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Evaluating Rent Dissipation in the Spanish Football Industry

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This article proposes to evaluate empirically the consequences of the rent-seeking behavior of football clubs on their costs. The empirical work entails estimating a football wage, result, and demand system with data on clubs competing in the first and second Spanish leagues during the 1996-2003 seasons. The estimation sheds light on wage distortions that differ from 45% to 52% throughout the period considered. This provides an interesting illustration of the financial difficulties faced recently by many European football clubs.

Keywords: *football industry; wage distortion; frontier; football demand*

INTRODUCTION

Recent theoretical literature on sport economics has proposed considering sporting contests from the perspective of the tournament and contest theory (Szymanski, 2002). In such a framework, sport clubs compete for a financial/nonfinancial prize. To win the prize, they expend costly effort and dissipate part of the rent that can be obtained from that prize, thus damaging their own profitability. Some features restrain the amount of rent-seeking expenditures, whereas others are likely to boost it.[1] The literature deals mainly with one issue at a time and it is not clear how the issues interrelate (Szymanski & Valletti, 2003). There seems, however, to be a

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consensus on the fact that the competitive interaction impinging on the activity of the contestants may create a financial distortion on their budgets with no relative improvement in performance. Our objective in this article is to focus on clubs competing in the Spanish football industry and provide an empirical evaluation of these rent-seeking expenditures as well as the wage distortions supported by these clubs. Our motivation regarding the choice of the football industry is twofold:

First, the football industry is an interesting candidate to consider if one is willing to deal with the theory of contests. Football leagues are nationwide contests where several clubs compete against each other throughout a certain period. Clubs spend costly effort to enroll the best players and increase their probability of reaching a particular result. Because they are production units of different sizes and they face different types of audiences, it is well accepted that these clubs have asymmetric valuations of the prizes offered. Moreover, a football league may offer different prizes, that is, the best ones compete to win the league or qualify for the European cup, whereas the weakest try to avoid relegation to second league (for more details, see Rosen & Sanderson, 2001). Different financial stakes that are worth taking into account characterize all of these different results. Finally, the recent explosion of expenditures following the advent of pay-per-view television has had an impact on the value of the different national leagues. The most profligate leagues will feature the highest number of international star players and will have the highest value on the international market.

Second, experience has shown that the European football industry is going through one of the most important crises in its history. Its clubs are very often forced to reduce their budget significantly or go bankrupt.[2] Examples illustrating this general tendency are numerous: In Spain, clubs spent only 92.3 million Euros to enroll new players in the national championship in 2002, which represents a cut of 211 million Euros with respect to what had been invested the year before (or 358 million Euros compared to 2 years prior). In Italy, three of the most famous clubs of the championship faced important financial difficulties. Two of them, Roma and Lazio, found it difficult to reduce their deficit and to meet the requirements to be allowed to register in the championship, whereas a third one, Fiorentina, went bankrupt. In addition, several players of the other teams reduced their earnings and some club directors advocated corrective measures.[3] In England, several clubs competing in the second league went close to bankruptcy (Bradford and Leicester, among others). In Germany, in 2002, the clubs invested 102.2 million Euros in hiring, which represents a 35% cut with respect to the previous year. The total amount of debt in 2003 in the Spanish and Italian leagues amounts to 1.625 and 1.800 billions Euros, respectively.[4] We argue that these financial difficulties are the direct consequence of the competitive interaction between clubs.

Our intention is to assess empirically how the amount of rent-seeking expenditure supported by clubs depends on several relevant features that characterize the football industry. To do so, we consider a simultaneous system of three wage–result–demand equations. Such a procedure allows accounting for the constraints impinging on the

activity of each club. Moreover, we choose to approach the definition of the wage equation from the perspective of the stochastic frontiers literature.[5] This implies considering a football club as a production unit that is involved in a production process whose ingredients, such as the production itself, and the inputs have to be identified. This is an interesting task in the particular context of the sport industry. Once the production process is identified, a wage frontier defining a relationship between a production level and the minimal average wage that allows the producer to reach the required production level can be determined.[6] The frontier thus provides us with a one-to-one relationship between, on one hand, a specific result made by a club under certain conditions and, on the other hand, a theoretical average wage. Considering all the production units competing inside a specific league allows us to identify this frontier. We argue then that the distance between such a frontier and the individual and observable average wage of a club provides a direct measure of the amount of expenditures of this club that produces no relative gain in performance but is supported at the equilibrium. We call such expenditure the individual wage distortion above the industry's frontier. In the context of the football industry, estimating an average wage frontier entails disentangling the minimum average wage that allows the football clubs to reach their production levels relative to the other competitors in the industry (i.e., their relative performances) from the part of the average wage due to the rent-seeking behavior of clubs in the vain attempt to enhance their relative position in the competition. This article proposes an empirical evaluation of the industry's global distortion as well as individual assessments for each club.

A possible drawback of this study is the highly aggregated nature of the data available. This is particularly true for financial data. The sources of revenue of a football club, as well as the different parts constituting its global budget, are difficult to observe. Note, for instance, that we use a measure of club average wage that aggregates the wages of the players of the same team as well as the wages of players and nonplayers inside a team. On one hand, vertical wage aggregation inside the club should be a minor problem because nonplayers represent a small share of the total wage bill (less than 5% in the period observed; Liga Nacional de Fútbol Profesional, www.lfp.es). On the other hand, some clubs may be characterized by a highly heterogeneous wage distribution across players. Working at a more aggregate level constrains the structure of the economic model under consideration and reduces the information that could be obtained from it. However, considering a simultaneous system of wage, performance, and demand might be helpful to treat part of the endogeneity that affects the variables under the control of each production unit. This is the methodology that we consider here.

The Spanish industry serves as a support for our study. Its organization as well as the behavior of its clubs have been particularly appealing throughout the past decade, as argued in detail in what follows. The database includes observations for the 40 clubs playing in first and second league throughout the period 1996-2002. In this article, we present the model to be estimated, describe the Spanish football industry in more detail, present the data as well as the estimation procedure and the results, propose a discussion, and make concluding remarks.

THE MODEL

Our aim in this section is to construct a football wage, result, and demand system that can be applied to the Spanish industry. The estimation of the model will allow us to explore the structure of the industry and provide an individual measure of the rent-seeking distortion that affects the average wage of each club participating in the contest.

Production and Costs

Each football club is a production unit. The club produces a result Y during the season. We need first to define the inputs that enter the production process. It is assumed that the result (Y) depends on the average quality of each player. Following Hoen and Szymanski (1999) and Szymanski (2000), we suppose that the average quality and the average cost of the player are closely related.[7] Considering that the cost of labor (w^*) instead of the usual quantity of labor (L) enters the production function is fair in the particular context of the football industry. The usual studies on production consider that firms are price takers and control for the quantity of labor to attain a particular production level. Such an approach does not fit the football industry. First, the firms may have sufficient power to affect the costs proposed at the equilibrium on the labor market. Second, given that the amount of players on the playground is restricted, it is well admitted that a higher number of players does not allow the teams to obtain better results. We therefore assume that what matters is the quality of the group of players and not its size. Besides the cost, experience (K) may be another good indicator of result. It is supposed to be fixed in the short run. The experience for each club will be measured by the number of years spent in first league and the number of years spent in second league. Note that a club with a long history in the first league is expected to have higher valuations of the prize for which it is competing.

