Inter-league competition for talent vs. competitive balance*

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Abstract

We analyze the distribution of broadcasting revenues by sports leagues. We show that when the teams engage in competitive bidding to attract talent in an isolated league, the league's optimal choice is full revenue sharing (resulting in full competitive balance). In contrast, when the teams of several leagues bid for talent, in equilibrium the leagues choose a performance-based reward scheme. We thus provide an explanation for the differences in revenue sharing rules for national TV rights used by the U.S. sports leagues (full revenue sharing) and European football leagues (performance-based reward).

Keywords: Sports league, revenue sharing, competitive balance.

JEL Classification: L19, L83

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1 Introduction

The organization of professional sports in the United States differs from the one in Europe in that for each sport, there is one main league (NBA for basketball, MLB for baseball, NFL for American football and NHL for hockey).[1] Consequently, since the movement of talent across the Atlantic is negligible, leagues in the United States enjoy a monopsony position in the market for talent. Thus, when American teams compete to attract the best players, only the distribution of talent is affected, while the total amount of talent in the league stays constant.

Conversely, Europe is characterized by one main sport (football) and in each country there is a top domestic league (Premiership in England, Ligue 1 in France, Serie A in Italy, Liga in Spain, ...). As a result, European leagues can increase their total amount of talent (and hence, their attractiveness to broadcasters) by poaching star players from a foreign league. An illustration of this is the concentration of French players from the Euro-2000-winning squad in England and Italy (15 out of 22) during the season 2000-2001, countries where broadcast revenues are much higher than in France (See Table 3).[2] Therefore, in Europe, not only the teams but the leagues as well have incentives to compete for talent.

Another difference between the United States and Europe is the revenue sharing rules used by the leagues. In the United States, revenues from national TV deals are shared in an egalitarian way. As Scully (1995) explains, *"National rights are evenly split among the clubs in the leagues without regards to the performance of particular clubs. It is assumed that these shared revenues are determined by league-*

[1] As pointed out by Cave and Crandall (2001), "*The NFL, MLB, NBA and the NHL currently have no professional competitors in their respective sports. These dominant positions have existed for at least two decades. Although entry by new leagues has been quite common in earlier decades, only one new league has been formed in the past 20 years.*"

[2] Further evidence of the enhanced attractiveness of leagues with the highest concentration of star players (Italy, Spain and England) is that top games from the Italian, Spanish and English leagues are broadcasted in France (Canal+, Sport+) and in the Netherlands (Canal+, RTL5).

wide talent levels."[3] In contrast, in Europe, in countries in which TV rights are sold collectively, the amount a team receives is closely related to its results obtained in the competition[4,5] (see Tables 1 and 2).

The goal of this paper is to show that the use of performance-based reward schemes by European football leagues can be explained by the competitive environment in which they operate. Conversely, the traditional argument of a demand for a balanced distribution of talent does not in itself explain the equal division rule used in the United States.

The intuition for our result is the following. If inter-league movements of players are not restricted and league-wide talent levels influence the revenue leagues get from national TV deals, then leagues compete for superstar players. However, they cannot do it in a direct way, since players are hired by teams. Hence, a league wishing to attract top players must provide the incentives for domestic teams to bid a higher price than foreign teams. Now, the value of a player who increases the probability of winning increases with the amount awarded to the winner. Hence, a performance-based reward increases the price domestic teams are willing to bid for top players.

By the above argument, one could rush to the conclusion that competing leagues

[3]National TV revenue sharing is also analyzed by Fort and Quirk (1995). As they explain, *"national TV contracts in all sports uniformly involve equal sharing of such revenues by all league teams (with some negotiated, temporary exclusion for expansion franchises). In a one-team-one-vote environment, equal sharing is more or less guaranteed because the national contract can be approved only if there is a virtual consensus among league teams. Weak-drawing teams can block unequal sharing proposal by refusing to permit televising of games involving them and strong-drawing teams."*

[4]There is also less revenue sharing of gate income in European football leagues than in most the of US sports leagues. For example, in England and Italy, there is no sharing of gate income while in Germany only 6% of gate income is paid to the league. In the NFL, 40% of net gate income goes to the visiting team. In baseball, 10% and 20% of gate income goest to the visiting team in the National League and in the American League, respectively.

[5]In England, the redistribution scheme also takes into account the number of times a team has been broadcasted.

should choose a winner-takes-all reward scheme. There are two reasons why this is not so. First, by increasing the winner's share the league makes it more difficult for the team who does not obtain a star player to attract the services of a "good" player. Second, the price paid for the star player is increasing in the share of the championship winner, since it increases the valuations of both domestic teams who then bid up the price.

