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Abstract

We study the sharing of revenues raised from the collective sale of broadcasting rights for La Liga, which is strongly regulated by the Spanish government since 2015. Regulation imposes, somewhat surprisingly, that lower bounds and performance measures outweigh the capability (of each club) to generate resources from selling broadcasting rights. Also, more disturbingly, the latter dimension cannot be rationalized by a sharing rule with solid normative grounds.

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1 Introduction

For sports clubs, the sale of broadcasting and media rights is currently their biggest source of revenue. We have seen huge (and somewhat controversial) efforts to resume competitions worldwide in the aftermath of the COVID-19 pandemic's first wave in order to secure broadcasting contracts (in spite of having empty stadiums). This has been, for instance, the case of the Spanish Football League (La Liga), a multi-million euro business with an increasing trend in the last decades (at least, until the pandemic hit), which will be the focus of this paper.[1]

According to official barometers in 2014, 48% of Spanish citizens were interested in football and (funnily enough) 67.4% declared themselves followers of a certain professional club. Three quarters of those acknowledged to watch their club's games on TV, whenever they could. Back then, FC Barcelona and Real Madrid CF, the two Spanish giant football clubs, earned each more than 20% of the revenues generated from broadcasting La Liga. This was in stark contrast with North American sport leagues, where contracts essentially involve equal sharing (e.g., Fort and Quirk, 1995). But also with other major European football leagues. For instance, in England, back then, the two clubs earning more only made together 13% of the revenues generated by the Premier League.[2] This aspect outraged the remaining Spanish football clubs, to the extent that it became a political issue, which prompted the Spanish government to regulate the business of broadcasting games on TV.[3]

Regulation was, by no means, minor. A detailed (18-page long) Royal Decree appeared in the Official Bulletin of the Spanish State on May 1st, 2015, stating the urgent measures to be implemented. The main aspect was to impose a collective sale of broadcasting rights.[4] Thus,

[1]The reader is referred to García and Rodríguez (2002), Ascari and Gagnepain (2006), Artero and Bandrés (2017), or García et al., (2020) among others, for alternative analyses of different aspects of Spanish football. For other European cases, see, for instance, Baroncelli and Lago (2006), Barros (2006), Buraimo et al., (2006), Frick and Prinz (2006), Gouguet and Primault (2006), Morrow (2006), or Bond and Adessa (2020).

[2]Some might argue this was the main reason why in the last 15 editions of the Spanish Football League only once the champion was neither FC Barcelona nor Real Madrid CF, whereas the Premier League witnessed 5 different champions in its last 8 editions.

[3]In the era of streaming, sports still seem to be mostly consumed via television programming (e.g., Lee, 2019). This might, nevertheless, change soon. For instance, Netflix announced in the Summer of 2020 that games from Ligue 1 would soon be available in their platform.

[4]Falconieri et al., (2004) provide a welfare analysis of collective vs. individual sale of TV rights, a dichotomy we shall bypass here. See also Noll (2007).

an ensuing key problem arose in which the revenues collected from the sale had to be shared among the clubs. To solve this problem, strict guidelines were also enforced by the Spanish government. As explicitly stated in the corresponding Royal Decree, the aim was to "limit differences among participating entities" by means of an "equitative distribution" according to sport outcomes, ticket sales and the capability to generate resources from selling broadcasting rights. The first two dimensions are somewhat objective and, thus, easy to obtain (provided clubs are sufficiently transparent about their ticket sales). The last dimension is more difficult to address and, thus, deserves more attention.

To wit, suppose the game involving clubs A and B generates \$1 million. To simplify matters, we may assume each game has a constant pay-per-view fee, which we normalize to \$1. How much of it should be attributed to club A and how much to club B? To answer this question, we recently introduced a formal model in Bergantiños and Moreno-Ternero (2020a), in which two polar and somewhat focal rules are salient. On the one hand, the *equal-split* rule, which allocates the revenues from each game equally among the two clubs playing (and aggregates across games). On the other hand, *concede-and-divide*, which concedes each club the audience from its fan base and divides equally the residual. Therefore, the former rule favors clubs with a small fan base, whereas the latter favors clubs with a large fan base. In Bergantiños and Moreno-Ternero (2020b), we characterize (by means of three appealing normative axioms) a family of rules compromising among these two rules (by means of convex combinations of the solutions suggested by each of them). This family has the additional virtue of granting the existence of a majority voting equilibrium, when allowing clubs to vote for any rule within the family, as well as to yield outcomes that are fully ranked according to the Lorenz dominance criterion, the most fundamental principle for the evaluation of inequality (e.g., Dasgupta et al., 1973). Due to the previous feature, the parameter describing the family can be considered as an estimation of the portion of viewers who watch a game without being a fan of one of the clubs playing the game (who watch all the games that club plays). This is reminiscent of the concept of *neutral* (as opposed to *hard-core*) fans introduced by Szymanski (2001).[5] In other words, a low value of the parameter is associated with a large fan base (hard-core fans) for participating clubs, whereas a high value of the parameter is associated with a small fan base for participating clubs.

[5]See also Peeters (2012).

An important aspect of the rules mentioned above is that they are minimalistic with respect to the informational viewpoint. More precisely, they do not require to know the audience of each game throughout the season, but rather the overall audience of each club in the whole tournament. This allows us to use them even when there is limited available data (as, unfortunately, happens to be the case with La Liga and all the other European football leagues).

The guidelines described in the Royal Decree to share the revenues collected from broadcasting are silent about the rewards for the capability to generate resources from selling broadcasting rights. To be more precise, only two minimal requirements are imposed: 1) one sixth of the total amount must be allocated according to this dimension; 2) no club can get less than 2% or more than 20% of the allocation in this dimension. In contrast, strict guidelines are imposed for the remaining dimensions. To wit, one half of the total endowment must be shared equally among all clubs. One fourth of the total endowment must be shared proportionally to sport performance in the last 5 seasons (with a very precise weighting scheme for the performance of each club). Finally, one twelfth of the total endowment must be shared proportionally to economic performance (ticket sales) in the last 5 seasons. We shall scrutinize each of these options for all the dimensions being considered.

