ORIGINAL

THE INFLUENCE OF AGGRESSIVENESS ON THE PERFORMANCE OF FOOTBALL TEAMS IN SPAIN

INFLUENCIA DE LA AGRESIVIDAD SOBRE EL RENDIMIENTO DE EQUIPOS DE FÚTBOL EN ESPAÑA

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ABSTRACT

Aggressiveness is a complex concept to define and one which includes actions intended to harm a rival. Such actions can be justified as a means to achieving the goals of the team, or simply a manifestation of explicit violence. The aim of this research was to test whether the belief that aggressive play reaps benefits has empirical support by analyzing its influence on the variation in the scoring of all matches in the 1st division of the Spanish football league,

for the 2007/2008 and 2008/2009 seasons. In order to do so, we distinguished between instrumental and hostile aggression as different levels of aggressiveness. Furthermore, we measured the performance of teams through changes in the scoreboard, that is to say, when a goal is scored. Results derived from the estimation of five different models showed, overall, that aggressiveness has a negative impact on team performance.
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KEYWORDS: Aggression, football, performance, hostile aggression, instrumental aggression, sports

RESUMEN

La agresividad es un concepto complejo de definir, y que engloba aquellas acciones encaminadas a dañar al rival. Pueden estar justificadas como un instrumento para conseguir el objetivo del equipo o ser una manifestación de violencia explícita. El objeto de esta investigación es comprobar si esa creencia sobre el juego agresivo tiene soporte empírico, al analizar su influencia en la variación en el marcador en los partidos disputados en la 1ª división de la liga española de fútbol durante las temporadas 2007/2008 y 2008/2009. Para ello, se distingue entre agresión instrumental y hostil como diferentes niveles de agresividad. Además, se mide el rendimiento de los equipos en relación al cambio en el marcador, una variable reflejada directamente sobre los goles, y no sobre otras variables de juego que pueden o no traducirse en cambios en el marcador. Los resultados muestran, globalmente, que la agresividad tiene efectos negativos sobre el rendimiento.

PALABRAS CLAVE: Agresividad, fútbol, rendimiento, agresión hostil, agresión instrumental, deportes

INTRODUCTION

In many sports, the performance of players and teams seems to be influenced by the degree of aggressiveness that is required or which they are able to reach. Some authors conclude that more aggressiveness is positively associated with performance, as in basketball (Zitek and Jordan, 2011), hockey (McCarthy and Kelly, 1978a, 1978b) and handball (Grange and Kerr, 2010). Moreover, there is evidence that this effect also has a negative impact on other sports, such as tennis (Hanegby and Tenenbaum, 2001) and on certain aspects of the game, such as precision and concentration (Gambetti and Giusberti, 2008). In any case, various studies reach the conclusion that the size of the effect differs depending on the type of sport. Therefore, aggressiveness should be taken into consideration when modeling the performance of athletes, together with other variables traditionally used in such studies (such as Arkes and Martinez, 2011 and Dobson and Goddard, 2011): the condition of home team or away team, the rest days between games, the momentum of teams, the quality difference between the teams, the stage of the season, the influence of attendance or the referee factor.

However, we find no empirical evidence on the effect of aggressiveness on the performance of football teams, although there are studies that show how the level of aggression increases with the level of competition (Coulomb-Cabagno and Rascle, 2006) and how aggressiveness is legitimized by the players as inherent to high-level competition (Traclet et al., 2009). The goal of this research is to test whether the belief that aggressive play benefits the team has empirical support by analyzing its influence on variations in match scores.

THE CONCEPT OF AGGRESSIVENESS

In sport, the concept of aggression may be defined as overt acts that violate the formal rules of the game and intentionally cause injury (Widmeyer et al., 2002). Since football, like many other sports, involves physical contact between players, measuring aggressiveness can be a complex task. Therefore, as Grange and Kerr (2010) stated, many authors admit it is difficult to incorporate the concept of attempting to harm or injure rival players in the definition of aggression in sport. It is worth recalling that the legitimate actions of the players on the field of play can cause accidental damage to opponents. This distinction is very important because it reflects the divergence between two disparate types of aggression: hostile and instrumental, both of which are discussed below.

On the one hand, Grange and Kerr (2010) defined instrumental aggression as one athlete intentionally hurting another, but the intention of this action is not the damage, but rather some other purpose, such as victory in the competition. On the other hand, hostile aggression aims only to physically or psychologically harm a person. This type of agression habitually occurs as a result of frustration caused when athletes lose. In addition, it also arises when athletes perceive referee decisions to be unfair, feel physical pain, or are playing below their potential. This distinction between instrumental aggression and hostile aggression is employed widely in the literature, although it is true that other authors propose other ways of categorizing these actions. So, like Grange and Kerr (2010) explain, authors such as Smith (1983) defends all aggressive actions in sports are instrumental aggressions, because to a greater or lesser extent all they are achieved to get the victory. Therefore, other classifications are also of interest, such as Kerr (2005) shows: legitimated aggression in the game, aggression due to anger, aggression to intimidate an opponent and spontaneous aggression by a player which causes pleasure feeling to the own aggressor.

