Overinvestment in European Football Leagues

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Abstract

In the last decade most clubs in European football leagues have experienced the paradox of rising revenues and declining profits. The present paper applies contest theory to provide an integrated framework of a team sports league and analyses the competitive interaction between clubs. We show that dissipation of the league revenue arises from "overinvestment" in playing talent. This overinvestment problem increases if the discriminatory power of the contest function increases, revenue-sharing decreases, and the size of an additional exogenous prize increases. We further show that clubs invest more when they play in an open compared to a closed league. The overinvestment problem within open leagues increases with the revenue differential between leagues.

Keywords: contests, sports league, overinvestment, revenue-sharing, promotion and relegation

JEL classification: L83; C72; D43; D72

1 Introduction

"A rising tide lifts all boats". While this statement is true for almost any industry, it obviously does not hold for the professional football leagues in Europe. In the past decade, many football clubs were able to increase total

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revenues due to higher broadcasting receipts, bigger crowds, sponsorship and a more professional approach to merchandising. According to Deloitte (2004), the combined revenue generated by the top divisions of Europe's "Big Five" leagues[1] increased by 190%: from approximately €1.9 billion in the season 1995/96 to €5.6 billion in the season 2002/03. Manchester United, the world's richest club, even augmented its turnover from €25 million in 1990 to €188 million in 2001, an increase by more than 750%.[2] However, at the same time there is growing evidence of a financial crisis spreading throughout the European football leagues. Striking examples are Italy's *Serie A* and Spain's *Primera Division:* The *Serie A* clubs accumulated total losses of €1.2 billion in the period from 1995/96 up to 2002/03, with 84% of theses losses sustained from 2000/01-2002/03.[3] In the *Primera Division* the total amount of debt in 2003 amounted to €1.6 billion.[4] Many European clubs face serious financial difficulties. Some even went bankrupt. Examples illustrating this general tendency are numerous: The Serie A club *AC Fiorentina* went bankrupt in 2002 and was relegated to the third Italian league. A court declared *AC Parma* insolvent in April 2004 with €310 million in debt. Furthermore *Lazio Rome* is €310 million in debt and *AS Rome* €300 million. Presently in England *Leeds United* faces serious financial problems and is near bankruptcy. In Spain *FC Barcelona* and *FC Valencia* are seriously in debt with €250 million and €125 million, respectively.[5] In the Bundesliga *Borussia Dortmund* is near insolvency after making a loss of €67 million in 2004 and being in debt with €118 million.[6] In Switzerland *Servette Genf* was declared insolvent in February 2005; after *FC Lugano* and *Lausanne Sports* in 2002 this is already the third club to go bankrupt. The Czech club *Bohemians Prague* could only be bailed out because fans donated more than €100'000.

How can this "paradox of rising revenues and declining profits" be explained? A first explanation stresses inadequate club constitutions. As organizations without residual claimants, traditional clubs are more likely to behave as win-maximizers. Having no ownership stakes in the operation and, at the same time, lacking genuine owners as monitors, club managers have discretion to maximize individual utility through sportive success. The chance to privatize a part of the fame and glamour derived from sporting success while socializing the inherent financial risks creates strong incentives to invest too much in playing talent. However, a closer look at the real situation in professional team sports shows the limitation of this constitutional explanation. The paradox of

[1] The "Big Five" leagues in Europe are: *Premier League* (England, 20 clubs), *Ligue1* (France, 20 clubs), *Bundesliga* (Germany, 18 clubs), *Primera Division* (Spain, 20 clubs) and the *Serie A* (Italy, 18 clubs).
[2] Economist (2002)
[3] Deloitte (2004)
[4] El Pais, 28th of August 2002.
[5] Kicker, 12th of January 2004.
[6] Annual report 2004 of *Borussia Dortmund*.

raising revenues and declining profits persists even in leagues where clubs have been transformed into capitalistic corporations with profit-maximizing owners. Obviously the problem must have deeper roots. In this paper we intend to deal with these roots. We will show that dissipation of the league revenue in a professional sports league arises from "overinvestment" in playing talent as a direct consequence of the ruinous competitive interaction between clubs.

