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FROM SPANISH PROFESSIONAL FOOTBALL**

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DOES PLAYING SEVERAL COMPETITIONS INFLUENCE A TEAM'S LEAGUE PERFORMANCE? EVIDENCE FROM SPANISH PROFESSIONAL FOOTBALL

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Abstract:

The sporting performance of professional football teams has often been assessed considering their results in the major regular competition, namely the national league. Here, we show that evaluating league performance without controlling for extra games played in other competitions might produce misleading results. Using Data Envelopment Analysis, we assess the performance of Spanish professional football teams in the League controlling for the extra games played in the King's Cup, Champions League and UEFA Cup. Results show that assessing performance omitting extra games underestimates teams' true performance in the League, the more extra games played leading to greater bias.

Keywords: Performance; Spanish professional football; Data Envelopment Analysis.

JEL Classification: C14, C61, L83.

Resumen:

La conducta deportiva de los equipos profesionales de fútbol se evalúa normalmente por los resultados obtenidos en la principal competición regular, la liga nacional. En este trabajo se muestra que la evaluación de la conducta en la liga sin tener en cuenta los partidos jugados en otras competiciones puede conducir a resultados erróneos. Haciendo uso de técnicas de Análisis Envoltante de Datos, se evalúa la conducta en Liga de los equipos españoles de fútbol profesional controlando por los partidos jugados en la Copa del Rey, la Liga de Campeones y la Copa de la UEFA. Los resultados muestran que evaluar la conducta omitiendo los partidos jugados en otras competiciones subestima el verdadero rendimiento de los equipos en la Liga, siendo mayor el sesgo conforme aumenta el número de partidos jugados en otras competiciones.

Palabras clave: Conducta; Fútbol profesional en España; Análisis Envoltante de Datos.

Clasificación JEL: C14, C61, L83.

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1. Introduction

Assessing performance is a deep-rooted topic within the field of economics. Furthermore, from the seminal manuscript by Rottenberg (1956), which introduces the notion of the *sport production function* applied to baseball, a number of papers have assessed the performance of professional teams in different sporting disciplines from the perspective of their management. For the most part, these studies have focused on highly popular sports such as basketball in the USA or football, which is by far the most widely followed sport in Europe and South America.

As far as the specific analysis of teams' sporting performance is concerned, following the applied research by Scully (1974), which analyses the relationship between player performance and salary, a wide range of topics have been studied. Some examples include individual player performance (Sueyoshi *et al.*, 1999; Torgler and Schmidt, 2007) and individual manager performance (Fizel and D'Itri, 1997 and Dawson *et al.* 2000a,b), as well as teams' sporting performance in accordance with the results obtained (Carmichael *et al.* 2000; Espitia-Escuer and García-Cebrián, 2008). Likewise, some papers have analysed the relationship between human capital and managerial performance (Dawson and Dobson, 2002; Lee and Berri, 2008), while others have assessed the final results of a season taking into account how attacking or defensive a team is (Zak *et al.*, 1979; Hofler and Payne, 1997; Hadley *et al.*, 2000; Espitia-Escuer and García-Cebrián, 2004, 2006; Boscá *et al.*, 2009). In addition to the above, some papers have analysed the performance of clubs considering sporting and financial objectives jointly (Haas, 2003a,b; Haas *et al.*, 2004; Barros and Leach, 2006, 2007; Barros and García del Barrio, 2008).

The research assessing the sporting performance of professional football teams has generally taken the final result in the national league as the only indicator of sporting results. The *Premier League* in England has received the most attention from researchers, although sporting performance analysis has also been applied to the *US Major League Soccer*, the *Spanish Professional Football League* and the *German Bundesliga*. However, professional football teams often take part in other official competitions apart from their regular national leagues. By way

of example, two club competitions are played at European level, namely the *Champions League* and the *UEFA Cup*. Likewise, many European countries have other official national competitions apart from the league, such as the *Football Association Challenge Cup* in England or the *King's Cup* in Spain.

Our argument in this paper is that evaluating the sporting performance of professional football teams in league without considering the number of games played in other official competitions might well lead to misleading results. The reasoning behind this assertion is really straightforward. Sporting performance is commonly assessed, as in most of the abovementioned papers, by comparing the sporting results observed in the league with potential results, which are determined by a team's endowment of, let us say, *productive* resources. Participating in other official competitions *consumes* resources, predictably reducing a team's potential in the league. As a result, omitting the number of games played in other official competitions will affect the result of performance measurement in the case of the league, penalising teams that play the most games which will tend to display, on equal terms, lower scores of performance.

As far as we are aware, very few papers have considered participation in other competitions in one way or another when evaluating performance in the national league; Audas *et al.* (2002), Haas (2003b), Guzman and Morrow (2007) and Barros and Leach (2007) are some examples. In Audas *et al.* (2002), the impact on performance of changing managers in the middle of the season was analysed using an ordered probit regression model and data from teams participating in the English *Premier League* from the 1972/73 to 1999/2000 season. The model accounts for the fact that, in addition to the *League*, English football teams also play the *Football Association Challenge Cup*. The argument maintained in the paper is that elimination from this competition affects performance in the *League* in subsequent matches, the effect being ambiguous. While elimination may result in a greater availability of resources in the *League*, suggesting an improvement in sporting results, it might also cause a loss of confidence, thus harming results in the *League*. The outcome obtained suggests that both effects are significant, although the second does appear to dominate.