One of the difficulties of measuring instrumental aggression is the discretion of the referee regarding the criminality of the offense. For example, Nevill et al. (2002) decided that the referees are influenced by the stadium atmosphere factor, as the substantial disagreement in the referees' decisions that each one takes, because none of the 47 challenges considered in the study resulted in a unanimous decision by all 40 qualified referees. If such a violation is not punished with a yellow card, then it is very difficult to record which actions are aggressive and which are not. Only through observational studies could such violent behavior be coded. Consequently, it would not be possible to use official

databases, which would result in a small sample size and the subsequent loss of statistical power to detect the possible effect on performance. This concern is referred to in Zitek and Jordan's (2011) study as a key element in this type of research.

The reasons why a player may make a hostile attack, when a priori it can seriously harm his team, have been explained by various theories, such as the instinct theory (see Husman and Silva, 1984) holding that human beings have a innate instinct to be aggressive, the theory of frustration-aggression (Dollard et al., 1939) as a result of not being able to achieve a goal the social learning theory (Bandura, 1973; Weinberg and Gould, 1995) explaining aggression as a learnt behavior by means of observation); and finally the revised frustration-agression hypothesis (Berkowitz, 1989) reviews the original theories of frustration-aggression and social learning, combining elements of both to explain aggressive behavior.

Aggression in sport is also a way to intimidate the opponent. The concept of bullying is defined as a tool to control the behavior of the opponent by causing fear (Crawford et al., 2004). This can be done intentionally, that is, when the aggression is intended not only to cause physical injury but also to intimidate the opponent. This situation occurs when an opponent's aggressive action is perceived as intimidating even when this was not intention of the offender.

Regarding the effect of aggressiveness on athletic performance, various empirical studies show conflicting results in different sports. Wright (2009) found that obvious aggressive actions and obstructionism in basketball were positively related to team performance. Meanwhile, Zitek and Jordan (2011) concluded that hostile attacks in the NBA were positively associated with enhancing the performance of players in different aspects of the game. Furthermore, Russell (1974) showed that the goals scored in ice hockey were positively related to the aggressive behavior of teams, which is a similar result to that obtained by McCarthy and Kelly (1978). These authors concluded that going behind in the last few minutes of a match increased the likelihood of a team engaging in aggressive behavior. However, Widmeyer and Birch (1984) found no such relationship with team performance. Meanwhile, Andrews (1974) and Wankel (1973) found a positive relationship between the number of victories of ice hockey teams and the penalties awarded against them. In handball, however, Albrecht (1979) found that winning teams committed more fouls than losing teams. In contrast, the study by Hanegby and Tenenbaum (2001) showed that aggressive behavior among tennis players, such as insulting the opponent, is negatively associated with performance. Beedi, Terry and Lane (2000) ultimately found that athlete anger is associated with a negative return in some studies, but positive in others.

As far as the authors of this paper are aware, this is the first study on football that addresses the association between aggressive play and team performance. In order to achieve this goal, we distinguish between instrumental and hostile aggression as different levels of aggression, as can be a obstruction or hitting an opponent, involving divergent playing behavior as can be achieving an objective, such as scoring a goal or injuring an opponent .In addition, we

measure the performance of teams using the change in the score, i.e. when there is a goal, such that performance is directly reflected by the goals and not other variables that may or may not result in changes in the score.

METHODOLOGY

DATA AND VARIABLES

We created a database using all the matches in the 2007/2008 and 2008/2009 seasons of the First Division of the Spanish professional football league. We also employed other secondary sources, such as the website of the Liga de Fútbol Profesional (Professional Football League in English), the league handbook compiled by Spanish national sports newspaper Marca (www.marca.com) and the ESPN Football website. We recorded the results of these games and the values of the different variables employed in the analysis, which we explain below. This database is an extension of an original database comprising all the match results from the 2002/2003 season to the 2009/2010 season, which served for auxiliary analysis.

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.

First, we describe the two key variables of this research: performance and aggressiveness, as measurement requires thorough justification.