A special feature of our model is the bidding mechanism we posit for the competitive allocation of talent, which is closely related to recent work on auctions with externalities (see Jehiel and Moldovanu, 1996 and 2000, and Jehiel et al., 1996). These auctions are characterized by interdependent valuations, where a bidder does not only care about winning, but also about who gets the object in case she does not win. In our model, if the winner of the auction is from the same league, then losing is not as harmful, since even though the team gets a smaller share, the total revenue of the league will remain high. However, if the winner is from the other league, the loss with respect to winning the auction is much higher, since the aggregate talent level of the league decreases.

Several papers have studied the influence of revenue sharing on the demand for sport (El Hodiri and Quirk, 1971, Atkinson, Stanley and Tschirhart, 1988, Fort and Quirk, 1995, Vrooman, 1995) or on the demand for players (Késenne, 2000, Booth, 2002). However, they focus on the optimality of cross subsidies as used in the monopsonistic[6] economy of the United States and do not study the implications of performance-based revenue sharing rules on inter-league competition for players.

The papers most related to ours are those of Hoehn and Szymanski (1999), Palomino and Rigotti (2000) and Szymanski (2001). As our model, Hoehn and Szy-

[6] Fort and Quirk (1995) do address the issue of rival leagues in the US context. However, their main conclusion is that the existence of competing leagues has been a transitory phenomenon, and the profit motives have always led either to a merger or to an exit. In Europe, at least to date, because of the national nature of the leagues, steady state rivalry is feasible. Note however, that the introduction of the Champions' League was a move in the same direction.

manski compare a league operating in a competitive environment and an isolated one. They study the impact of the participation of top clubs in international competitions on the competitive balance of the domestic leagues. They do not address the issue of the optimal level of revenue sharing. Palomino and Rigotti (2000) consider a multi-period situation in which the demand for sport depends on the aggregate talent level, competitive balance and the effort produced by teams. They show that demand maximization does not lead to full revenue sharing, since even though revenue sharing fosters competitive balance among teams, it also lowers their incentives to win (and hence their equilibrium level of effort).

Szymanski (2001) considers an isolated league and studies the impact of several types of reward schemes on profit and investment in talent. He finds that teams' profits and investment in talent are increasing and decreasing, respectively, in the level of revenue sharing. Also, when a source of revenue that is sensitive to the level of competitive balance (such as broadcast income) is used to fund a prize, then performance-based reward may lead to a less balanced competition.

Finally, our model is related to other spheres of the economic activity. First, it can be seen as an example of games played through agents studied by Prat and Rustichini (2003). The main difference between the sport competition we consider and their more "standard" framework is that the reward scheme the leagues propose cannot be based on the identity of the teams which attract star players. It can only based on the outcome of the competition. That is, a team that paid a high price to attract star player but which happens to lose in the competition will be rewarded less than a team without star player which effectively won the competition, though the team with star players contributed more to league-wide talent.

Second, our model is related to some of those on competition for capital or foreign direct investment. In this respect, our model can be seen as an extension of Huber (1996) and Naylor and Santoni (2003). Huber considers a situation in which *small* open countries decide tax rates on wages income and capital, and where price-taking firms compete for internationally mobile capital.

Our model can be reinterpreted along these lines as one in which *large* countries choose tax rates (hence take into account how other countries respond to their fiscal actions), and oligopolistic firms compete for international capital.

Naylor and Santoni (2003) develop a 3-stage game played by two firms based in two different countries, and without international trade of goods by firms. In the first stage, firms decide whether to make a foreign direct investment (i.e., open a plant) in the other country. Then, trade unions (with a preference for employment) and firm managers negotiate wages at the plant level. In the last stage production takes place.

Along these lines, our model can be understood as one in which in the first stage industry-wide wage negotiation takes place, and then firms decide the location of their plants and their production level. With respect to Naylor and Sandroni's model, the union's strategy has a double impact on employment in our model: the level of foreign direct investment (i.e, the number of plants in a country) and the production level in each plant.

The organization of the paper is as follows. Section 2 presents the model. Section 3 considers the case of isolated leagues. Section 4 analyses the competition between leagues and Section 5 argues the robustness of our results. Finally, Section 6 concludes.

2 The model

We present the simplest possible model that still enables us to address the issue of optimal revenue sharing when there is (potential) competition for players between leagues.[7] There are two leagues, a and b. Each league is made up of two teams, $t_{j,1}$ and $t_{j,2}$ ($j = a, b$). Each team is composed of one player and teams of the same league compete in a championship.