Our main message is that, in spite of the absence of strict guidelines for the broadcasting dimension, the actual allocation implemented by La Liga for that dimension cannot be properly rationalized. We also find arbitrary, and difficult to justify, the small relative weight given to this dimension (one sixth of the total amount). Maybe the reason was simply political, as a larger weight would improve the (relative and absolute) position of the two Spanish giant clubs, thus enhancing the reason that motivated the regulation in the first place.

As mentioned above, this paper is a new stage in our research agenda dealing with sharing the revenues raised from the collective sale of broadcasting rights (e.g., Bergantiños and Moreno-Ternero, 2020a; 2020b; 2020c; 2020d). As such, it connects to a literature dealing with broadcasting sports (e.g., Késenne, 2000; Cave and Crandall, 2001; Falconieri et al., 2004; Szymanski and Késenne, 2004; Noll, 2007; Peeters, 2011; 2012; Hansen and Tvede, 2016). It also touches the sizable literature on fair allocation (e.g., Thomson, 2017, 2019).

The rest of the paper is organized as follows. We introduce the model in Section 2. In Section 3, we apply our model to the case of La Liga. We conclude in Section 4.

2 The model

We consider an extension of the model introduced by Bergantiños and Moreno-Ternero (2020a). Let N describe a finite set of clubs playing in a certain league with a double round-robin format. Its cardinality is denoted by n. We assume $n \geq 3$. Let E denote the endowment (coming from the collective sale of broadcasting rights) to be allocated among clubs in N. We assume that a portion of the endowment (E_1) is split equally; another portion (E_2) is shared according to sport performance (table standings at the end of the season); another portion (E_3) according to economic performance (ticket sales); and the remaining portion ($E_4 = E - E_1 - E_2 - E_3$) according to broadcasting audiences. More precisely, we consider the following four dimensions:

1. **Lower bounds**. The first dimension secures a certain amount for each club. In the case of La Liga, this is an equal split of half the overall endowment. That is, $E_1 = \frac{E}{2}$ and
$$\varphi^1(E_1) = \left(\frac{E_1}{n}, \cdots, \frac{E_1}{n}\right).$$
Other portions of the overall endowment ($E_1 = \beta E$, for some $\beta \in [0, 1]$) are obviously feasible. Likewise, we may consider alternative (unequal) lower bounds. The literature on fair allocation is flooded with meaningful lower bounds with a long tradition of use. To consider alternative lower bounds in our case, one should resort to some (possibly, heterogeneous) *claim* of clubs. A natural one would be the total audience of the games played by the club throughout the season. Precisely, for problems of adjudicating conflicting claims, Moreno-Ternero and Villar (2004) introduced a pivotal lower bound, which is one n-th of the truncated claim (by the available endowment for this dimension, i.e., E_1).

2. **Sport performance**. Let $\rho = (\rho_1, \ldots, \rho_n)$ denote the index of sport performance for all clubs in the league. In the case of La Liga, this index is a weighted average of the table standings in the last 5 seasons. Other options are obviously feasible. For instance, it seems more compelling to consider instead cardinal information -scorings- rather than just ordinal information at the end of the season. In other words, Atlético Madrid's performance in the season 2018/2019 (second place with 76 points) seems to be poorer than Real Madrid's performance in the season 2014/2015 (second place with 92 points) and, therefore, we might want to reward them differently. Furthermore, La Liga suggests $E_2 = \frac{E}{4}$, and a proportional allocation of this amount according to the index, i.e.,
$$\varphi^2(E_2) = (\sigma\rho_1, \ldots, \sigma\rho_n),$$

where $\sigma = \frac{E_2}{\sum_{i=1}^{n} \rho_i} = \frac{\frac{E}{4}}{\sum_{i=1}^{n} \rho_i}$. Alternatives to the proportional allocation are also feasible. Here, we can also resort to the sizable literature on the adjudication of conflicting claims (e.g., O'Neill, 1982; Thomson, 2019).

3. **Economic performance**. Let $\xi = (\xi_1, \ldots, \xi_n)$ denote the index of economic performance for all clubs in the league. In the case of La Liga, this index is an average of the (game and season) ticket sales in the last 5 seasons. Other relevant economic dimensions are ignored (for instance, merchandising and transfer fees). La Liga suggests $E_2 = \frac{E}{12}$, And the suggested allocation is, again, proportional according to the index, i.e.,

$$\varphi^3(E_3) = (\tau\xi_1, \ldots, \tau\xi_n),$$

where $\tau = \frac{E_3}{\sum_{i=1}^{n} \xi_i} = \frac{\frac{E}{12}}{\sum_{i=1}^{n} \xi_i}$. As mentioned above, alternatives to the proportional allocation are also feasible.

4. **Broadcasting performance**. In this dimension, La Liga is silent.[6] This is surprising because it refers to the crucial aspect ultimately driving revenues. TV platforms will be eager to broadcast highly demanded games to attract more consumers and sponsors. So it seems natural to reward clubs bringing more audiences. We then resort to our prior work on this topic to address this dimension.

   Formally, for each pair of clubs $i, j \in N$, we denote by a_{ij} the broadcasting audience (number of viewers) for the game played by i and j at i's stadium. We use the notational convention that $a_{ii} = 0$, for each $i \in N$. Let $A \in \mathcal{A}_{n\times n}$ denote the resulting matrix of broadcasting audiences generated in the whole tournament involving the clubs within N.

   Let $\alpha_i(A)$ denote the total audience achieved by club i, i.e.,

$$\alpha_i(A) = \sum_{j\in N}(a_{ij} + a_{ji}).$$

   Without loss of generality, we normalize the revenue generated from each viewer to 1 (to be interpreted as the "pay per view" fee). Thus, we sometimes refer to $\alpha_i(A)$ as the *claim* of club i, as suggested above. When no confusion arises, we write α_i instead of $\alpha_i(A)$.

