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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 forces some soccer teams to temporarily play home matches in empty stadiums. We find that referees punish away players more harshly and home players more lightly when the games are played in front of spectators compared to when they are not. This indicates that referees exhibit home bias caused by social pressure from the spectators.

JEL Code: J00.

Keywords: social pressure, bias, incentives, personnel economics, natural experiment.

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1. Introduction

The role of social pressure on behavior is an important element in many areas of the society (e.g., for workplace productivity, politics, the judicial system, social customs and sports). There is a voluminous theoretical literature in economics that deals with this topic (see e.g. Akerlof 1980, Bernheim 1994, and Becker and Murphy 2000) but there is considerably less empirical work.[1]

The contribution of this paper is to provide such evidence from the impact of spectators on the behavior of referees. 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, 24 games have so far been played without spectators in the Italian soccer leagues Serie A and Serie B.

Our empirical identification strategy is to compare the behavior of the same referee in games with and without spectators, i.e., we make use of referee specific-fixed effect specifications. We find large and statistically significant effects that away players received fewer punishments (i.e., fewer fouls and cards) in the games they played without spectators while the home players were often punished more harshly. This strongly suggests that pressure from the spectators affects the referees' behavior.

This paper is related to a small literature on the behavior of referees. For example, Garicano et al. (2005) and Dohmen (2005) find that referees systematically favor the home team by shortening close games where the home team is ahead, and lengthening close games where the home team is behind.[2] Thanks to the exogenous source of variation in the number of spectators in the Italian soccer leagues, we believe that our research strategy adds considerably to this literature.

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.

[1] Interesting exceptions are Garicano et al. (2005), Dohmen (2005) and Sutter and Kocher (2004).
[2] 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.

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 Serie A and Serie B clubs, 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, which altogether consists of 842 games.[3] Currently, 24 games have been played without spectators due to the inability to comply with the act. Apart from Calcio Catania and Brescia Calcio, all teams are now allowed to have spectators again.[4] Table 1 shows the games that have been played without spectators.

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.[5] If one player receives two yellow cards, or one instant red card, then he is sent off the pitch. This implies that his team has to play one man short, which is a significant disadvantage.[6] So far, 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 is currently approximately 20.[7]

[3] The 20 teams in serie A and the 22 teams in serie B play each other twice per year.
[4] 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 without spectators. Due to this special regulation, and since the hooligan event may be correlated with the clubs' 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.
[5] If the foul is committed close 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.
[6] He may also be suspended for games in the future. This, however, does not affect the number of players on the pitch.
[7] 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. The referees additionally receive 3 500 euro per game in serie A and 2 000 euro per game in Serie B.

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 use the following set up. Let Y_{ij} denote referee *i*'s behavior in game *j* (fouls, yellow cards, and red cards) and let *no_spectators* be an indicator variable for the games when the teams were forced to play without any spectators. We can now estimate the effect of having no spectators on the referee's behavior by running the regression

$$Y_{ij}=\alpha_j + \beta no_spectators_{ij} + v_{ij}, \quad (1)$$

where α_j is a referee fixed effect. The parameter β measures the effect of having no spectators on the behavior of the referee. It is important to note that the parameter β is identified *only* by the within referee variation since 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.[8] To be able to test whether the referee is biased, we separate the behavioral response of a referee towards both the home team and the away team in games with many or with no spectators. The referee is biased if he would give the home team *more* punishments (e.g., fouls, yellow cards and red cards) compared to the away team in the games without spectators. In other words, we estimate separate regressions of (1) for both the home team and the away team, and define the bias of the referee as the difference between the coefficient β for the home team, β^{Home}, and the away team, β^{Away}. Thus, the referee is biased due to social pressure if $\beta^{Home}>\beta^{Away}$ and unbiased if $\beta^{Home}=\beta^{Away}$.[9] Here, we implicitly assume that the incentives of players of both the home team and away team are affected similarly of the presence or absence of spectators and the only reasons why $\beta^{Home}>\beta^{Away}$ is because of the behavior of the referee. If players are affected by spectators,

[8] The average number of spectators is 18 376 in serie A and 8 286 in serie B**.**

[9] This approach is equivalent to a "difference-in-difference" model, i.e., Y= δhome_team +θ no_specators + πhome_team×no_spectators + referee fixed effects, where home_team is an indicator of whether the team is a home team or not. Thus, this set up consists of a group fixed effect (home_team), a treatment indicator (no_specators), and an interaction between the group and treatment indicators (home_team×no_specators) where the different-in difference parameter is $\pi=\beta^{Home}-\beta^{Away}$. This specification makes it clear that the identifying assumption is that there are no other interactions between group and treatment except for the treatment (no-spectators) itself.

then we find it likely that home teams play *more* intensively in front of spectators. Thus, if anything, our estimate of the size of the bias of the referee is likely to be underestimated.

3. Results

In this section we provide evidence on the behavior of Italian referees, i.e., results from estimating equation (1) for both the home and away teams. Table 3 shows the results from these regressions. Columns 1 and 2 display the results for the number of fouls. The results are striking: while the referee gives the away team 2.6 *fewer* fouls when there are no spectators, he gives the home team 1.7 *more* fouls. Thus the estimate of the referee bias is 1.7-(-2.6) = 4.3 fouls. This is highly statistically significant as can be seen by the *t*-test for equality of the two parameters, $\beta^{Home}=\beta^{Away}$ in the third row of the column. Since the average number of fouls is 19 per team and game, the bias effect is as high as 23 percent.

