How inefficient are football clubs?
An evaluation of the Spanish arms race

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Abstract

This paper proposes an empirical evaluation of the inefficiency that affects the budgets of football clubs in the Spanish football industry. The empirical work entails the estimation of a football budget, performance, and demand system with data on clubs competing in the first and second leagues during the 1996-2002 seasons. It is suggested that the average budget distortion in the industry was close to twenty per cent in 2002. This provides an interesting illustration of the financial difficulties faced recently by most European football clubs.

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1. **Introduction**

The 2002-2003 European football season opens while the European football industry is going through one of the most important crisis of its history. Very often, clubs are forced to reduce their budget significantly or are not even capable of balancing their budget anymore and go bankrupt. Examples illustrating this general tendency are numerous: in Spain, clubs spent only 92.3 Millions Euros to enroll new players in the national championship this year, which represents a cut of 211 Millions Euros (358 Millions respectively) with respect to what had been invested the year before (two years before respectively). 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 be allowed to register in the championship, while a third one, Fiorentina, went bankrupt. In addition, several players of the other teams accepted to reduce their earnings and some club directors advocated some corrective measures.[1] In England, Chelsea, one of the richest clubs of the country, is not allowed to hire any player since it got too much into debt. Moreover, several clubs competing in the second league are close to bankruptcy (Bradford and Leicester among others). In Germany, the clubs invested this year 102.2 Millions Euros in hiring, which represents a 35% cut with respect to the previous year.[2]

Experts usually argue that one of the main reasons for such a decline is that television channels, which have constituted the main source of clubs' revenues over the last ten years, are facing financial difficulties.[3] Since clubs are loosing their most lucrative source of revenue, they are not capable of facing the explosion of their budgets and the growing increase of players' wages.[4]

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[1] See for instance the interview of Galliani (vice president of A.C. Milan and president of the Italian Football League) who advocates salary caps in the Corriere della Sera, 18th of May 2002. Moreover, on November 5th, 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.

[2] These data have been collected in El País, 28th of August 2002 and in L'Equipe, 23rd of October 2002.

[3] Via Digital in Spain, as well as RAI in Italy have decided to reduce by 50% their investment in football broadcasting. Two major groups, ITV Digital in England, and Kirch in Germany went bankrupted. In France, Canal Plus is willing to reduce significantly its participation in the football industry.

[4] In this respect it is important to note that 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 since they could prevent a player from changing team if the compensation fee did not satisfy them. The situation was very much alike 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. Any player willing to breach the contract in order to change club has to pay the compensation fee mentioned above. The main consequence has been that the compensation fees and players' wages have greatly increased since 1995.

Determining the real causes of the financial difficulties faced by European football clubs does not enter the scope of this paper. Instead, we propose to shed light on the budget distortions that affect these clubs. Such an approach may be interesting for both regulatory and methodological purposes.

First, nobody would deny that clubs expenditures have exploded, and that they are not linked to players' productivity. As suggested by Rosen and Sanderson (2000), this is the direct consequence of the *arms race* that football clubs are playing against each other. Given that the typical objective of a European football club is to win, clubs managers are willing to enroll the best players in order to increase the probability of success of their team.[5] The success seeking behavior clearly induces negative externalities among teams since one club trying to increase its probability of success reduces the probability of success of the other clubs. The other clubs react through a budget increase and the whole process results in a zero-sum game regarding performance and in excessive wages and compensation fees.[6] Rosen and Sanderson (2000) compared this situation to the one where countries invest in national military defense in order to improve their relative position.[7] This paper proposes an empirical evaluation of such distortions affecting expenditures. This entails measuring a global distortion for the whole industry, but also deriving individual assessments for each club. The results we obtain usually go along with the initial intuition, i.e., the most famous clubs face important distortions.

Second, we choose to approach the problem of appraising budget distortions through the window of the frontiers literature.[8] This implies being able to identify properly the nature of the production process under consideration as well as the ingredients of this process, such as the nature of the production itself and the inputs required. This is an interesting task in the particular context of the sport industry. Estimating a budget frontier implies defining a relationship between a production level and the minimal budget that allows the producer to reach the required production level. Efficient production units are located on the frontier. Inefficient agents are those above the frontier. The distance between the theoretical frontier and the real

[5] It is usually suggested that European football clubs depart from sport professional clubs in the U.S. in the sense that they care more about their ranking in the national championship than their profit. Professional teams in the U.S. are usually thought as profit maximizers, while 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). Prestige and visibility are priceless contributions for the persons in charge of the organization of the club. The general rule is that the owners of European football clubs are at the same time the holders of one or several private companies. Besides prestige and visibility, the management of a football club can also be seen as a way to advertise their core business or implement vertical integration. Extreme cases may be the ones of those who started a political career through sport competition.