Because players obviously perform aggressive actions in the course of the 90 minutes of a football match, the score at any time may influence the aggressiveness of the opposing team in the subsequent part of the game. What we propose in this research is to take partial results as the dependent variable. One indicator of the performance of football teams during the course of a match is scoring a goal. A goal allows the team that scores to get closer to the ultimate goal of winning or at least drawing a match or reducing the advantage of the opposing team.

That is, a change in the score leads to a new match. This approach to modeling performance is similar to the Adjusted Plus / Minus System (Winston, 2009) in basketball, whereby there are $Z +1$ different matches within the same game depending on the Z different combination of players on the court. Applying a similar reasoning in our study, we consider $(Z +1) * k$ distinct matches, where Z reflects the changes in the score of a match k. Thus, for each game k, $Z+1$ nested cases.

Therefore, the performance variable Y shows a change in the score: 1 if the local team scores a goal, 2 if the visiting team does. Hence, Y is a vector $(Z +1)*k$ rows. This procedure would provide a nominal variable that could be modeled by means of multinomial regression. By dividing each match into time periods, the number of cases increased to 2881 for the two seasons

considered. This sample is large for this type of studies and similar to the size of the study conducted by Zitek and Jordan (2011).

Regarding the measurement of aggressiveness, our proposal is based on the concept of aggressiveness as actions intended to harm an opposing player. The most flagrant case is hostile aggression, which in football results in a red card and the player being sent off. As referees provide their reasons for showing cards in their post-match report, this information can be used to build categories.

Since not all aggressive actions yield red cards, yellow cards are also subjected to analysis. The referee usually shows a yellow card, in the case of aggressive actions, to punish the player when such actions are not sufficiently violent to warrant a player being sent off. Table 1 shows similar concepts in different categories, but actually, score sheet have a more detailed analysis that explains why the referee make a decision. It could be concluded that the concept of instrumental aggression refers to many of these cases, which the referee deems punishable, but legitimately part of the sport. The categories were established by the authors, according to referee's description in the score sheet about cards showed and the colour of them.

Table 1 shows the reasons for showing cards. The table includes individual categories, considering instrumental aggression and hostile aggression. The classification above may be subject to debate and we admit that studying the influence of aggressive behavior on team performance is an extremely difficult task. Consequently, we aim to create four variables, namely "hostile aggression", "instrumental aggression", "offenses yielding warnings" and "offenses without warnings".

Table 1. Offenses coded as instrumental aggression and hostile aggression

Instrumental aggression*	Kind of card
- Tackling an opponent	Yellow
- Foul Play	Yellow
- Holding an opponent	Yellow
- Hitting an opponent	Yellow
- Pushing an opponent	Yellow
- Arguing with an opponent	Yellow
- Obstruction	Yellow
- Recurring offenses	Yellow
- Illegitimately preventing a clear goal-scoring opportunity	Red
Hostile aggression	
- Foul Play	Red
- Hitting an opponent	Red
- Pushing an opponent	Red
- Tackling an opponent	Red
- Unsporting behavior	Red
Nonaggressive offenses	
- Complaining to the referee	Yellow
- Intercepting the ball with your hand	Yellow
- Standing in front of the wall	Yellow
- Preventing a free kick from being taken	Yellow
- Simulating offenses	Yellow
- Kicking the ball away	Yellow
- Wasting time	Yellow
- Disobeying referee instructions	Yellow
- Taking a free kick without authorization	Yellow
- Insulting the referee	Red
- Complaining	Red

* Two instrumental aggressions that are sanctioned with yellow cards result in the player being sent off

Source: Compiled from information contained in the rules of refereeing

Using these four variables and the possible interaction between them, we capture the unlawful conduct of each team and their aggressive behavior. Data from these variables are recorded in referees' post-match reports.

As part of our statistical model, we include a set of control variables that help to relate aggressiveness to performance. The choice of these variables is widely advocated in the literature.

We include variables such as the advantage of playing at home (e.g. Pollard and Gomez, 2009; Pollard and Pollard, 2005; Neave and Wolfson, 2003). This variable includes atmosphere factors such as *the influence of attendance* (Dohmen 2003), *attendance relative to stadium capacity* (Page and Page, 2010) and *proximity to the pitch* considered such as a dichotomous variable for the case of an athletics track between the pitch and the stands (Dohmen, 2008; Buraimo et al, 2010; Dawson and Dobson, 2010).

Other variables related to the football schedule are the rest days between games (Reed and O'Donogue, 2005) considered as dichotomous variable: if they have had weekdays match of other competitions other than league, and the stage of the season (Sampaio, Drikwater and Leite, 2010), which is divided into periods when there are a large number of matches or periods when clubs approach the time when they must achieve their objectives (Dobson and Goddard, 2011).