[6] The only proviso is that no club receives more than 20% or less than 2% of the overall endowment for this dimension, and that $E_4 = \frac{E}{6}$.

We define $\overline{\alpha}$ as the average audience of all clubs. Namely,

$$\overline{\alpha} = \frac{\sum_{i \in N} \alpha_i}{n}.$$

For each $A \in \mathcal{A}_{n \times n}$, let $||A||$ denote the total audience of the tournament. Namely,

$$||A|| = \sum_{i,j \in N} a_{ij} = \frac{1}{2} \sum_{i \in N} \alpha_i = \frac{n\overline{\alpha}}{2}.$$

A broadcasting rule is a mapping that associates with each (audience) matrix the list of the amounts the clubs get from the total (broadcasting) revenue. Thus, formally, $R : \mathcal{A}_{n \times n} \to \mathbb{R}^n$ is such that, for each $A \in \mathcal{A}_{n \times n}$,

$$\sum_{i \in N} R_i(A) = ||A||.$$

If we interpret a broadcasting rule as the index of broadcasting performance, then, consistently with the previous two dimensions, we assume that the allocation is proportional according to the index, i.e.,

$$\varphi^4(E_4) = \left(\kappa R_1(A), \cdots, \kappa R_n(A)\right),$$

where $\kappa = \frac{E_4}{||A||} = \frac{\frac{E}{6}}{||A||}$, where the last equality follows from La Liga's suggestion regarding this dimension. As mentioned above, alternatives to the proportional allocation are also feasible.

Two rules stand out as focal for this problem (e.g., Bergantiños and Moreno-Ternero, 2020a). First, the so-called *equal-split rule*, which splits equally the audience of each game a_{ij} among the two clubs, thus ignoring the existence of fans for each club. The total audience assigned to each club is computed as the sum, over all games played by such club, of the audiences assigned to each game. Formally,

Equal-split rule, ES: for each $A \in \mathcal{A}_{n \times n}$, and each $i \in N$,

$$ES_i(A) = \frac{\alpha_i}{2}.$$

Second, the so-called *concede-and-divide*, which concedes each club its number of fans and divides equally the rest.[7]. For each club i we estimate f_i, the number of fans of club

[7]The term was coined by Thomson (2003) in a different setting.

i. Now, for each game, a_{ij} is didided as follows: i receives $f_i + \frac{a_{ij}-f_i-f_j}{2}$ and j receives $f_j + \frac{a_{ij}-f_i-f_j}{2}$. Again, the total audience assigned to each club is computed as the sum over all games played by such club. Bergantiños and Moreno-Ternero (2020a) prove that this rule could be computed through the following formula.

Concede-and-divide, CD: for each $A \in \mathcal{A}_{n\times n}$, and each $i \in N$,

$$CD_i(A) = \frac{(n-1)\,\alpha_i - ||A||}{n-2}.$$

The two rules are somewhat extreme (and polar) in their treatment of (*neutral* versus *hard-core*) fans. That is why in Bergantiños and Moreno-Ternero (2020b) we consider a family of rules that offer a compromise between the *equal-split rule* and *concede-and-divide*. They are defined as convex combinations of the two rules. Formally,

Compromise rules, $\left\{C^\lambda\right\}_{\lambda\in[0,1]}$: for each $\lambda \in [0,1]$, each $A \in \mathcal{A}_{n\times n}$, and each $i \in N$,

$$C_i^\lambda(A) = (1-\lambda)ES_i(A) + \lambda CD_i(A).$$

At the risk of stressing the obvious, note that when $\lambda = 0$ then C^λ coincides with the *equal-split* rule, whereas when $\lambda = 1$ then C^λ coincides with *concede-and-divide*. That is, $C^0 \equiv ES$ and $C^1 \equiv CD$.

It turns out that the family encompasses all rules satisfying three basic (and normatively solid) axioms, referring to principles (such as impartiality) with a long tradition of use in the theory of justice (e.g., Moreno-Ternero and Roemer, 2006).

In summary, La Liga's proposed scheme is the following:

$$\begin{aligned}\Phi^R_{\rho,\xi}(E) &= \Phi^R_{\rho,\xi}(E_1+E_2+E_3+E_4) = \sum_{i=1}^{3}\varphi^i(E_i) + R(E_4)\\ &= \left(\frac{E_1}{n},\cdots,\frac{E_1}{n}\right) + (\sigma\rho_1,\ldots,\sigma\rho_n) + (\tau\xi_1,\ldots,\tau\xi_n) + (\kappa R_1(A),\cdots,\kappa R_n(A)),\end{aligned}$$

where $E_1 = \frac{E}{2}$, $\rho = (\rho_1,\ldots,\rho_n)$ is the sport performance index, $\sigma = \frac{E_2}{\sum_{i=1}^n \rho_i} = \frac{\frac{E}{4}}{\sum_{i=1}^n \rho_i}$, $\xi = (\xi_1,\ldots,\xi_n)$ is the economic performance index, $\tau = \frac{E_3}{\sum_{i=1}^n \xi_i} = \frac{\frac{E}{12}}{\sum_{i=1}^n \xi_i}$, $\kappa = \frac{E_4}{||A||} = \frac{\frac{E}{6}}{||A||}$, and R is an unspecified broadcasting rule as those introduced above.

3 The real life case

We now take the model introduced above to the data. The 20 clubs playing La Liga during the season 2017-18, and the allocation of the revenues raised from selling the broadcasting rights for that season (in millions of euros and in percentage terms) are in Table 1.[8] As we can see, two clubs (Barcelona and Real Madrid) dominated the sharing, collecting (when combined) almost 23% of the pie. This is, nevertheless, a considerable reduction from previous years in which they collected together almost one half of the pie (as mentioned at the introduction).

According to the guidelines in the Royal Decree, half of the overall revenue was shared equally. This means 33.14 million euros for each club. This appears in Column 4 (Lower bound) of Table 1.

