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DO WE SACK THE MANAGER... OR IS IT BETTER NOT TO? EVIDENCE FROM SPANISH PROFESSIONAL FOOTBALL

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Abstract

Sports club executives are eager for their teams' to perform well in sports competitions. In team sports, the manager takes important decisions that affect the sporting performance of the team. Although the manager is contracted for a period of at least one season, clubs frequently change managers halfway through that period. Before taking that decision, the Board of Directors probably ask themselves: *Do we sack the manager… or is it better not to?* The aim of this paper is to evaluate the impact of a mid-season change of manager on the sporting performance of Spanish professional football teams. In doing so, program efficiency is assessed with *Data Envelopment Analysis* techniques. The main result is that a mid-season change of manager improves sporting performance, but does not allow a team to perform as well as others that have not changed managers halfway through the season.

Keywords: Sports; performance; managerial change; Data Envelopment Analysis; program efficiency; Spanish professional football.

JEL Classification: C14, C61, L83

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1. INTRODUCTION

Maintaining a good level of sporting performance is essential for the interests and financial situation of sports clubs. Income through members, ticket sales and commercial rights are closely linked to teams' sporting results. One small difference in the end-of-season result can entail a significant difference in the club's ability to generate income, particularly if the club is relegated or fails to qualify for international competitions (Tena & Forrest, 2007). Therefore, sports club executives are obviously interested in their teams performing well in sporting competitions.

In most sports, a manager's job is vital for achieving good sporting results. This is particularly true in the case of team sports such as football, basketball, rugby or hockey, where the manager is responsible for making crucial decisions that affect the performance of the team. In these sports, managers help executives to design the club's transfer strategy in order to build a balanced squad in all positions. They work with the trainers to plan and regulate players' work rate throughout the season. They decide which players will start each match and the tactics to be employed based on their own team and the quality of the opposing side. They make changes in tactics and players during the course of matches and may even act as psychologists in the dressing room.

However, a manager's job is probably the most vulnerable at any sports club. It is true that managers are admired when their teams achieve good results, but when results are not favourable, all eyes are on them. At such times, the fact that managers are responsible for the decisions made and their constant public exposure in the media make them prime targets for heavy criticism that can lead to their dismissal. In this sense, the manager is just another employee of the club which, like any other company, hires workers to achieve certain goals. In sports, the squad, including players and the manager, is designed to last for at least one complete season. As a result, any change during the season is unforeseen and can affect the sporting results of the team.

Do we sack the manager… or is it better not to? This is surely the first question that football club executives ask themselves when, for one reason or another, they are considering changing managers halfway through the season. An executive team that behaves rationally would decide to change managers if they thought such a move would improve the sporting performance of the team. However, a change of manager mid-season is not an easy decision. It implies reconsidering all the pre-season planning and work carried out and that is a risky strategy. Likewise, it is difficult to predict the impact of changing managers on the sporting performance of the team.

The literature on leader succession and organizational performance (Grusky, 1963) allows us, however, to outline some arguments as regards the theoretical relationship between mid-season manager changes and teams' sporting performance. According to the *common-sense theory*, the decision to change managers is normally taken following a series of negative sporting results. It is therefore logical to expect the new manager to be able to improve the sporting performance of the team (Kesner & Sebora, 1994). Conversely, the *vicious-circle theory* upholds that a change of manager disrupts the team and has a negative impact on sporting performance. The main reason is that a change of manager halfway through the season involves a change in strategy, which the team needs time to adapt to and learn (Rowe *et al.*, 2005). Finally, the *ritual spacegoating theory* states that the role of a manager is not relevant when it comes to explaining the sporting performance of teams (Gamson & Scotch, 1964). Manager dismissals are simply a strategy on behalf of club executives to appease members and fans following a series of bad sporting results. However, the sporting performance of the team will remain unchanged, as this is primarily determined by the quality of the players. In other words, the manager is nothing more than a scapegoat for the team's poor results.

This paper studies the relationship between a mid-season change of manager and the sporting performance of the teams that played in the First Division of *La Liga Española de Fútbol Profesional* (Spanish Professional Football League, hereafter referred to as *La Liga*) in the seasons running from 2001/02 to 2008/09. Unlike the previous studies carried out in this line of research, which mostly use parametric analysis techniques, we use Data Envelopment Analysis (DEA). Likewise, as far as we are aware, this is the first study performed on professional football teams in Spain and, as such, our results could be of interest to club executives. Some of the questions that our assessment of performance could answer include: Are the dismissal of the manager and the sporting performance of the team related in any way? Are the teams that change managers seen to perform significantly differently to those which do not? What changes in team efficiency occur when a manager is dismissed? The main result is that changing managers halfway through the season improves sporting performance.

The remainder of the paper is organized as follows. Section 2 briefly reviews the literature on this field of research. Section 3 deals with methodological issues. Section 3 describes the data and the empirical model and discusses the results. Finally, section 4 summarizes and concludes.