[6] Fort and Quirk (2002) shows that, while profit maximizing clubs equate marginal costs to marginal revenue, players receive higher wages in leagues where clubs are maximizing their performance under a solvency constraint.

[7] Akerlof (1976) described the same situation as a 'rat race' game.

[8] For a survey of the literature using stochastic production frontier analysis in sport, see chapter 5 in Dobson and Goddard (2000).

budget provides a direct measure of the inefficiency of the agent. Thus, in the context of the football industry, estimating a budget frontier entails disentangling the efficient part of the budget that allows the football clubs to reach their production levels, i.e., their sporting performances, from the inefficient part that is the outcome of the *arms race* game (taken as exogenous here) that clubs are playing against each other to enhance their relative position in the competition.

An important 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. This constraints the structure of the economic model under consideration and reduces the information that could be obtained from it. However, considering a simultaneous system of budget, performance and demand might be helpful in order 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 has been particularly appealing over the last decade, as argued in detail in what follows. The database includes observations for the forty clubs playing in first and second league over the period 1996-2002. The next section presents the model that will be estimated. This model considers a simultaneous equations structure where the budget of the clubs, as well as their performance and demand, is determined. The budget function includes an unobservable parameter accounting for the clubs inefficiency. Section 3 is dedicated to a careful description of this industry and the data. Section 4 sheds light on the estimation procedure and presents the results. Section 5 proposes a discussion and Section 6 concludes.

2. The model

Our aim in this section is to construct a football cost, performance 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 distortion that affects the budget of each club participating to the competition.

Production and Costs

Each football club is a production unit. The director of the production process is the president of the club. In a first step, the president sets an expected performance Y to be reached by his team during the season. Then, he defines in a second step the minimum budget B required in order to achieve the expected outcome.

We need first to define the inputs that enter the production process. It is assumed that the performance of a team 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. 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 in order 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 result.[9] We therefore assume that what matters is the quality of the group of players and not its size. Beside the costs, the experience *K* may be another good candidate to explain the performance of a team. It is supposed to be fixed in the short run. We also introduce a third term, namely ψ, to account for the unpredictable events, that are beyond the control of the club, and that might affect the performance of the team. Let *X* be a vector of additional explanatory variables that will be emphasized at the moment of the estimation. The production function of each unit can then be represented as

$$Y = f(w, K, X, t, \psi | b), \tag{1}$$

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

In order to account for budget distortions above the frontier, we distinguish the relevant average cost *w* from the observed distorted average cost $\tilde{w}$. We assume that the ratio of observed to relevant costs quantities is a direct measure of the inefficiency of each club. Hence, the relationship between *w* and $\tilde{w}$ can be represented as

$$\tilde{w} = w \exp(\theta), \tag{2}$$

where θ is a strictly positive parameter that represents budget inefficiency. It is only known by the director of the production process and is therefore unknown to the econometrician. Note that $\tilde{w}$ converges to *w* as θ goes to zero.

Each director of the production process is supposed to minimize the budget *B* that allows her to reach the expected performance *Y*. From equation (1), we know that, to reach the objective *Y*, the manager must pay the relevant average cost (that is, buy the relevant average quality)

$$w = f^{-1}(Y, K, X, t, b, \psi). \tag{3}$$

[9] Ideally, the production process should account for the number of units of talent that enters each club. Each player enrolled in the team would be worth a particular amount of units. This would allow defining a price for each unit of talent. This approach, far to subjective, is difficult to put into practice.

To attract the best players available and enhance its relative position with respect to the other teams, the manager distorts costs $\tilde{w}$ above *w*. The associated budget is then defined as

$$B = wL\exp(\theta) = B(L, Y, K, X, t, \theta, \varepsilon | \beta), \tag{4}$$

where *L* is the number of players enrolled in the team, ε is an error term and β is a vector of parameters to be estimated. Note that ε depends on ψ and *b* while β is a function of *b*. The budget equation given in (4) is a stochastic frontier that needs to be estimated. Again, an efficient club budget is close to the theoretical frontier. Inefficiency θ is given by the distance that separates the observed budget B_i of team *i* from the frontier. In order to account for the potential endogeneity of the performance *Y*, we propose to estimate simultaneously a performance and a demand equation.

Performance and demand

The relation between performance *Y* and demand *D* in the football industry results from two effects that need to be considered.