One quarter of the overall revenue is shared according to league performance. By league performance, La Liga refers to a weighting system considering the standings at the end of the previous five seasons. More precisely, the champion in a given season gets 17% of the amount that season. The second one gets 15%. It continues down the line with 13%, 11%, 9%, 7%, 5%, 3.5%, 3%, 2.75%, 2.5%, 2.25%, 2%, 1.75%, 1.5%, 1.25%, 1%, 0.75%, 0.5% and 0.25%, respectively. A zero score is given to those clubs that played in the second division, or below, in one of those years. One quarter of the budget is then allocated proportionally to the resulting weighted average of those 5-year standings, with a weight of 35% for the last season, 20% for the previous to last season and 15% for each of the other three. This appears in Column 5 (Performance) of Table 1.

One twelfth of the overall revenue is shared proportionally to economic performance, to be understood as the average amount raised by each club in ticketing during the last 5 seasons. This appears in Column 6 (Ticket sales) of Table 1.[9]

The last column of Table 1 gathers the residual amounts for each club, to be interpreted as the amounts associated to the capability of each club to generate resources from selling broadcasting rights. We shall focus on this (key) dimension first.

[8] The source is La Liga's website. See, for instance, http://www.laliga.es/lfp/reparto-ingresos-audiovisuales

[9] For this, we consider data on season tickets for the previous three seasons, which are the only ones available, obtained from Palco 23, the leading newspaper in economic information of the sport business in Spain. See, for instance, https://www.palco23.com/clubes/los-clubes-arrancan-la-liga-santander-con-cerca-de-600-000-abonados.html and https://www.palco23.com/clubes/los-clubes-de-primera-y-segunda-rozan-los-800000-abonados-en-2017-2018.html

Insert Table 1 about here

3.1 Broadcasting performance

As mentioned above, one sixth of the overall amount (i.e., 220.93 millions) is allocated according to the capability of each club to generate resources from selling broadcasting rights. We can therefore compute directly the allocations provided for that amount by any of the rules described in Section 2 and compare with the way in which La Liga actually allocates this amount (Table 2, Column 4). To do so, we need first the overall audience (in millions) of each club (during the season 2017-2018) which are listed into Column 2 of Table 2.[10] Their normalizations are listed into Column 3 of Table 2.[11]

Insert Table 2 about here

Columns 5 and 9 in Table 2 provide the allocations given by the *equal-split* and *concede-and-divide* rules for that portion of the budget. Column 7 does the same for the *intermediate compromise* rule, i.e., the rule $C^{0.5}$. The corresponding allocations in relative terms (percentages) appear in Columns 6, 8 and 10, respectively. In the last column of this table (Column 11), we explore whether the amount obtained by each club in the allocation used in practice corresponds to some *compromise* rule. For instance, Real Madrid receives the amount that the rule $C^{0.85}$ would yield for this setting. In contrast, Betis receives less than the amount proposed by any rule within the family because $5.27 < \min\{15.70, 20.86\}$. On the other hand, Barcelona receives more than the amount proposed by any rule within the family because $41.51 > \max\{25.28, 41.10\}$.

Viewers of each game can essentially be divided in two categories: those watching the game because they are fans of one of the clubs playing and those watching the game because they thought that the specific combination of clubs rendered the game interesting. As mentioned above, and in line with Szymanski (2001), we refer to them as *hard-core* (club) fans and *neutral* (football) fans, respectively. We argue that the revenue generated by the first category should

[10] The data come again from Palco 23, which refers to Havas Sports and Entertainment as its source.

[11] The total audience of the entire season is 197.05 millions, and the total revenue to allocate in this dimension is 220.93 millions of euros. Thus, to identify total audience with total revenue, we have to scale up audiences proportionally.

be allocated to the corresponding club, whereas the revenue generated by the second category should be divided equally between both clubs.[12]

The *equal-split* rule and *concede-and-divide* are two extreme rules from the point of view of treating fans. The former assumes that only *neutral fans* exist. The latter assumes that there are as many *hard-core fans* as possible (compatible with the real data). Thus, the allocation obtained by a club should be somewhat in between the allocations proposed by both rules to such a club. In other words, there should be a rule within the compromise rules explaining the outcome for each club. We can infer from Table 2 that less than half of clubs obtain amounts that can be rationalized by some *compromise* rule, i.e., within the amounts suggested by the *equal-split* and *concede-and-divide* rules. More precisely, we observe that six clubs are favored by the actual allocation, in the sense that the amount each gets is above the amounts suggested by any *compromise* rule. Five clubs obtain amounts below those suggested by the members of the *compromise* rules. The remaining nine clubs obtain amounts suggested by the compromise rule whose parameter is given by the corresponding cell in the last column. Note that one cannot infer from here that the allocation implemented by La Liga favors clubs with lower or higher audiences. The "above" category includes clubs such as Barcelona (the second most watched club) and Leganés (the least watched club). The "below" category includes clubs such as Betis (the third most watched club) and Villareal (the fifth least watched club). Clubs with intermediate audiences (such as Athletic Bilbao or Español) might belong to one or the other category.

It is also remarkable to notice that the axiom of *Symmetry* is not verified, as two clubs (Real Sociedad and Girona) have equal audiences but obtain (quite) different amounts. As a matter of fact, we have several related disturbing features too. For instance, Real Madrid has a higher audience than Barcelona but receives a smaller amount. The case of Betis is even more remarkable, as it has the third largest audience but it actually receives the fourth smallest amount (only above those obtained by Valencia, Getafe and Villarreal).[13]

In what follows, we analyze, step by step, the other dimensions considered in the Royal Decree.

[12]Forrest et al., (2005) empirically identify that neutral fans are more likely to create increased demand for televised matches than they are to increase demand for stadium seating.

[13]A caveat though is that Betis had more games broadcasted in non-subscription TV than the other clubs.

3.2 Lower bounds

The first requirement in the Royal Decree is to share equally half of the overall endowment. That means a fixed amount (33.14 million) for each club. But we could do differently, guaranteeing a reasonable (but not necessarily fixed) lower bound for each club. It goes without saying that such a move would benefit teams with larger audiences.