Factors directly related to the team or club as well as the distance covered by the away team (Dobson and Goddard, 2011), the momentum of teams, thereby serving as predictors of subsequent match results (Dobson and Goddard, 2011; Arkes and Martinez, 2011) by measuring the differences between the recent form of both teams. Another variable considered is the quality difference between the teams (Arkes and Martinez, 2011) taken as an indicator of the potential of each team in the first and second half of the season and also considering this potential differently for home and away matches. Also, we considered other variable such as the effect of *changing managers midseason* (Martinez, 2012; Wagner, 2010) as a dichotomous variable.

The referee is another important factor. According to the regulations of FIFA games, Article 5 states that *"Every football match is controlled by a referee who has full authority to enforce the Laws of the Game in the match to which he has been appointed"* which indicates that the referee is the highest authority on the pitch, determining all the actions that take place, and these decisions are definitive and could have an influence on the final score. Therefore, it is important to measure referee experience using several indicators, such as the number of *matches refereed in the first division and the number of international matches the referee has been in charge of*.

Apart from measuring aggressiveness, this research also considers the *number of red and yellow cards accumulated,* and other variables considered are the *minutes of play in each period* and the *score in the previous period.* This latter variables will take the values 0,1 or 2 depending if result is kept unchanged, the local team scores or the away team scores), since we are considering "several matches within a single match". Table 2 presents the descriptive statistics of the variables considered.

Table 2. Descriptive statistics of the variables considered

Variable	Obs	Category	frequency		
Change in score (response variable)	2881	0	758		
		1	1219		
		2	905		
Time of the season	2881	1	1136		
		2	733		
		3	638		
		4	374		
	Obs	Mean	Stand.	Min	Max
Match before a cup match (HT)	2881	0,12	0,32	0	1
Match before a cup match (AT)	2881	0,12	0,32	0	1
Match after a cup match (HT)	2881	0,12	0,32	0	1
Match after a cup match (AT)	2881	0,11	0,31	0	1
Match before a Europe League match (HT)	2881	0,02	0,16	0	1
Match before a Europe League match (AT)	2881	0,03	0,17	0	1
Match after a Europe League match (HT)	2881	0,03	0,17	0	1
Match after a Europe League match (AT)	2881	0,02	0,16	0	1
Match before a Champions League match (HT)	2881	0,06	0,24	0	1
Match before a Champions League match (AT)	2881	0,04	0,21	0	1
Match after a Champions League match (HT)	2881	0,04	0,20	0	1
Match after a Champions League match (AT)	2881	0,05	0,22	0	1
Difference in runs	2529	-0,18	4,73	,14	12
Potential difference	2881	5,43	7,54	-17	24
Distance to local team ground (ln)	2881	5,87	1,09	0	6,92
Referee experience (ln)	2724	4,37	1,04	0	5,5
Referee international matches (ln)	2724	1,46	1,70	0	4,57
Attendance	2267	29985	19382	5000	98248
Occupancy (%)	2267	73,71	19,15	16,79	104,17
Athletics Track	2881	0,14	0,34	0	1
Change of manager in that match (HT)	2881	0,014	0,12	0	1
Change of manager in that match (AT)	2881	0,015	0,12	0	1
Time lapse	2881	24,36	21,69	0	97
Home team ahead in the previous period	2881	0,36	0,48	0	1
Away team ahead in the previous period	2881	0,25	0,43	0,	1
Yellow cards accumulated (HT)	2881	0,79	1,19	0	7
Yellow cards accumulated (AT)	2881	0,96	1,38	0	8
Red cards accumulated (HT)	2881	0,047	0,23	0	2
Red cards accumulated (AT)	2881	0,06	0,25	0	2
Instrumental aggressions (HT)	2881	0,55	0,57	0	6
Hostile aggressions (HT)	2881	0,017	0,13	0	2
Nonaggressive offenses (HT)	2881	0,16	0,44	0	4
Instrumental aggressions (AT)	2881	0,61	0,97	0	7
Hostile aggressions (AT)	2881	0,014	0,11	0	1
Nonaggressive offenses (AT)	2881	0,18	0,47	0	4

Note: HT = Home Team, AT= Away Team

DATA ANALYSIS

In order to analyze the effect of aggressiveness on performance, we need to build a statistical model to control for the many variables that may confound the effect. Thus, we propose a multinomial logistic regression model with the following specification:

$$ln\left\{\frac{\Pr(y_i = s|x_{mi})}{1 - \Pr(y_i = r|x_{mi})}\right\} = \beta_0 + \sum_{1}^{m} \beta_m x_{mi}$$

where y_i is the response variable (0: there is no change in the score, 1: the home team scores a goal, 2: the away team scores a goal). Each of these categories is labeled s or r depending on whether it is the category to be evaluated (s) or the reference (r). Meanwhile, x_{mi} are the set of m covariates that influence the probability of the response variable being s against r, the distribution of the responses given the covariates being multinomial.