Before proceeding with the model, we will give a short overview of the existing literature: The first academic analyses of the economics of sports were presented by Rottenberg (1956), Neale (1964) and Sloane (1971). They studied the structural characteristics of the markets in which professional sports teams operate. El-Hodiri and Quirk (1971) formalized the insights developed in the early literature in the first general economic model of a sports league, based on a dynamic decision-making mathematical framework. Fort and Quirk (1995), Vrooman (1995) and Vrooman (2000) updated this framework, however, without explicitly modelling competition and interaction among the clubs. Even though already Canes (1974) suggested the danger of a ruinous competition in sports leagues,[7] the tendency to overinvest as a result of strategic interaction between the clubs was not addressed in these models. Whitney (1993) was the first to formalize ruinous competitions within sports leagues using a labour market model. He suggested that the market for star athletes could be subject to "destructive competition" which drives some participants out of the market even though it is inefficient for them to leave. The recent sports economics literature has suggested to model the competition among clubs by making use of contest theory.[8] Szymanski (2003) applied Tullock's (1980) rent-seeking contest[9] to model a symmetric winner-takes-all league. However, he did not explicitly address the problem of overinvestment in his model. Dietl and Franck (2000) and Dietl et al. (2003) were the first to model the overinvestment problem based on contest theory. Our paper substantially extends their analysis by providing an integrated framework which allows to study a league with clubs competing for an endogenously determined league prize. We also model the effects that typical features of European football such as exogenous prizes and promotion and relegation have on talent investments.

The remainder of the paper is organized as follows: In Section 2 we present our basic model of a league with profit-maximizing clubs competing for an endogenously determined league prize. In Section 3 we consider a league in

[7] Canes (1974) showed that there exists a tendency in the sports industry to over-employ athletic talent, which is considered as a "strategic input".

[8] The first approaches in contest theory were made by Lazear and Rosen (1981), Green and Stokey (1983) and Nalebuff and Stiglitz (1983).

[9] The simple Tullock model has been extended in various ways (for a collection of relevant articles see e.g. Lockard and Tullock (2001)): inter alia different valuations of the prize, asymmetric players, sequential play, cooperative behaviour and dynamic games have been considered.

which an additional exogenously given prize is offered to the winner of the championship in addition to the endogenous league prize. Section 4 provides a two-period dynamic two-league model incorporating a system of promotion and relegation. Finally, section 5 concludes.

2 A league model with an endogenous league prize

2.1 The basic 2 club model

The following elementary league model describes the investment behavior of profit-maximizing clubs which are organized as public limited companies in a professional team sports league. The league consists of 2 clubs where each club $i \in \{1, 2\}$ invests a certain amount x_i in playing talent. This amount includes transfer fees, player and coach salaries, winning bonuses, training expenses and medical attendance.[10] The investments x_i generate costs for each club, which are given by $C_i(x_i)$. We assume that the investment costs in playing talent are linear resulting in constant marginal costs, i.e. $C_i'(x_i) = c_i$ and are equal for the two clubs, i.e. $c_1 = c_2 = c$.

The league's total revenue $R(x_1, x_2)$ is assumed to be a concave function of aggregate investments in playing talent, given by:

$$R(x_1, x_2) := (x_1 + x_2)^{\frac{1}{2}}$$

This function reflects the fact that with raising investments in playing talent, e.g. better players, the league becomes more attractive for fans or TV-broadcasters and therefore the league income increases. This is a reasonable assumption for the major soccer leagues in Europe, since these leagues compete with each other. If a club such as Real Madrid contracts stars like Zidane or Beckham revenues increase in the *Primera Division* in Spain and decrease ceteris paribus in Italy's *Serie A* or England's *Premier League*. In addition to this, we assume that investments in playing talent have decreasing returns to scale. This fact of satiation is modelled in our revenue function via the square root function. For example, contracting Figo increases the league revenue less if Ronaldo and Beckham are already playing in this league.[11]

Furthermore, we are considering a league with a revenue sharing arrangement.

[10] For reasons of simplicity we sum up these different investments under the notion "investment in playing talent".

[11] We have neglected the possibility that the league's revenue is affected by competitive balance, since in the open European football leagues the relevance of competitive balance is considered dispensable.

In the European major soccer leagues revenues from national TV deals are distributed according to rules established by the National Soccer Associations. In general, such revenue sharing schemes also allow for the defeated club to receive a certain amount of the league revenue. In our model the share of the endogenously determined league prize $R(x_1, x_2)$ which is awarded to the winner of the championship is given by the parameter $\alpha \in [\frac{1}{2}, 1]$, while the share awarded to the defeated club is given by $(1 - \alpha)$. Hence, the winner receives $\alpha R(x_1, x_2)$, while the defeated club gets $(1-\alpha)R(x_1, x_2)$. The limiting case $\alpha = 1$ describes a "winner-takes-all" league, whereas $\alpha = \frac{1}{2}$ describes a league in which all clubs get the same share of the league revenue, independent of on-field success.