Haas (2003b) used *Data Envelopment Analysis (DEA)* to assess the performance of the professional football teams that participated in the English *Premier League* in the 2000/01 season. His specification of the model included a dummy variable for teams also participating in the *Champions League* or the *UEFA Cup*. This author argues that *big* teams hoping to be successful not only in the *League*, but also in European competitions, must use more resources, as more and better players are needed. Therefore, these teams would appear to be more inefficient if performance were evaluated without taking account their participation in official competitions other than the *League*.

Moreover, Guzman and Morrow (2007) assessed the change in productivity of football teams in the English *Premier League* from the 1997/98 to 2002/03 season by computing Malmquist productivity indices. The differences between teams participating in European competitions and those that had participated only in domestic competitions were investigated, but not found to be statistically significant. Finally, Barros and Leach (2007) evaluated the performance of teams participating in the English *Premier League* from the 1998/99 to 2002/03 season using an econometric cost frontier model. In the specification of the model, the authors introduce a contextual variable signaling teams playing in either of the two European competitions, finding that total cost decreases on participating in these competitions.

All of the abovementioned papers introduce a variable representing participation in other competitions in order to analyse league performance, but mostly in a marginal way. In other words, computing performance scores for the league accounting for the influence of playing other official competitions is not actually the central point being researched.

Our contribution to this field of research is to assess sporting performance in the league while controlling for the number of extra games played in other official competitions. In doing so, *DEA* techniques and output distance functions are used on a dataset corresponding to professional football teams that were in the First Division of the *Spanish Professional Football League* from the 2001/02 to 2007/08 season. Performance scores are then compared with others stemming from a conventional assessment of performance in which extra games are omit-

ted, thus enabling us to compute an index of the impact that omitting participation in other competitions has on performance measurement in the *League*. The foremost result is that controlling for extra games really does matter when measuring sporting performance in the *League* and that the conventional approach underestimates the *true* performance of teams playing extra games.

We believe the results of our research might be of interest to team managers, as they could be provided with sound information and use it to enhance their sporting management. Moreover, assessing *League* performance while controlling for games played in other competitions could also shed some light on issues such as: should we believe managers who put down poor results to participating in several competitions? Does underperforming in other competitions pay off in terms of *League* results? Is it a good idea to change your transfer strategy when the number of competitions a team plays and its objectives change?

The rest of the paper is organised as follows: Section 2 describes the *Spanish Professional Football League*. Section 3 describes football as a productive activity and explains the methodology. In Section 4, data and results are presented, while Section 5 summarises and concludes.

2. Measuring sporting performance using league results: the *Professional Football League* in Spain

Football, as in the rest of Europe, is the most popular sport in Spain and was introduced by British immigrants at the end of the 19th Century. Professional football began in Spain following the approval of the first Professional Football Regulations in 1929. The first ever National League Championship, popularly known as '*La Liga*', was held that same year. The social, economic and media impact of football in Spain is extraordinary. In terms of income, the Spanish *League* is one of the *big five* leagues in Europe and is ranked third in the world in terms of attendance to football stadiums (Deloitte 2008a). Furthermore, two internationally renowned clubs with supporters all over the world play in the Spanish *League*, namely Real Madrid Club de Fútbol and Fútbol Club Barcelona.

Real Madrid was voted the best team in the world in the 20th Century by the *Fédération Internationale of Football Association (FIFA)*. Similarly, the *International Federation of Football History and Statistics (IFFHS)* ranks Barcelona and Real Madrid first and third respectively in the *All-time Club World Ranking*, based on results obtained between 1991 and 2007. The two teams were also ranked first and third respectively in Europe in terms of income in the 2006/07 season (Deloitte, 2008b). Real Madrid and Barcelona have, between them, won 49 of the 77 leagues played in Spain since 1929 and boast the best players with the greatest contemporary media impact. Likewise, many footballers that have played in either Real Madrid or Barcelona have been named *FIFA World Player* since the creation of this award in 1991, including, Romario, Ronaldo (three times), Zidane (also three times), Rivaldo, Figo, Ronaldinho (twice) and Cannavaro.

Since the first *League*, there have been few changes to the competition system. Teams are divided into different categories and only those in the First Division (20 teams at present) and the Second Division (22 teams) are considered professional. Teams play a double (home and away) round-robin tournament against all the other teams in their division. A win is worth three points, while a loss is worth none. If a match ends in a draw, both teams are awarded one point a piece. At the end the season, after 38 rounds of matches, the team with the most points is declared Champion of the *League*. Furthermore, it is worth highlighting that *League* results have important implications for the following season. The top six teams at the end of the season in the First Division are entitled to play European competition the following season¹, whereas the last three teams in the *League* are relegated to the Second Division.

As mentioned in the introduction, the final result in the *League* is the most used indicator in the literature when it comes to measuring the sporting performance of professional football teams. There are several reasons for this. In the first place, even if a team plays in various competitions, performing well in the *League* is of the utmost importance for the sporting man-

¹ The top four teams play the *Champions League* and the fifth and sixth-place teams play the *UEFA Cup*.

agement of the club, as a poor result could lead to missing out on European competition the following season or, if applicable, to relegation. In the second place, the *League* is the competition that best illustrates how well a football team has performed, as it is the tournament that involves the least amount of luck. In other official competitions where survival is determined by home and away or even one-off knock-out matches, success can be determined by random factors that have nothing to do with team management. In the *League*, all the teams play 38 matches and, unlike what can occur in other competitions, chance cannot put a team out of the competition.