2. Brief Review of the Literature

Numerous studies have analyzed the importance of the manager for a team to achieve good sporting results. Several papers have assessed the performance of teams, including the performance of the manager. Moreover, other papers have searched for evidence of the relationship between a team's sporting results and certain characteristics of the manager, including experience, matches won in past seasons, salary and whether or not the manager had been a player or assistant manager for the same team. Empirical studies have been carried out on several sports including baseball (Smart *et al.*, 2008), basketball (Fizel & D'Itri, 1996), rugby (Carmichael & Thomas, 1995) and also football (Dawson *et al.*, 2000a, 2000b; Dawson & Dobson, 2002).

Furthermore, several papers have analyzed the influence of a mid-season change of coach on teams' sporting performance. While empirical research has been published in the case of basketball (Fizel & D'Itri, 1997, 1999; Giambatista, 2004), hockey (Audas *et al.*, 2006) and baseball (Fabianic, 1994), the sport that has received the most attention is football. This sporting discipline includes research on the *Premier League* in England (Audas *et al.*, 1997, 1999, 2002), the *Eredivisie* in the Netherlands (Bruinshoofd and ter Weel, 2003; Koning, 2003; Ter Weel, 2005), *La Liga* in Spain (Tena & Forrest, 2007), the German *Bundesliga* (Salomo and Teichmann, 2000) and the *Calcio* in Italy (De Paola & Scoppa, 2008).

As regards methodology, most of the papers that have studied the impact of a mid-season change of manager on sporting performance have employed parametric approaches. Ordered probit models have mostly been used (Tena & Forrest, 2007; Flores *et al.*, 2008), although ordinary least square regressions (Cannella & Rowe, 1995; Rowe *et al.*, 2005), two stages least square regressions (De Paola & Scoppa, 2008), conditional logit models (Maximiano, 2006) and random effect panel data models (Brown, 1982) have also been used. Finally, some papers have carried out statistical analyses of simple indicators (Audas *et al*., 1997), while only a few have employed non-parametric approaches based on *DEA* techniques and combined with parametric probit regressions, jointly aimed at ascertaining the determinants of managerial efficiency (Fizel & D'Itri, 1997, 1999).

As mentioned in the introduction, taking the decision to change managers is not easy, as it is difficult to predict what impact it will have on the team's performance. In accordance with this, empirical research on manager changes and teams' sporting performance is inconclusive. While a few papers find empirical evidence supporting the idea that mid-season manager dismissals improve sporting performance (Fabianic, 1984; McTeer *et al*. 1995), many papers conclude that changing managers damages a team's sporting performance (Brown, 1982; Audas *et al.*, 1997, 2002; Rowe *et al.*, 2005; Audas *et al.*, 2006). Furthermore, some studies find that changing managers has little effect on the sporting performance of teams (Koning, 2003; Bruinshoofd & Weel, 2003).

Nevertheless, a review of the literature does reveal a couple of issues of vital importance that should be taken into account when studying the impact of changing managers halfway through a season on sporting performance. The first refers to the sporting situation of the team when the decision to dismiss the manager is taken, and the second to the difference in potential of the opposing teams that the former and new manager face.

As regards the sporting situation of the team before the manager is dismissed, it is reasonable to believe that dismissal occurs following a series of negative results. Therefore, the sporting performance of the team under the new manager can be expected to improve. It will simply be difficult for the new manager to obtain worse results than his/her predecessor. However, this does not necessarily mean that the change of manager will be positive, as we will never know how the team would have performed if the club had stuck with the same manager until the end of the season. The literature has attempted to solve this problem in two different ways. Both cases require researchers to predict how the team would have performed had the manager not been dismissed. On the one hand, some papers have compared the sporting results of the team after the change of manager to a control group, normally made up of teams that perform at a similar level, but which have stuck with the same manager all season (Brown, 1982; Bruinshoofd & Weel, 2003).

On the other hand, another approach has been to compare the performance of the team after the change of manager to the performance of the same team over longer periods of time, instead of the matches leading up to the dismissal (Audas *et al.*, 2006; Tena & Forrest, 2007). The idea is to assess the sporting performance of the team after the change of manager to how the team would have performed on the basis of their long term performance. The main drawback of this approach is, however, that when the team has been significantly revamped during the period of reference (change of players, managers or even Board of Directors) the comparison becomes entirely meaningless.

The second problem for researchers is related to the difference in quality of opposing teams. When the results of the old and new manager are compared, researchers must take into account the difference in quality of the teams that the two managers have had to play against. In order to solve this problem, most studies have introduced variables that represent the potential or quality of the opposing teams that each manager has faced (Rowe *et al.*, 2005; Tena & Forrest, 2007).