The investments in playing talent determine the probability of success. This is a meaningful assumption, since Michie and Oughton (2004) show, that for instance in the English *Premier League* there is a strong positive correlation between relative wage expenditures and championship performance of clubs (measured by each club's share of points). The more a club invests in playing talent in relation to the other clubs, the better its performance in the league. At the European level a similar correlation between these two variables can be perceived. Clubs from the rich "Big Five" leagues which have high budgets are the most successful in the European championships. Take for example the UEFA Champions League, where from 1993 to 2003 95% of the participating clubs in the semi-finals originate from these "Big Five" leagues. The probability of success is a function, called "contest success function" (CSF) and, in our model, equals the ratio of each club's talent investment to total talent investment. Formally, the CSF maps the vector (x_1, x_2) of talent investment into probabilities for each club. In the economic literature the most common version to model a CSF is via the logit approach,[12] which will also be applied in our model. The probability of success for club $i = 1, 2$ in this imperfectly discriminating contest is defined as

$$P_i^\gamma(x_1, x_2) := \frac{x_i^\gamma}{x_1^\gamma + x_2^\gamma}$$

Since only one of the two clubs can win the championship, it must hold: $P_j^\gamma(x_1, x_2) = (1 - P_i^\gamma(x_1, x_2))$ with $i, j = 1, 2$. The parameter $\gamma > 0$, the so-called "discriminatory power" of the CSF, measures how easily money buys on-field success. With other words, γ determines the ease of affecting the probability of winning the championship by a certain level of talent investment and specifies how much impact the club's own investments in playing talent have on its winning probability. γ also reflects the importance of luck or coincidence in a game. Luck plays a less important role in sports with high scores or a high frequency of matches. As γ increases, the marginal costs of influencing the probability of success decreases, i.e. the probability of winning the champi-

[12] See for example Lockard and Tullock (2001) or Szymanski (2003).

onship increases for the club i with the higher level of talent investment x_i and differences in talent investments affect the winning probability in a stronger way.[13] In the limiting case where γ goes to infinity, we would have a so-called "all-pay auction", i.e. a perfectly discriminating contest, where the club with the highest talent investment wins the prize with probability one. However, for a sporting contest this is not a realistic assumption since the club with the highest investment in playing talent cannot be certain of winning the championship race. If the two clubs invest the same amount in playing talent, the probability of winning equals $\frac{1}{2}$ for each club. In case that no club is willing to invest a positive amount in talents, i.e. $x_1 = x_2 = 0$ the respective probability is then defined as $P_i^\gamma(0,0) := \frac{1}{2}$. Furthermore, it is straightforward to verify that the CSF of club i is an increasing function in the club's own investments x_i and a decreasing function in the other club's investments x_j.[14]

We start our analysis by considering the league's optimum which serves as a benchmark case. The league's optimal level $(\bar{x}_1, \bar{x}_2)$ of talent investments maximizes the social surplus of both clubs and is defined as

$$(\bar{x}_1, \bar{x}_2) = \arg \max_{(x_1,x_2)} (R(x_1, x_2) - C(x_1 + x_2))$$

Solving this maximization problem yields:[15]

$$(\bar{x}_1,\bar{x}_2) = (\frac{1}{8c^2}, \frac{1}{8c^2}) \tag{1}$$

The terminologies "overinvest" and "underinvest" are defined as situations in which a club invests in equilibrium more and less, respectively, than in the league optimum.

The expected payoffs for the clubs are determined by the following (expected) profit functions:

$$\begin{aligned} E(\Pi_1) &= P_1^\gamma \alpha R(x_1, x_2) + P_2^\gamma (1-\alpha) R(x_1, x_2) - C_1(x_1) \\ &= \frac{(x_1^\gamma - x_2^\gamma)\alpha + x_2^\gamma}{x_1^\gamma + x_2^\gamma} R(x_1, x_2) - cx_1 \end{aligned} \tag{2}$$

$$\begin{aligned} E(\Pi_2) &= P_2^\gamma \alpha R(x_1, x_2) + P_1^\gamma (1-\alpha) R(x_1, x_2) - C_2(x_2) \\ &= \frac{(x_2^\gamma - x_1^\gamma)\alpha + x_1^\gamma}{x_1^\gamma + x_2^\gamma} R(x_1, x_2) - cx_2 \end{aligned} \tag{3}$$

The expected payoff of club i depends on the probability of winning P_i^γ multiplied by the share α of the endogenous league prize awarded to the winner,

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[13] Since $\frac{\partial P_i^\gamma}{\partial \gamma}(x_1,x_2) = \frac{x_1^\gamma x_2^\gamma (\log x_i - \log x_j)}{(x_1^\gamma + x_2^\gamma)^2} > 0 \Leftrightarrow x_i > x_j$.