We also introduce a third term, namely ε, to account for the unpredictable events that are beyond the control of the club and that might affect its result. Let X be a vector of additional explanatory variables that will be emphasized at the moment of the estimation. We define the production function of each unit as the following:

$$Y = f(w^*, K, X, t, \varepsilon \mid \beta), \tag{1}$$

where β is a vector of parameters describing the technology and t is a trend.

From Equation 1, we know that to obtain the result Y, the manager must pay the relevant average cost (i.e., buy the relevant average quality):

$$w^* = f^{-1}(Y, K, X, t, \varepsilon \mid \beta). \tag{2}$$

We argue that an unobservable individual distortion (θ) affects the primal average cost (w^*) of each club. This distortion results from the competitive interaction between clubs, which is taken as exogenous here; it does not improve their relative performance but instead entails an upward cost distortion. Because this term is unobservable, it needs to be evaluated through the estimation process. Hence, the observed average wage w is as follows:

$$w = w^* \exp(\theta) = f^{-1}(Y, K, X, t, \varepsilon \mid \beta)\exp(\theta). \quad (3)$$

Note that the introduction of a trend (t) allows us to shed light on the propensity of the football technology to be more costly throughout the years. We expect t to have a positive effect on the clubs' average wage (w). The average wage equation given in Equation 3 is a stochastic frontier that needs to be estimated.

The result (Y) obtained by the club may itself depend on factors such as the characteristics of this club and the environment where the production process takes place, that is, Y may itself be endogenous. For instance, clubs performing better may be the ones with a higher share of foreign players, with a higher share of members of the national team, those with a new coach, or those facing a higher demand. All of these variables also might affect the average wage and therefore need to be accounted for in separate equations. It is therefore proposed to estimate a result and a demand equation jointly with the wage equation.

Result and Demand

The relation between result (Y) and demand (D) in the football industry depends on two effects that need to be considered.

On one hand, demand depends on the result of the team (see Dobson & Goddard, 2001; Hoen & Szymanski, 1999; Szymanski & Smith, 1997). We expect the audience to be attracted by teams that are performing better during the season. Whether the players are foreigners, whether they play in national teams, the arrival of a new trainer, and the number of titles won by the club in the past also are features that are worth taking into account. It is important as well to consider the attractiveness of the team, which implies taking into account the fact that the team presents an offensive or defensive configuration. This effect can be captured through several variables, such as the position of the players on the field or the number of goals scored. Finally, we expect the size of the potential market faced by each club to be another important ingredient to determine demand.

Note that our demand expression does not include a price variable. This is due to the absence of systematic information on prices for clubs in our database. We can only observe upper and lower bonds of seasonal tickets prices for first division from 2000-2003 (our database includes clubs competing in first and second

division from 1996-2003). Because data are scarce and because prices are certainly endogenous, that is, they may depend on the rent-seeking activity of clubs, we remove the price variable from the demand equation. Note that this should not affect the estimation significantly because most empirical studies in football fail to find a significant relationship between prices and attendance, especially in samples with a short time dimension.[8] The demand function is of the following form:

$$D = D(Y, A, Z, S, t, \eta \mid \gamma), \tag{4}$$

where A and Z denote attractiveness and characteristics of the team, S is the size of the market, η is an error term, and γ is a vector of parameters. We also introduce a trend whose effect on demand is expected to be positive, that is, demand should be increasing from one year to the other. Increasing broadcasting of football matches has completely changed the size and composition of demand and revenues for football clubs. Starting mainly in the 1980s, the impact of television broadcasting accelerated in the 1990s especially thanks to the advent of pay-per-view. The pay-per-view system has dramatically increased market size for a single match.

On the other hand, the result (Y) must be adjusted to the level of demand (D), so the former is endogenous to the latter. We therefore assume that the result of a team is constrained by the size of its audience. The main motivation for such an assumption is that a larger audience generates larger revenues and more ambitious results. Here, we simply introduce a reduced form of a dynamic and technical adjustment process between result (Y) and demand (D) that we specify as follows:

$$Y = \theta(D, \rho \mid \delta), \tag{5}$$

where ρ is an error term and δ is a vector of parameters.

Note that the demand function in Equation 4 is interpreted as a short-run demand because it takes the result (Y) as given. By replacing Y in this demand function by its expression in Equation 5, we obtain a reduced form interpreted as the long-run demand function, defined as follows:

$$D = \varphi(A, Z, S, t, \xi \mid d), \tag{6}$$

where ξ is an error term, which depends on ρ and η, and d is the final vector of parameters to be estimated. Estimating Equations 5 and 6 avoids the simultaneity problem that exists between D and Y.

We do not consider the effect of the uncertainty of outcome on demand. Several authors, including Neale (1964), have noted the connection between uncertainty of outcome in sporting contests with their popularity. It is usually considered that uncertainty of outcome is due to a close championship race with several teams in contention or the absence of long-run domination by a particular

team. The main reason why uncertainty of outcome is discarded in this analysis is that the Spanish championship is probably the most unbalanced of all major European leagues. Between 1946 and 1999, Barcelona and Real Madrid won 39 titles out of 54. Moreover, from 1946 onward, only 15 teams finished in the top three places, the smallest number among the major European football leagues. Throughout the period of observation, that is, between 1996 and 2003, Real Madrid and Barcelona were ranked in the top two places 57% of the time. Moreover, in the same period, there was an average 6-point difference between the team ranked first and the one ranked second.

The next step consists in estimating Equations 3, 5, and 6. Note that the whole model under consideration is sequential. Because the system gives rise to a block-recursive structure, each equation can be estimated separately. We turn now to the description of the Spanish industry and the data available.

THE SPANISH INDUSTRY

The Spanish professional league is a natural candidate for our purpose. Note first that the Spanish clubs have been among the most profligate ones regarding expenditures on wages and compensation fees. Table 1 shows two rankings of the highest wages given in Europe in 1999 and of the biggest compensation fees that have ever been paid.

Second, Spanish clubs are not present on the stock market yet, contrary to English clubs for instance, and this might have a significant impact on clubs' policies. Apart from being a source of finance, the stock market also acts as a constraint on expenditures and losses because clubs are responsible toward their shareholders. In Spain, an assembly composed of fellows supporting the team generally elects the president of the club. Because the fellows care about sportive results rather than profits, it seems that nonpecuniary results are particularly important in the valuation of the prizes for Spanish clubs, exacerbating rent seeking. Indeed, club presidents are pressed to raise expenditures levels to enroll the best players. This specific context is therefore particularly appropriated for our study.

Another interesting characteristic of the Spanish industry may lie in the fact that the ethnical and cultural pride of some of its clubs strengthens competitive and even aggressive behaviors on the labor demand side. The performance of the team assumes therefore a peculiar importance, as a matter of nationalistic pride, adding up to increase the valuation of the rent and the associated rent-seeking expenditure level.