3. METHODOLOGY

3.1. Assessing technical efficiency with Data Envelopment Analysis: A brief comment

Data Envelopment Analysis techniques were introduced by Charnes *et al.* (1978) in a paper that used mathematical programming to pursue Farrell's approach to technical efficiency measurement (Farrell, 1957). This contribution to a then new body of literature has, to date, produced a wealth of contributions in multiple fields of research (Gattoufi *et al.*, 2004, review the empirical literature). In essence, *DEA* is a non-parametric approach to efficiency measurement that evaluates the performance of peer units allowing the construction of a *surface* over the data, the so-called technological frontier, which permits the observed behaviour of a decision-making unit (*DMU* henceforth) to be compared with best observed practices. One important advantage of this approach to performance measurement is flexibility, as it allows the frontier to be constructed without imposing a parametric functional form on technology or on deviations from it (inefficiencies). Further details on *DEA* can be found in Cooper *et al.* (2007).

Regarding the main insights of our production model, let us start by considering that we observe a sample of *n* *DMUs*, each DMU_j ($j=1,\dots,n$) using *m* inputs x_{ij} ($i=1,\dots,m$) to produce *s* outputs y_{rj} ($r=1,\dots,s$). Moreover, we assume that the technology employed to transform inputs into outputs satisfies the standard properties initially suggested by Shephard (1970). Under this set of assumptions, technical performance can be assessed through the model known as the *BCC model* after the paper by Banker, Charnes & Cooper (1984). Using *DEA*, the *BCC* output-oriented score of technical efficiency for DMU_0 can be formally computed from the following mathematical program:

$$\text{BCC output-oriented efficiency} = Max_{\lambda_j,\theta_0}\ \theta_0$$

$$\begin{aligned}
\text{subject to:}\quad & \sum_{j=1}^{n}\lambda_j x_{ij} \le x_{i0} && i=1,\dots,m && \text{(i)} \\
& \sum_{j=1}^{n}\lambda_j y_{rj} \ge \theta_0 y_{r0} && r=1,\dots,s && \text{(ii)} \qquad (1)\\
& \lambda_j \ge 0 && j=1,\dots,n && (iii) \\
& \sum_{j=1}^{n}\lambda_j = 1 && && (iv)
\end{aligned}$$

x_{i0} and y_{r0} standing for the observed values of input *i* and output *r* on DMU_0, respectively. Moreover, λ_j is an intensity variable representing the weighting of DMU_j in the composition of the efficient frontier that represents best observed practices. Also, variable returns to scale are assumed.

The solution obtained from program (1) for DMU_0, namely the parameter θ_0^*, is restricted to be equal to or greater than one and measures the maximal feasible proportional increase of all outputs that this unit could achieve without increasing its use of productive resources. Thus it assesses Farrell-Debreu-type technical efficiency (Farrell, 1957), also called weak efficiency. A score of efficiency equal to one indicates that DMU_0 is technically efficient, while the greater the distance from this figure, the higher the technical inefficiency.

However, once Farrell-Debreu efficiency has been reached, additional increases might be still possible in some output directions, as well as further reductions in some input directions, bringing DMU_0 into a Pareto-Koopmans or strongly efficient status (Koopmans, 1951). The problem is that the *BBC-model* only identifies weakly efficient *DMUs*, thus failing to discover input excesses and output shortfalls. Identifying slacks in both input and output directions requires the following program to be worked out in a second stage (Ali & Seiford, 1993):

$$
\begin{aligned}
& Max_{\lambda_j, s_{i0}^-, s_{r0}^+} \; s_0 = \sum_{i=1}^{m} s_{i0}^- + \sum_{r=1}^{s} s_{r0}^+ \\
& \text{subject to:} \quad \sum_{j=1}^{n} \lambda_j x_{ij} + s_{i0}^- = x_{i0} \qquad i = 1,...,m \qquad \text{(i)} \\
& \qquad \sum_{j=1}^{n} \lambda_j y_{rj} - s_{r0}^+ = \theta_0^* y_{r0} \qquad r = 1,...,s \qquad \text{(ii)} \\
& \qquad \lambda_j \geq 0 \qquad j = 1,...,n \qquad (iii) \\
& \qquad \sum_{j=1}^{n} \lambda_j = 1 \qquad (iv)
\end{aligned}
\qquad (2)
$$

s_{i0}^- and s_{r0}^+ being, respectively, the slacks in input *i* and output *r* of DMU_0.

Summarizing, this two-stage approach to assessing technical performance calculates, in the first stage, proportional increases in outputs necessary for every DMU_j in the sample achieving Farrell-Debreu or weak efficiency. Then, in the second stage, additional improvements for particular inputs and/or outputs required for DMU_j to attain Pareto-Koopmans or strong efficiency are computed.

3.2. Estimating program efficiency

The methodological approach to evaluate program efficiency was developed in one of the first empirical papers on *DEA* by Charnes *et al.* (1981). This paper suggests that groups of *DMUs* belonging to different programs might have different technological frontiers due to program differences. The technical efficiency of *DMUs* operating under different programs is assessed by distinguishing between *managerial efficiency* and *program efficiency*. While the former assesses the performance of *DMUs* when they are compared to the frontier of the group or program they belong to, program efficiency identifies differences in performance between programs.