[14] Formally, $\frac{\partial P_i^\gamma}{\partial x_i} = \frac{\gamma x_1^\gamma x_2^\gamma}{x_i(x_1^\gamma + x_2^\gamma)^2} > 0$ and $\frac{\partial P_i^\gamma}{\partial x_j} = -\frac{\gamma x_1^\gamma x_2^\gamma}{x_j(x_1^\gamma + x_2^\gamma)^2} < 0$.

[15] We only consider the symmetric optimum.

plus the probability of losing $(1 - P_i^\gamma)$ multiplied by the share $(1-\alpha)$ of the endogenous league prize awarded to the defeated club, minus the investment costs in playing talent $C_i(x_i)$.

The club-owners choose an investment level of playing talent such that expected profits are maximized. Hence, club i solves $\max_{x_i} E(\Pi_i)$, where $E(\Pi_i)$ is given above by equations (2) and (3). Since we consider a symmetric contest-model, the clubs necessarily invest the same amount of resources in equilibrium. Hence, for the Nash-equilibrium investments (x_1^*, x_2^*) it must be the case that $x_1^* = x_2^*$. With this assumption of symmetric equilibrium allocations in turn, the FOC for an interior Nash-equilibrium for each club i is given by

$$\frac{\partial E(\Pi_i)}{\partial x_i} = \frac{(1+\gamma(4\alpha-2))}{4\sqrt{2x_i^*}} - c = 0, \quad i = 1,2$$

yielding the following equilibrium expected symmetric investment levels:[16]

$$(x_1^*, x_2^*) = (\frac{1}{32c^2}(1+\gamma(4\alpha-2))^2, \frac{1}{32c^2}(1+\gamma(4\alpha-2))^2) \tag{4}$$

The equilibrium investments vary directly with the value of the discriminatory power γ of the CSF, the share α of the league prize awarded to the winner and marginal costs c. Plugging these investment levels into the (expected) profit functions (2) and (3) yields the equilibrium expected payoff $E(\Pi_i^*)$ for club i:

$$E(\Pi_i^*) = \frac{1}{32c}(3 + 2\gamma(4\alpha-2) - 4\gamma^2(2\alpha-1)^2), \quad i = 1,2$$

The existence of an equilibrium in pure strategies depends on the discriminatory power γ of the CSF and the parameter α of the revenue-sharing agreement.[17] By restricting the discriminatory power γ to $0 < \gamma \leq \bar{\gamma}(\alpha) := \frac{3}{4\alpha-2}$, we ensure the existence of a Nash-equilibrium in pure strategies, since then each club receives non-negative equilibrium payoffs, i.e. $E(\Pi_i^*) \geq 0 \quad \forall \gamma \in (0, \bar{\gamma}]$ and $i = 1,2$.[18] The threshold value $\bar{\gamma}(\alpha)$ depends on the share $\alpha \in [\frac{1}{2}, 1]$ of R awarded to the winner. That is, in a league of perfect revenue-sharing

[16] It is straightforward to verify that the second order sufficiency conditions are satisfied.

[17] The existence of Nash-equilibria in the Tullock contest is discussed in the rent-seeking literature e.g. in Lockard and Tullock (2001). In our case we can show that if $\gamma > \bar{\gamma}$ or $\alpha > \bar{\alpha}$, the FOCs and SOCs fail to characterize the global maximum. Nevertheless, there exists a symmetric mixed-strategy equilibrium, since the conditions for the corresponding existence theorem in Dasgupta and Maskin (1986) are satisfied. The case of mixed-strategies in a discrete choice set is analysed for a rent-seeking setting e.g. by Baye et al. (1994).

[18] Formally: $E(\Pi_i^*) \geq 0 \; \forall \gamma \in [\bar{\gamma}_1, \bar{\gamma}_2]$ with $\bar{\gamma}_1 = -\frac{1}{4\alpha-2}$ and $\bar{\gamma}_2 = \frac{3}{4\alpha-2}$. We can concentrate on the interval $(0, \bar{\gamma}_2]$, since γ is assumed to be strictly positive and $\bar{\gamma}_1 < 0$.