Finally, the Spanish professional league seems to have fully accomplished the Bosman revolution because it is one of the most internationally open of the European leagues: In 1999, only 61% of players were Spanish nationals. As a result, some of the best European and non-European players are participating to the Spanish competition, which might be the strongest one in Europe.

TABLE 1: Wages and Compensation Fees

Wages, 1999 (per week, in Euros)		*Compensation Fees (up to 2002 in Euros)*	
1. Del Piero (Italy)	114,922	1. Zidane (Spain)	75,100,000
2. McManaman (Spain)	108,537	2. Figo (Spain)	61,400,000
3. Kluivert (Spain)	95,769	3. Crespo (Italy)	59,760,000
4. Anelka (Spain)	92,576	4. Vieri (Italy)	51,460,000
5. Vieri (Italy)	92,576	5. Mendieta (Italy)	48,000,000
6. Ronaldo (Italy)	83,000	6. Ferdinand (England)	46,800,000
7. Effenberg (Germany)	79,806	7. Overmars (Spain)	41,500,000
8. Balakov (Germany)	79,806	8. Anelka (Spain)	39,000,000
9. Elber (Germany)	54,269		
10. Shearer (England)	46,480		
11. Owen (England)	39,840		

SOURCE: Dobson and Goddard (2001); *El País*, August 28, 2002.

ESTIMATION AND RESULTS

We present in this section the estimation of the system defined above and the estimation results. The variables entering the equations are first examined in more detail.

The System

The demand function is specified as follows:

$$\ln D = d_0 + d_1\, SYS + d_2 \ln GOAL + d_3\, SFOR + d_4\, SFORW + d_5\, SNAT + d_6\, TRAIN + d_7 \ln POP + d_8\, t + \xi. \quad (7)$$

As said above, the variables to be considered in the demand function should be the size of the market, the attractiveness, and the characteristics of the team.

The strategic scheme elected (*SYS*) and the number of goals scored during the season (*GOAL*) are used as proxies to evaluate the attractiveness of the team. There are mainly two types of strategic schemes implemented by teams: three forwards and three midfielders or two forwards and four midfielders. The variable *SYS* takes a value of 1 if the former strategy is implemented and 0 otherwise. We expect a more offensive strategy (i.e., with three forwards) to attract a larger audience. Likewise, we expect the number of goals scored to have a positive effect on demand.

There are several variables that can be viewed as good candidates to describe the characteristics of the team. First, foreign players playing outside their own country are typically highly skilled and have a significant influence on the performance of the team. Thus, we include two variables in Equation 7 to consider the effects of foreign players on demand: *SFOR* is the share of foreign players and *SFORW* is the share of foreign players from outside Europe among the foreign players. These two variables should have a positive effect on demand. Second, Spanish players who

also are members of the national team are expected to have an ability that is higher than the average. Therefore, the share of such players (*SNAT*) also is accounted for. We anticipate demand to be positively influenced in this case. Third, we introduce a dummy variable (*TRAIN*) that takes a value of 1 if the trainer of the team is new and 0 otherwise. The manager is responsible for the training and the organization of the team. The presidents of the clubs decide on changing trainers when new (higher) results are in order. The audience is usually highly sensitive to such a decision and *TRAIN* should have a positive effect on demand.

The last explanatory variable is *POP*. It denotes the size of the population of the city to which the club under consideration belongs. Obviously, teams representing large urban areas attract a larger audience. This variable acts as a proxy for the market size and, thus, we expect it to have a positive effect on demand.

The characterization of the endogenous variable *D* is now required. The audience is roughly defined as the set of individuals supporting the team. It includes spectators attending the games in the stadium, those watching the games on television, and people generally following the performance of the club through the media. To evaluate and measure the size of such an audience is a difficult task. However, a very useful proxy can be considered for that matter. We use the average effective attendance during the season as a proxy for general audience. Note that this allows us to take into account two individual effects. The first effect, denoted as the size effect, implies that a more popular team plays in a bigger stadium, which is consistent with a larger audience; it can be seen as a long-run effect. The second effect, denoted as the liking effect, is a short-run effect. It implies that the instantaneous attendance of the stadium gets close to full capacity when the team is performing well, which should be a clear indicator of how the general audience behaves along the season. Taken together, these two effects should be helpful for our purpose.

We turn now to the result equation. It is simply determined as follows:

$$\ln Y = \xi_0 + \xi_1 \ln \hat{D} + \rho. \tag{8}$$

Note that $\hat{D}$ is the predicted value of D obtained from the estimation of Equation 7. We need to define a measure of the variable Y. The result of the club is measured by an index of actual performance of this club along the season. A simple and fair instrument is the number of points obtained by each team at the end of the season. Any victory is worth three points, whereas a draw yields one point. All first-league teams are credited a surplus of points equal to the total amount obtained by the best team of the second league at the end of the season. Doing so enables us to consider the 40 teams simultaneously, as if they all belonged to one single league.

The last equation to be estimated is the average wage function. It is defined as follows:

$$\ln w = \beta_0 + \beta_1 \ln \hat{Y} + \beta_2 DIV + \beta_3 \ln UEFA + \beta_4 \ln K_1 + \beta_5 \ln K_2 + \beta_6 \ln CAPS + \beta_7 t + \theta + \varepsilon. \tag{9}$$

The average wage is measured by the annual total budget divided by the number of players. Note that total budget includes the total wage bill as well as depreciated fee expenditures that must be paid to purchase players from other clubs.

Several explanatory variables are required to identify individual distortions above the wage frontier from the effects that are responsible for rent-seeking expenditures and are common to the whole industry. The right side of Equation 9 includes the number of players L, the result Y, and the experience K. Note that we use the predicted result $\hat{Y}$ obtained from the estimation of Equation 8. The experience K is decomposed into two variables. The first one, K_1, denotes the number of years spent in first league, whereas K_2 indicates the number of years spent in second league. We expect these two variables to have opposite effects on clubs' expenditures. Indeed, the valuation of the prize by teams' presidents, and thus their behavior regarding expenditures, should depend on the history of the performance of the club since its creation. For instance, a club with a long history in the first league is expected to have higher valuations and, thus, higher long-run results and larger wages. Likewise, a club that spent most of its history in second league may not be able and/or willing to afford high expenses.

Besides result and experience, we introduce additional variables to capture part of the heterogeneity among production units. The first one (*UEFA*) is a dummy variable that takes a value of 1 if the team simultaneously competes in the European league and 0 otherwise. This variable should have a positive influence on wages because being committed on two fronts needs additional units of talents. Another variable of interest is *CAPS*, which measures the number of times the players of the team have been enrolled in their respective national squad. This variable enables us to control for the quality of the players enrolled in the team and also should have a positive effect on wages. In addition, we use a dummy variable (*DIV*) that takes a value of 1 if the team is competing in first division and 0 otherwise. This variable should most certainly have a positive effect on wages. Finally, a trend (t) is introduced.