Since the cases may be nested within a single match (cluster), the assumption of independence may be questioned. Hoechle (2007) revises the different options that researchers can use to correct the standard errors of estimates in these situations, the choice of computing robust errors for each cluster being the most suitable in this case.

Subsequently, we have estimated five different models with Stata 12.0, using the method of maximum likelihood and correcting standard errors to relax the assumption of independently distributed residuals. Thus, the estimation produces consistent standard errors if residuals are correlated within each cluster, but uncorrelated between clusters. Models have the next features:

1. The first model includes all the covariates finally considered.
2. The second model excludes the covariates with data missing to measure the effect of aggressiveness, employing the greatest number of cases possible.
3. The third model restricts the first model to those cases where the time lapses are greater than five minutes
4. The fourth model restricts the first model to those cases where the time lapses are greater than ten minutes
5. The fifth model excludes the cases where the different in score is greater than 3 goals.

It is worth recalling that the objective of this study is to analyze the influence of aggressive behavior on changes in the score. Therefore we believe it is appropriate to set a filter in the 3 and 4 models in relation to the duration of the periods, considering these behaviors require a minimum amount of time to emerge and subsequently materialize as possible effects on performance (Martinez and Martinez, 2010; Sampaio, Drikwater and Leite, 2010).

Regarding the 5 model, an extra filter is necessary to ensure a certain degree of consistency in the sample obtained. Wilcox (2010) precisely recommends rejecting outliers to obtain more robust estimates, considering the matches in which there is a large goal difference between the two teams may belong to different populations.

RESULTS

Table 3 presents the results of the estimation, distinguishing between the likelihood of the home team scoring a goal against no change in score, and the probability of the away team scoring a goal against no change in the score. In addition, the variables related to the type of aggression, both for the home and away team, were normalized by minutes.

The different options available to specify the model enables us to obtain strong evidence in some cases and weaker in others, regarding the significance of the effect of the covariates on changes in the score.

The number of yellow cards accumulated in previous periods influences the changes in the score, both for the home and away teams. The number of cards accumulated has a similar effect on the probability of both the home and away team scoring a goal. Thus, the more yellow cards a team has, the less likely it is to score a goal. There is also weaker evidence that red cards accumulated by the home team increase the likelihood of the away team scoring, and also that the red cards accumulated by the away team decreases that likelihood.

Table 3. Estimated coefficients of the variables that are significant at 95%

	Scoring the home team in front of draw					Scoring the away team in front of draw				
	M1	M2	M3	M4	M5	M1	M2	M3	M4	M5
Match before a Europe League match (AT)	.94	.85								
Match after a Champions League match (HT)	-.89		-.87	-.95	-.97					
Potential difference	.050	.060	.057	.055	.059	-.044	-.034	-.048	-.043	-.038
2nd part of the season compared to 1st	-.42		-.45	-.65	-.75	-.38				-.46
Change in manager in that match (AT)		-.51		-.74	-.74					
Home team ahead in the previous period	-.65	-.72	-.57	-.60	-.65	-.56	-.48	-.64	-.71	-.71
Away team ahead in the previous period						-.45	-.41	-.51	-.46	-.46
Yellow cards accumulated (HT)	-.58	-.51	-.56	-.46	-.46	-.47	-.43	-.45	-.42	-.42
Yellow cards accumulated (AT)	-.40	-.36	-.38	-.43	-.45	-.41	-.42	-.36	-.36	-.35
Red cards accumulated (HT)						.72	.59			
Red cards accumulated (AT)						-.65		-.85		
Instrumental aggressions (HT)	-4.5	-4.7	-7.32	-9.1	-9.7					
Nonaggressive offenses (HT)	-8.4	-6.5	-7.95	-1.52	-1.13					
Instrumental aggressions (AT)						-4.77	-6.01	-5.78	-8.01	-8.18
Nonaggressive offenses (AT)		-1.95		-8.41	-9.16			-20.46	-28.99	-29.22

Model 1: 1903 cases; Clusters: 495; Pseudo R2: 0.16. Includes all covariates
Model 2: 2873 cases; Clusters: 759; Pseudo R2: 0.15. Excludes cases with missing covariates
Model 3: 1563 cases; Clusters: 495; Pseudo R2: 0.15. Model 1 restricted to periods of time > 5 minutes
Model 4: 1277 cases; Clusters: 495; Pseudo R2: 0.15. Model 1 restricted to periods of time > 10 minutes
Model 5: 1241 cases; Clusters: 495; Pseudo R2: 0.15. Model 1 restricted to periods of time > 10 min and only when the difference is no more than 3 goals.