A natural option to set the reasonable lower bound (RLB) comes from the literature on adjudicating conflicting claims (e.g., O'Neill, 1982; Thomson, 2019) and it sets the bound at one n-th of the claim of each club, or the endowment to share (whichever is smaller). Formally, we define the profile of reasonable lower bounds as $b = (b_i)_{i \in N}$, where, for each $i \in N$,

$$b_i = \frac{1}{n} \min\{\alpha_i, E_1\}.$$

For instance, in the case of Real Madrid,

$$b_{RM} = \frac{1}{20} \min\{316.85, 662.8\} = 15.84.$$

Now, given the configuration of the problems we are considering, these lower bounds (when aggregated) amount only to one tenth of the overall amount. If, following the suggestion in the Royal Decree, we want to allocate one half of the overall amount in lower bounds, we can simply scale up all those amounts (multiplying by 5 each). This is what appears in Column 4 at Table 3.

Alternatively, we could devote the remaining portion of this first one half of the endowment to the broadcasting dimension, while leaving the others constant. In other words, we would allocate each club its reasonable lower bound and then 17/30 of the overall endowment (one sixth was already devoted to the broadcasting performance, whereas two fifths would be the extra coming from this lower bounds dimension) would be shared according to a broadcasting rule. Note that, if the rule happens to be the *equal-split* rule, then the allocation coincides with the suggestion made above (allocating five times its reasonable lower bound to each team). With any other rule, we would have different amounts. The last columns of Table 3 gather the amounts for the case of the *intermediate compromise* rule ($C^{0.5}$) and *concede-and-divide*, respectively.

Insert Table 3 about here

3.3 Sport performance

As mentioned above, the Royal Decree requires to share a quarter of the overall endowment based on sport performance in the last 5 seasons. But this is done according to a specific (and somewhat arbitrary) weighting scheme for the ordinal standings in each season. We consider two plausible alternatives here.

One modifies the weighting scheme to consider a homogeneous one in which each step is equally distant from each other. In the same vein as the Premier League, we consider that, in each season, the champion gets 20 points, whereas the second gets 19 points, the third gets 18 points and so on until the last one gets 1 point. Then, the allocation is made proportionally to the overall score obtained after a weighted aggregation of the last 5 seasons, with weights being 35% for the last one, 20% for the previous to last, and 15% for the remaining three. The results appear in the third column of Table 4 (Homogeneous).

The second alternative considers a scheme determined by the cardinal information offered by the scoring at the end of the season (and not just the ranking). Each club would get, each season, an amount equal to the points obtained and, again, the allocation is made proportionally to the overall score obtained after a weighted aggregation of the last 5 seasons, with weights being 35% for the last one, 20% for the previous to last, and 15% for the remaining three. The results appear in the fourth column of Table 4 (Points).

Insert Table 4 about here

We can observe from Table 4 that the two powerhouses (Real Madrid and Barcelona), as well as Atlético de Madrid, are largely favored by the current scheme in practice for this dimension. On the other edge, the majority of the remaining clubs are worse treated with that scheme than with the others. Based on this, one is tempted to say that the egalitarian desideratum in the first dimension is not only forgotten with this one, but, actually, somewhat swallowed. Replacing the egalitarian lower bound by the more sensible allocation of (reasonable) lower bounds, and considering an alternative scheme in the performance dimension might have a similar overall effect.

3.4 Economic performance

The Royal Decree also requires to share one twelfth of the overall endowment proportionally to economic performance in the last 5 seasons.[14] By economic performance, La Liga refers to the revenues generated from ticket sales in the last five seasons. We found problems to obtain the data for this dimension. As a matter of fact, we only have data on season tickets (which are less expensive, per capita, than individual game tickets) for three seasons (instead of five). With that main caveat in mind, we can still observe that strong clubs (mostly Barcelona and Real Madrid, but also Atlético Madrid) are largely favored in this dimension too.

We then suggest alternative protocols. To do so, we resort again to the literature on adjudicating conflicting claims. Instead of proportional allocation, we can consider one of the other three classical rules to solve claims problems, which can be traced back to ancient sources such as the Talmud or Maimonides (e.g., Thomson, 2019). More precisely, the constrained equal awards rule (CEA) distributes the endowment equally among all agents, subject to no agent receiving more than she claims. The constrained equal losses rule (CEL) imposes that losses are as equal as possible subject to no one receiving a negative amount. Finally, the Talmud rule behaves like the first or the second rule, depending on whether the endowment falls short or exceeds one half of the aggregate claim, using half-claims instead of claims. Formally, if $c = (c_i)_{i \in N}$ denotes the profile of claims and E the amount to divide, then

- $CEA(c, E) = (\min\{c_i, \lambda\})_{i \in N}$, where $\lambda \geq 0$ is chosen so that $\sum_{i \in N} \min\{c_i, \lambda\} = E$.
- $CEL(c, E) = (\max\{0, c_i - \lambda\})_{i \in N}$, where $\lambda \geq 0$ is chosen so that $\sum_{i \in N} \max\{0, c_i - \lambda\} = E$.
- $T(c, E) = \left(\min\{\frac{1}{2}c_i, \lambda\}\right)_{i \in N}$ if $E \leq \frac{1}{2}\sum_{i \in N} c_i$ and $T(c, E) = \left(\max\{\frac{1}{2}c_i, c_i - \lambda\}\right)_{i \in N}$ if $E \geq \frac{1}{2}\sum c_i$, where λ is chosen so that $\sum_{i \in N} T_i(c, E) = E$.

Table 5 reports the allocations obtained with each of these rules when the endowment is one twelfth of the overall revenue (namely, 110.46) and the claim of each club is the average of ticket sales in the three seasons (collected in Column 2). Because the endowment is almost one half of the aggregate claim, the proportional and Talmud outcomes (Columns 3 and 6, respectively) are quite similar. The constrained equal-awards allocation favors small clubs whereas the constrained equal-losses allocation favors large clubs.

Insert Table 5 about here

[14] This is part of what La Liga dubbed *social relevance*, together with the broadcasting dimension.