Columns 3 and 4 report the results for the number of yellow cards. Once again, we see a striking difference between a referee's behavior towards the home team and the away team in games without spectators. The referee gives somewhat fewer yellow cards to the home team (-0.48) in the games without spectators compared to the games with spectators. But because they give the away team much fewer yellow cards, -1.16, the estimate of the referee bias is -.0.48-(-1.16) =.68 cards, which is statistically significant at the 5.7 percent level. In columns 5 and 6, we present the results on the number of red cards. The differential impact on the home and away team is in line with the previous results. The referee bias is -.06-0.13=.07 red cards, which is statically significant at the 10 percent level**.** The average number of yellow and red cards is 2.62 and 0.105 respectively. The estimated referee bias therefore constitutes a 26 percent effect for yellow cards, and a 70 percent effect for red cards. Table 4 shows that these results are robust to including home team and away fixed effects. The estimated bias effect is 4.56 for fouls, 0.61 for yellow cards, and 0.07 for red cards. In fact, the results also hold without any controls (i.e., referee and team fixed effects) since the estimated bias effect is 3.96 for fouls (t=3.98, p-value=0.000), 0.63 for yellow cards (t=2.00, p-value=0.052), and .085 for red cards (t=1.74, p-value=0.089). Finally, the results on referee bias do not change when serie A and serie B are studied separately as can be seen from Tables 5 and 6 respectively (the estimated effects are however less precisely measured). Taken together, the consistency of the estimated bias effect across different specifications and across different outcomes of the referee strongly suggests that the estimated referee effect is caused by social pressure from the crowd.

4. Conclusions

Soccer referees are supposed to be neutral. Yet, we find evidence that Italian referees change their behavior 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.

An alternative explanation of our findings is that players, rather than referees, change their behavior in games without spectators. However, for this explanation to be true, home players must play *less* intensively in games with spectators compared to without. We find it more reasonable that home teams play more aggressively in games with spectators. Thus, we are probably understating the true referee bias effect.

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.

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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[10]	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

[10] 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. Behavior of the referee regarding the away and home teams

	Fouls		Yellow cards		Red cards	
	Home team	Away team	Home team	Away team	Home team	Away team
No spectators	1.74	-2.62	-.48	-1.16	-.06	-.13
	(.83)	(.83)	(.25)	(.16)	(.05)	(.03)
Referee fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
t-test: $\beta^{Home}=\beta^{Away}$	*t*= 3.91		*t*= 1.96		*t*= 1.71	
p-value within parenthesis	(0.000)		(0.057)		(0.095)	
R^2	0.1120	0.1076	0.1106	0.0975	0.0704	0.0802
Number of observations	578	578	582	582	582	582

Note: Standard errors clustered at the level of referee.

Table 4. Behavior of the referee regarding the away and home teams controlling for home and away team fixed effects

	Fouls		Yellow cards		Red cards	
	Home team	Away team	Home team	Away team	Home team	Away team
No spectators	2.29	-2.27	-.52	-1.13	-.06	-.14
	(.69)	(.96)	(.25)	(.25)	(.06)	(.06)
Referee fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Home team fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Away team fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
t-test: $\beta^{Home}=\beta^{Away}$	*t*= 3.76		*t*= 1.89		*t*= 1.64	
	(0.001)		(0.066)		(0.108)	
R^2	0.3596	0.3953	0.3302	0.3007	0.2145	0.2083
Number of observations	578	578	582	582	582	582

Note: Standard errors clustered at the level of referee.

Table 5. Serie A. Behavior of the referee regarding the away and home teams

	Fouls		Yellow cards		Red cards	
	Home team	Away team	Home team	Away team	Home team	Away team
No spectators	2.29	-2.63	.15	-.96	-.14	-.18
	(1.34)	(1.54)	(.54)	(.24)	(.05)	(.09)
Referee fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
t-test: $\beta^{Home}=\beta^{Away}$	*t*= 2.67		*t*= 1.54		*t*= 2.03	
	(0.011)		(0.131)		(0.050)	
R^2	0.1200	0.1383	0.1541	0.1461	0.1197	0.1680
Number of observations	277	277	277	277	277	277

Note: Standard errors clustered at the level of referee.

Table 6. Serie B. Behavior of the referee regarding the away and home teams

	Fouls		Yellow cards		Red cards	
	Home team	Away team	Home team	Away team	Home team	Away team
No spectators	1.31	-2.37	-.74	-1.35	-.08	-.12
	(1.00)	(1.22)	(.31)	(.26)	(.08)	(.06)
Referee fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
t-test: $\beta^{Home}=\beta^{Away}$	*t*= 2.74		*t*= 1.37		*t*= 1.25	
	(0.009)		(0.177)		(0.219)	
R^2	0.1909	0.1746	0.1734	0.1366	0.1292	0.1482
Number of observations	301	301	305	305	305	305

Note: Standard errors clustered at the level of referee.

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