($\alpha = \frac{1}{2}$), existence of the Nash-equilibrium is guaranteed for all values $\gamma > 0$ of the discriminatory power. Whereas in a winner-takes-all league ($\alpha = 1$), the upper bound of the interval $(0, \bar{\gamma}]$ in which the Nash-equilibrium exists is given by $\bar{\gamma}(1) = \frac{3}{2}$. Similarly, by restricting α to $\frac{1}{2} \leq \alpha \leq \bar{\alpha}(\gamma) \leq 1$ with $\bar{\alpha}(\gamma) := \frac{1}{2} + \frac{3}{4\gamma}$, we obtain non-negative equilibrium payoffs and therefore the existence of the Nash-equilibrium.[19] In the symmetric equilibrium (4) the clubs realize identical strictly positive investment levels and therefore obtain an equal probability of $\frac{1}{2}$ to receive the endogenously determined league prize $R(x_1^*, x_2^*) = \frac{(1+\gamma(4\alpha-2))}{4c}$. Furthermore, the equilibrium investments in playing talent (x_1^*, x_2^*) generate costs for each club i amounting to $C_i(x_i^*) = \frac{(1+\gamma(4\alpha-2))^2}{32c}$.

By introducing the "ratio of revenue dissipation" denoted D, we are able to measure the degree of dissipation of the league revenue. In our model the ratio D is defined as:[20]

$$D(\alpha, \gamma) := \frac{\bar{T} - T^*}{\bar{T}} = \frac{1}{4}(\gamma(4\alpha - 2) - 1)^2$$

$\bar{T} := R(\bar{x}_{1,}\bar{x}_2) - C(\bar{x} + \bar{x}_2)$ and $T^* := R(x_1^*, x_2^*) - C(x_1^* + x_2^*)$ characterize the net surplus at the league optimum and the Nash-equilibrium, respectively. The higher the ratio $D(\alpha, \gamma)$, the higher the degree of dissipation in the league. If both α and γ are bigger than the threshold values $\alpha^*(\gamma) := \frac{1}{2} + \frac{1}{4\gamma}$ and $\gamma^*(\alpha) := \frac{1}{4\alpha-2}$, then $D(\alpha, \gamma)$ is increasing with α and with γ, respectively. Moreover, the ratio $D(\alpha, \gamma)$ is within the interval $[0, 1]$, since we assumed that $\gamma \leq \bar{\gamma}(\alpha)$ and $\alpha \leq \bar{\alpha}(\gamma)$.[21]

Comparative statics for the Nash-equilibrium investments (x_1^*, x_2^*) and the ratio of dissipation $D(\alpha, \gamma)$ yield the following results:

- as marginal costs c for talent investments decrease, the equilibrium investment level x_i^* of each club increases.

However, altering marginal costs does not affect dissipation of the league revenue, since the ratio of dissipation $D(\alpha, \gamma)$ is independent of c. Hence, marginal costs have no influence on the overinvestment problem.

[19] Formally: $E(\Pi_i^*) \geq 0\ \forall \alpha \in [\bar{\alpha}_1, \bar{\alpha}_2]$ with $\bar{\alpha}_1 = \frac{1}{2} - \frac{1}{4\gamma}$ and $\bar{\alpha}_2 = \frac{1}{2} + \frac{3}{4\gamma}$. We can concentrate on the interval $[\frac{1}{2}, \bar{\alpha}_2]$, since γ is assumed to be bigger or equal $\frac{1}{2}$ and $\bar{\alpha}_1 < \frac{1}{2}$.

[20] In the rent-seeking literature the ratio D is called "ratio of rent dissipation". See for instance Chung (1996).

[21] Formally, $\frac{\partial D(\alpha,\gamma)}{\partial \alpha} = 2\gamma(\gamma(4\alpha - 2) - 1) > 0 \Leftrightarrow \alpha > \frac{1}{2} + \frac{1}{4\gamma}$ and $\frac{\partial D(\alpha,\gamma)}{\partial \gamma} = \frac{1}{2}(4\alpha - 2)(\gamma(4\alpha - 2) - 1) > 0 \Leftrightarrow \gamma > \frac{1}{4\alpha-2}$. Moreover, $\lim_{\alpha \to \alpha^*} D(\alpha, \gamma) = \lim_{\gamma \to \gamma^*} D(\alpha, \gamma) = 0$ and $\lim_{\alpha \to \bar{\alpha}} D(\alpha, \gamma) = \lim_{\gamma \to \bar{\gamma}} D(\alpha, \gamma) = 1$.

- as the discriminatory power γ of the CSF increases, i.e. money buys on-field success more easily, the equilibrium investment level x_i^* of each club increases.