The results are clear in stating that an increase in instrumental aggressions by the home team is associated with a lower probability of scoring and the same applies to the away team and their chance of getting a goal. Therefore, this kind of offense hurts the teams that commit them, not their opponents. In addition, the result is similar in the case of nonaggressive offenses, an increase in which decreases the likelihood of a team scoring a goal. Hostile aggressions, however, do not have a significant effect on the probability of scoring a goal for either the home team or the away team.

However, the same does not occur with nonaggressive offenses on behalf of the away team, also making the home team less likely to score a goal, albeit to a lesser extent than the away team.

In relation to quantifying the size of these effects, we calculated several *odds ratios*. Thus, for model M4, an increase in an instrumental aggression of 90 minutes committed by the home team results in that team being 10% less likely to score a goal. However, if that extra aggression is committed by the away team, it reduces that probability by 8.5%. It is noteworthy that the yellow cards accumulated by home and away teams reduce the probability of both scoring by 35%. Finally, when the away team commits an additional nonaggressive offense, it decreases the likelihood of both teams scoring (home team by 8% and away team by 28%).

DISCUSSION

In sports like football, the traditional gap between instrumental aggression and hostile aggression is absolutely necessary, because violent attacks aimed at injuring an opponent are usually punished by sending the player off the field, leaving his team short-handed for the remainder of the game. This has no effect on improving team performance.

This research analyzes the effect of aggressive behavior on the performance of football teams, reflecting the probability of the home team and the away team scoring a goal. After recording the instrumental and hostile aggressive actions and nonaggressive offenses during the periods in each match when there is a change in the score, we find that aggressiveness does not increase the likelihood of scoring a goal. Moreover, instrumental aggressions have a negative effect, that is to say, increasing this type of aggressive behavior actually decreases the team's chance of scoring.

The consequences derived from aggressive behavior go beyond the negative effect on performance at the time when there are changes in the score, because teams also accumulate cards. Consequently, this decreases the probability of scoring a goal in subsequent periods of the same match. Thus, there is no empirical evidence to defend aggressive behavior in football, because of their effect on leaving the team short of players or putting a strain on the team to perform certain defensive actions due players who have a yellow card being fearful of receiving a second, which would result in the player being sent off.

The only effect that the conduct of one team has on the performance of another team is linked to nonaggressive offenses. Nonaggressive offenses committed by the away team also decrease the likelihood of the home team scoring a goal, albeit to a lesser extent than in the case of the away team that commits them. However, this also implies an increase in the number of cards accumulated, which would negatively affect the offending team in subsequent periods. This could coincide with the notion of the "tactical foul" in order to hinder the opposing team's attack. Therefore, this would be the only empirical support for offenses committed actually negative affecting the opposing team, such offenses not being considered either instrumental or hostile aggressions.

We may interpret that cards do not reflect that a team is aggressively trying to score a goal, but instead are trying to defend their goal. It is worth recalling that the purpose of teams at certain stages of a match may be to maintain the result rather than to score a goal. And this situation could occur not only after going ahead, but also when teams are happy with a draw. It is very important to take this into account, since it allows for another interpretation of the effects of aggressiveness. As noted, instrumental aggressions decrease the probability of scoring a goal in the case of either the home or away team that commit them, but this is not the case for the team that does not. That is, instrumental aggressions on behalf of a team hurt that team rather than the opponent.

This research provides more empirical evidence for professional sports that contradicts the positive effects found by authors such as Andrews (1974), Albrecht (1979), Wankel (1973), Wright (2009) or Zitek and Jordan (2011). It is also important to distinguish between aggression and intensity in the game, as both concepts are often used as equivalents. Intensity refers to the work done per unit of time, so a football team can play very intensely (pushing hard, being direct in their attacking play, etc...), but not at all aggressive. Therefore, intensity should not be confused with aggression because the former does not involve violent acts, whereas the latter does (to a greater or lesser extent and legitimized or not legitimized by the course of the match).

The results of our study obviously depend on the approach taken to measure performance variables and aggressiveness, splitting the match into periods. The applicability of this model should be used in future research related to sport performance, considering that teams adjust their style of playing during each period depending on the score at the start of that period. Our study provides a picture that is much less contaminated by the effect of the course of each match, so it has a great advantage in that it isolates the effect of aggressiveness on performance.

One of the main limitations of the study as it has been mentioned in other sections, is that the aggressive actions recorded can only be the ones that are punished with cards. This is the main limitations of this research, which should be covered by future observational studies to record all actions punishable in a match and then to implement a similar analysis approach to the one implemented in this study.