There are five potential players: two players of (relatively) low talent (l) two

[7] In the Discussion, we will argue that our findings are robust to generalizations of this model.

players of a medium level of talent (m) and one player of high talent (h). The quality of the players influences the probability that a team wins the competition. If both teams in a league are of the same level, their probability of winning the championship is 1/2 each. A h-team opposed to a l-team wins the championship for certain,[8] while

$$\text{Prob}\{m \text{ wins against } l\} = \text{Prob}\{h \text{ wins against } m\} = \pi$$

with $\pi \in (1/2, 1)$.

Leagues sell the rights to broadcast the competition to TV networks and the price networks are willing to pay depends on the quality of the competition, i.e., the level of competitive balance and the quality of the players involved in the league. The level of competitive balance is measured by the uncertainty of a competition. The closer are the probabilities of winning of the two competing teams, the larger is the level of competitive balance. Hence, leagues with two teams of the same quality are the most balanced (since the probabilities of winning are equal, 1/2) while a league with a h team and a l team is the least balanced (since the difference between the winning probabilities is 1).

Let $K(q_1, q_2)$ be the price paid by a network if the two teams participating in a league are of quality q_1 and q_2. We make the following assumption

$$K(h,m) > K(m,m) > K(m,l) > K(h,l) = K(l,l) = 0$$

The inequalities $K(h,m) > K(m,m)$ and $K(m,l) > K(l,l)$ mean that an increase in skills dominates a decrease in competitive balance, provided that the resulting level of competitive balance is not too low. The inequality $K(m,l) > K(h,l)$ means that an increase in skills is dominated by a decrease in competitive balance when the resulting level of competitive balance is very low. Finally, $K(h,l) = K(l,l) = 0$ is a normalization, meaning that there is practically no demand for games with no uncertainty or games played only by low-quality players.[9]

[8] This is just a simplifying assumption.

[9] Our model thus fits Rosen's (1981) definition of Superstars: a small percentage of an already reduced field of agents who are responsible for most of the traded volume.

Each league splits its broadcasting revenues between the winner and the loser of the championship it organizes. We denote $\alpha_j \geq 1/2$ the share which is awarded to the winner. Thus, α_j measures the level of revenue sharing chosen by league j. The two extreme cases are $\alpha_j = 1/2$ and $\alpha_j = 1$, which correspond to the league choosing full revenue sharing – thus not rewarding the teams on the basis of their performance – and to a contest, where the winner takes all, respectively.

Following Atkinson, Stanley and Tschirhart (1988), we assume that, in order to set the revenue sharing rule, a league behaves as a cartel of the teams involved in the championship whose objective is to maximize the teams' joint profit.[10] Note that the maximization of joint profits means that, in addition to its revenue from TV deals (K), a league also internalizes the cost that obtaining talent inflicts on its teams.[11]

In addition to the collusive behavior in setting the revenue shares the teams also compete with each other on two levels.[12] First, they compete in an auction to attract the players. Second, they compete "on the field" with the other team from the same league. Their objective is to maximize their expected profit.

We consider the following sequence of events: Leagues a and b choose simultaneously their level of revenue sharing α_a and α_b, respectively. Teams observe α_a and α_b and simultaneously make salary offers to h . Following Jehiel and Moldovanu (1996), in order to obviate existence issues, we assume that there is a smallest monetary unit ε. h accepts the highest bid.[13] If several teams make the highest bid, h chooses a team randomly. Next, the losing teams bid simultaneously for the ms. The two

[10] In practice, the governing body of a league is comprised of one voting representative from each member club and major issues must be approved by majority or supermajority vote. (See Flynn and Gilbert, 2001). Here, we implicitly assume that the maximisation of the joint profits has been approved as the objective of the league and its implementation has been delegated to a commissioner.

[11] In the Discussion, we explain how our results change if this assumption is relaxed.

[12] This coexistence of collusion and competition is a distinguishing feature of the sports industry.

[13] Note that this mechanism is not optimal for the h player: he could extract more rent in a menu auction (see Bernheim and Whinston, 1986), where the losing teams of the same league as the winner would also pay for the positive externality created by the h player's presence in the league.

highest bidders get an m. Finally, the team still without a player is allocated one l at zero cost (since it is the only bidder in the auction). Once the teams are composed, the championships take place.

3 The benchmark case: an isolated league

As a benchmark, we consider the case in which there is only one league, whose (two) teams are bidding for players from the entire pool of potential players.[14] This corresponds to the case of US sports leagues, which face no outside competition for players.