3.5 Further insights

As mentioned above, the *equal-split* rule and *concede-and-divide* are two extreme rules from the point of view of the fan effect and one would like to compromise between them. We have provided a whole family of *compromise rules*, but should we pick one among them?

The *equal-split* rule panders *neutral fans*, whereas *concede-and-divide* does so with *hard-core fans*. In practice, we know the total number of viewers of each game, but not the partition in those two categories. Nevertheless, it is possible to estimate the average number of *hard-core fans* and *neutral fans* watching the games. For instance, we can take a sample of viewers and ask them to report the games they have watched, and if they are *hard-core fans* of some club. Let p_h denote the percentage of viewers who have watched a game being a *hard-core fan* of some of the clubs. Then, $1 - p_h$ denote the percentage of viewers who have watched a game without being a *hard-core fan* of some of the clubs. In Bergantiños and Moreno-Ternero (2020b), we argue that C^{p_h} could be a salient rule among those within the family of compromise rules.

Unfortunately, we do not know p_h. Thus, we have considered the *compromise* rule that yields a closer allocation to the allocation given by Column 4 in Table 2 (according to the Euclidean distance), which is the rule corresponding to $\lambda = 0.71$. Notice that according to official barometers in 2014, 67.4% declared themselves followers of a certain professional club, which confirms that such 0.71 could be a reasonable estimation of p_h.

We then decided to compare in Table 6 the allocation being implemented by La Liga (second column in that table) with the allocation provided by the rule $C^{0.71}$ (third column in that table). We observe from that table that one club (Betis) obtains in the allocation implemented by La Liga 14.1 millions of euros less than with $C^{0.71}$. Other five clubs (Valencia, Celta, Español, Villareal and Getafe) also obtain less (with deficits ranging from 0.23 millions, in the case of Getafe, to 7.67 millions, in the case of Valencia). The remaining fourteen clubs (including Barcelona and Real Madrid) obtain more (with surplus ranging from 0.08 millions, in the case of Sevilla, to 5.75 millions, in the case of Real Sociedad).

Insert Table 6 about here

4 Discussion

We have expanded our research agenda on the problem of sharing the revenues from the collective sale of broadcasting rights for sports leagues, to analyze in detail the specific case of La Liga, the Spanish Football League, which was highly regulated by the Spanish government in 2015. Our analysis indicates that the (minoritarian) portion of the endowment allocated based on audiences is not rationalized, which casts doubts on the allocation implemented by the Spanish Football League Association.

We, nevertheless, believe that some interesting lessons can be obtained from the hybrid schemes suggested by the Spanish Football League Association.

On the positive side, they guarantee all participating clubs lower bounds, which have a long tradition in normative work (e.g., the conflicting claims literature, or the fair allocation literature). They also compromise between the "needs-blind" view carried by performance pay and the "incentives-blind" view carried by an equal sharing of the whole pie, which seems to be another reasonable desideratum.

On the negative side, a key aspect of hybrid schemes is to decide how to share a portion of the pie based on audiences and, as mentioned above, that does not seem to be sufficiently justified in the allocation implemented by the Spanish Football League.

Given that performance measures require enriching the informational basis of the model (bringing a new prior into the problem), one might consider first *semi-hybrid* rules in which only lower bounds and broadcasting rules are combined. For instance, consider the rule in which one half of the overall amount is equally shared whereas the other half is shared according to the *equal-split* rule. Formally, for each $A \in \mathcal{A}_{n\times n}$, and each $i \in N$,

$$ES_i^h(A) = \frac{||A||}{2n} + \frac{1}{2}ES_i(A),$$

It turns out this rule is precisely the intermediate member of the UE-family of rules we study elsewhere (e.g., Bergantiños and Moreno-Ternero, 2020d).[15]

Likewise, we could consider *concede-and-divide* instead of the *equal-split* rule in the above definition. Formally, for each $A \in \mathcal{A}_{n\times n}$, and each $i \in N$,

$$CD_i^h(A) = \frac{||A||}{2n} + \frac{1}{2}CD_i(A).$$

[15]If instead of considering equal weights for the lower bound and the equal-split rule, we consider all possible convex combinations, we obtain the whole family.

Then, the rule is precisely the intermediate member of the UC-family of rules we also study elsewhere (e.g., Bergantiños and Moreno-Ternero, 2020d).[16]

We acknowledge that there are additional aspects (going beyond audience figures) that might be relevant for the sharing process. Performance is certainly one of them, and we elaborated on that above (along the lines suggested by La Liga and beyond). Nevertheless, one might argue that performance will also be somewhat reflected in the audience matrix. Performing well might increase the number of fans. Or, at the very least, (if one endorses a stronger conception of fans, connected to identity), one should at least accept that performing well should attract more "neutral viewers", i.e., individuals interested in watching some games played by that club.

Additional sources of revenue, such as qualification to other tournaments and merchandising, transferring players, or ticket sales, are certainly relevant too. Nevertheless, as we write at the introduction, the sale of broadcasting and media rights is now the biggest source of revenue for most sports clubs. Furthermore, we believe that these additional sources have a different nature to broadcasting revenues, which are collectively obtained. Merchandising is mostly individual. The same could be argued for performance bonuses (such as qualifying for other tournaments), transfers or ticket sales (although some competitions impose partial sharing on revenues from ticket sales, typically, these are entirely handled by the club owning the stadium).

Regarding ticketing, we believe it would be interesting to address the problem of setting the optimal pricing of season versus game tickets for each club. This is a similar problem to the so-called museum pass problem (e.g., Ginsburgh and Zang, 2003; Bergantiños and Moreno-Ternero, 2015), a specific problem of sharing the revenue from bundled pricing. A proper analysis of this problem would require to deal with the complex relationships that might exist between both prices.[17] This sort of considerations are beyond the scope of this paper.