If γ is bigger than the threshold value $\gamma^*(\alpha)$, then each club overinvests in playing talent,[22] i.e. $x_i^* > \bar{x}_i$, and the degree of dissipation of the league revenue increases with γ. The intuition behind this result is that if smaller differences in playing talent have a stronger impact on the probability of success, the clubs have a stronger incentive for higher talent investments. Moreover, if the discriminatory power γ equals the threshold value $\bar{\gamma}(\alpha) = \frac{3}{4\alpha-2}$, then the net surplus T^* at the Nash-equilibrium amounts to zero and the ratio of dissipation $D(\alpha, \gamma)$ reaches its maximum of one. In this case the clubs dissipate the whole league revenue through their investment behavior. Empirical data suggests that the correlation between investments in playing talent (e.g. wage expenditure) and league performance has become stronger in all European football leagues in the last decade. Michie and Oughton (2004) show that for instance in the English *Premier League* the correlation coefficient between wage expenditures and league performance increased from 0.68 in the year 1993 up to 0.73 in 2003.[23] Hence, it seems to be increasingly the case that money buys on-field success. In other words, the ease of affecting the probability of winning the championship by investments in playing talent has augmented.

- as the share α of the league prize awarded to the winner increases, i.e. league's revenue is distributed more unequally, the equilibrium investment level x_i^* of each club increases.

If α is bigger than the threshold value $\alpha^*(\gamma)$, then each club overinvests in playing talent and the degree of dissipation of the league revenue increases with α. Moreover, revenue dissipation is maximal, i.e. the ratio $D(\alpha, \gamma)$ amounts to one, if the parameter α equals the threshold value $\bar{\alpha}(\gamma) = \frac{1}{2} + \frac{3}{4\gamma}$. In this case the net surplus T^* at the Nash-equilibrium is zero. We conclude that less revenue-sharing induces the clubs to increase their investments in playing talent and therefore contributes to aggravate the overinvestment problem. The result that a bigger spread between first and second prize leads to higher equilibrium efforts is well-known in contest theory and follows from the stronger incentives to win. Empirical data shows a development to less revenue-sharing in the last decade in the European football leagues, i.e. the share α of the league prize awarded to the winner has increased. Michie and Oughton (2004)

[22] However, in a league with perfect revenue-sharing, i.e. $\alpha = 0.5$, each club will invest less in equilibrium than in the league optimum, independent of the discriminatory power γ. Clearly, if each club gets the same share of the league's revenue, irrespective of field success, incentives to invest in playing talents are low.

[23] Both coefficients are statistically significant at the 1% level with a confidence interval of 0.99.

show that 1993 revenues in the *Premier League* were distributed nearly equally among the 22 clubs. The top five clubs possessed 26.8% of league's total revenue which is only slightly above the 22.7% level that would reflect equal revenue-sharing. However, the distribution of the league's total revenue became much more unequal. In 2003 the top five clubs held more than 45% of the revenue, which is clearly above the 25% level reflecting equal revenue-sharing in a league of now 20 clubs. A similar development is observable for the distribution of revenue from domestic television rights. In the season 1992/93 the bottom ranked club received €1.8 million of the revenue from domestic television rights, whereas the top ranked club obtained €3.6 million. Until the season 2003/04 the gap between top and bottom ranked club has increased significantly. The bottom ranked club received €20.1 million and the top ranked club €49.2 million.

Summarizing the results derived above yields that if (a) the discriminatory power γ of the CSF is within the interval $(\gamma^*, \bar{\gamma}] = (\frac{1}{4\alpha-2}, \frac{3}{4\alpha-2}]$ or (b) the parameter α of the revenue-sharing agreement is within the interval $(\alpha^*, \bar{\alpha}] = (\frac{1}{2}+\frac{1}{4\gamma}, \frac{1}{2}+\frac{3}{4\gamma}]$ existence of a Nash-equilibrium is guaranteed in which each club overinvests in playing talent and therefore dissipates parts of the league's revenue. However, the increase of the investment level in playing talent does not affect the winning-probability in equilibrium, since both clubs simultaneously increase their investments and will end up with identical equilibrium investments. The same relative performance among the clubs could be obtained at the league optimum, i.e. $P_i^\gamma(x_1^*, x_2^*) = P_i^\gamma(\bar{x}_1, \bar{x}_2) = \frac{1}{2}$. Even though the clubs would be better off if they agreed upon the investment level in the league optimum, this solution does not characterize a feasible equilibrium strategy due to strategic interaction, i.e. cannot be sustained without cooperation. Starting at the league optimum $\bar{x}_i$, club i has an incentive to increase its investments in talents, since this behavior raises the probability of winning the share of the endogenous league prize awarded to the winner. However, the other club j has the same incentive and therefore the clubs are caught in a typical prisoners' dilemma type of equilibrium. As a result, both clubs will enter in a ruinous competition leading to the symmetric Nash-equilibrium where each club overinvests in playing talent, with no relative gain in performance compared to the league optimum.