In a closed economy, when deciding how much to bid for the acquisition of h, a team knows that if it does not acquire h, then its opponent will. Also, the loser of the first auction will obtain the services of an m for free. Hence, for any $\alpha \geq 1/2$, the value of h is

$$V(\alpha) = (\pi\alpha + (1-\alpha)(1-\pi))\,K(h,m) - (\pi(1-\alpha) + \alpha(1-\pi))\,K(h,m). \quad (1)$$

The first term represents the gain of a h-team when opposed to a m-team while the second term represents the expected gain of a m-team when opposed to a h-team. Note that $V(\alpha)$ can be rewritten as

$$V(\alpha) = (2\alpha - 1)\,(2\pi - 1)\,K(h,m) \geq 0. \quad (2)$$

When a league is isolated, its revenue is independent of the level of revenue sharing it chooses. However, the level of revenue sharing does affect the price paid for h. Therefore, the league chooses the value of α that minimizes the transfer from the teams to the players.

Proposition 1 *When the league's objective is to maximize the joint profits of teams, it sets $\alpha^* = 1/2$.*

[14] Our result would be unaltered if we reduced the pool of potential players, as long as there was one preferred over the rest (e.g. $\{h, m(,l)\}$ or $\{m, l(,l)\}$).

Proof: Since the revenues are constant, the league wants to minimize the price paid for h. Since both teams value him at $V(\alpha)$ this will be the price as well, and the result follows directly from the fact that $V(\alpha)$ is increasing in α. •

Hence, an isolated league representing the team owners will choose full revenue sharing even in the absence of any competitive balance consideration.

In our simple model, this solution would leave the teams without an incentive to win and, therefore, star players would earn the same salary as regular players. This extreme result is due to the fact that we have not taken into account additional performance-related revenues for the teams like merchandising, part of gate revenues, or local TV deals, which are not re-allocated by the league. Also in North America player unions are much stronger than in Europe, what can lead – *ceteris paribus* – to higher player salaries. In addition, it is widely recognized that teams (both owners and players) have non-pecuniary incentives to win as well. Note, however, that the formal inclusion of these effects into the model would not change the revenue sharing result.

4 Competition between leagues

In this section, we consider the case where there are two leagues that compete for the same pool of players. Thus, all four teams are bidding for the services of the players. At the same time, the leagues' choices of the levels of revenue sharing are transformed from two independent decision problems into a non-cooperative game, where we look for Nash equilibria. Before turning to the leagues' problem, we need to characterize the equilibrium of the sub-game following an arbitrary pair of revenue-sharing rules, so that we can identify the leagues' payoff functions.

When bidding for h, a crucial concern of a team is whether its adversary is expected to obtain the services of an m. Denote by $V(m|y,\alpha)$ the value of an m to a team whose adversary has a y player ($y = h, m, l$). If $V(m|h,\alpha_a) \geq V(m|m,\alpha_b)$, then the teams of league a know that upon obtaining h they will play in a (h, m)-league, hence sharing the gross amount $K(h, m)$.[15] In such a case, the teams from league b will share the gross amount $K(m, l)$. Conversely, if $V(m|h, \alpha_a) < V(m|m, \alpha_b)$, then the teams of league a know that upon obtaining h they will play in a (h, l)-league, so they will not want to make a positive bid for h.

Assume that team $t_{a,1}$ gets h. Then, the value of an m to team $t_{a,2}$ is

$$V(m|h, \alpha_a) = [\pi(1 - \alpha_a) + (1 - \pi)\alpha_a]K(h, m), \tag{3}$$

while the value of an m to a team from league b given that the opponent gets an m is

$$V(m|m, \alpha_b) = \frac{1}{2}K(m, m) - [\pi(1 - \alpha_b) + (1 - \pi)\alpha_b]K(m, l). \tag{4}$$

It follows that $V(m|h, \alpha_a) \geq V(m|m, \alpha_b)$ is equivalent to

$$\alpha_b \leq \frac{\pi K(m, l) - \frac{1}{2}K(m, m) + [\pi + (1 - 2\pi)\alpha_a]K(h, m)}{(2\pi - 1)K(m, l)}. \tag{5}$$

Denote by $f(\alpha_a)$ the right-hand side of this inequality as a function of α_a. Note that, since $\pi > 1/2$, $f(\alpha_a)$ is strictly decreasing in α_a. It is straightforward to verify that it is strictly decreasing in π as well. Let $\alpha^*(\pi)$ denote the solution to $\alpha = f(\alpha)$. That is,

$$\alpha^*(\pi) = \frac{\pi[K(m, l) + K(h, m)] - \frac{1}{2}K(m, m)}{(2\pi - 1)\,[K(m, l) + K(h, m)]}. \tag{6}$$

Note that $\alpha^*(\pi)$ strictly decreases with π. Consequently its lowest possible value is at $\alpha^*(1) = 1 - \frac{K(m,m)}{2[K(m,l)+K(h,m)]} > 1/2$.