Computing program efficiency requires four steps to be followed. In the first step, the sample is divided into two or more subsamples or groups, one for each of the different programs considered. Then, mathematical programs (1) and (2) need to be applied to each subsample in order to compute *managerial* or *intra-program efficiency*, which assesses the performance of each *DMU* when it is compared to the best observed practices within its own program.

In the second place, the production plans of the inefficient *DMUs* in each group must be projected onto the technological frontier of their own group. The objective is to eliminate intra-program inefficiency by making all the units in one same program appear as strongly or Pareto-Koopmans efficient. As a result, the potential improvement in DMU_0 would be the result of a proportional increase plus a specific increase in its outputs and a specific decrease in each of its inputs. Formally, the values for inputs and outputs projected onto the efficient frontier would be as follows:

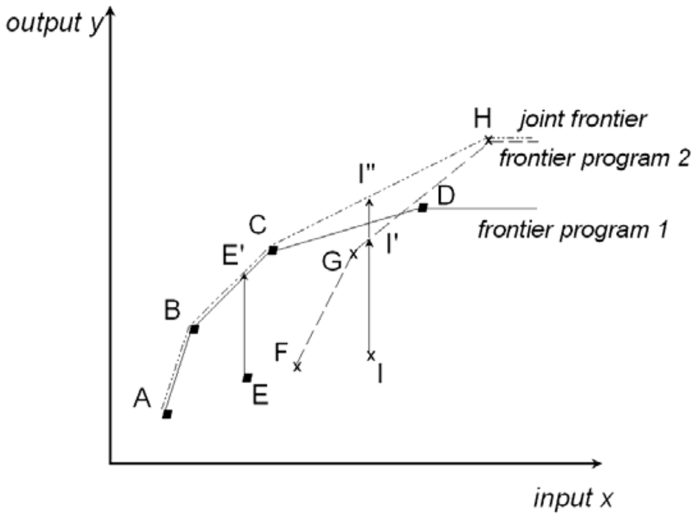
$$\hat{x}_{i0} = x_{i0} - s_{i0}^{-*} \qquad i = 1,...,m \text{ , and} \qquad (3)$$

$$\hat{y}_{r0} = \theta_0^* y_{r0} + s_{r0}^{+*} \qquad r = 1,...,s \text{ ,} \qquad (4)$$

where, let us remember, θ_0^* is the solution obtained for DMU_0 from mathematical program (1), while s_{i0}^{-*} and s_{r0}^{+*} are, respectively, the optimal slacks in input *i* and output *r* of this productive unit obtained from the solution to program (2).

The third step consists of solving the mathematical program (1) once again for all the *DMUs* in the sample, using the adjusted data obtained in the previous step. That is, the values of inputs and outputs that are derived from expressions (3) and (4). Therefore, *inter-program efficiency* is estimated, allowing us to assess the difference in efficiency between programs, once individual or inter-program inefficiencies have been eliminated. The fourth and final step requires the use of several tests aimed at evaluating the statistical significance of the differences in efficiency among programs.

Figure 1.- Managerial and program efficiency



In order to further illustrate the concept of program efficiency, *Figure 1* provides graphic intuition of the difference between managerial efficiency and program efficiency. Let us keep things as simple as possible by assuming that we observe nine *DMUs* labelled A to I, which are all using a single input *x* to produce a single output *y*. In addition, *DMUs* A, B, C, D and E (represented in the picture by dots) operate under a common program (*program 1),* while *DMUs* F, G, H and I (represented by crosses) operate under *program 2*. The segment ABCD, i.e. observations on efficient units A, B, C and D and their convex linear combinations, and the horizontal extension from point D give shape to the technological frontier of units operating under the first program, while the segment FGH and the x-axis parallel extension from the latter shape the frontier of *DMUs* within the second program. In addition, the frontier considering all *DMUs* together or joint frontier is shaped by observations on efficient units A, B and C, all belonging to program 1, in addition to unit H, which belongs to program 2.

Let us focus our attention on production units E and I, which are unmistakably inefficient. The projection of DMU_E onto the technological frontier of its own program, i.e. the comparison of its production plan with best observed practices within program 1, locates point E at point E', showing that DMU_E incurs in a certain degree of managerial or intra-program inefficiency. In other words, this unit could increase output *y* without additional use of input *x*. Furthermore, once managerial inefficiency has been eliminated by transforming data on input and output according to expressions (3) and (4), projection of the resulting point E' onto the joint frontier reveals that no intra-program inefficiency exists or, in other words, DMU_E is operating under the best performing program.

What happens when we compare the production plan of DMU_I with best observed practices within its own program? Projection onto the technological frontier of program 2 yields point I', showing that DMU_I is not using the best managerial practices. However, projection of DMU_I onto the joint frontier after eliminating managerial inefficiency yields point I'', which shows that once the best performance that the technology of program 2 allows is achieved, additional improvements could still be possible by moving to the best performing program. In other words, DMU_I is affected by program inefficiency. Summarizing, while managerial efficiency applies to *DMUs* operating under a common program, program efficiency deals with the efficiency gains that can be secured by moving *DMUs* from their current program to that which performs the best.

