.22)	(1.14)	(0.27)	(0.22)	(0.025)	(0.022)
R^2	0.010	0.005	0.018	0.047	0.010	0.005
Observations	554	602	554	610	554	610

Note: Standard errors clustered at the level of referee.* Significant at the 10 percent level, ** Significant at the 5 percent level, *** Significant at the 1 percent level.

Table 8. Players' outcomes

	Number of shots on target	Number of shots off target	Number of tackles	Tackle success %	Passing accuracy %	Ball possession %
	(1)	(2)	(3)	(4)	(5)	(6)
Referee bias	-0.44	-0.43	2.77	4.96	-3.29	2.16
	(0.40)	(0.58)	(4.66)	(6.44)	(3.06)	(3.71)
Home	1.16***	0.82***	-0.20	0.43	0.85	0.92
	(0.14)	(0.13)	(0.60)	(1.03)	(0.43)	(0.69)
No spectators	-0.14	-0.20	2.16	1.71	3.79	-3.59
	(0.40)	(0.53)	(1.85)	(4.16)	(2.30)	(2.04)
Constant	3.83***	4.63***	20.00***	79.64***	75.67***	49.58 ***
	(0.14)	(0.12)	(0.34)	(0.78)	(0.31)	(0.49)
R^2	0.0545	0.0278	0.0097	0.0051	0.0096	0.0061
Observations	1,160	1,160	546	546	546	546

Note: Standard errors clustered at the level of referee. The data on the number of shots on and off target is taken from the Italian newspaper La Gazzetta dello Sport's home page and the other players' outcomes are taken from Eurosport's home page. Eurosport only reports data from Serie A, while La Gazzetta dello Sport has data both from Series A and B. * Significant at the 10 percent level, ** Significant at the 5 percent level, *** Significant at the 1 percent level.