On one hand, demand depends on the performance of the team (see Szymanski and Smith, 1997, Hoen and Szymanski, 1999, and Dobson and Goddard, 2001). We expect the audience to be attracted by teams that are performing better during the season and/or that set higher objectives. Whether the players are foreigners or not, whether they play in national teams, the arrival of a new trainer, the number of the titles won by the club in the past, whether the team plays in first or second division are also 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 like for instance the position of the players on the field, the number of goals scored or the number of victory obtained. 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 should however not affect the estimation significantly since most empirical studies in football fail to find a significant relationship between prices and attendance, especially in samples with a short time dimension.[10] The demand function is of the form

$$D = D(Y, A, Z, S, t, \eta | \gamma), \tag{5}$$

where *A* and *Z* denote attractiveness and characteristics of the team, *S* is the size of the market, *t* is a trend, η is an error term and γ is a vector of parameters.

[10] "In general, match-attendance models tend to have difficulty in identifying a relationship between variables such as admission prices […] and attendances." (Dobson and Gerrard, 2001, p. 326).

On the other hand, the performance Y must be adjusted to the level of demand D, so the former is endogenous to the latter. We therefore assume that the performance 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 objectives. Here we simply introduce a reduced form of a dynamic and technical adjustment process between performance Y and demand D that we specify as follows

$$Y = \phi(D, t, \rho | \delta), \tag{6}$$

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

Note that the demand function in equation (5) is interpreted as a short-run demand since it takes the performance Y as given. By replacing Y in this demand function by its expression in equation (6), we obtain a reduced form interpreted as the long-run demand function, defined as

$$D = \varphi(A, Z, S, t, \xi | d), \tag{7}$$

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 (6) and (7) avoids the simultaneity problem that exists between D and Y.

The next step consists in estimating equations (4), (6) and (7). Note that the whole model under consideration is sequential. First, attractiveness and characteristics of the team, as well as market size determine the magnitude of demand. Second, demand establishes the attainable performance. Third, the director of the production process determines the average cost that allows her to reach the objective, and thus the budget is determined. Since 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.

3. The Spanish industry

The Spanish Professional league is a natural candidate for our purpose. The aim of this section is to justify the motivation of our choice and present the industry as well as the database.

The industry

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 been paid ever.

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 towards their shareholders. In Spain, the person in charge of the administration of the club, i.e., the president of the club, is generally elected by an assembly composed of fellows supporting the team. As the fellows care about sportive results rather than profits, it is quite straightforward to assume that clubs presidents are pressed to raise expenditures levels in order to enroll the best players. This specific context is therefore particularly appropriated to our study, since it tends to create an *arms race* type of environment.

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 Gerrad (2001) and El País, 28th of August 2002.

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. Because of this nationalistic significance attached to football clubs, supporters put more pressure on presidents.

Note moreover that the Spanish professional league is one of the most unbalanced of all European Leagues. Between 1946 and 1999 two clubs (Barcelona and Real Madrid) won 39 titles out of 54. Moreover, from 1946 onwards, only 15 teams finished in the top three places and this is the smallest number among all European football leagues. Success seeking behavior and the absence of clear budget constraint together usually lead to more unbalanced competitive outcomes.[11] As explained, these are also the factors that induce clubs reach excessive expenditures levels by participating to the *arms race*.

Finally, the Spanish professional league seems to have fully accomplished the Bosman revolution since it is one of the most internationally open of the European Leagues: in 1999

[11] See Fort and Quirk (2002) for a discussion of this issue.

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. It is interesting to determine whether or not such an outcome requires active participation from the clubs in excessive spending habits.

Data

In order to test the economic model of the next section, we need data on clubs budgets as well as data on the supply and demand of the industry. The following sections will present in detail the construction of the variables of interest. The database could be constructed using the annual data collections edited by the Spanish sport newspaper *Marca* from the 1996-1997 season to the 2001-2002 season, which implies six years of observations. Observations on the forty clubs competing in first and second league could be collected each year. The outcome is a database including 249 observations.[12] Note that we could not keep track of teams going down to third division or further down. This implies that some teams may disappear from one year to the other, i.e., all teams are not necessarily observed six times over the period and we observe more than forty different teams in the sample. In order to complete the database on the demand side some additional data have been collected from the website of the Instituto Nacional de Estatisticas (INE).