4. DATA, MODEL SPECIFICATION AND RESULTS

4.1. Data and model specification

From the pioneering paper by Rottenberg (1956), which introduces the notion of *sport production function* applied to baseball, and the first experimental work by Scully (1974), it has been common practice to consider sport as a production process. Using this as a basis, a large number of papers have studied the performance of football teams, mostly by analyzing their results on the pitch. The production process of a football team can be summarized as having to achieve the best sporting result possible in all competitions making use of the resources it has.

This article studies the sporting performance of Spanish football teams that played in *La Liga* in the seasons dating from 2001/02 to 2008/09, both inclusive. Data come from the annual reports published by the *Professional Football League* and the yearbook of *Marca*, the leading sports newspaper in Spain according to market share. All observations are pooled in a single data set that includes 160 observations, which refer to 20 teams participating in each of the 8 seasons studied.[1]

Over this period, a total of 56 teams changed managers halfway through a season, which is an average of 7 manager changes per season. Moreover, one same team changed managers twice in one season on 14 occasions. These figures do not include temporary changes, that is, when another member of the club's coaching staff provisionally takes over the management of the team until a new manager is hired. Normally, such provisional managers only carry out the technical role of a manager for one match.

In order to analyze the relationship between a change of manager and the sporting performance of Spanish football teams, three models have been considered, namely MODEL1, MODEL2 and MODEL3. Using the methodology described in Section 3, *DEA* techniques are employed in all three models to calculate the program efficiency of different groups of football clubs, depending on whether they have changed manager mid-season or stuck with the same manager the entire season. Similarly, we assume the existence of variable returns to scale (Barros & Leach, 2006) and employ output-oriented measures of performance, as the input variables used in the analysis are not controlled by the manager. *Table 1* summarizes the features of the production process in each model, while *Table 2* presents descriptive statistics of the input and output variables used.

Table 1. Summary of model specifications

	MODEL1	MODEL2	MODEL3
Inputs			
BUDGET	X	X	X
SPECTATORS	X		
SPECTATORS_C		X	X
Outputs			
POINTS	X		
POINTS_C		X	
QI-POINTS_C			X
EXTRA-GAMES	X		
EXTRA-GAMES_C		X	X

MODEL1 aims to verify whether any differences in efficiency exist between the group of teams that have changed manager halfway through the season and those which have stuck by the same manager for the entire season. As a result, two programs are defined, namely *programYES* for the teams that changed manager mid-season and *programNO* for the teams that maintained the same manager for the entire season. The production process is portrayed by two outputs, namely the points obtained in *La Liga* at the end of the season (POINTS) and the extra matches played in other competitions (EXTRA-GAMES), and two inputs, namely the team budget (BUDGET) and the number of spectators that go to the ground to watch home matches (SPECTATORS).

[1] Every season three teams are relegated and therefore no longer play in *La Liga*, while another three are promoted from a lower division. As a result, the teams included in the sample are different every season.

Table 2. Sample descriptive statistics

	Mean	*Standard deviation*	*Minimum*	*Maximum*
Inputs				
BUDGET	67,819	83,677	4,140	407,000
SPECTATORS	28,366	16,945	7,884	76,279
SPECTATORS_C	27,441	16,805	7,675	76,279
Outputs				
POINTS	0.4558	0.1153	0.2105	0.76315
POINTS_C	0.4281	0.1415	0.0476	0.76315
QI-POINTS_C	0.4270	0.1421	0.0441	0.76315
EXTRA-GAMES	7.8437	6.1812	1	26
EXTRA-GAMES_C	0.1852	0.1689	0	0.6842

Following several previous studies (Espitia-Escuer & García-Cebrián, 2006; Barros & Leach, 2006; Barros *et al.*, 2008), our first output, variable POINTS, is a measure of the points obtained by a team in *La Liga* expressed as a percentage of the maximum number of points that could have been obtained by winning all the games played in a season. Although *La Liga* is normally the main regular competition in which football teams participate, they may also take part in other competitions at either national or international level. As pointed out by Picazo-Tadeo and González-Gómez (2010), football teams are multi-output enterprises, so omitting games played in competitions other than *La Liga* might well lead to biased estimates of performance.

In Spain, all professional teams playing in the *La Liga* participate in *La Copa del Rey* (King's Cup, hereafter referred to as *La Copa*) and some of them also play European competitions such as the *Champions League* or the *Europa League*, known as the *UEFA Cup* until the 2008/09 season. However, isolating a measure for output in *La Copa*, the *Champions League* and the *Europa League* leads to serious difficulties in our production model. The reason is twofold. On the one hand, the qualification system differs considerably from one competition to another and, moreover, several modifications have been introduced over the period studied in this paper. On the other hand, one team can jump from the *Champions League* to the *Europa League* in the middle of the season, which makes it extremely difficult to isolate a different measure of output for these competitions. In order to homogenize the measurement of output in these competitions, we have computed the variable EXTRA-GAMES as the number of games played in competitions other than *La Liga* (González-Gómez & Picazo-Tadeo, 2010). Other considerations aside, given the qualifying system a higher number of games played means a team has gone further in the competition thus achieving a better sporting result.