Data

To test the economic model, we need data on the financial performance of the clubs as well as data on the supply and demand of the industry. The database is constructed using the annual data collection edited by the Spanish sport newspaper *Marca.* The collection dates back to the beginning of the 1990s but relevant information regarding clubs competing in the second league could only be obtained from 1996. Therefore, our sample includes information on all clubs of first and second league starting with the 1996-1997 season up to the 2002-2003 season, which represents 7 years of observation. *Marca* is a rich source of data regarding clubs' budgets as well as players' and teams' characteristics and performances, stadiums affluences, clubs' historical course, and so forth. The first league includes 20 clubs, whereas the second league may include 20 or 22 clubs. At the end of each season, the 3 clubs ranked at the bottom of first league go

down to second league. Likewise, the 4 worst clubs of second league are relegated to third league and the 3 best clubs are promoted to first league.

Note that two samples will be considered. The first sample is an unbalanced panel that includes 281 observations. Some clubs may disappear from one year to the other, that is, may go down to third league and hence may disappear from the sample, whereas new ones may appear because some third-league clubs are promoted and ascend to second league. The result is a database of 50 different clubs that are not necessarily observed seven times throughout the period. The second sample that will be considered is a balanced panel. Considered simultaneously, a balanced panel allows us to drop all the clubs that compete in third league at least once during the period of observation and thus reduce the heterogeneity among the economic agents. The balanced panel includes observations on 28 clubs observed seven times throughout the period. To complete the database, the data on urban areas' population (variable *POP* in Equation 7) have been collected from the Web site of the Instituto Nacional de Estatisticas (INE, www.ine.es). Summary statistics regarding the variables are provided in Table 2.

Estimation

The system to be estimated is made of Equations 7, 8, and 9. Because it is sequential, the three expressions can be estimated separately. The three error terms ξ, ρ, and ε are supposed to be independent and to have a normal density function (with mean of 0 and respective variances σ_ξ^2, σ_ρ^2, and σ_ε^2). Maximum likelihood applied to Equations 7 and 8 does not require additional specifications. However, when estimating the cost function expressed in Equation 9, a difficulty arises due to the fact that the term θ is unobservable. We will assume that θ is characterized by a density function $f(\theta)$ defined over an interval $(0, \infty)$.

The error structure $u = \theta + \varepsilon$ adopted in Equation 9 follows a panel data specification where ε is assumed to be *i.i.d* $N(0, \sigma_\varepsilon^2)$ and θ is a nonnegative term accounting for distortions above the theoretical frontier.[9]

We need now to say something about the density $f(\theta)$ and the way the estimation is performed. Denoting as $t = 1, \ldots, T$ and $i = 1, \ldots, N$, the subscripts for time and clubs, respectively, five different procedures of estimation are considered:

1. The first procedure considers that the θs are constant over time but vary across clubs. Moreover, the density $f(\theta)$ is half normal, that is, the θ_1 are i.i.d $N^+(0, \sigma_\theta^2)$.
2. The second procedure is similar to the previous one except that the density $f(\theta)$ is truncated normal, that is, the θ_1 are i.i.d $N^+(\mu, \sigma_\theta^2)$. This allows the distribution to have a nonzero mode and provides a somewhat more flexible representation of the pattern of the distortion θ in the data. Note that an additional parameter μ needs then to be estimated.
3. The third procedure assumes that the θs differ from one club to the other and vary systematically with time. They are of the form $\theta_{it} = \theta_t \exp(-\eta(t - T))$ and are assumed to be i.i.d as truncations at 0 of the $N^+(0, \sigma_\theta^2)$ distribution. Note that this specification requires an additional parameter η, identical for all clubs, to be estimated.

TABLE 2: Summary of Variables (Statistics of the Unbalanced Panel)

Variable	*Description*	M	SD
W	Average wage in Euros	875,496	1,465,913
Y	Result measured as the number of points obtained over the season	93.5	41.4
K_1	Years spent in first league	23.9	25.1
K_2	Years spent in second league	17.6	12.4
UEFA	Takes value of 1 if the team simultaneously competes in the European cup, 0 otherwise	0.178	
CAPS	Total number of caps in the national team (all players taken together)	87.6	142.6
D	Demand, effective audience as a year average	17,143	17.154
SYS	Takes value of 1 if the team is organized as 4-3-3 (four defenders, three midfields, and three forwards), 0 otherwise	0.110	
SFOR	Share of foreign players in the team	0.254	
SFORW	Share of foreign players from outside Europe among the foreign players	0.586	
GOAL	Number of goals scored throughout the season	49.5	12.6
SNAT	Share of players enrolled in a national team	0.184	
TRAIN	Takes value of 1 if the trainer is new, 0 otherwise	0.459	
VICTO	Number of victories obtained	14.3	4.9
DIV	Takes value of 1 if team plays in first league, 0 otherwise	0.500	
POP	Population size of the community the club belongs to	523,458	800,464

4. The next procedure is similar to the previous one except that the density $f(\theta)$is truncated normal, that is, the θ_i are i.i.d $N^+(\mu, \sigma_\theta^2)$.
5. Note that the four previous specifications require the ε_{it} and the θ_i to be distributed independently of each other and of the regressors. Moreover, specific distributional forms are necessary for θ. These two constraints can be relaxed if the θ_i are considered as fixed effects. This procedure can be performed through the estimation of a different constant β_{0i} for each club. This approach is interesting in the sense that the assumption that the distortion θ_i may not be independent from the result *Y* should not be discarded. Moreover, this is an additional mean to provide more evidence on the robustness of the results because the chosen distributional form for θ may influence the individual estimates $\hat{\theta}_i$.

The results of the different estimations are presented below. Three types of comments are worth emphasizing. First, because two databases are considered, we specify 10 different sets of results for the estimation of the wage function.[10] Our aim is to show that the estimation results regarding the distortions θs are robust to the nature of the data set and the type of estimation considered.

Second, note that with panel data, the estimator is able to distinguish each club's individual persistence from statistical noise. Therefore, the realization of θ_i for a particular firm can be identified, thus overcoming the limitation of a cross-section

from which one can only identify the expectation of θ_i conditional on statistical noise (see Sickles, 2003, for a discussion of this issue).

Finally, note that the identification of the theoretical frontier $w^* = f^{-1}(Y, K, X, t, \varepsilon \mid \beta)$ requires observing some clubs that are not affected by rent dissipation. Hence, absolute rent dissipation values are obtained instead of relative values. We believe that accounting for second-division clubs is helpful on that matter. Moreover, among the clubs competing in the first league are the ones from the Basque country (one of the Spanish provinces). These clubs have the particularity of mostly enrolling Basque players, the most extreme case being Athletic Club from Bilbao's hiring only players from its own province. We are confident that in this latter case, rent dissipation activity is almost nil, as will be confirmed in the results presented in the next section.

Results

The results are reproduced in Tables 3 and 4. We present first the ones on the demand and result equations.

Consider the result equation. The R^2 is equal to .559 if the unbalanced panel (.549 for balanced) is taken into consideration. All of the parameters are strongly significant. The result suggests that performance is affected by the size of the audience. Moreover, the nature of the data set considered does not affect the demand elasticity of performance in a significant manner.