4. Estimation and results

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

The system

The demand function is specified as

$$\begin{aligned}\ln D = d_0 + d_1 SYS + d_2 TRAIN + d_3 DIV + d_4 FEU + d_5 FW + d_6 NAT + \\ d_7 TIT + d_8 t + d_9 \ln GOAL + d_{10} \ln VIC + d_{11} \ln POP + \xi.\end{aligned} \tag{8}$$

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*), the number of goals scored during the season (*GOAL*), and the number of victories (*VIC*) obtained during the season are used as proxies in order 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

[12] We dropped 3 observations.

midfielders. The variable *SYS* takes value one if the former strategy is implemented, and zero otherwise. We expect a more offensive strategy (i.e., with three forwards) to attract a larger audience. Likewise, we expect the numbers of goals scored and victories obtained 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, we consider the number of foreign players. A distinction is made between foreigners from Europe (*FEU*) and foreigners from the rest of the world (*FW*). Typically, foreign players playing outside their own country are highly skilled and have a significant influence on the performance of the team. These two variables should then have a positive effect on demand. Second, Spanish players who are also members of the national team are also expected to have an ability that is higher than the average. The number of such players (*NAT*) should then be also accounted for. We anticipate demand to be also positively influenced in this case. Third, we introduce a dummy variable (*TRAIN*) that takes value one if the trainer of the team is new, and zero 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) objectives are in order. The audience is usually highly sensitive to such a decision and *TRAIN* should have a positive effect on demand. Fourth, the number of titles (*TIT*) won by the club in the past is introduced in order to test whether clubs with a more prestigious reputation attract a larger audience. Finally, we use a dummy variable (*DIV*) that takes value one if the team is competing in second division, and zero otherwise. This variable should most certainly have a negative 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, but also 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 performance equation. It is simply determined as

$$\ln Y = \delta_0 + \delta_1 \ln \hat{D} + \delta_2 t + \rho \,. \tag{9}$$

Note that $\hat{D}$ is the predicted value of *D* obtained from the estimation of equation (8). We need to define a measure of the performance *Y*. 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 while 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 forty teams simultaneously, as if they all belonged to one single league.

The last equation to be estimated is the budget function. It is defined as

$$\ln B = \beta_0 + \ln L + \beta_1 \ln \hat{Y} + \beta_2 \ln K_1 + \beta_3 \ln K_2 + \beta_4 \ln CAPS + \beta_5\, EUR + \beta_6\, t + \theta + \varepsilon \,. \tag{10}$$

Budget includes total wage and fee expenditures that must be paid in order to purchase players from other clubs.

Several explanatory variables are required to disentangle the effects due to individual inefficiency from other effects common to all production units. Besides inefficiency θ, we introduce first on the right side of the equation the number of players *L*, the performance *Y*, and the experience *K*.

Note that we use the predicted performance $\hat{Y}$ obtained from the estimation of equation (9). The experience *K* is decomposed into two variables. The first one, K_1, denotes the number of years spent in first league while 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 behavior of each president regarding expenditures should depend on the history of the performance of the club. For instance, a club with a long history in the first league is expected to have higher long run objectives and larger budgets. Likewise, a club, which spent most of his history in second league, may not be able and/or willing to afford high expenses.

Besides performance and experience, we introduce additional variables in order to capture part of the heterogeneity among production units. The first one (*EUR*) is a dummy variable that takes value one if the team simultaneously plays the Spanish and a European championship, and zero otherwise. This variable should have a positive influence on expenditures since 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 it should also have a positive effect on the budgets. Finally a trend t is introduced.

Summary statistics regarding the variables are provided in Table 2. We turn now to the estimation procedure.

Estimation

The system to be estimated is made of equations (8), (9) and (10). Since 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 0 and respective variances σ_ξ^2, σ_ρ^2 and σ_ε^2.)

Maximum likelihood applied to equations (9) and (10) does not require additional specifications. However, when estimating the cost function expressed in (10), a difficulty arises due to the fact that the inefficiency θ is unobservable. We will assume that the parameter θ has a density function $f(\theta)$ defined over an interval $\left[\underline{\theta},\overline{\theta}\right]$ where $\underline{\theta}$ ($\overline{\theta}$) corresponds to the highest (lowest) efficiency level. Hence, not only the vector of parameters β but also the distribution of the efficiency parameter can be estimated.

We assume $f(\theta)$ to be a beta density with scale parameters μ and ν. The choice of this distribution is dictated by two considerations. First, in view of the relationship between the efficient and actual levels of wages defined by equation (2), the spending inefficiency parameter is conveniently defined as a percentage. This is readily obtained since the beta density is defined over the interval [0, 1]. Second, choosing a beta density is an adequate normalization that does not impose strong restrictions, since the shape of the distribution is dictated by the estimation of the scale parameters μ and ν.