Proposition 2 *Let* $\bar{\alpha}(\pi) = \min\{\alpha^*(\pi), 1\}$. *The unique symmetric subgame-perfect equilibrium has both leagues set* $\bar{\alpha}(\pi)$ *as the revenue-sharing rule.*

[15] To see this, note that –by symmetry– the teams of the league which does not have h either both get an m player or neither of them does. No tie – and thus random assignment – is possible, since when $V(m|h, \alpha_a) = V(m|m, \alpha_b)$, then the b-league teams actually have a lower valuation, exactly because of the probability that they might end up as an (m, l) league.

Proof: First, assume that $\alpha^*(\pi) < 1$. The proof is based on Figure 1, which depicts $f(.)$ and $f^{-1}(.)$ in the space of strategic variables: $(\alpha_a, \alpha_b) \in [1/2, 1]\times$ $[1/2, 1]$. Note that both $f(.)$ and $f^{-1}(.)$ are continuous and strictly decreasing. It is straightforward to show that we always have $f^{-1}(1/2) < f(1/2)$ and that the condition $\alpha^*(\pi) < 1$ (that is, the two curves intersect within the figure)[16] implies $f^{-1}(1) > f(1)$.

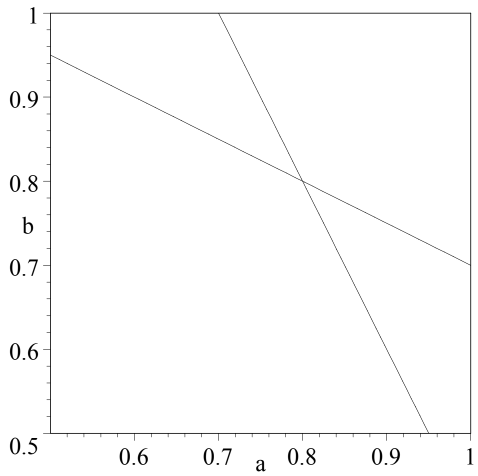

Figure 1

By (5), given a pair (α_a, α_b), if league a obtains h then it will also obtain an m if and only if $\alpha_b \leq f(\alpha_a)$. By the same token, if league b obtains h then it will also obtain an m if and only if $\alpha_a \leq f(\alpha_b)$, or $\alpha_b \leq f^{-1}(\alpha_a)$. Therefore, we have four regions, with the lower as above (denoted by (H_a,H_b) on Figure 1), the upper with neither league wanting h ($\bar{\mathrm{H}}_a$,$\bar{\mathrm{H}}_b$), while the other upper left is where only league a wants him (H_a,$\bar{\mathrm{H}}_b$) and the lower right where only league b does ($\bar{\mathrm{H}}_a$,H_b). Note the latter two regions involve asymmetric revenue sharing rules, so a symmetric equilibrium cannot be there.

Consider the case (H_a,H_b). Here, all teams are willing to bid up to their valuation, so the league whose teams have it higher will obtain h. Next, note that if a team obtains h in equilibrium, this is also beneficial to the league, since the team internalizes

[16]Note that $\alpha = f(\alpha) \Longleftrightarrow f^{-1}(\alpha) = \alpha$ and therefore the two curves intersect at α^*.

the cost but not all the benefit. Now, if team t_{a1} obtains h, then in the bid-for-m stage, the unique equilibrium is such that team t_{a2} bids $V(m|l,\alpha_b)+\varepsilon$, teams from league b bid $V(m|l,\alpha_b)$, and team t_{a2} gets an m, where[17]

$$\begin{aligned} V(m|l,\alpha_b) &= [\pi\alpha_b+(1-\alpha_b)(1-\pi)K(m,l)]-[\pi(1-\alpha_b)+(1-\pi)\alpha_b]K(m,l) \\ &= (2\alpha_b-1)(2\pi-1)K(m,l). \end{aligned} \tag{7}$$

Let $V_{x,y}(\alpha)=(2\pi-1)(2\alpha-1)K(x,y)$. (Note that $V_{h,m}(\alpha)=V(\alpha)$ and $V_{m,l}(\alpha)=V(m|l,\alpha)$.) It follows that at the bid-for-h stage, teams from league a value h at $V(h|m,\alpha_a,\alpha_b)$ and teams from league b value h at $V(h|m,\alpha_b,\alpha_a)$, where

$$V(h|m,\alpha_j,\alpha_{j'})=V_{h,m}(\alpha_j)+V_{m,l}(\alpha_{j'}). \tag{8}$$

Here, the last term represents the amount saved from not having to pay for an m player in the bid-for-m stage. Note that $V(h|m,\alpha_a,\alpha_b)>V(h|m,\alpha_b,\alpha_a)$ if and only if $\alpha_a>\alpha_b$. Moreover, $V(h|m,\alpha_j,\alpha_{j'})$ is increasing both in α_j and in $\alpha_{j'}$. Consequently, the best response to any revenue sharing rule by the other league is to set one that is ε higher (since once they have h they want to minimize his price). As a result, there can be no equilibrium in which either league chooses $\alpha<\bar{\alpha}(\pi)$.