3. *League versus King's Cup and European competitions: Analysis of League performance, model specification and methodological notes*

3.1. Sporting management and analysis of League performance

Sports clubs are unusual companies in that obtaining profits is not the main objective of club executives. According to Boscá *et al.* (2009), in this type of company sporting results are more important in terms of business management than financial results. In fact, in Europe a club's finances are considered a limitation for achieving sporting objectives (Szymanski and Smith, 1997; Ascari and Gagnepain, 2006). The legal framework that regulates professional football in Spain results in clubs putting even more emphasis on sporting results, stipulating that their social goal should be to participate in professional sporting competitions and, if applicable, promoting and developing sports, as well as other activities that are either related to or stem from playing sports. What is more, if obtaining profits were more important than sporting results, many teams would have folded by now, bearing in mind the poor economic situation of professional football in Spain (Boscá *et al.* 2008).

One of the key aspects of managing the sporting side of a team is the planning undertaken at the beginning of the season, and playing in several competitions is an extremely important part of this. Apart from the *League*, all First Division teams in Spain play the *King's Cup*, while some also play European competitions: *Champions League* or *UEFA Cup*. As a result, on top of the 38 matches played each season in the *League* by First Division teams, we have to

add a minimum of two matches (if a team is eliminated in the first round of the *King's Cup* and is not playing European competition) and a maximum of 24 (in this case assuming a team plays the final of the *King's Cup* and also the final of a European competition)².

Therefore, depending on the rules of the various competitions that teams play and their success in each, by the end of the season they will have played a different number of matches. And differences can be significant: the team that plays the least could play 38 matches, while the team that plays the most could play as many as 60. Participation in several official competitions throughout the season has been used on occasions to justify poor results in the *League*. Halfway through the season, it is quite common to read or hear managers and club executives blaming poor results on players being overtired. Likewise, some managers frequently blame the loss of a match on the physical tiredness or even a lack of concentration on behalf of players due to changing from one competition to another in a short space of time.

However, supporters rarely understand how a poor performance in the *League* can be justified by the fact that their team is playing several competitions. Fans think that professional footballers, who are certainly very well paid, should be prepared to meet the demands of playing in various competitions. Meanwhile, club executives normally defend their team in public, when they talk about their team in press conferences or they are interviewed by journalists, but privately demand better results from both managers and players. So, who is right, the fans or the club? Does playing in different competitions really undermine a team's performance in the *League*?

Knowing whether or not playing more matches really does affect a team's performance in the *League* could provide team managers and club executives with important information to improve the sporting management of the team. On the one hand, should evidence be provided in favour of this hypothesis, some teams might well reconsider their strategy for the season in the various competitions they are participating. For example, let us imagine a modest First Di-

² This calculation is based on the competition model used in the three competitions, the *League*, *King's Cup* and European competition (*Champions League* and *UEFA Cup*) in the 2007/08 season.

vision team that plays three competitions and does its best to win every match. Is it really worthwhile to make such an effort in all three competitions? Is that the best strategy when a team could suffer in the *League* to the point of being relegated to the Second Division? Would a team have changed its sporting strategy had the club known beforehand that by putting 100% into all competitions the team's *League* potential would be reduced? These are just a few relevant questions.

On the other hand, if playing in several competitions undermines a team's performance in the *League*, the transfer policy of teams that wish to play their best in all three competitions should be different. In this case, transfer strategies should take into account not only the quality of players, but also team equilibrium (defence, midfield, attack), their physical strength and the risk of suffering an injury. For example, if playing in several competitions affects the performance of a team significantly, the team could consider, with the same budget, signing stronger players that are less prone to injury.

3.2. Model specification

Football can be considered, as noted in the introduction, as a productive activity in which teams use available resources in order to maximize their sporting results. Unfortunately, not all teams are successful in achieving this goal, so sporting performance can be assessed by comparing sporting results obtained to the potential of the team, which is determined by its availability of resources. One basic step when assessing performance is modelling the production structure and selecting the variables to represent outputs and inputs, which is not always an easy task.

The output variable this paper uses to measure football teams' sporting results is the number of points obtained at the end of the *League*. Some authors have used other measures, such as the number of matches won (Hofler and Payne, 1997, 2006; Hadley *et al.*, 2000) or the percentage of matches won out of the total played (Porter and Scully, 1982; Scully, 1994; Fizek and D'Itri, 1996, 1997; Dawson *et al.*, 2000a,b). However, as it is possible in football for matches to end in a draw, we believe it is more appropriate to measure sporting performance

by means of points obtained at the end of the season. This variable is also used by Espitia-Escuer and Garcia-Cebrian (2004, 2006, 2008) and Barros and Leach (2006).

Meanwhile, inputs should illustrate the sporting potential of the team. Four inputs are included in the specification of our model: players on the squad, supporters that attend matches, trophies won in national or international competitions and, finally, seasons played in the First Division. The number of players represents the amount of factors available to the manager, while the rest of inputs are proxies of the quality of the team, players and coaching staff.

The number of players on the squad available throughout the season has been considered an input in the productive process of football teams by many authors, including Espitia-Escuer and Garcia-Cebrian (2004, 2006) and Barros and Leach, (2006). Although only 11 players actually play, squads have more than, on average, 25 players. One explanation for this is that managers can make up to three substitutions in every official match. Moreover, it is a long season and there may be injuries or the manager might decide to ration the effort made by players by rotating them when the team has to play several matches in a row. Managers normally want at least two players for each position.