2.2 The general N-club case

In this subsection we show that we can extend our 2-club model to the N-club case and still obtain similar results. In a league with $i \in I = \{1, .., N\}$ clubs, the league's revenue function is given by:

$$R(x_1, x_2, ..., x_N) := (x_1 + ... + x_N)^{\frac{1}{2}}$$

As in the 2-club case, league's revenue R increases in aggregate talent investments with decreasing returns to scale. Again, our N-club league features a revenue-sharing agreement with $\alpha \in [\frac{1}{2}, 1]$ characterizing the share of the endogenous league prize awarded to the winner of the championship. For reasons of simplicity we assume that each of the defeated $(N-1)$ clubs receives the same share of the remaining league's revenue, i.e. each defeated clubs receives $\frac{1-\alpha}{N-1} R(x_1, ., x_N)$.

In the N-club case the probability of winning the championship for club $i \in I$ is defined as:[24]

$$P_i^\gamma(x_1, x_2, .., x_N) := \frac{x_i^\gamma}{\sum_{j=1}^N x_j^\gamma}$$

By assuming constant marginal costs which are equal among the clubs, i.e. $C_i(x_i) = cx_i \ \forall i \in I$, we can describe the (expected) profit function for club i as:

$$\begin{aligned} E(\Pi_i) = & P_i^\gamma(x_1, .., x_N)\alpha R(x_1, .., x_N) \\ & + (1 - P_i^\gamma(x_1, .., x_N))\frac{1-\alpha}{N-1} R(x_1, .., x_N) - C_i(x_i) \end{aligned} \quad (5)$$

Club-owners maximize expected profits by choosing a level of talent investments according to the following FOCs, which define implicitly the reaction function of club i:

$$\frac{\partial E(\Pi_i)}{\partial x_i} = \alpha(\frac{\partial P_i^\gamma}{\partial x_i} R + P_i^\gamma \frac{\partial R}{\partial x_i}) + \frac{1-\alpha}{N-1}(\frac{\partial R}{\partial x_i} - (\frac{\partial P_i^\gamma}{\partial x_i} R + P_i^\gamma \frac{\partial R}{\partial x_i})) - c = 0$$

By assuming an interior symmetric Nash-equilibrium in pure strategies, i.e. $x_1^* = x_2^* = ... = x_N^*$, the FOCs are

$$\frac{(1 + \gamma(2\alpha N - 2))}{2\sqrt{N^3 x_i^*}} = c, \quad i \in I$$

yielding the following equilibrium expected investment level for club i:[25]

$$x_i^* = \frac{(1 + \gamma(2\alpha N - 2))^2}{4N^3c^2} \quad (6)$$

In equilibrium, each club invests the same amount in playing talent and has the same probability of $\frac{1}{N}$ of receiving the share α of the endogenously determined league prize $R(x_1^*, .., x_N^*)$. Existence of Nash-equilibria in pure strategies is guaranteed if the discriminatory power γ and the parameter α of the

[24] If none of the clubs invests anything in talents, i.e. $x_i = 0 \ \forall i \in N$, the corresponding probability is then defined as $P_i^\gamma(0, .., 0) := \frac{1}{N}$.
[25] The second order sufficiency conditions are satisfied.

revenue-sharing agreement are restricted to $0 < \gamma \leq \bar{\gamma}$ and $\frac{1}{2} \leq \alpha \leq \bar{\alpha} \leq 1$, respectively, since then each club receives non-negative equilibrium payoffs.[26]

As in the 2-club case, lower marginal costs c, a higher discriminatory power γ of the CSF and less revenue-sharing (i.e. a higher parameter α) induce the clubs to increase their equilibrium investments x_i^*. Moreover, if the league already contains a sufficient number of clubs and enlarges, the club's individual investment level x_i^* decreases, whereas the league's aggregate investment level Nx^* increases. That is, the individual investment level x_i^* is a decreasing function in N for $N > \frac{3(2\gamma-1)}{2\alpha\gamma}$, whereas the aggregate investment level $Nx^* = \frac{(1+\gamma(2\alpha N-2))^2}{4N^2c^2}$ is an increasing function in N for $\gamma > \frac{1}{2}$.[27] In other words, by an enlargement of the league each club expends less in playing talent, but the aggregate investments of all clubs increase.