We denote by $L_{it}(\theta)$ the likelihood of a data point (a team i observed at period t) conditional on θ. Since the variable θ is unobservable, only the unconditional likelihood can be computed, i.e.,

$$L_{it} = \int_0^1 L_{it}(x)x^{\nu-1}(1-x)^{\mu-1}\frac{\Gamma(\nu+\mu)}{\Gamma(\nu)\Gamma(\mu)}dx\,, \tag{11}$$

where $\Gamma(.)$ is the gamma function. Assuming that observations are independent, the log-likelihood function for our sample is just the sum of all individual log-likelihood functions obtained from equation (11).

Results

Table 3 reports the estimation of the system. We present first the results of the demand and performance equations. Most of the parameters are significant (at least at the 5% level) in the demand equation. The exceptions are the constant and *TIT*, which is significant at the 10% level, and *TRAIN*, which is not significant. All the parameters are significant in the performance equation.

A first set of results goes along with the initial intuition. Thus, demand increases with the number of goals scored (*GOAL*) and the number of victories obtained (*VIC*). Moreover, it is positively affected if the team strategy responds to a more offensive profile (*SYS* takes value one). Thus, this suggests that the audience increases when the game is more entertaining and risky and when the team is a winner.

Then, one can notice that the reputation of the team is an important factor. Indeed, demand appears to be larger if competition occurs in the first league (*DIV*). Likewise, a higher number of players simultaneously enrolled in the Spanish national squad (*NAT*), as well as the number of titles previously obtained by the club (*TIT*) significantly influences demand. These are not surprising results since the audience may be attracted first by great teams, or by teams with a prestigious history.

The striking result comes from the variables that account for the origin of foreign players. The reader might remember that a distinction is made between foreign European players (*FEU*) and players from the rest of the world (*FW*). The estimation suggests that players from the rest of the world sway positively demand while the quantity of European players may have a negative impact on demand. It is not completely clear why such a result has been obtained. One possible explanation could be the following: typically, most non-European players of the Spanish league come form South America. In the view of the audience, such players may be culturally similar to Spanish players and may not alter the national identity of the team, and this may not be the case with European non-Spanish players. This requires however that the audience care about such national identity. Another possible explanation relies on the supposed comparative advantage of the different types of players. Again, in the 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. And this would explain why the quantity of European non-Spanish players has a negative impact on demand.

The population size of the city (*POP*) from which the team originates has a positive 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. Contrary to what has been predicted, the latter suggests that our database does not provide any empirical evidence regarding the way demand is affected by the hiring of a new trainer.

The performance equation provides strong empirical evidence on the positive relationship between demand and performance in the industry.

We focus now on the cost expression. Besides the constant, all the parameters are significant (at least at the 5% level). As expected, the coefficient of $\hat{Y}$ is positive, which implies that a higher performance requires a greater budget. Note moreover that a 1% increase in performance requires a less than 1% increase in costs, meaning that the industry is characterized by economies of scale. The parameters of K_1 and K_2 are positive and negative, respectively. This confirms that the history of the club performance matters when defining the budget. As explained previously, the director of the production process is more inclined to set up a large budget if the club performed well in the past. On the other hand, weak performances in the past act as a break upon objectives. The parameters of *UEFA* and *CAPS* are positive. This suggests first that costs are higher if the team is involved simultaneously in the European championship since playing more games requires more units of talent. Second, the budget is more important if the quality of the players is higher, as shown by the impact of the number of players enrolled in a national team on costs. Note also that the parameter of the trend t is positive implying that the costs of the whole industry are increasing over time.

Both scale parameters μ and ν can be estimated so that a prediction of the density $f(\theta)$ can be obtained. It has an exponential shape that is skewed to the right, which suggests that the clubs are on average rather efficient (the probability to pick up a club with a θ lower than 0.5 is greater than one half).

5. Evaluating individual cost distortions

From the estimation of the three equations system, predictions of individual efficiency parameters can also be recovered. Using a procedure initiated by Jondrow et al. (1982), one may recover an estimate for each individual efficiency parameter using the values of the residuals obtained from the estimation of the budget equation. The budget distortion can be easily obtained since it is just equal to $\exp(\theta)$.

First, we discuss inefficiency across individual teams. Table 4 provides individual estimates of the inefficiency and cost distortion indexes for the thirty-nine teams in 2001-2002.[13] The inefficiency and distortion indexes of the average firm are 0.194 and 1.201 respectively. This implies that the observed budget of the average firm lies 20.1% above the theoretical frontier. A first result to note is that inefficiency does not apply only to teams competing in the first league. Indeed, it appears that the most inefficient team this season competes in the second league. As the estimated distortion changes from one year to the other, Table 5 presents the average values over the six years of the sample.[14] Note that the inefficiency levels lie between 13.5% and 29.1%. Among the six most inefficient teams over this period are (*i*) two teams struggling for the first position (Real Madrid and Deportivo), (*ii*) two teams coming up from second league

[13] Note that there should be forty teams in the table. We dropped the team that came from the third league this year. Previous years results are available upon request.