Concerning inputs, the variable BUDGET represents the annual budget of the club measured in thousands of € at 2009 prices and is intended to be a proxy of the quality of the team. The clubs with the highest level of income can afford to sign the most coveted players[2] and managers on the market, who will foreseeably have more skills and know-how. In other productive activities, it is often assumed

[2] Nobody doubts the indisputable quality of Cristiano Ronaldo. However, even though all the teams would like him to play for them, very few could afford the 94 million € that Real Madrid paid for him in 2009.

that there are no significant differences in factor prices or productivity. But in football, player and manager wage costs vary hugely and are justified by individual characteristics that are seen to influence sporting results. The relationship between the sporting quality of a team and its financial capacity has been analyzed by Szymanski and Smith (1997). Furthermore, Forrest and Simmons (2002) and Haas (2003) have studied the relationship between expenditure and teams' sporting success.

SPECTATORS has been calculated as the average attendance at home games each season and is intended to proxy one of the dimensions of the so-called *home-field effect*: the crowd factor (Nevill *et al.*, 2002). Team performance improves[3] when backed by the support and cheering of their fans at home games, mainly due to social psychology factors (Edwards & Archambault, 1989). Apart from giving the home team heart, a large crowd at a football ground could intimidate the players of the visiting team and have an effect on the decisions made by referees and linesmen[4] (Nevill *et al.*, 2002; González-Gómez & Picazo-Tadeo, 2010).

In MODEL2 we assess program efficiency distinguishing three programs. One program for teams that do not change manager mid-season, namely *programNo,* and two programs for teams that dismissed the manager halfway through the season, namely *programYES1*, which includes data for the period the first manager was in charge of the team and *programYES2*, including data referring to the period the second manager is in charge.[5] The variables BUDGET and SPECTATORS_C are used as inputs, the latter having been calculated as the average number of spectators at home matches during the period the manager in question was in charge of the team. Outputs are measured by the variables POINTS_C, calculated as a ratio of points obtained under the direction of each manager over maximum points possible, and EXTRA-GAMES_C, obtained from the number of extra matches played over matches played in *La Liga* under each manager. This last variable is also included as a ratio to homogenize the information, as the time the first and second manager are in charge of the team may not necessarily coincide.

Finally, MODEL3 controls the results obtained from MODEL2 bearing in mind the difference in quality of the opposing teams during each manager's period in charge of the side. The only difference with respect to the previous model is that now POINTS_C is replaced by QI-POINTS_C, which is a measure of the points obtained in *La Liga* by the team under the orders of each manager over maximum points possible, adjusted by an index of quality of opposing teams.

The quality index has been constructed as the coefficient between the average quality of opposing teams played against under the direction of each manager and the average quality of opposing teams that are faced throughout the entire season. At the same time, the quality of a team is proxied by the

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[3] In fact, in the football world, the home crowd is commonly known as the "twelfth man".

[4] In football circles there was talk for a long time about the "stage fright" that the Santiago Bernabeu stadium caused the rivals of Real Madrid. Nowadays, people talk about the enormous pressure that the Liverpool home crowd exert on rivals at Anfield Road.

[5] This program also includes the time that the third manager held the post in the case of those teams which changed managers twice in the same season. That is, the data from the second and third manager have been aggregated as if they were one sole manager. One alternative to this would have been to consider a further program for the period the third manager was in charge. However, this option led to a dimensionality problem in *DEA* programs due to the small number of cases observed.

average number of points per match it has obtained at the end of the season. Formally, the quality index of the opposing teams faced by manager *m* is calculated as follows:

$$\text{Quality index of rivals of manager } m = \frac{\text{Average points per game of the rivals of manager } m}{\text{Average points per game of all rivals in the season}} \quad (5)$$

A quality index score of more (less) than one indicates that the manager has faced higher (lower) quality rivals than the average. The indicator will be equal to one in the case of the teams that maintain the same manager throughout the entire season. Obviously, the quality index will also be equal to one if the change of manager occurs precisely halfway through the season, as both managers will face the same teams.

4.2. Results

This section discusses the results obtained regarding the program efficiency of the various models and programs specified in Section 4.1. We have not included the results of managerial efficiency, as our interest lies in analyzing the differences in efficiency between the group of teams that changed manager halfway through the season and the group that stuck by the same manager for the entire season. Notwithstanding, both aggregated and individual results for intra-program or managerial efficiency are available upon request.

Table 3 presents the averages and other descriptive statistics of program efficiency for the various programs under consideration in each of the three models. In order to assess the statistical significance of differences in efficiency between programs, following the recommendations in the literature (Brockett & Golany, 1996), we have employed a simple *t-test* for equality of means and the non-parametric *Mann-Whitney ranksum test* (*MW* test henceforth) for programs in MODEL1 and the *Kruskal-Wallis test* (*KW* test henceforth), which generalizes the *MW* test for three or more groups in the case of MODEL2 and MODEL3. Results are in *Tables 4*, 5 and *6*.