Consider now the demand equation. The R^2 (.940 if the panel is unbalanced and .878 if the panel is balanced) suggests that the variables selected strongly explain the size of the audience. A first set of results goes along with our initial intuition. Thus, demand significantly increases with the number of goals scored (*GOAL*).[11] Moreover, it is positively affected if the club strategy responds to a more offensive profile (*SYS* takes a value of 1).[12] This suggests that the audience increases if the team considered presents a higher offensive profile.

Unsurprisingly, the characteristics of the squad enrolled in the club are essential to explain demand. The audience responds positively and significantly to a higher share of players with experience in the national team of their country of origin (*SNAT*). This latter variable is a good candidate to account for quality in the team. A striking result also comes from the variables related to the national identity of players. The estimation sheds light on the fact that the share of players (*SFOR*) from outside Spain negatively sways demand. It should be noted, however, that the parameter for *SFOR* is only significant at 10% in the balanced panel, whereas it is not significant in the unbalanced panel. Moreover, if the share of players from outside Europe among foreign players (*SFORW*) is higher, then demand is positively and significantly affected. These two results may suggest the following: First, the audience may have a preference for Spanish players. Second, most non-European players of the Spanish league come from South America and, in view of the audience, such players may be culturally similar to Spanish players and may not alter the national identity of the club. Another possible explanation relies on the supposed

TABLE 3: Estimation Results: Result and Demand

Parameter	*Unbalanced Panel*	*Balanced Panel*
	Result	
Constant	3.381*** (0.058)	3.522*** (0.072)
$\hat{D}$	0.434*** (0.021)	0.391*** (0.024)
σ_ρ	0.304*** (0.012)	0.268*** (0.013)
R^2	.559	.549
	Demand	
Constant	–2.378*** (0.5675)	–2.824*** (0.682)
SYS	0.143 (0.100)	0.178* (0.107)
SFOR	–0.266 (0.243)	–0.538* (0.285)
SFORW	0.245** (0.105)	0.560*** (0.136)
GOAL	0.738*** (0.151)	0.896*** (0.180)
SNAT	2.326*** (0.197)	2.198*** (0.214)
TRAIN	0.002 (0.061)	–0.034 (0.072)
POP	0.225*** (0.033)	0.185*** (0.038)
T	0.043*** (0.016)	0.061*** (0.019)
σ_ξ	0.508*** (0.021)	0.491*** (0.025)
R^2	.940	.878
Number of observations	281	196

NOTE: The unbalanced panel contains 50 clubs of first and second division observed throughout the period 1996-2003. The balanced panel includes 28 clubs observed throughout the same period. Standard errors are in parentheses.
*$p < .10$. **$p < .05$. ***$p < .01$.

comparative advantage of the different types of players. Again, in view of the audience, South American players convey the idea of an entertaining and attractive way of playing, which is not necessarily associated with continental European players.

The population size of the city (*POP*) from which the club originates has a positive and significant effect on demand. Likewise, demand increases over time, as indicated by the positive parameter of the trend *t*. Finally, note that the coefficient of *TRAIN* is not significant in any of the estimations. Contrary to what has been predicted, the latter suggests that our databases do not provide any empirical evidence regarding the way demand is affected by the hiring of a new trainer.

We focus now on the wage expression. Table 4 presents six different sets of results where the following distinctions are made: (a) The panel is unbalanced, the θs are constant over time but vary across clubs, and the density $f(\theta)$ is half normal; (b) the panel is unbalanced, the θs differ from one club to the other and vary systematically with time, and the density $f(\theta)$ is half normal; (c) the panel is unbalanced and the θs are treated as fixed effects; (d) the panel is balanced, the θs are constant over time but vary across clubs, and the density $f(\theta)$ is half normal; (e) the panel is balanced, the θs differ from one club to the other and vary

TABLE 4: Estimation Results: Average Wage

	Unbalanced Panel			*Balanced Panel*		
Parameters	*1*	*2*	*3*	*4*	*5*	*6*
Constant	0.105 (0.878)	0.528 (0.880)	2.730*** (0.456)	–0.161 (1.075)	0.392 (1.096)	1.136* (0.686)
$\hat{Y}$	0.564*** (0.068)	0.482*** (0.066)	0.208*** (0.032)	0.625*** (0.072)	0.515*** (0.079)	0.173*** (0.034)
DIV	0.439*** (0.106)	0.446*** (0.104)	0.398*** (0.099)	0.306** (0.123)	0.310** (0.121)	0.329*** (0.116)
UEFA	0.182** (0.073)	0.160** (0.072)	0.149** (0.062)	0.169** (0.070)	0.148** (0.070)	0.141** (0.063)
K_1	0.340*** (0.031)	0.344*** (0.032)	0.290*** (0.087)	0.343*** (0.038)	0.347*** (0.038)	0.741*** (0.195)
K_2	–0.093*** (0.034)	–0.094*** (0.035)	–0.147** (0.073)	–0.124*** (0.038)	–0.122*** (0.039)	–0.150** (0.075)
CAPS	0.030 (0.028)	0.029 (0.028)	0.028 (0.025)	0.049 (0.031)	0.050* (0.030)	0.039 (0.029)
t	0.104*** (0.010)	0.083*** (0.015)	0.111*** (0.009)	0.120*** (0.011)	0.098*** (0.016)	0.109*** (0.011)
σ_ε^2	0.278*** (0.057)	0.380*** (0.103)	0.270[a]*** (0.011)	0.321*** (0.087)	0.446*** (0.149)	0.271[a]*** (0.013)
η	—	–0.061** (0.030)	—	—	–0.057* (0.030)	—
Number of observations		281			196	

NOTE: The unbalanced panel contains 50 clubs of first and second division observed throughout the period 1996-2003. The balanced panel includes 28 clubs observed throughout the same period. Columns 1 and 4 are half-normal distributions, θ_i is constant over time but varies across clubs; columns 2 and 5 are half-normal distribution, θ_{it} varies over time and across clubs; columns 3 and 6 are fixed effects technique, no distribution required, θ_i constant throughout time but varies across clubs. Standard errors are in parentheses.

a. $^{*}\sigma_\varepsilon$

*$p < .10$. **$p < .05$. ***$p < .01$.

systematically with time, and the density $f(\theta)$ is half normal; and (f) the panel is balanced and the θs are treated as fixed effects. In the course of the estimation, it appeared that the parameter μ was never statistically different from 0. We therefore discarded the truncated normal distributions and focus on half normal ones.

We observe only small deviations of the parameter values across the different sets of results. As expected, the coefficient of $\hat{Y}$ is always positive and significant, which implies that a higher performance requires a greater wage. Note that a 1% increase in performance requires a less than 1% increase in wages, meaning that the industry is characterized by economies of scale. The parameters of K_1 and K_2 are always positive and negative, respectively, and significant. This confirms that the history of the club performance matters when defining the wage. As explained previously, the director of the production process is more inclined to set up a large average wage if the club performed well in the past. On the other hand, weak performances in the past act as a break on results. The parameters of *UEFA* are all positive and significant. This suggests that the average wage is higher if the club is involved simultaneously in the European championship. Surprisingly, the coefficient of *CAPS* turned out to be nonsignificant and failed to act as a variable that accounts for quality in the team. Note, however, that the coefficients of *CAPS* are positive, as expected. The variable *DIV* that takes a value of 1 if the club competes in first league and 0 otherwise presents a positive and significant parameter in all the models. This entails that the average wage is higher when the clubs compete in first division. Note also that the parameter of the trend *t* is positive, implying that the average wage of the whole industry is increasing over time.