Another future research stream should be the inclusion of the percentage ball possession of teams in the study. This variable is not recorded in secondary sources by time lapses and it is impossible to encode it. Theoretically, we could propose that those teams that gain ball possession have much more probabilities to suffer a aggression than teams with low ball possesion. Therefore, the number of aggressions made by teams could be associated with this variable.

The benefits of considering a random effect should be carefully studied in future research. It is worth recalling that many of the clusters had no more than 1, 2 or 3 nested data and that several covariates have also been used to control for the various characteristic effects of each match, such as the score in the previous period. The convergence problems in estimating with the Stata Gllamm package in models with numerous covariates should also be taken into account. In this sense, future research should consider carefully whether or not one approach is superior to another.

Therefore, we believe that managers should not encourage aggressive behavior. It is true that an aggressive player can perform very well in various facets of the game (Zitek & Jordan, 2011). However, overall, aggressive teams perform poorly, as our study clearly demonstrates.

REFERENCIAS BIBLIOGRÁFICAS

Albrecht, D. (1979). Zur sportartspezifischen aggression im wettkapfspiel. Sportwissenshaft, 9, 78-91.

Andrews, R. (1974). A Spearman rank order correlation for 18 NHL teams. In National Hockey League Guide. Montreal: NHL publishers.

Arkes, J. y Martinez, J. A. (2011). Finally, evidence for a Momentum Effect in the NBA. Journal of Quantitative Analysis in Sports, 7 (3) Article 13. https://doi.org/10.2202/1559-0410.1304

Bandura, A. (1973). Aggression: a social learning analysis. Englewood Cliffs, NJ: Prentice-Hall.

Berkowitz, L. (1989). Frustration-aggression hypothesis: Examination and reformulation. Psychological Bulletin, 105, 59-73. https://doi.org/10.1037/0033-2909.106.1.59

Coulumb-Cabagno, G., y Rascle, O. (2006). Team sports players' observed aggression as a function of gender, competitive level, and sport type. Journal of Applied Sport Psychology, 36, 1980–2000. https://doi.org/10.1111/j.0021-9029.2006.00090.x

Crawford, B. J., Stuart, M. J., Smith, A. M., y Brennan, R. D. (2004). Intimidation in ice hockey: An exploratory assessment. In D. J. Pearsall, & A. B. Ashare (Eds.), Safety in ice hockey: Fourth volume, (pp. 26-39). West Conshohocken, PA: American Society for Testing and Materials International. https://doi.org/10.1520/STP11606S

Dobson, S. y Goddard, J. (2011). The economics of football. 2nd Edition. New York; Cambridge University Press. https://doi.org/10.1017/cbo9780511973864

Dohmen, T. J. (2003). In support of the supporters? Do social forces shape decisions of the imparciality? Discussion Papers IZA DP 755. Institute for the Study of Labor.

Dohmen, T. J. (2008). The influence of social forces: Evidence from the behavior of football referees. Economic Inquiry, 46, 411-424. https://doi.org/10.1111/j.1465-7295.2007.00112.x

Dollard, J., Doob, L., Miller,N., Mowrer, O., y Sears, R. (1939). Frustration and aggression. New Haven : Yale University Press. https://doi.org/10.1037/10022-000

Gambetti, E., y Giusberti, F. (2008). Dispositional anger and risk decision-making. Mind & Society, 8, 7-20. https://doi.org/10.1007/s11299-008-0052-z

Grange, P., y Kerr, J. H. (2010). Physical aggression in Australian football: A qualitative study of elite athletes. Psychology of Sport and Exercise, 11, 36-43. https://doi.org/10.1016/j.psychsport.2009.04.006

Hanegby, R., y Tenenbaum, G. (2001). Blame it on the racket: Norm-breaking behaviours among junior tennis players. Psychology of Sport and Exercise, 2, 117-134. https://doi.org/10.1016/S1469-0292(00)00017-0

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. Stata Journal, 7, 281–312.