[14] Tenerife and Villareal have been dropped since they appeared to be clear outliers during several seasons.

and trying to fill the gap with good first league teams (Alavés and Mallorca), and (*iii*) teams struggling every year either not to be relegated back to second league or to be promoted to first league (Salamanca and Sporting). At the bottom of the table there are mostly teams settled in second division. A very interesting and particular case is Athletic Bilbao, one of the best clubs in the history of the Spanish League. This club exhibits a very low level of inefficiency overall. The main reason for this result may be searched in the fact that this club always hired Basque players, which reduced its incentives to participate to expensive players-seeking activities. On the basis of the observations above, one may conclude that inefficiency levels, i.e., incentives in participating to the *arms race*, derive from different targets and behaviors. It seems that (*i*) the best clubs running for winning the League as well as those struggling in order to avoid relegation are particularly exposed to the *arms race* effect, since the prize/punishment is very high, and (*ii*) the clubs that are more established in their division are able to shelter themselves somewhat from the harmful effect of the race on expenditures.

Second, it is interesting to examine the difference between the two divisions. Figure 1 shows the average percentage cost distortion for first and second leagues over the six years of the sample.[15] The two leagues start with the same level of average cost distortion of 19%. From then onwards, they drift apart. On the one hand, first league cost distortion shows an upward trend up to 22.1%. On the other hand, second league cost distortion decreases over the years down to a level of 15.7%. It is not clear what caused this behaviour. It is tempting, however, to relate the increase in the cost distortion to the dramatic increase in revenues for first division teams in recent years, mainly due to the TV rights. Bigger revenues are reflected in their bigger total costs and may have led first division teams to greater inefficiency. Figure 2 shows that the gap in total costs between first and second league clubs clearly widens over the years. Given that, it is not surprising that the gap in the average nominal distortion also increased over the years as shown by Figure 3.

Table 6, instead, proposes an estimation of the nominal cost distortions for individual teams in the 2001-2002 season. As expected, first league clubs face the highest nominal distortion since they support the highest budgets. Unsurprisingly, Real Madrid, Barca, Valencia and Deportivo are located at the top of the ranking. Indeed, their annual budgets are far beyond the ones of their competitors and their distortion indexes indicate that they have been extremely active in players-seeking activities this season. Note that the total sum of cost distortion amounts to roughly 200 millions Euros, while the average for first and second division clubs is of 8.4 and 1.3 millions Euros respectively.

[15] In what follows, we take out Tenerife and Villareal in calculating the 1999-2000 average distortion for second division, because of the reasons outlined above.

6. Conclusion

Considering simultaneously the demand, the performance, and the budget of football clubs performing in the Spanish league has allowed us to obtain interesting results regarding the structure of the industry and the inefficiency of these clubs.

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

Second, from the analysis of the inefficiency and cost distortion, empirical evidence has been provided on important budget distortions faced by clubs competing in the Spanish industry. The estimated cost distortion in nominal terms during the 2001-2002 season amounts to a stunning figure of roughly 200 Millions Euros.

European football clubs have entered into what Rosen and Sanderson (2000) called an *arms race* that turned out to have dramatic effects for their budgets. Such a race consists in enrolling the best players available so that each club may be able to enhance its relative position with respect to its competitors, which are pushed to follow suit. It may have always existed, however, budgets distortions effects have been particularly spectacular over the last decade, thanks to the advent of television interest for football broadcasting. The results in this paper well illustrate the importance of the financial crisis faced by the Spanish industry and other European countries at the end of 2002.

One could be disappointed by the highly aggregated nature of the financial data and would expect a more disaggregated model to perform better. It would be interesting to take into account other effects such as the opening of the European frontiers or the "superstar effect" mentioned by Rosen (1981). Modeling these effects calls for data including observations on wages and compensation fees, as well as information regarding individual revenues coming form advertising. Once these data are available, a more structural approach can be implemented. Thus, the research agenda will be complete.