The remaining inputs are proxies of the quality of the team and attempt to illustrate their financial power³. This is easy to justify, as the clubs with the highest level of income can afford to sign the most coveted players and managers on the market, who will foreseeably have more skills and know-how. In other productive activities, it is often assumed that there are no significant differences in the price of factors or their productivity. However, in football, player and manager wage costs vary enormously and are justified by individual characteristics that are seen to influence sporting results.

³ The estimation of the sporting quality of a team and its players and manager by means of a club's financial capacity was first undertaken by Szymanski and Smith (1997). The relationship between wages and player characteristics and between wages and team success has received a great deal of attention in the literature (Dobson and Goddard, 1998; Késenne, 2000; Forrest and Simonns, 2002, 2004; Hall *et al.*, 2002).

Spanish football teams earn income through match-day takings, television broadcasting and publicity. We have included match-day attendance, the number of seasons in the First Division and the number of trophies won in official competitions⁴ as proxies of Spanish football teams' sources of income. The number of spectators is a proxy of the income made through match-day attendance, both directly through tickets and the sale of season tickets, apart from capturing the amount of intimidation spectators can exert on referee decisions. The number of trophies won in official competitions is a proxy of the income a team can make from television broadcasting and publicity. It is logical to assume that greater sporting success is related to higher income from these two sources of financing. Furthermore, as some teams have not won any official competitions, we also incorporate the number of seasons that a team has played in the First Division of Spanish football. In this sense, one can expect teams with more experience in the competition to register better results (Kahane, 2005).

Finally, we have included two control variables in the model: the number of matches played in the *King's Cup* and the number of matches played in European competitions (*Champions League* or *UEFA Cup*). These two variables aim to capture the effect of playing other official competitions on a team's performance in the *League*. The reason for distinguishing between the number of extra matches played in both competitions is that players may make more of an effort in one competition, and therefore be more debilitated afterwards, than in the other. In this sense, playing extra matches in the *King's Cup* may affect the performance of the team in the *League* differently to playing extra matches in the *Champions League* or the *UEFA Cup*.

3.3. Methodological notes

Once the production structure of professional football teams has been modelled, sporting performance can be assessed by using benchmarking techniques, through either econometric

⁴ The lack of transparency of Spanish football clubs makes it difficult to include variables such as ticket sale income or broadcasting rights and the same occurs with player transfer fees (Boscá *et al.*, 2008).

approaches or non-parametric methods based on *Data Envelopment Analysis (DEA)* (Charnes *et al.*, 1978). In this paper we have opted for *DEA* techniques and mathematical programming.

DEA essentially allows us to compute a measure of relative performance for each productive unit in a sample, football teams in our case, by comparing observed performance, which is determined by input and output vectors, to best observed practices. *DEA* has significant advantages over the econometric approach to performance measurement and has been widely used to assess performance in sporting activities, particularly football. Emrouznejad *et al.* (2008) review the empirical literature on *DEA*, while further details on this approach to performance measurement can be found in Cooper *et al.* (2007).

In more technical terms, let us consider that we observe the sporting result in the *League* of a set of $k = 1, \dots, K$ teams of football⁵, variable y_l , as well as their endowment of inputs as described in Section 3.2, which are denoted by the vector \mathbf{x} . Moreover, let us assume that the production process is defined by a technology that establishes all the feasible relationships between inputs and output and satisfies the properties suggested by Shephard (1970):

$$T = \left[(\mathbf{x}, y_l) : \mathbf{x} \text{ can produce } y_l \right] \quad (1)$$

The relative performance in the *League* of each observation in the sample can be evaluated by using the conventional *output distance function* defined as (Shephard, 1970):

$$D_o(\mathbf{x}, y_l) = \text{Inf} \left[\theta : \left(\mathbf{x}, \frac{y_l}{\theta} \right) \in T \right] \quad (2)$$

This indicator of performance is upper-bounded to one, the lower the score the worse the performance, and measures the maximum increase in sporting results in the *League* attainable without using additional resources. Making use of *DEA* techniques, the performance indicator

⁵ These observations might also belong to the same team in different seasons.

from expression (2) can be computed for observation k' from the following linear programming problem⁶:

$$\begin{aligned}
 D_o(\mathbf{x}^{k'}, y_l^{k'})^{-1} &= \text{Max}_{z^k, g^{k'}} g^{k'} \\
 \text{subject to:} \\
 g^{k'} y_l^{k'} &\leq \sum_{k=1}^K z^k y_l^k \quad l = \text{League} & (i) \\
 x_n^{k'} &\geq \sum_{k=1}^K z^k x_n^k \quad n = \text{players; spectators; seasons in the} \\
 &\quad \text{First Division; trophies} & (ii) \\
 z^k &\geq 0 \quad k = 1, \dots, K & (iii) \\
 \sum_{k=1}^K z^k &= 1 & (iv)
 \end{aligned} \tag{3}$$

z^k being a set of intensity variables determining the efficient combination of observations team k' is compared to. Moreover, x_n^k stands for observation on input n of team k , while y_l^k represents the points won in *League* by team k .

Program (3) assesses the sporting performance in the *League* of team k' by comparing its observed result in this competition with, let us say, an efficient *productive plan* that makes use of no more resources. This benchmark might correspond either to an observed efficient team in the sample or to an efficient productive plan resulting from a linear combination of several observed productive plans. A feature of this measure of interest for the purpose of our research is that the performance of each team in the sample is assessed by comparing it to all other teams in the sample, i.e. performance of a team playing, for instance, 20 or more extra games, might be assessed by comparing its output and inputs with those belonging to a team playing just one or two extra games.