Can we have an equilibrium in the ($\bar{\mathrm{H}}_a$,$\bar{\mathrm{H}}_b$) region? Here, none of the teams wants to bid for h in the first stage. Consequently, that auction is declared deserted, and the teams proceed to the m auction.[18] Note that unless $\alpha_a=\alpha_b$, both ms will end up in the same league. Without loss of generality, assume that league a gets the two ms. Then, in the next stage, the two teams from a bid to attract h.[19] After that, the two teams from b bid for the m of the team from a which got h.

[17]The first term represents the expected gain of a m-team given that the opponent is a l-team, the second term represents the expected gain of a l team given that the opponent is a m-team. The value of getting the remaining m is the difference between the two.

[18]The result would be unchanged, if we assigned the h player randomly to one of the teams first and then proceeded with the m auction.

[19]h is now valuable for teams from a since they know that they will be in a (h,m)-league if one of them attracts h.

Note that because of the Bertrand competition, the winner and the loser of either auction is going to have the same expected payoff. Thus, the additional revenue an m (obtained in the first auction) generates is the difference between the payoff of the m-team in an (h, m)-league and the l-team in an (m, l)-league:

$$W(\alpha_a) = [\alpha_a(1-\pi) + (1-\alpha_a)\pi](K(h,m) - K(m,l)).$$

Note that the function $W(\alpha)$ is decreasing in α. Hence, we expect that in the bid for-m stage, the league with the lower α gets the ms.

If $\alpha_a < \alpha_b$, the expected payoff of league a is then

$$P(\alpha_a, \alpha_b) = K(h,m) - 2W(\alpha_b) - V_{h,m}(\alpha_a).$$

This can be rewritten as

$$P(\alpha_a, \alpha_b) = 2(2\pi - 1)(\alpha_b - \alpha_a)K(h,m) + 2[\pi + \alpha_b(1-2\pi)]K(m,l).$$

Conversely, if $\alpha_a > \alpha_b$, the expected payoff of league a is $K(m,l) - V_{m,l}(\alpha_a)$. (League b gets the two ms in the first stage and one team from league a buys an m later at the price $V_{m,l}(\alpha_a)$). Clearly, league a is better off with $\alpha_a < \alpha_b$ than $\alpha_a > \alpha_b$.

So, we can now analyze the game played by the two leagues and show that there is no equilibrium in $(\bar{H}_a, \bar{H}_b)$. Note that for any $\alpha_b < \alpha^*(\pi)$, there is no α_a such that $(\alpha_a, \alpha_b) \in (\bar{H}_a, \bar{H}_b)$ *and* league a gets the ms in the first stage. Consequently, in such a case league a's payoff is $K(m,l) - V_{m,l}(\alpha_a)$. On the other hand, deviating to $\alpha_a = 1/2$ gives the larger payoff of $K(m,l)$. This implies that there cannot be an equilibrium with $\alpha_b < \alpha^*(\pi)$. By a symmetric argument, there cannot be an equilibrium with $\alpha_a < \alpha^*(\pi)$ either. Next, note that when both revenue sharing parameters are above $\alpha^*(\pi)$, it is always possible to deviate and undercut the opponent with an $\alpha \in (\bar{H}_a, \bar{H}_b)$. We deduce that there cannot be an equilibrium in $(\bar{H}_a, \bar{H}_b)$ (except at (α^*, α^*), of course). •

A crucial assumption for the result of Proposition 2 is the unrestricted movement of players between leagues. In practice such a "freedom" of movement is very recent.

It followed the 1995 Bosman Ruling. It is interesting to note that in France, until the season 1998-1999, full revenue sharing was the rule that that the league switched to a performance-based reward scheme as of the season 1999-2000.[20] Taking decision-making lags into account, it is thus reasonable to assume that the new reward scheme was introduced as a result of the greater player mobility.

From Proposition 2, we deduce the following corollary.

Corollary 1 *There is never full revenue sharing in any sub-game perfect equilibrium. In fact, whenever*

$$2(1-\pi)\,[K(m,l)+K(h,m)] \geq K(m,m), \tag{9}$$

the unique equilibrium is fully dependent on performance (winner takes all).