Finally, the parameter η is negative and significant. This is an interesting result, which shows that the clubs' wage distortions over the theoretical frontier follow a systematic and significant increase over time. This suggests that the overall value of the Spanish football league as well as the valuation of the prizes by clubs have increased, as indicated by the theory. The average increase from one year to the other is estimated to be close to 6%, regardless of which database is considered. A simple likelihood ratio test allows testing Model 2 against Model 1 and Model 5 against Model 4. The LR test statistic is equal to 4 if the panel is unbalanced (3.2 if balanced), which confirms that the model that allows θ to increase over time is preferred to a model where θ remains constant over time.[13]

EVALUATING INDIVIDUAL WAGE DISTORTIONS

From the estimation of the three equations system, predictions of individual wage distortion parameters θ can be recovered using the procedures initiated by Hausman and Taylor (1981) and Battese and Coelli (1988). The wage distortion over the theoretical frontier is simply defined as $\exp(\theta)$.

Table 5 provides estimates of the individual $\exp(\theta_1)$. Five sets of results are presented; they are associated with Models 1-5, defined above. Note that Specification 6 has been discarded because the constant and the output parameter are not significant, which may alter the validity of our estimates.[14]

TABLE 5: Estimation Results: Efficiency Exp (θ)

Unbalanced Panel						*Balanced Panel*			
1		*2*		*3*		*4*		*5*	
Tenerife	3.059	Tenerife	3.135	Tenerife	3.662	Tenerife	3.153	Tenerife	3.189
Villareal	2.608	Real Madrid	2.779	Real Madrid	3.177	Villareal	2.512	Real Madrid	2.659
Real Madrid	2.429	Villareal	2.703	Deportivo	2.895	Real Madrid	2.341	Villareal	2.583
Deportivo	2.070	Barca	2.316	Barca	2.583	Deportivo	2.204	Deportivo	2.325
Barca	2.050	Deportivo	2.226	Villareal	2.347	Alavés	2.072	Barca	2.227
Málaga	1.989	Málaga	2.041	Málaga	2.195	Barca	1.996	Alavés	2.110
Alavés	1.950	Alavés	2.019	Mallorca	2.075	Mallorca	1.920	Mallorca	1.956
Mallorca	1.842	Mallorca	1.899	Alavés	2.052	Valencia	1.578	Valencia	1.713
Xeres	1.825	Celta	1.888	Valencia	1.902	Rayo Val.	1.479	Rayo Val.	1.549
Getafe	1.650	Xeres	1.862	At. Madrid	1.775	Salamanca	1.478	At. Madrid	1.486
Merida	1.626	Valencia	1.745	Rayo Val.	1.763	Real Socied.	1.377	Salamanca	1.446
Valencia	1.591	Getafe	1.728	Xeres	1.723	Celta	1.368	Celta	1.418
Numancia	1.548	Merida	1.577	Getafe	1.699	At. Madrid	1.367	Real Socied.	1.399
Extremadura	1.530	Numancia	1.565	Celta	1.634	Sporting	1.347	Sporting	1.359
Salamanca	1.497	At. Madrid	1.547	Extremadura	1.543	Betis	1.299	Betis	1.332
Lleida	1.450	Recreativo	1.513	Salamanca	1.543	Zaragoza	1.287	Zaragoza	1.323
Recreativo	1.437	Extremadura	1.505	Lleida	1.537	Las Palmas	1.247	Valladolid	1.286
Ecija	1.410	Salamanca	1.485	Merida	1.516	Badajoz	1.236	Racing San.	1.275
At. Madrid	1.400	Rayo Val.	1.452	Real Socied.	1.507	Racing San.	1.230	Las Palmas	1.241
Real Socied.	1.381	Real Socied.	1.418	Sporting	1.484	Albacete	1.200	Albacete	1.163
Rayo Val.	1.377	Lleida	1.413	Betis	1.481	Oviedo	1.174	Oviedo	1.163
Sporting	1.372	Sporting	1.396	Murcia	1.464	Leganés	1.156	Leganés	1.147
Celta	1.310	Betis	1.346	Levante	1.443	Eibar	1.142	Eibar	1.128
Betis	1.300	Ecija	1.330	Racing San.	1.376	Valladolid	1.110	At. Bilbao	1.111
Las Palmas	1.280	Zaragoza	1.328	Numancia	1.338	At. Bilbao	1.104	Espanyol	1.102
Levante	1.280	Levante	1.321	Leganés	1.307	Sevilla	1.104	Sevilla	1.097
Zaragoza	1.278	Murcia	1.297	Recreativo	1.288	Espanyol	1.093	Osasuna	1.090

Logrones	1.252	Racing San.	1.276	Logrones	1.265				
Murcia	1.251	Univ. Lpalmas	1.261	Oviedo	1.255				
Albacete	1.250	Badajoz	1.259	Badajoz	1.229				
Toledo	1.247	Valladolid	1.247	Toledo	1.219				
Univ. LPalmas	1.245	Racing Fer.	1.235	Compostela	1.214				
Racing San.	1.216	Córdoba	1.227	Ecija	1.191				
Compostela	1.210	Logrones	1.221	Albacete	1.187				
Racing Fer.	1.199	Toledo	1.220	Valladolid	1.166				
Córdoba	1.190	Albacete	1.219	Espanyol	1.143				
Leganés	1.190	Leganés	1.201	Córdoba	1.114				
Hercules	1.180	Compostela	1.189	Hercules	1.106				
Oviedo	1.164	Oviedo	1.170	Eibar	1.080				
Eibar	1.160	Jaen	1.160	Ourense	1.046				
Jaen	1.150	Hercules	1.159	Racing Fer.	1.044				
At. Bilbao	1.130	Eibar	1.157	Sevilla	1.005				
Ourense	1.127	At. Bilbao	1.150	Almería	1.000				
Sevilla	1.112	Espanyol	1.114	At. Bilbao	1.000				
Valladolid	1.105	Sevilla	1.111	Elche	1.000				
Espanyol	1.100	Ourense	1.109	Jaen	1.000				
Osasuna	1.096	Osasuna	1.096	Osasuna	1.000				
Elche	1.080	Elche	1.082	Univ. LP	1.000				
Almería	1.070	Almería	1.063	Zaragoza	1.000				
M	1.452	*M*	1.525	*M*	1.517	*M*	1.524	*M*	1.569

NOTE: Columns 1 and 4 are half-normal distribution, θ_i constant over time but varies across clubs; columns 2 and 5 are half-normal distribution, θ_{it} varies over time and across clubs; column 3 is the fixed effects technique, no distribution required, θ_{it} constant over time but varies across clubs. The table presents the mean for each club throughout the period.