Although this approach, along with other very similar approaches, has been widely used to evaluate the sporting performance of professional football teams in several countries, our concern in this paper is, as reasoned previously, that it might lead to misleading results if playing other competitions affects teams' potential in the *League*, penalising teams that play more extra

⁶ Variable returns to scale are imposed (see Banker *et al.*, 1984).

games. To overcome this drawback, we propose evaluating sporting performance in the *League* while controlling for the number of extra games played in other competitions. This can be readily done by solving the following program for each observation k' in the sample:

$$D_O^{\text{controlling}} \left(\mathbf{x}^{k'}, y_l^{k'} \right)^{-1} = \text{Max}_{z^k, \mu^{k'}} \mu^{k'}$$

subject to:

$$\mu^{k'} y_l^{k'} \leq \sum_{k=1}^K z^k y_l^{k'} \quad l = \text{League} \quad (i)$$

$$x_n^{k'} \geq \sum_{k=1}^K z^k x_n^k \quad n = \text{players; spectators; seasons in the First Division; trophies} \quad (ii)$$

$$z^k \geq 0 \quad k = 1, \dots, K \quad (iii)$$

$$\sum_{k=1}^K z^k = 1 \quad (iv)$$

$$\sum_{k=1}^K z^k g_c^k \geq g_c^{k'} \quad c = \text{Kings' Cup; European competitions} \quad (v)$$

g_c^k standing for the number of extra games played by team k in competition c .

As compared to program (3), program (4) introduces further restrictions, namely restrictions in (v), which force the performance of observation k' to be assessed by comparing its productive plan with a plan corresponding to an efficient team, or the productive plan resulting from a linear combination of some efficient teams, playing at least the same number of extra games in both the *King's Cup* and European competition, either the *Champions League* or the *UEFA Cup*⁷. Obviously, scores of performance computed as the solution to program (4) are equal to or greater than those derived from program (3), the difference representing the opportunity cost in terms of the loss of potential in the *League* as a result of playing extra games in other competitions. The reasoning behind this assertion is, as already noted, really straightforward: playing extra games in the *King's Cup* or European competitions consumes, let us say, *productive* resources endowed with an opportunity cost, thus reducing the potential of teams in the *League*.

⁷ As mentioned in Section 3.2, different constraints concerning the number of extra games played in the *King's Cup* and European competitions are introduced, because the impact on team potential in the *League* of playing in both competitions is expected to be different.

Furthermore, the impact of playing extra games in terms of the potential lost in the *League* can be measured as the difference between the scores of performance computed without controlling for extra games played in the *King's Cup* and European competitions and those computed controlling for these extra games. Formally:

$$\text{Impact of playing extra games}^{k'} = \left[D_o^{\text{controlling}}(\mathbf{x}^{k'}, y_l^{k'}) - D_o(\mathbf{x}^{k'}, y_l^{k'}) \right] \quad (5)$$

This index will take values equal to or greater than zero, the greater the value the higher the impact of extra games on team potential in the *League*. Now that the model has been specified and the main insights into the methodology have been explained, the next section describes the data and the empirical results obtained for the assessment of the sporting performance of Spanish professional football teams.

4. Performance in the First Division of the Spanish Professional Football *League*: Data and results

4.1. Data

The data base this research uses refers to professional football teams in the First Division of the Spanish *League* between the 2001/02 and 2007/08 seasons inclusive. The information comes from the annual reports of the '*Liga de Fútbol Profesional*' (*Spanish Professional Football League*) and refers to the 20 teams in the First Division in each of the seven seasons under analysis. It must be noted that the information does not refer to the same teams throughout the entire period, as some teams were relegated to the Second Division over the sample period while others were promoted to the First Division. *Table 1* provides a statistical description of the sample.

As can be appreciated from the information referring to the control variables, the differences in terms of the average number of matches played in competitions other than the *League* are certainly significant. The team that has competed most at European level (in either the *Champions League* or the *UEFA Cup*) has played an average of 17 matches per season, while other teams have not played a single match. Differences are somewhat less significant in the

King's Cup, with the average number of matches played ranging from nine to one. Even more striking differences can be observed in certain seasons, e.g. in the 2007/08 season, Fútbol Club Barcelona played a total of 58 matches, 38 in the *League*, 8 in the *King's Cup* and 12 in the *Champions League*. In contrast, Real Murcia Club de Fútbol, Club Atlético Osasuna, Real Club Deportivo de la Coruña and Unión Deportiva Almería only played 40 matches, 38 in the *League* and two in the *King's Cup*, after being knocked out in the first round.

4.2. Results

In order to assess the sporting performance of Spanish professional football, observations on the 20 teams in each of the 7 seasons studied have been pooled, giving a sample of 140 observations. Then, both scores of performance, without controlling for extra games played in competitions other than the *League* and controlling for these extra games, have been computed using programs (3) and (4), respectively. Results are in *Table 2*, which also presents the indices of the impact of playing extra games on performance in the *League* computed according to expression (5). The figures are the averages across teams in each of the seasons studied.