Proof: As we have shown in the proof of Proposition 2, there can be no equilibrium (not even asymmetric) in which either league chooses $\alpha < \bar{\alpha}(\pi)$. Since we have also shown above that $\bar{\alpha}(\pi) > 1/2$, the first result is already established. We have also seen (in the proof of Proposition 2) that $\bar{\alpha}(\pi) = 1$ implies a unique equilibrium with two winner-takes-all leagues. Now, $\bar{\alpha}(\pi) = 1$ when $\alpha^*(\pi) \geq 1$, which is equivalent to (9). •

Given that the level of revenue sharing chosen in equilibrium is parameter dependent, in the next subsection, we provide a representative parametric example.

4.1 A parametric example

A reasonable way to model the worth of a league, $K(.,.)$, is by the product of some measure of aggregate talent and a measure of competitive balance. The second can

[20] It is also worth mentioning that in France, following the Sport Law of July 16, 1984, amended by the law of July 13, 1992, the league is the owner of the broadcasting rights. As a consequence, the adoption of a performance-based reward scheme is not the result of rich teams threatening to sell their broadcasting rights individually if such a performance-based reward scheme is not adopted.

be proxied by $1 - \Pr\{stronger\ team\ wins\}$. This captures the value of competitive balance, since it is decreasing in the difference in winning probabilities, and gives zero when one team is sure to win.

Now, let the intrinsic value of talent be given by $T(m,l) = 1$, $T(m,m) = z$ and $T(h,m) = z^2$, with $z > 1$. Then the league worths become $K(m,l) = 1 - \pi$, $K(m,m) = z/2$ and $K(h,m) = z^2(1-\pi)$. Substituting into (6) we obtain that $\alpha^*(\pi) = \frac{\pi(1-\pi)\left(1+z^2\right)-z/4}{(2\pi-1)(1-\pi)(1+z^2)}$. It is easy to check that $\alpha^*(\pi) > 1$ for $\pi < 1 - \frac{1}{\sqrt{8}} = 0.646$ for any z consistent with the model.[21] Thus, for relatively small competitive imbalance, for any difference in talent, fully performance related revenues arise in equilibrium. For a qualitative picture of the situation when the issue of competitive balance is more relevant, Figure 2 displays $\alpha^*(.7)$ as a function of z :

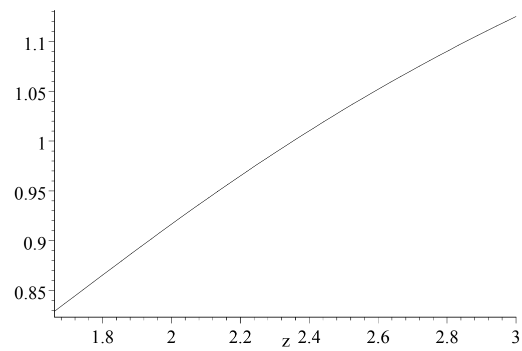

Figure 2

As expected, as we increase the value of talent holding competitive balance constant, the case for performance related revenue sharing gets monotonically stronger.

5 Discussion

In this section, we argue that the conclusions based on the analysis of the seemingly restrictive model of the previous sections are surprisingly(?) robust.

Alternative objective functions

[21] In order to have $K(h,m) > K(m,m)$, we need $z > 1/(2(1-\pi))$

We have assumed that the objective function of the leagues is to maximize their domestic aggregate net surplus. This may not be the case in general, since not all teams incur the cost of hiring talent with equal probability. In this case, teams are likely to bargain over the fraction of expenses the league should internalize in its objective function. Consequently, it seems more realistic to assume that the league will internalize the expenses of the clubs only partially. In other words, the true objective function of a league is somewhere in between the maximization of joint revenues and the maximization of aggregate net surplus. However, under this, more elaborate, hypothesis our results would remain unchanged. The reason is that the teams' valuations of h, just as before, are increasing in α. Therefore, full revenue sharing (i.e., $\alpha = 1/2$) cannot be an equilibrium.

Other sources of income

We have considered the case in which teams have only one source of income. If there are multiple sources of income, two cases have to be differentiated: all incomes are subject to revenue sharing or some incomes are not subject to revenue sharing. However, in either case, our results remain unchanged.

If all the sources of income are subject to revenue sharing then an increase in the sharing of any source of revenue decreases the value of top players for teams. Therefore, a league choosing $\alpha = 1/2$ never attracts h. It follows that leagues still choose performance-based revenue sharing rules in equilibrium.