Several results are worth emphasizing. First, note that the estimation results are usually robust to the nature of the estimation procedure or the data set under consideration. They show little difference with respect to the ranking of the clubs and the evaluation of their individual distortion. Second, 10% to 16% of clubs in the unbalanced sample (18% to 21.4% in the balanced sample) have a distortion greater than 2, that is, their observed average wage is more than 2 times higher than the theoretical wage predicted by their performance. This suggests a strong discrepancy between a few firms that can support heavy distortions of their expenses and the others that suffer from higher financial constraints. Unsurprisingly, the most famous clubs in the history of the Spanish league belong to this first group with the highest distortion, signaling a more active rent-seeking activity. Third, notice that first-league and second-league clubs can be indifferently found along the different positions of the five different rankings, suggesting that there is no clear persistence in the relationship between each league and the wage distortions of the clubs.

Finally, consider the unbalanced panel.[15] The means for the average club of the sample range from 1.452 to 1.525, that is, the distortion of the average firm lies from 45.2% to 52.5% above the frontier. The average club supports a budget of 19.8 million Euros throughout the period.[16] This implies that such a club bears an absolute distortion of 6.1 to 6.8 million Euros above the theoretical frontier. Note that this club would have reached the same performance if no distortion had been dissipated, that is, with a budget that ranges from 13 to 13.7 million Euros. A similar remark can be provided for the whole Spanish football industry. Consider, for instance, the last year of observation, that is, the 2002-2003 season. The whole industry supported during this period a total budget of 1.182 billion Euros, whereas the total distortion above the theoretical frontier ranged from 368 to 407 million Euros, depending on whether estimation procedures 1, 2, or 3 are considered. Again, all of the clubs of both first and second league would have reached the same performance if these distortions had not been dissipated.

CONCLUSION

Considering simultaneously the demand, the result, and the average wage of football clubs performing in the Spanish league has allowed us to obtain interesting results regarding the structure of the industry and the financial results of these clubs.

First, the parameters of the variables of interest are usually significant and have the expected signs; individual estimates of wage distortions go well with basic intuitions. This suggests that the methodology chosen in this article presents some empirical relevance.

Second, the empirical results have shed light on important wages and budget distortions faced by clubs competing in the industry for the different prizes. The estimated budget distortion in nominal terms during the 2002-2003 season amounts to a stunning figure of 368 to 407 million Euros. It seems that rent dissipation is particularly high for the Spanish football industry, in accordance with casual observation of losses and debts of football teams.

The results in this article illustrate well the importance of the financial difficulty faced by many clubs in the Spanish industry and other European countries at the end of 2003. A recent special issue of the *Journal of Sports Economics* (Vol. 7, No. 1) on a potential financial crisis in the European football industry sheds light on this issue. In particular, it seems to be well admitted that many clubs in Europe are facing an imbalance between incomes and expenditures, as well as a rising debt. This is particularly true for small and large clubs in Italy and small clubs in England, Scotland, Belgium, and Portugal. Note that observing small clubs facing financial deficits goes in line with our result that wage distortion affects clubs from any division or any position in the final ranking of the championship. Paradoxically, the main cause of the financial crisis in these clubs has been the increasing amount of income entering the game, from television and other sources.

There may be several solutions to such crises: First, following the tight regulation that has been practiced in France, the Union of European Football Associations could require from clubs annual audited financial statements or proof that clubs have no overdue payments for transfer activities or no payment owing to employees. The union could condition the participation of clubs to European competitions on these criteria. A second possible solution is to adopt American practices: American major leagues such as basketball, baseball, or American football are usually financially stable organizations. They implement several regulatory mechanisms such as salary caps, draft rules, or revenue sharing and redistribution rules. Redistribution rules is maybe the most appealing scheme but is currently difficult to put into practice in Europe because clubs are facing the punishment of being relegated to a lower division. Hence, the European football industry may have to restructure its competition framework and may impose greater restrictions on the mobility of clubs between upper and lower divisions.

NOTES

1. In the symmetric setting of Tullock (1980), the individual effort (or rent-seeking expenditure) increases with the value of the prize and decreases with the number of contestants. It is suggested that players are caught in a prisoner's dilemma type of equilibrium, that is, the probability of winning is the same for each player and is therefore independent from the level of effort provided at the equilibrium. From the point of view of the contestants, the least costly situation to be obtained is then the one where they are able to coordinate on a symmetric equilibrium with the lowest possible level of effort. Such equilibrium is not feasible because the strategic interaction among the players leads to a higher level of expenditure with no relative gain in performance. This model has been extended in various ways. It has been suggested, for instance, that teams may have different valuations of the prize (Hillman & Riley, 1989; Nti, 1999; Stein, 2002). Asymmetric valuations tend to generate a bias toward underdissipation of the rent, making the total rent dissipation smaller than what could be obtained in a symmetric context. Likewise, competitors may be offered several prices simultaneously. Clark and Riis (1996, 1998) show that in a multiple prize and symmetric players' setting, the amount of rent seeking is reduced compared to a situation where there is a unique price. Finally, the value of the prize that clubs are competing for may itself be endogenous. Chung (1996), for instance, proposes a framework where the value of the prize increases with the effort spent by all the participants.

Contexts as different as economic organizations, war, competition for natural monopoly, patent races, political rent seeking, and sport competitions can be described as contests where players spend resources to win a prize. Rent seeking with asymmetric valuations of the prize is probably the most common situation encountered in practice. Political candidates competing to win an election or employees struggling for a job promotion are potential examples. Each competitor may have a private valuation of the prize, which may depend on his or her own characteristics and/or experience. This feature is also the most common in sport competition: A club/player that has just been promoted to first division may have a different valuation of a top position in the ranking than an experienced club, which has been competing for years to obtain it. Likewise, sport disciplines, such as basketball or football, that imply promotion, relegation, or qualification for a European competition are all examples of simultaneous contests where competitors may be offered several prizes simultaneously (e.g., win the championship, avoid relegation, qualify for the European cup). In multistage contests, such as a tennis championship, players usually compete for a single prize, that is, the final victory in the tournament. Finally, research and development's investment to obtain a monopoly right is an example of a case where the value of the prize that firms are competing for is endogenous: In this case, the monopoly's profit increases with total investments. We are not aware of such endogenous prize framework in a sport competition environment.

2. Experts usually argue that there are two main reasons for such a decline. First, television channels, which have constituted the main source of clubs' revenues throughout the past 10 years, are facing financial difficulties or decide to significantly reduce their expenditures on football broadcasting. This is the case of Via Digital or Canal Plus in Spain, RAI in Italy, ITV Digital in England, and Kirch in Germany. Second, the introduction of the Bosman law in 1995 dramatically changed the European football labor market regulations. Before 1995, any club willing to hire a player had to pay a compensation fee to the former club even if the contract had expired. Hence, even out-of-contract players were not completely free to leave their employer. Moreover, the clubs were not allowed to employ more than three players coming from abroad. The clubs had strong bargaining power because they could prevent a player from changing teams if the compensation fee did not satisfy them. The situation was very similar to the case of clubs' monopsony power described by Rottenberg (1956) in the baseball industry. Since 1995, an out-of-contract player can freely negotiate with a team and does not have to pay any compensation fee to his former club. The clubs now anticipate this new ingredient and provide the players with incentives to sign long-term contracts. The main consequence has been that the compensation fees and players' wages have greatly increased since 1995. Taken together, these two effects had important consequences on clubs' liability. Because clubs are losing their most lucrative source of revenue, they are not capable of handling the explosion of their budgets and the growing increase of players' wages.