Let us recall here that these scores of performance are upper-bounded to one and that they measure the maximum attainable increase in sporting results in the *League* without making use of additional inputs. Considering averages from seasons 2001/02 to 2007/08, performance in the *League* without controlling for extra games scores 0.733, showing that teams have performed to 73.3% of their potential given their resource endowment. Conversely, when performance is assessed controlling for extra games played in the *King's Cup* and European competitions, average performance goes up to 0.756, showing that now 75.6% of potential is reached. As noted in Section 3.3, the difference captures the opportunity cost of playing other competitions in terms of the potential lost in the *League*. In other words, part of the inefficiency detected by the scores of performance computed omitting extra games is actually due to the *consumption* of productive resources as a consequence of participating in official competitions other than the *League*.

Table 3 displays the average performance from seasons 2001/02 to 2007/08 for all teams that participated in the First Division of the Spanish *League* over this period. The first column shows the number of seasons played in the First Division of the *League* within the period analysed, while the last displays the average number of extra games played per season in the *King's Cup* and European competitions. The first result worth highlighting is that the impact of playing the *King's Cup* and European competitions on performance in the *League* is rather different among teams. As expected, the impact is greater on the teams that have played more extra games, as shown by the coefficient of correlation between the average number of extra games per season played and the impact on performance of playing extra games, which is 0.45.

With the purpose of going further into the analysis of our results, let us take Getafe Club de Fútbol and Fútbol Club Barcelona as two teams that represent quite different performances. Getafe Club de Fútbol is a small team founded in 1983 in a city with 150,000 inhabitants and which played in the First Division of Spanish football for the first time in the 2003/04 season. Since then, the club has played the *UEFA Cup* on a regular basis and has also enjoyed good runs in the *King's Cup*. The estimated performance score of this team is equal to one in both scenarios, that is both controlling and not controlling for extra matches played, thus indicating that Getafe has played to its full potential. In other words, Getafe has performed excellently in the *League*, meaning that regardless of the number of matches played in the *King's Cup* and the *UEFA Cup*, the team could not really be expected to perform better in the *League*.

Fútbol Club Barcelona is one of the most important teams in international football which is usually among the top four teams in the First Division of the Spanish *League* at the end of any season. The average *League* performance score for this team without controlling for matches played in other competitions is 0.870, whereas if performance is calculated controlling for the matches played in the *King's Cup* and the *Champions League* (an average of 15.7 matches per season), the score is 0.915. This information could be relevant for club executives. The first score indicates that, with the resources available, Barcelona has performed, on average, to 87% of its potential in the *League*. However, if the number of extra matches played is controlled for,

the team is estimated to have performed to 91.5% of its potential in the *League*. The difference denotes the opportunity cost of playing other official competitions apart from the *League* in terms of a loss of potential in the latter. In other words, part of this team's managerial inefficiency in the *League* detected by the performance score that does not take into account extra matches played, could actually be attributed to participating in the *King's Cup* and the *Champions League*.

Going back to the main concern of this paper, the relevant issue was whether playing several competitions in one season influences a team's performance in the *League*. According to our results, the answer is yes, as shown by the difference between, let us say, *conventional* scores of performance and scores controlling for the number of extra games played. Furthermore, in order to evaluate the statistical significance of this difference we have performed a simple *t-test* for equality of means, in addition to the non-parametric *Wilcoxon signed-rank* test for equality of distributions. In addition, the *Spearman correlation* test has been used to ascertain whether the Spanish football teams in the sample rank differently according to both assessments of performance⁸. The results from seasons 2001/02 to 2007/08, as well as for the whole period, are presented in *Table 4*.

According to the results for the *t-tests*, the difference between average performance derived from both assessments is statistically significant with a confidence level of 95% in all seasons, except for 2007/08, where the *p-value* is 0.091. The results from the *Wilcoxon* test indicate that the distributions of both sets of scores of performance are statistically different with a confidence level of 99% for all seasons with the exception once again of season 2007/08 (the *p-value* is 0.014). However, from the results of the *Spearman* test, we reject the hypothesis that evaluations of performance under our two scenarios lead to statistically different rankings of Spanish professional football teams (*p-values* are negligible). In less technical words, while

⁸ Efficiency estimates involve a certain number of ones creating ties in the calculation of ranks. In order to overcome this difficulty, we have established a ranking of efficient teams in accordance with their importance as benchmarks measured as the number of times they act as a reference for other inefficient teams in the sample (Charnes *et al.*, 1985).

controlling for extra games leads to estimates of performance statistically different to those stemming from an assessment where extra games are omitted, both assessments do not lead to statistically different rankings in terms of performance.

Finally, *Table 5* shows the relationship between the impact of playing extra games on performance in the *League* and the results obtained in the *King's Cup* and European competitions. Results are presented for the three teams that are most affected by playing extra games in each season. In the first place, the teams that feel the impact the most are always those that have had a good run in competitions other than the *League*, regardless of whether it is the *King's Cup*, the *UEFA Cup* or the *Champions League*.

In the second place, in view of the results of this research, playing more matches in competitions other than the *League* cannot be attributed the blame for a team being relegated over the period under study. In this sense, out of the 21 teams that were relegated over the seven seasons being studied, only one could place the blame on having played in other competitions; Real Club Recreativo de Huelva, a small team that made the final of the *King's Cup* in the 2002/03 season after playing nine matches in the competition. The performance score in the *League* for this team without considering the extra matches played in the *King's Cup* is 0.653, whereas after adjusting to control for these matches, the score rose to 1. In other words, as a consequence of Recreativo de Huelva reaching the final of the *King's Cup*, which by the way it lost, the team's potential in the *League* fell by almost 35%. The question for club management seems, therefore, obvious: was it worth playing the *King's Cup* or would it perhaps have been a better idea to forget this competition and concentrate on the *League*?