Table 3. Estimates of program efficiency for models 1,2 and 3

		Mean	*Standard deviation*	*Minimum*	*Maximum*	*Observations*
MODEL1	*ProgramNO*	1.00048	0.00303	1	1.02428	104
	ProgramYES	1.09906	0.06399	1	1.25717	56
MODEL2	*ProgramNO*	1.00991	0.02074	1	1.13551	104
	ProgramYES1	1.16023	0.08741	1	1.43561	56
	ProgramYES2	1.03820	0.07142	1	1.46077	56
MODEL3	*ProgramNO*	1.01248	0.02251	1	1.14512	104
	ProgramYES1	1.15919	0.08279	1	1.31269	56
	ProgramYES2	1.03127	0.06928	1	1.46953	56

Table 4. Results for t-test and Mann-Whitney test for programs in MODEL1

		ProgramNO	*ProgramYES*
t-test for equality of means [a]	Mean efficiency	1.00048	1.09906
	Difference of means	-0.0985	
	t-statistic (*p-value*)	-11.5213 (*0.0000*)	
Mann-Whitney test [b]	Mean of ranks	54.56	128.68
	Z-statistic (*p-value*)	9.6518 (*0.0000*)	

[a] *The null hypothesis is that the difference of means is equal to zero.*

[b] *The null hypothesis is that the two samples are drawn from the same population.*

Table 5. Results for the Kruskal-Wallis test [a] *for programs in MODEL2*

	ProgramNO	*ProgramYES1*	*ProgramYES2*
Mean of ranks	69.80	179.52	109.36
H-statistic (p-value)		112.20 (*0.0001*)	

[a] *The null hypothesis is that the three samples are drawn from the same population.*

Table 6. Results for the Kruskal-Wallis test [a] *for programs in MODEL3*

	ProgramNO	*ProgramYES1*	*ProgramYES2*
Mean of ranks	74.52	179.75	100.36
H-statistic (p-value)		104.48 (*0.0001*)	

[a] *The null hypothesis is that the three samples are drawn from the same population.*

Before discussing the results, let us comment on how our methodological approach tackles the first of the problems mentioned in Section 2 concerning the poor sporting results of teams usually observed before taking the decision to dismiss the manager. On the one hand, when comparing the sporting performance of teams under the orders of the first and second manager, we resort to a solution used frequently in the literature that consists of introducing the teams that did not change managers as a control group and which are used to construct the joint technological frontier.

On the other hand, the approach to program efficiency employed in this research also allows us to account for this problem. While it is true that the decision to change managers is normally taken following a series of negative results, this may not always be the case. Discrepancies between the manager and the Board of Directors or the players themselves can be, on occasions, what really triggers the change, even when the sporting performance of the team has not declined, at least not excessively.[6] Such teams will more than likely be part of the efficient frontier of the group of teams under the orders of the first manager. Under the program efficiency approach, when inefficient teams are projected onto the frontier of best practices of their group, managerial or intra-program inefficiency is being eliminated, forcing teams under the orders of the first manager to perform efficiently under the constraint of being part of their own program. In less technical words, the starting point of our comparison to assess inter-program efficiency is not the observed sporting performance of teams with the first coach, but rather the performance that these teams could have achieved by reaching best practices within their own program or group.

Going back to the results, MODEL1 shows that the teams which do not change managers (*programNO*) perform, on average, better than the teams that have dismissed their manager mid-season (*programYES*). Furthermore, according to the results of the *t-test* and the *MW* test, the difference is statistically significant. However, MODEL1 does not allow us to verify whether the change of manager improves or worsens the sporting performance of the team. This is precisely the objective of MODEL2 and MODEL3.

Let us recall, as detailed in Section 3, that MODEL2 includes a program for teams that do not change managers halfway through the season (*programNO*), and two different programs for the teams that do, one for the first manager (*programYES1*) and another for the second manager (*programYES2*). According to the results for the *KW* test, we reject the null hypothesis that the three samples are drawn from the same population (see *Table 5*), so that we can accept that differences in program efficiency among these programs are statistically significant. In addition to this, we have performed bilateral comparisons between programs within MODEL2 using the simple two-sample *t-test* for equality of means and the *MW* test. Results are presented in *Table A1* in the Appendix and show that the teams which do not change manager mid-season are more efficient than those which do, under both the first and the second manager. Furthermore, the bilateral comparison of the efficiency averages of *programYES1* and *programYES2* confirms that changing managers does improve the efficiency of the team. In all cases the relationships are statistically significant at standard confidence levels.