We conclude acknowledging that we have not treated another interesting (and somewhat related) issue, also beyond the scope of the paper: the (optimal) number of clubs participating in a league. As of today, only one of the five major football leagues in Europe does not have

[16]If instead of considering equal weights for the lower bound and concede-and-divide, we consider all possible convex combinations, we obtain the whole family.

[17]Betis, an important club from La Liga had a related controversial issue after the COVID-19 cancellation of the last games of the 2019/2020 season. Instead of returning the proportional amount of the season tickets for the cancelled games, it decided to return (with several alternatives to the direct cash rebate) a lower amount. The rationale was that none of the cancelled games were against the most attractive clubs in La Liga (namely, the two powerhouses Real Madrid, Barcelona, as well as Sevilla, the historic rival from the same town).

20 clubs.[18] Nevertheless, the co-called Project Big Picture, recently unveiled, is suggesting the Premier League cut from 20 to 18 clubs (with the Championship, League One and League Two each retaining 24 teams) and this trend might eventually be followed by La Liga, Serie A and Ligue 1. We believe there are several potential arguments playing a role in this decision. One could indeed be to maximize the joint revenues from broadcasting. More clubs imply more games to be broadcasted and, in principle, more revenues to be collected. On the other hand, one might argue that too many games might exhaust viewers and, thus, audiences might be hurt (which would eventually be translated into lower revenues from broadcasting). Another is a feasibility condition given by the calendar (a year simply cannot accommodate too many games, especially in sports like football in which it is compulsory to have at least 48 hours between two games played by a same club, and international competitions coexist with domestic ones). Entry costs can also impose a relevant feasibility condition. For instance, participating clubs might be required to own a stadium with a sufficiently large capacity. Political considerations might even play a role (as in the case described in the footnote above). Finally, strong clubs (which have stronger additional sources of revenue, mostly related to international competitions) normally favor smaller numbers, whereas weak clubs favor higher numbers, which requires a bargaining protocol.

[18]Incidentally, the Spanish league had 22 clubs for a short period following a bizarre situation (with strong political ramifications) that occurred in 1995. During the summer of that year, the National Football League Association decided to relegate Sevilla FC and Celta de Vigo to the third division due to a lack of documents proving the economic viability of their budgets. Two clubs from the second division (Albacete and Real Valladolid) were promoted to get their seats in La Liga (and the same was done from the third to the second division). In the aftermath of that decision, massive demonstrations occurred in Seville and Vigo, which even prompted the Spanish government to request the National Football League admitting both clubs back into La Liga. To avoid counterpart demonstrations in Albacete and Valladolid, a *Solomonic* (and somewhat chaotic) decision was taken: it was sanctioned that La Liga would have 22 clubs during the upcoming two seasons. For the season 1997/1998, La Liga returned back to the 20-club format (whereas the second division endorsed then a 22-club format that lasts until today).

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Table 1. Breakdown of La Liga's allocation across dimensions

Club	Alloc. 17-18	Alloc. 17-18 (%)	Lower bound	Performance	Ticket sales	Residual
Real Madrid	148,00	11,16	33,14	49,08	24,81	40,96
Barcelona	154,00	11,62	33,14	55,56	23,79	41,51
Betis	52,90	3,99	33,14	10,91	3,59	5,27
Atlético Madrid	110,60	8,34	33,14	48,74	11,57	17,15
Valencia	65,70	4,96	33,14	23,22	6,17	3,17
Sevilla	74,00	5,58	33,14	25,22	5,72	9,92
Celta	52,90	3,99	33,14	10,65	2,07	7,04
Málaga	53,50	4,04	33,14	6,60	2,46	11,29
Athletic Bilbao	73,20	5,52	33,14	17,68	12,15	10,23
Español	52,40	3,95	33,14	8,69	3,69	6,88
Las Palmas	46,80	3,53	33,14	3,07	2,77	7,82
Levante	45,10	3,40	33,14	4,22	0,83	6,91
Girona	43,30	3,27	33,14	3,28	0,34	6,53
Real Sociedad	61,50	4,64	33,14	12,70	3,68	11,98
Deportivo Coruña	46,00	3,47	33,14	3,15	2,74	6,97
Villareal	65,50	4,94	33,14	29,65	1,73	0,98
Alavés	46,10	3,48	33,14	4,13	1,02	7,81
Getafe	44,50	3,36	33,14	6,22	0,54	4,60
Eibar	46,30	3,49	33,14	6,73	0,38	6,05
Leganés	43,30	3,27	33,14	1,87	0,42	7,87
Total	1325,60	100,00	662,80	331,40	110,47	220,93

Table 2. Broadcasting performance

Club	Audiences	Norm aud.	Alloc 17-18	ES	ES (%)	C^{0,5}	C^{0,5} (%)	CD	CD (%)	C^lambda
Real Madrid	47,10	52,81	40,96	26,40	11,95	34,94	15,81	43,47	19,67	0,85
Barcelona	45,10	50,57	41,51	25,28	11,44	33,19	15,02	41,10	18,60	Above
Betis	28,00	31,39	5,27	15,70	7,10	18,28	8,27	20,86	9,44	Below
Atlético Madrid	25,50	28,59	17,15	14,30	6,47	16,10	7,29	17,90	8,10	0,79
Valencia	19,50	21,86	3,17	10,93	4,95	10,87	4,92	10,80	4,89	Below
Sevilla	18,50	20,74	9,92	10,37	4,69	10,00	4,52	9,62	4,35	0,60
Celta	17,80	19,96	7,04	9,98	4,52	9,39	4,25	8,79	3,98	Below
Málaga	17,60	19,73	11,29	9,87	4,47	9,21	4,17	8,56	3,87	Above
Athletic Bilbao	17,20	19,28	10,23	9,64	4,36	8,86	4,01	8,08	3,66	Above
Español	16,70	18,72	6,88	9,36	4,24	8,43	3,81	7,49	3,39	Below
Las Palmas	15,90	17,83	7,82	8,91	4,03	7,73	3,50	6,54	2,96	0,46
Levante	15,10	16,93	6,91	8,46	3,83	7,03	3,18	5,60	2,53	0,54
Girona	14,90	16,71	6,53	8,35	3,78	6,86	3,10	5,36	2,43	0,61
Real Sociedad	14,90	16,71	11,98	8,35	3,78	6,86	3,10	5,36	2,43	Above
Deportivo Coruña	14,30	16,03	6,97	8,02	3,63	6,33	2,87	4,65	2,10	0,31
Villareal	13,80	15,47	0,98	7,74	3,50	5,90	2,67	4,06	1,84	Below
Alavés	13,70	15,36	7,81	7,68	3,48	5,81	2,63	3,94	1,78	Above
Getafe	13,50	15,14	4,60	7,57	3,43	5,64	2,55	3,70	1,68	0,77
Eibar	13,10	14,69	6,05	7,34	3,32	5,29	2,39	3,23	1,46	0,32
Leganés	11,90	13,34	7,87	6,67	3,02	4,24	1,92	1,81	0,82	Above
Total	394,10	441,86	220,93	220,93	100,00	220,93	100,00	220,93	100,00	