5. Summary and conclusions

Many papers have recently assessed the sporting performance of professional football teams. For the most part, performance has been evaluated considering the sporting results obtained in the major regular competition in which teams participate, mostly the national league. However, during the course of a season, football teams can participate in additional competi-

tions other than the league. Our argument in this paper is that assessing league performance without controlling for the extra matches played in other competitions might lead to biased results, and teams deemed inefficient might well be efficient if performance were evaluated controlling for these extra games. The reason is that playing other competitions consumes, let us say, *productive* resources, thus reducing league potential.

This manuscript contributes to the existing literature in this field of research by using *Data Envelopment Analysis* techniques and output distance functions to assess the performance of professional football teams playing in the First Division of the Spanish *League* from 2001/02 to 2007/08. Scores of performance are computed controlling for the number of extra matches played in the *King's Cup* and European competitions, either the *Champions League* or the *UEFA Cup*. Then, these scores are compared with scores of performance derived from a *conventional* assessment in which extra games are omitted, thus enabling us to compute an index of the impact of playing extra games on *League* performance.

Our major findings are as follows. First, *conventional* assessment of *League* performance underestimates the *true* performance of Spanish football teams. The more extra games played in other official competitions, the greater the bias. Second, controlling for extra games increases the average scores of performance, the difference with regard *conventional* scores representing the opportunity cost of participating in the *King's Cup* and/or European competitions. Third, both means and distributions of *conventional* scores of performance and scores computed controlling for extra games are statistically different, although Spanish professional football teams do not seem to rank differently when they are ordered in accordance with both criteria. All these results can be summarised in an overall conclusion: playing extra games in other competitions matters when assessing performance in the *League*. Accordingly, future research on performance of professional football teams should take into account this circumstance.

Finally, our belief is that the assessment of performance we make in this paper could provide team managers with sound information to enhance club management. From a managerial perspective, our results indicate that when planning the sporting side of teams at the beginning

of a season, it is worthwhile taking into account that, when fully committed to all competitions, there could be a trade-off between the results obtained in each. Therefore, depending on the potential of each team, at the beginning of the season clubs should consider which strategy is the most suitable: either not being fully competitive in any of the competitions the team is playing or fighting to get as far as possible in all the competitions. This decision should influence the strategy a team is to follow as well as its transfer policy.

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Table 1. Sample description. Averages from seasons 2001/02 to 2007/08.

<i>Variable</i>	<i>Mean</i>	<i>Standard deviation</i>	<i>Maximum</i>	<i>Minimum</i>
<i>Output</i>				
Points obtained in the <i>League</i> at the end of each season	51.8	13.0	85	24
<i>Inputs</i>				
Number of players in each season	27.1	2.6	35	21
Average number of spectators per match	28,432	16,811	76,279	8,195
Trophies in national and international competitions	11.1	18.9	69	0
Number of seasons played in the First Division	41.0	26.1	77	1
<i>Variables of control</i>				
Number of games played in European competitions	3.7	5.3	17.0	0.0
Number of games played in the <i>King's Cup</i>	4.1	2.7	9.0	1.0

Table 2. Performance in the Spanish Professional Football *League*. Averages from seasons 2001/02 to 2007/08.

<i>Season</i>	<i>Performance in the League</i>		
	<i>Performance without controlling for extra games</i>	<i>Performance controlling for extra games</i>	<i>Impact of playing extra games</i>
2001/02	0.736	0.764	0.028
2002/03	0.723	0.768	0.045
2003/04	0.721	0.743	0.022
2004/05	0.756	0.782	0.026
2005/06	0.682	0.735	0.053
2006/07	0.729	0.777	0.048
2007/08	0.729	0.748	0.019
<i>Mean</i>	<i>0.733</i>	<i>0.756</i>	<i>0.024</i>
<i>Standard deviation</i>	<i>0.022</i>	<i>0.018</i>	<i>0.014</i>

*Table 3. Team performance in the First Division of the Spanish Professional Football League
Average from seasons 2001/02 to 2007/08.*