If some income is not subject to revenue sharing but is increasing in performance, the value a team is willing top bid for h or for an m is increasing in α. Therefore, our results remain unchanged: leagues choose performance-based revenue sharing rules.

Asymmetric leagues

The model we consider assumes that revenues from the sale of broadcasting rights are the same in the two leagues as a function of teams' quality. This may not be the case. For example, if the two leagues organize domestic competitions in two countries of different population size, then it is likely that the league of the larger country has higher broadcasting revenues for a given quality of the competition. In this respect, assume that $K_a(q_1, q_2) = K_b(q_1, q_2) + H$ ($H > 0$). The main difference with the previous section is that the value of an m given that the other team from the same league got h is league dependent. Assume that league a gets h, then $V_a(m|h, \alpha_a) > V_b(m|m, \alpha_b)$ is equivalent to

$$\alpha_b \leq \frac{\pi K(m,l) - \frac{1}{2}K(m,m) + [\pi + (1-2\pi)\alpha_a][K(h,m) + H]}{(2\pi - 1)K(m,l)} = f_a(\alpha_a)$$

Similarly, $V_b(m|h, \alpha_b) > V_a(m|m, \alpha_a)$ is equivalent to

$$\alpha_b \leq \frac{\pi K(h,m) - \frac{1}{2}[K(m,m) + H] + [\pi + (1-2\pi)\alpha_a][K(m,l) + H]}{(2\pi - 1)K(h,m)} = f_b(\alpha_a)$$

Now, the solution of $f_a(\alpha_a) = f_b(\alpha)$ is

$$\alpha_a^*(H) = \frac{[K(h,m) - K(m,l)]\{\pi[K(h,m) + K(m,l)] - \frac{1}{2}K(m,m)\} + \frac{H}{2}K(m,l)}{(2\pi - 1)[K(h,m) - K(m,l)][K(h,m) + K(m,l) + H]} > \frac{1}{2}$$

Furthermore, $f_b(1/2) > 1/2$. Proceeding as in the proof of Proposition 2, this implies that the region (H_a, H_b) is non-empty. As a consequence, there is no equilibrium with full revenue sharing.

Budget constraints

In a previous version of this paper (Palomino and Sákovics, 2000), we have analyzed a model where there are only two player types but the teams face a budget constraint. They can only spend on the players an amount that they can surely afford by the end of the season. The results are similar to those of the current paper. Here the incentive to keep competing leagues from offering fully performance based rewards is that the lower the loser's share is the stricter the budget constraint becomes. In the limit as the cost of bankruptcy disappears, the only equilibrium is both leagues offering a winner takes all system.

6 Conclusion

We have analyzed the distribution of broadcasting revenues by sports leagues which maximize their teams' joint profit. In the context of an isolated league, we have shown that when the teams engage in competitive bidding to attract talent, the league's optimal choice is full revenue sharing (resulting in full competitive balance) even if the revenues depend on the level of competitive balance. This result is overturned when the league has no monopsony power in the talent market. When the teams of several leagues bid for talent, the equilibrium level of revenue sharing is bounded away from the full sharing of revenues: leagues choose a performance-based reward scheme. These results hold even if teams have multiple sources of income either subject or not to revenue sharing or if leagues are asymmetric.

We thus provide an explanation of the observed differences in revenue sharing rules used by the U.S. sports leagues and European football leagues. In the US, each league is a monopsonist and splits revenues from national TV deals evenly among teams. Conversely, in Europe, domestic football leagues compete for talent and, when TV rights are sold collectively, use a performance-based scheme to redistribute broadcasting revenues to teams.

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Ranking	Fixed Amount	Variable Amount	Total
1	54.5	45.5	100
2	54.5	40.25	94.75
3	54.5	36.75	91.25
4	54.5	31.5	86
5	54.5	29.75	84.25
6	54.5	28	82.5
7	54.5	24.5	79
8	54.5	21	75.5
9	54.5	19.25	73.75
10	54.5	17.5	72
11	54.5	14	68.5
12	54.5	10.5	65
13	54.5	8.75	63.25
14	54.5	7	61.5
15	54.5	5.25	59.75
16	54.5	2	56.5
17	54.5	2	56.5
18	54.5	2	56.5

Table 1: Revenue allocation in the LNF (season 1999-2000, in Million FF). Source: L'Equipe

Country	Best/Worst
England	2.2
France	1.8
Germany	1.7

Table 2: Ratio of revenues for the season 1999-2000 is some top European football leagues. Source: L'Equipe.

	England	France	Germany	Italy
1999/2000	402	343	212	596
2000/2001	598	326	399	621

Table 3: Broadcast revenues some top European football leagues (millions of Euros). Source: Deloitte & Touche Sport Analysis