The foregoing results could change when the quality of the opposing teams faced by the two different managers in the same season is considered. The purpose of MODEL3 is precisely to account for these differences in quality. As explained in Section 4.1, in MODEL3 the output variable POINTS is replaced by QI-POINTS, which rewards the managers who have faced above average teams in terms of quality and penalizes the managers who have played against below average teams. The differences in efficiency between the three programs can also be accepted as being statistically significant in this model. Here we have also performed bilateral comparisons between programs using the simple two-sample *t-test* for equality of means and the *MW* test. The results obtained are in *Table A2* in the Appendix and confirm the conclusions drawn from MODEL2. Again, we find that, following a mid-season change of manager, team performance under the second manager is better than under the first. Not-

[6] As an example, this could be the case of Real Madrid in the 2008/09 season, when German manager Bernd Schuster was replaced by Spaniard Juande Ramos.

withstanding, although changing managers does result in an improvement, sporting performance does not reach the level obtained by the teams that do not change managers.

In short, poor team planning at the beginning of the season can result in teams performing worse, triggering the dismissal of the manager. The results of our research show that changing managers halfway through the season improves a team's sporting performance, but under no circumstances allows it to reach the level of performance displayed by the teams that planned the season better and found it unnecessary to change managers.

5. SUMMARY AND CONCLUSIONS

Sports clubs are eager to record positive sporting results, as this guarantees the support of fans and makes it easier to generate income. When the sporting performance of a team fails to meet the expectations of the executive team, the latter is forced to take action. On many occasions, the manager bears the brunt of the criticism and is sacked. Although the manager is hired as part of the plan for the entire season, mid-season manager changes are not uncommon. *Do we sack the manager... or is it better not to?* is more than likely the first question that the Board of Directors asks before making a decision.

This research is aimed at shedding further light on the current debate regarding the relationship between dismissing the manager and sporting performance. We analyze the impact that changing managers has on the sporting performance of the teams that played in *La Liga* in the seasons dating from 2001/02 to 2008/09, both inclusive. Our main contribution to the existing literature in this field of research is the use of *Data Envelopment Analysis* techniques and the assessment of so-called program efficiency. This approach allows us to separate the inefficiency that can be attributed to the management of the club, from program efficiency, due to a given group or production program which, in this case, is established depending on whether or not a team has changed managers mid-season.

Our primary results are as follows: first, a club normally changes managers halfway through a season when the team is not performing well. Second, changes of manager have improved the sporting performance of Spanish football teams. Third, although sporting performance improves after a change of manager, the team is unable to record the same level of performance as the teams that have not changed managers. These results suggest that changing managers can be the right decision in order to improve a team's sporting performance, but under no circumstances will this move be as successful as correctly planning the squad and the team of specialists at the beginning of the season.

In comparison to the results of previous research on the effect of changing managers on sporting performance, our findings do not support the *vicious-circle* or *ritual spacegoating* theories, but rather appear to contribute empirical substance to the *common-sense* theory. That is, deciding to change managers can improve the sporting performance of football teams. This result might be of interest to club executives: when a team is not performing well, deciding to change managers mid-season can improve the situation and not only appease fans and the media. Consequently, as regards the question that was the reason behind this study, we would have to respond that changing managers can be a good move when a team is not performing well. However, the executive team would be recommended to plan the season well beforehand to avoid finding themselves in a situation where they must change managers halfway through.

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Appendix

Table A1. Results for t-test and Mann-Whitney test for bilateral comparisons of programs in MODEL2

		ProgramNO vs. ProgramYES1		*ProgramNO vs. ProgramYES2*		*ProgramYES1 vs. ProgramYES2*	
t-test for equality of means [a]	Difference of means	-0.15031		-0.02829		0.12202	
	t-statistic (*p-value*)	-12.67711 (*0.0000*)		-2.89925 (*0.0000*)		8.08906 (*0.0000*)	
Mann-Whitney test [b]	Mean of ranks	54.41	128.95	67.88	103.93	79.07	33.93
	Z-statistic (*p-value*)	9.70547 (*0.0000*)		4.69354 (*0.0000*)		-7.35547 (*0.0000*)	

[a] *The null hypothesis is that the difference of means is equal to zero.*
[b] *The null hypothesis is that the two samples are drawn from the same population.*

Table A2. Results for t-test and Mann-Whitney test for bilateral comparisons of programs in MODEL3

		ProgramNO vs. ProgramYES1		*ProgramNO vs. ProgramYES2*		*ProgramYES1 vs. ProgramYES2*	
t-test for equality of means [a]	Difference of means	-0.14671		-0.018787		0.12792	
	t-statistic (*p-value*)	-13.00349 (*0.0000*)		-1.97378 (*0.0265*)		8.86685 (*0.0000*)	
Mann-Whitney test [b]	Mean of ranks	54.82	128.20	72.20	95.91	80.05	32.95
	Z-statistic (*p-value*)	9.55522 (*0.0000*)		3.08729 (*0.0017*)		-7.67552 (*0.0000*)	

[a] *The null hypothesis is that the difference of means is equal to zero.*
[b] *The null hypothesis is that the two samples are drawn from the same population.*

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