<i>Team</i> ⁽¹⁾	<i>Performance in the League</i>				<i>Average extra games per season</i>
	<i>Seasons in the First Division</i> ⁽²⁾	<i>Without controlling for extra games</i>	<i>Controlling for extra games</i>	<i>Impact of playing extra games</i>	
Real Madrid Club de Fútbol	7	0.909	0.970	0.062	17.0
Fútbol Club Barcelona	7	0.870	0.915	0.045	15.7
Valencia Club de Fútbol	7	0.826	0.852	0.026	13.1
Sevilla Club de Fútbol	7	0.774	0.815	0.041	12.3
Real Club Deportivo de la Coruña	7	0.783	0.853	0.070	12.1
Getafe Club de Fútbol	4	1.000	1.000	0.000	10.3
Villarreal Club de Fútbol	7	0.898	0.926	0.028	10.0
Real Club Celta de Vigo	5	0.710	0.713	0.003	8.4
Real Zaragoza	6	0.615	0.728	0.113	8.0
Real Betis Balompié	7	0.658	0.688	0.030	7.4
Club Atlético Osasuna	7	0.625	0.699	0.074	7.3
Real Club Deportivo Mallorca	7	0.685	0.725	0.040	6.3
Real Club Deportivo Espanyol	7	0.614	0.671	0.057	6.1
Club Deportivo Numancia	1	1.000	1.000	0.000	6.0
Athletic Club de Bilbao	7	0.631	0.649	0.017	6.0
Cádiz Club de Fútbol	1	0.468	0.468	0.000	6.0
Club Atlético de Madrid	6	0.688	0.700	0.012	5.7
Real Club Recreativo de Huelva	3	0.774	0.891	0.117	5.0
Real Valladolid	4	0.686	0.686	0.000	4.5
Málaga Club de Fútbol	5	0.715	0.732	0.017	4.2
Deportivo Alavés	3	0.739	0.747	0.009	3.7
Rayo Vallecano	2	0.704	0.704	0.000	3.5
Real Sociedad de Fútbol	6	0.629	0.629	0.000	2.8
Levante Unión Deportiva	3	0.624	0.624	0.000	2.7
Real Racing Club de Santander	6	0.706	0.738	0.032	2.5
Unión Deportiva Las Palmas	1	0.551	0.551	0.000	2.0
Gimnàstic de Tarragona	1	0.490	0.490	0.000	2.0
Real Murcia Club de Fútbol	2	0.442	0.442	0.000	2.0
Unión Deportiva Almería	1	1.000	1.000	0.000	2.0
Albacete Balompié	2	0.587	0.587	0.000	1.5
Club Deportivo Tenerife	1	0.494	0.494	0.000	1.0

⁽¹⁾ *Teams are ordered according to the average number of extra games per season played.*

⁽²⁾ *Number of seasons played in the First Division during the period analysed.*

Table 4. Some tests of hypothesis of the difference between scores of sporting performance without controlling for extra games and controlling for these games (*p-values* in parenthesis).

<i>Season</i>	t-test ⁽¹⁾ <i>t-statistic</i>	<i>Wilcoxon test</i> ⁽²⁾ <i>Z-statistic</i>	<i>Spearman test</i> ⁽³⁾ <i>ρ-Spearman</i>
2001/02	-2.143 (0.045)	-2.628 (0.008)	0.953 (0.000)
2002/03	-2.322 (0.031)	-3.246 (0.001)	0.840 (0.000)
2003/04	-2.640 (0.016)	-2.962 (0.003)	0.964 (0.000)
2004/05	-2.361 (0.029)	-2.802 (0.005)	0.972 (0.000)
2005/06	-2.459 (0.023)	-2.962 (0.003)	0.844 (0.000)
2006/07	-2.417 (0.025)	-3.110 (0.001)	0.856 (0.000)
2007/08	-1.777 (0.091)	-2.438 (0.014)	0.972 (0.000)
20001/02 to 2007/08	-5.874 (0.000)	-7.653 (0.000)	0.922 (0.000)

⁽¹⁾ *The null hypothesis is the equality of means.*

⁽²⁾ *In this case, the null hypothesis is that both distributions are the same.*

⁽³⁾ *The null hypothesis is that both variables are independent.*

Table 5. Three largest impacts on performance in the *League* of playing extra games. Seasons 2001/02 to 2007/08.

<i>Season</i>	<i>Team</i>	<i>Impact of playing extra games</i>	<i>Number of extra games</i>	<i>Remarks</i>
2001/02	Real Madrid Club de Fútbol	0.206	26	Winner of the <i>Champions League</i> and <i>King's Cup</i> finalist
	Fútbol Club Barcelona	0.138	17	<i>Champions League</i> semi-finalist
	Real Club Deportivo de la Coruña	0.122	23	Winner of the <i>King's Cup</i>
2002/03	Real Club Recreativo de Huelva	0.347	9	<i>King's Cup</i> finalist
	Real Club Deportivo Mallorca	0.196	9	Winner of the <i>King's Cup</i>
	Málaga Club de Fútbol	0.084	12	Quarter-finalist of the <i>UEFA Cup</i> and the <i>King's Cup</i>
2003/04	Real Madrid Club de Fútbol	0.130	19	<i>King's Cup</i> finalist and <i>Champions League</i> quarter-finalist
	Real Zaragoza	0.089	9	Winner of the <i>King's Cup</i>
	Real Club Deportivo de la Coruña	0.083	16	<i>Champions League</i> semi-finalist
2004/05	Real Betis Balompié	0.167	9	Winner of the <i>King's Cup</i>
	Club Atlético Osasuna	0.160	8	<i>King's Cup</i> finalist
	Athletic Club de Bilbao	0.056	16	<i>King's Cup</i> semi-finalist
2005/06	Real Zaragoza	0.401	9	<i>King's Cup</i> finalist
	Real Club Deportivo Espanyol	0.133	17	Winner of the <i>King's Cup</i>
	Sevilla Club de Fútbol	0.124	19	Winner of the <i>UEFA Cup</i>
2006/07	Club Atlético Osasuna	0.271	20	<i>UEFA Cup</i> and <i>King's Cup</i> semi-finalist
	Real Club Deportivo Espanyol	0.269	17	<i>UEFA Cup</i> finalist
	Real Zaragoza	0.182	8	<i>King's Cup</i> semi-finalist
2007/08	Real Racing de Club de Santander	0.191	8	<i>King's Cup</i> semi-finalist
	Fútbol Club Barcelona	0.092	20	<i>Champions League</i> and <i>King's Cup</i> semi-finalist
	Valencia Club de Fútbol	0.083	15	Winner of the <i>King's Cup</i>

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