3. See, for instance, the interview with Galliani (vice president of A. C. Milan and president of the Italian Football League), who advocates salary caps in the Corriere della Sera, May 18, 2002. Moreover, on November 5, 2002, the so-called G-14, a group of Western Europe's biggest clubs, met in Brussels to draw up new rules and proposed that from 2005, its members restrict their salary bills to 70% of the club's turnover.

4. These data have been collected in *El País*, August 28, 2002; *L'Equipe*, October 23, 2002; and *Repubblica*, June 8, 2003.

5. The stochastic frontier analysis is frequently used in sport economics (e.g., see Hofler & Payne, 1996, 1997; Chap. 5, Dobson & Goddard, 2001, for a survey). Data Envelopment Analysis (DEA) may be another potential technique, although it is less often employed in sport economics. Note that it is usually considered that the stochastic approach is more applicable in situations where measurement errors and random effects influence the data, as is the case in our study. Although some recent developments in stochastic DEA have attempted to address the issue of DEA'S being nonstochastic, we choose in this article a broadly parametric approach for ease of exposition given that we use a three-equations structure.

6. It is usually suggested that European football clubs differ from sport professional clubs in the United States in the sense that they care more about their ranking in the national championship than

their profit. Professional teams in the United States are usually thought as profit maximizers, whereas European clubs may only be performance seekers in sport competition. This idea goes back to the seminal contributions of Rottenberg (1956), Neale (1964), and Sloane (1971) and has been more recently advocated by Szymanski and Smith (1997).

7. Note that as suggested by an anonymous referee, we assume away rent seeking on the part of the players. The "superstar effect," as defined by Rosen (1981), may provide some players with a higher bargaining power at the moment of determining individual wages and may therefore affect the rent dissipation by clubs and/or the estimated wage frontier. A database including observations of several European leagues could allow evaluating, for instance, how the wage frontier of each national industry depends on the star player to average player ratio in each country. We leave this concern for future research.

8. "In general, match-attendance models tend to have difficulty in identifying a relationship between variables such as admission prices . . . and attendances" (Dobson & Goddard, 2001, p. 326).

9. A survey of references on this issue can be found in Kumbhakar and Lovell (2000). All models were estimated using the FRONTIER41 software, written by Tim Coelli.

10. Note that while presenting the results, it will be suggested that μ is never statistically different from 0. The models considering truncated normal distributions will then be discarded and only six sets of results will be presented.

11. We also tested the effect of the lagged $GOAL_{t-1}$ on demand. The results suggested that $GOAL_{t-1}$ had a lower and less significant impact on demand than $GOAL_t$. Note that football demand in Spain is highly sensitive to current performance, as suggested by very frequent instantaneous drops in demand for clubs performing badly, even if they have a prestigious historical performance record. Moreover, an additional variable, *VIC*, namely, the number of victories obtained during the season, also had a positive effect on demand. However, it presented strong evidence of correlation with the number of goals scored and has therefore been discarded.

12. Note, however, that the effect of *SYS* is globally nonsignificant. This is probably due to the fact that our aggregate measure shows little variance and partially fails to account for the subtle difference of strategies across clubs.

13. The levels of significance are 5% and 10% (unbalanced and balanced panel, respectively).

14. The fixed-effect specification uses the constant as the reference to evaluate firms' individual effects.

15. Results on the balanced sample are available upon request.

16. The budget is just defined as the Average Wage × the Number of Players enrolled in the club.

REFERENCES

Battese, G. E., & Coelli, T. J. (1988). Prediction of firm-level technical efficiencies with a generalized frontier production function and panel data. *Journal of Econometrics*, *38*, 387-399.

Chung, T. Y. (1996). Rent-seeking contest when the prize increases with aggregate efforts. *Public Choice*, *87*, 55-66.

Clark, D. J., & Riis, C. (1996). A multi-winner nested rent-seeking contest. *Public Choice*, *87*, 177-184.

Clark, D. J., & Riis, C. (1998). Influence and the discretionary allocation of several prizes. *European Journal of Political Economy*, *14*, 605-625.

Dobson, S., & Goddard, J. (2001). *The economics of football*. Cambridge, UK: Cambridge University Press.

Hausman, J. A., & Taylor, W. E. (1981). Panel data and unobservable individual effects. *Econometrica*, *49*, 1377-1398.

Hillman, A. L., & Riley, J. G. (1989). Politically contestable rents and transfers. *Public Choice*, *1*, 17-39.

Hoen, T., & Szymanski, S. (1999). The Americanization of European football. *Economic Policy*, pp. 205-233.

Hofler, R. A., & Payne, J. E. (1996). How close to their offensive potential do football teams play? *Applied Economic Letters*, *3*, 743-747.

Hofler, R. A., & Payne, J. E. (1997). Measuring efficiency in the national basketball association. *Economics Letters*, *55*, 293-299.

Kumbhakar, S. C., & Lovell, C. A. K. (2000). *Stochastic frontier analysis*. Cambridge, UK: Cambridge University Press.

Neale, W. C. (1964). The peculiar economics of professional sports. *Quarterly Journal of Economics*, *78*, 1-14.

Nti, K. O. (1999). Rent-seeking with asymmetric valuations. *Public Choice*, *75*, 415-430.

Rosen, S. (1981). The economics of superstar. *American Economic Review*, *71*, 845-858.

Rosen, S., & Sanderson, A. (2001). Labor market in professional sports. *Economic Journal*, *111*, 47-68.

Rottenberg, S. (1956). The baseball players labor market. *Journal of Political Economy*, *64*, 242-258.

Sickles, R. C. (2003). *Panel estimators and the identification of firm-specific efficiency levels in parametric, semiparametric, and nonparametric settings* [Mimeo].

Sloane, P. (1971). The economics of professional football: The football club as utility maximiser. *Scottish Journal of Political Economy*, *17*, 121-146.

Stein, W. E. (2002). Asymmetric rent-seeking with more than two contestants. *Public Choice*, *113,* 325-336.

Szymanski, S. (2000). A market test for discrimination in the English professional soccer leagues. *Journal of Political Economy*, *108*, 590-603.

Szymanski, S. (2002). *The economic design of sporting contest: A review* [Mimeo].

Szymanski, S., & Smith, R. (1997). The English football industry: Profit, performance and industrial structure. *International Review of Applied Economics*, *11*, 135-153.

Szymanski, S., & Valletti, T. M. (2003). *First and second prizes in imperfectly discriminating contests* [Mimeo].

Tullock, G. (1980). Efficient rent-seeking. In J. M. Buchanan, R. D. Tollison, & G. Tullock (Eds.), *Toward a theory of the rent-seeking society*. College Station: Texas A&M University Press.

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