Table 3. Lower bounds

Club	Alloc 17-18	Norm aud.	5RLB=RLB+ES	RLB+C^{0.5}	RLB+CD
Real Madrid	33,14	316,85	79,21	99,69	120,17
Barcelona	33,14	303,40	75,85	94,83	113,81
Betis	33,14	188,36	47,09	53,29	59,49
Atlético Madrid	33,14	171,54	42,89	47,22	51,55
Valencia	33,14	131,18	32,80	32,64	32,49
Sevilla	33,14	124,45	31,11	30,21	29,31
Celta	33,14	119,74	29,94	28,51	27,09
Málaga	33,14	118,40	29,60	28,03	26,45
Athletic Bilbao	33,14	115,71	28,93	27,05	25,18
Español	33,14	112,34	28,09	25,84	23,59
Las Palmas	33,14	106,96	26,74	23,90	21,05
Levante	33,14	101,58	25,40	21,95	18,51
Girona	33,14	100,24	25,06	21,47	17,88
Real Sociedad	33,14	100,24	25,06	21,47	17,88
Deportivo Coruña	33,14	96,20	24,05	20,01	15,97
Villareal	33,14	92,84	23,21	18,80	14,38
Alavés	33,14	92,16	23,04	18,55	14,06
Getafe	33,14	90,82	22,70	18,07	13,43
Eibar	33,14	88,13	22,03	17,09	12,16
Leganés	33,14	80,05	20,01	14,18	8,35
sum	662,80	2.651,20	662,80	662,80	662,80

Table 4. Sport performance

Club	Alloc 17-18	Homogeneous	Points
Real Madrid	49,08	30,90	29,78
Barcelona	55,56	32,47	31,80
Betis	10,91	16,36	13,68
Atlético Madrid	48,74	30,82	28,42
Valencia	23,22	22,47	20,97
Sevilla	25,22	25,12	22,05
Celta	10,65	17,19	14,90
Málaga	6,60	12,56	13,11
Athletic Bilbao	17,68	19,17	19,39
Español	8,69	16,28	17,23
Las Palmas	3,07	5,95	7,69
Levante	4,22	8,18	11,71
Girona	3,28	6,36	6,21
Real Sociedad	12,70	18,84	18,41
Deportivo Coruña	3,15	6,11	10,06
Villareal	29,65	26,19	21,65
Alavés	4,13	8,01	9,56
Getafe	6,22	11,48	10,77
Eibar	6,73	13,30	14,05
Leganés	1,87	3,64	9,92
Sum	331,40	331,40	331,38

Table 5. Economic performance

Club	Ticket sales	Alloc 17-18	CEA	CEL	Talmud
Real Madrid	50,44	24,81	9,51	40,32	23,79
Barcelona	48,36	23,79	9,51	38,24	23,79
Betis	7,29	3,59	7,29	0,00	3,65
Atlético Madrid	23,52	11,57	9,51	13,40	11,76
Valencia	12,54	6,17	9,51	2,42	6,27
Sevilla	11,63	5,72	9,51	1,51	5,81
Celta	4,21	2,07	4,21	0,00	2,11
Málaga	5,00	2,46	5,00	0,00	2,50
Athletic Bilbao	24,69	12,14	9,51	14,57	12,35
Español	7,49	3,69	7,49	0,00	3,75
Las Palmas	5,63	2,77	5,63	0,00	2,82
Levante	1,69	0,83	1,69	0,00	0,85
Girona	0,70	0,34	0,70	0,00	0,35
Real Sociedad	7,49	3,68	7,49	0,00	3,74
Deportivo Coruña	5,57	2,74	5,57	0,00	2,78
Villareal	3,51	1,73	3,51	0,00	1,76
Alavés	2,08	1,02	2,08	0,00	1,04
Getafe	1,10	0,54	1,10	0,00	0,55
Eibar	0,77	0,38	0,77	0,00	0,39
Leganés	0,85	0,42	0,85	0,00	0,42
Sum	224,57	110,46	110,45	110,46	110,46

Table 6. Closest compromise

Club	Alloc 17-18	Compromise	Diference
Real Madrid	40,96	38,52	2,44
Barcelona	41,51	36,51	5,00
Betis	5,27	19,37	-14,10
Atlético Madrid	17,15	16,86	0,29
Valencia	3,17	10,84	-7,67
Sevilla	9,92	9,84	0,08
Celta	7,04	9,14	-2,10
Málaga	11,29	8,94	2,36
Athletic Bilbao	10,23	8,53	1,70
Español	6,88	8,03	-1,15
Las Palmas	7,82	7,23	0,59
Levante	6,91	6,43	0,48
Girona	6,53	6,23	0,31
Real Sociedad	11,98	6,23	5,75
Deportivo Coruña	6,97	5,63	1,34
Villareal	0,98	5,12	-4,15
Alavés	7,81	5,02	2,78
Getafe	4,60	4,82	-0,23
Eibar	6,05	4,42	1,62
Leganés	7,87	3,22	4,65
Sum	220,93	220,93	0,00