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Table 2: Summary of variables

Variable	Description	Mean	Standard Deviation
C	Cost (budget) in thousands Euros	17,895	25,043
Y	Performance measured as the number of points obtained	92.164	39.142
K_1	Years spent in first league	22.871	23.547
K_2	Years spent in second league	16.718	11.564
L	Number of players	22.421	2.420
UEFA	Takes value 1 if the team simultaneously competes in the European cup, 0 otherwise	0.168	
CAPS	Total number of caps in the national team (all players taken together)	84.542	129.686
D	Demand, effective audience as a year average	16.497	15.970
SYS	Takes value one if the team is organized as 4-3-3 (four defenders, three midfields and 3 forwards), 0 otherwise	0.096	
FEU	Number of foreign players from Europe	2.144	2.463
FW	Number of foreign players from outside Europe	3.630	2.321
GOAL	Number of goals scored	49.718	11.995
NAT	Number of players enrolled in the Spanish national team	4.253	5.478
TRAIN	Takes value 1 if the trainer is new, 0 otherwise	0.473	
TITLES	Number of titles won	4.425	5.478
VICTO	Number of victories obtained	14.248	4.175
DIV	Takes value 1 if team plays in second league, 0 otherwise	0.510	
POP	Population size of the city the club belongs to	501,495	740,021

Table 3: Estimation Results

Parameter	Estimate	Standard Deviation
Costs		
Constant	-0.519	0.725
$\hat{Y}$	0.829	0.177
K_1	0.209	0.032
K_2	-0.113	0.030
UEFA	0.262	0.098
CAPS	0.109	0.024
t	0.115	0.017
σ_ε	0.418	0.024
μ	0.714	0.154
ν	2.909	0.871
Performance		
Constant	3.272	0.042
$\hat{D}$	0.483	0.017
σ_ρ	0.223	0.010
Demand		
Constant	-1.057	0.606
SYS	0.196	0.100
FEU	-0.037	0.017
FW	0.031	0.014
GOAL	0.576	0.191
NAT	0.048	0.013
TRAIN	-0.047	0.058
TITLES	0.007	0.004
VICTO	0.309	0.128
DIV	-0.660	0.098
POP	0.174	0.026
t	0.054	0.018
σ_ξ	0.443	0.020

Table 4: Estimated inefficiency and distortion indexes (2001-2002)

Team	Inefficiency	Distortion
Sporting*	0.338	1.403
Villarreal	0.311	1.365
Real Madrid	0.289	1.336
Alavés	0.288	1.333
Tenerife*	0.275	1.317
Valencia	0.246	1.280
Barcelona	0.225	1.253
Deportivo	0.199	1.221
Málaga	0.198	1.219
Racing Santander	0.197	1.218
Numancia	0.196	1.217
Murcia*	0.194	1.214
Real Sociedad	0.191	1.211
Mallorca	0.180	1.198
Córdoba*	0.179	1.197
Atlético Madrid*	0.179	1.196
Betis*	0.178	1.195
Levante*	0.176	1.193
Oviedo	0.172	1.188
Leganés*	0.172	1.188
Espanyol	0.171	1.187
Rayo Vallecano	0.170	1.185
Las Palmas	0.169	1.184
Osasuna	0.167	1.182
Extramadura*	0.162	1.176
Celta	0.157	1.170
Zaragoza	0.157	1.170
Jaén*	0.156	1.169
Xeres*	0.152	1.165
Valladolid	0.150	1.162
Racing Ferrol*	0.133	1.142
Recreativo*	0.131	1.141
Elche*	0.127	1.135
Badajoz*	0.126	1.135
Albacete*	0.121	1.129
Eibar*	0.119	1.127
Athletic Bilbao	0.119	1.126
Sevilla*	0.116	1.123
Salamanca*	0.100	1.105

Note: * Teams playing in second league**.**

Table 5: Estimated distortion indexes (1996-2002)

Team	Average Distortion (%)
Alaves	1.291
Deportivo	1.277
Sporting	1.274
Mallorca	1.261
Real Madrid	1.255
Salamanca	1.241
Barcelona	1.225
Real Sociedad	1.220
Las Palmas	1.211
Valencia	1.208
Albacete	1.206
Malaga	1.204
Atletico Madrid	1.202
Betis	1.197
Zaragoza	1.187
Logrones	1.187
Racing Santander	1.186
Se villa	1.185
Cordoba	1.182
Oviedo	1.182
Extremadura	1.180
Celta	1.178
Hercules	1.175
Osasuna	1.171
Rayo Vallecano	1.170
Lleida	1.166
Numancia	1.163
Valladolid	1.162
Espanyol	1.158
Badajoz	1.157
Recreativo	1.155
Compostela	1.154
Elche	1.153
Athletic Bilbao	1.150
Levante	1.150
Toledo	1.148
Jaén	1.146
Leganés	1.144
Merida	1.141
Eibar	1.135