Husman, B: F. y Silva, J.M. (1984) *Aggression in sport: Definitional and theoretical considerations. In J.M. Silva & R.S. Weinberg (Eds.) Psychological foundations of sport. Champaign Illinois: Human Kinetics.*

Kerr, J. H. (2005). *Rethinking aggression and violence in sport. Routledge: London.*

Martínez, J. A. y Martínez, L. (2010). *El uso de indicadores de desempeño normalizados para la valoración de jugadores: El caso de las estadísticas por minuto en baloncesto. European Journal of Human Movement, 24, 39-62.*

Martínez, J. A. (2012). *Entrenador nuevo, ¿victoria segura? Evidencia en baloncesto. Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte.* https://doi.org/10.1080/00223980.1978.9921446

McCarthy, J. F., y Kelly, B. R. (1978a). *Aggression, performance variables, and anger self-report in ice hockey players. Journal of Psychology, 99, 97-101.*

McCarthy, J. F., y Kelly, B. R. (1978b). *Aggressive behavior and its effect on performance over time in ice hockey athletes: An archival study. International Journal of Sport Psychology, 9, 90-96.* https://doi.org/10.1080/00223980.1978.9921446

Neave, N., y Wolfson, S. (2003). *Testosterone, territoriality, and the 'home advantage'. Physiology and Behavior, 78, 269-275.* https://doi.org/10.1016/S0031-9384(02)00969-1

Nevill, A. M., Balmer, N. J. y Williams, A. M. (2002) *The influence of crowd noise and experience upon refereeing decisions in football. Psychol. Sport Exer., 3, 261–272.* https://doi.org/10.1016/S1469-0292(01)00033-4

Page, K. y Page, L. (2010). *Alone against the crowd: Individual differences in referees' ability to cope under pressure. Journal of Economic Psychology, 31, 192-199.* https://doi.org/10.1016/j.joep.2009.08.007

Pollard, R. y Pollard, G. (2005). *Long-term trends in home advantage in professional team sports in North America and England (1876–2003). Journal of Sports Sciences, 23, 337–350.* https://doi.org/10.1080/02640410400021559

Pollard, R. y Gómez, M. (2009). *Home advantage in football in South-West Europe: long term trends, regional variation, and team differences. European Journal of Sport Science, 9, 341–352.* https://doi.org/10.1080/17461390903009133

Reed, D. y O'Donoghue, P. G. (2005). *Development and application of computer-based prediction methods. International Journal of Performance Analysis of Sport (e) 5 (3), 12-28.*

Russell, G. W. (1974). *Machiavellianism, locus of control, aggression, performance and precautionary behavior in ice hockey. Human Relations, 27, 825–837.* https://doi.org/10.1177/001872677402700901

Sampaio, J., Drikwater, E. J. y Leite, N. M. (2010). *Effects of season period, team quality, and playing time on basketball players' game-related statistics. European Journal of Sport Science, 10 (2), 141-149.* http://dx.doi.org/10.1080/17461390903311935

Smith, M. D. (1983). *Violence and sport. Butterworths: Toronto.*

Traclet, A., Rascle, O., Souchon, N., Coulomb-Cabagno, G., Petrucci, C. y Ohbuchi, K. (2009). *Aggression in Soccer: An Exploratory Study of*

Accounts Preference. Research Quarterly for Exercise and Sport, 80, 398-402. https://doi.org/10.1080/02701367.2009.10599577

Wagner, S. (2010). Managerial succession and organizational performance—Evidence from the German Soccer League. Managerial and Decision Economics, 31 (6), 415-430. https://doi.org/10.1002/mde.1495

Wankel, L. M. (1973): An examination of illegal aggression in inter-collegiate hockey. In Williams, I. D., and Wankel, L.M. (Eds.): Proceedings of the Fourth Canadian Psycho-Motor Learning and Sports Psychology Symposium (531-542). Ottawa: National Health and Welfare.

Weinberg, R.S. y Gould, D. (1995). Foundations of Sport and Exercise Psychology. USA: Human Kinetics.

Widmeyer, W. N. y Birch, J. S. (1984). Aggression in professional ice hockey: A strategy for success or reaction to failure? Journal of Psychology, 117, 77-84. https://doi.org/10.1080/00223980.1984.9923661

Widmeyer, W. N., Dorsch, K. D., Bray, S. R. y McGuire, E. J. (2002). The nature, prevalence, and consequence of aggression in sport. In J. M. Silva & D. E. Stevens (Eds.), Psychological foundations of sport (328–351). Boston: Allyn & Bacon.

Wilcox, R. R. (2010). Fundamentals of Modern Statistical Methods: Substantially Improving Power and Accuracy. Springer, 2nd Ed, New York. https://doi.org/10.1007/978-1-4419-5525-8

Winston, W. L. (2009). Mathletics: how gamblers, managers, and sports enthusiasts use mathematics in baseball, basketball, and football. New Jersey: Princeton University Press.

Wright, M. A. (2009). The relationship between team-level aggression and basketball performance. Master Thesis. The Georgia Institute of Technology: Atlanta.

Zitek, E. M., y Jordan, A. H. (2011). Anger, aggression, and athletics: Technical fouls predict performance outcomes in the NBA. Athletic Insight, 3, 29–39.

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