Figure 1

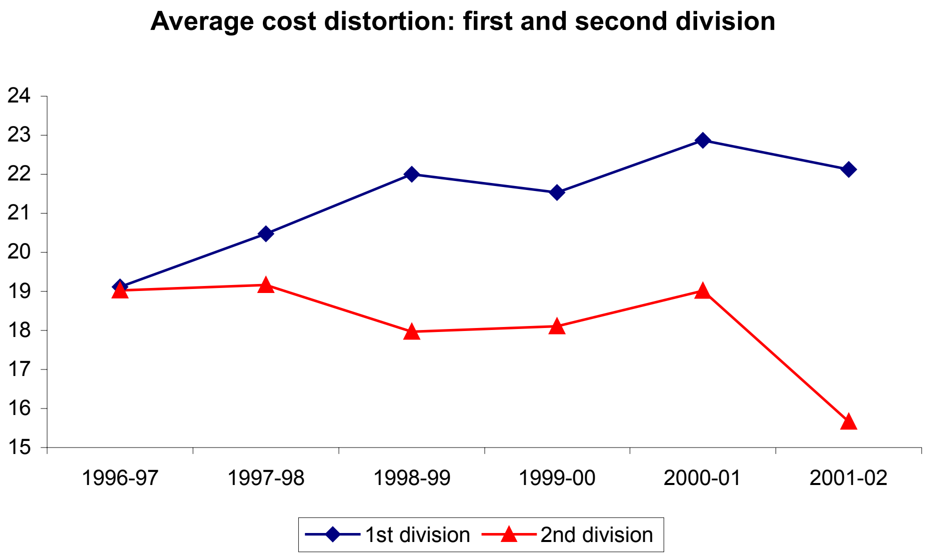

Figure 2

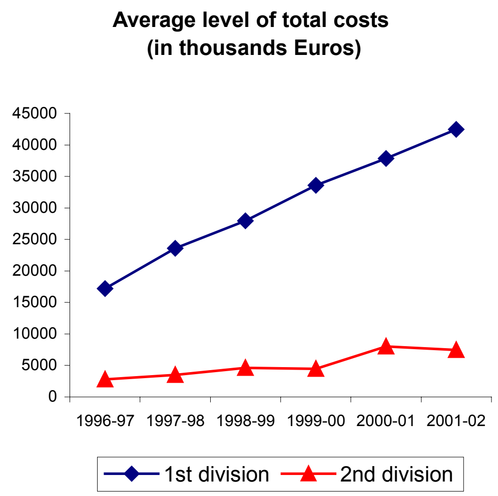

Figure3

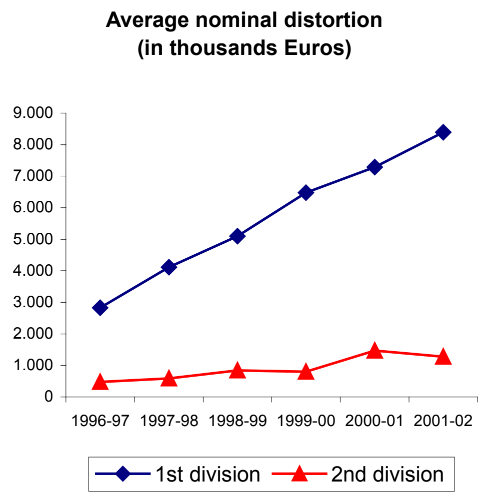

Table 6: Estimated distortion and current budget in thousands Euros (2001-2002)

Team	Distortion	Budget
Real Madrid	45,364	180,288
Barca	31,162	154,207
Valencia	15,815	72,296
Deportivo	10,349	57,091
Villarreal	7,238	27,043
Atlético Madrid*	5,925	36,058
Real Sociedad	5,425	31,112
Alavés	5,265	21,034
Celta	5,264	36,058
Tenerife*	5,063	21,034
Espanyol	5,021	31,851
Sporting*	4,837	16,827
Zaragoza	4,286	29,435
Athletic Bilbao	4,061	36,148
Mallorca	3,980	24,038
Betis*	3,929	24,038
Málaga	3,786	21,034
Las Palmas	3,372	21,635
Valladolid	2,770	19,832
Racing Santander	2,152	12,019
Sevilla*	1,977	18,029
Oviedo*	1,906	12,019
Rayo	1,883	12,019
Osasuna	1,760	11,418
Murcia*	1,273	7,212
Levante*	1,216	7,512
Córdoba*	1,187	7,212
Numancia	966	5,409
Xeres*	597	4,207
Extramadura*	542	3,606
Elche*	525	4,387
Jaén*	524	3,606
Albacete*	468	4,087
Leganés*	453	2,855
Recreativo*	409	3,305
Salamanca*	345	3,606
Badajoz*	322	2,704
Racing Ferrol*	300	2,404
Eibar*	271	2,404

Note: * Teams playing in second league**.**

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