In order to analyze when overinvestment in playing talent occurs in a N-club league, we again need to compute the league optimum $\bar{x}_i$, which is given for club $i \in I$ by $\bar{x}_i = \frac{1}{4Nc^2}$,[28] determining the ratio of dissipation D as:

$$D(\alpha, \gamma, N) = \frac{\bar{T} - T^*}{\bar{T}} = \frac{1}{N^2}(\gamma(2N\alpha - 2) + 1 - N)^2$$

The ratio D increases by an enlargement of the league, i.e. clubs dissipate more of the league revenue, if the league contains a sufficient number of clubs and if $\gamma > \frac{1}{2}$.[29] As in the 2-club case, existence of the Nash-equilibrium is guaranteed in which each club overinvests in playing talent and therefore dissipates parts of the league's revenue if (a) the discriminatory power γ is within the interval $(\gamma^*, \bar{\gamma}]$ with $\gamma^*(\alpha, N) := \frac{N-1}{2N\alpha-2}$ or (b) the parameter of revenue-sharing α is within the interval $(\alpha^*, \bar{\alpha}]$ with $\alpha^*(\gamma, N) := \frac{1}{N} + \frac{N-1}{2N\gamma}$.[30] Marginal costs c again have no influence on the overinvestment problem.

3 A league model with an additional exogenous league prize

We assume that our 2-club league now offers an exogenously given prize denoted Q besides the endogenously determined league prize $R(x_1, x_2)$. The exogenous prize is solely awarded to the winner of the championship. The en-

[26] Formally, if $\gamma \in (0, \bar{\gamma}]$ with $\bar{\gamma}(N, \alpha) := \frac{N^3\alpha + N^2(1-2\alpha) - N + 1}{2(N-1)(N\alpha-1)}$ and $\alpha \in [\frac{1}{2}, \bar{\alpha}]$ with $\bar{\alpha}(N, \gamma) := \frac{N(1-N)+2\gamma(1-N)-1}{N(N^2+2\gamma-2N(1+\gamma))}$ then $E(\Pi_i^*) \geq 0$.
[27] $\frac{\partial x_i^*}{\partial N} > 0 \Leftrightarrow N \in (\frac{(2\gamma-1)}{2\alpha\gamma}, \frac{3(2\gamma-1)}{2\alpha\gamma})$ and $\frac{\partial Nx^*}{\partial N} > 0$ for all $N > 2$, if $\gamma > \frac{1}{2}$.
[28] We only consider the symmetric optimum.
[29] $\frac{\partial D(\alpha,\gamma,N)}{\partial N} > 0$ if $N > \frac{2\gamma-1}{2\alpha\gamma-1}$ and $\gamma > \frac{1}{2}$.
[30] If $\alpha > \alpha^*$ and $\gamma > \gamma^*$ then each club invests more in the Nash-equilibrium than in the league optimum and the ratio of dissipation increases in α and γ, respectively.

dogenous league prize $R(x_1, x_2) = (x_1 + x_2)^{\frac{1}{2}}$ is distributed among the clubs according to a revenue-sharing agreement, with $\alpha \in [\frac{1}{2}, 1]$ characterizing the share of $R(x_1, x_2)$ which is awarded to the winner of the league, while $(1-\alpha)$ is the share of $R(x_1, x_2)$ received by the defeated club. For the sake of simplicity, we assume that the CSF for club i is henceforth given by $P_i(x_1, x_2) = \frac{x_i}{x_1+x_2}$, i.e. the discriminatory power γ amounts to one. By assuming constant and equal marginal costs for both clubs, i.e. $C_i(x_i) = cx_i$, the expected profit of club $i = 1, 2$ is given by

$$E(\Pi_i) = P_i(\alpha R(x_1, x_2) + Q) + (1 - P_i)(1 - \alpha)R(x_1, x_2) - C_i(x_i)$$

yielding the following FOC of profit-maximization for each club:

$$\frac{\partial E(\Pi_i)}{\partial x_i} = \alpha(\frac{\partial P_i}{\partial x_i}R + P_i\frac{\partial R}{\partial x_i}) + \frac{\partial P_i}{\partial x_i}Q + (1-\alpha)(\frac{\partial R}{\partial x_i} - (\frac{\partial P_i}{\partial x_i}R + P_i\frac{\partial R}{\partial x_i})) - c = 0$$

By assuming symmetric equilibrium investments, i.e. $\widetilde{x}_1^* = \widetilde{x}_2^*$, the FOCs are given by

$$\frac{(4\alpha - 1)}{4\sqrt{2\widetilde{x}_i^*}} + \frac{1}{4\widetilde{x}_i^*}Q = c, \quad i = 1, 2$$

determining the following Nash-equilibrium $\widetilde{x}_i^*$ for club i as:[31]

$$\widetilde{x}_i^* = \frac{Q}{4c} + \frac{(4\alpha - 1)}{64c^2}((4\alpha - 1) + \sqrt{32cQ + (4\alpha - 1)^2}) \tag{7}$$

By increasing the exogenous prize Q, each club is induced to spend more on playing talent, since $\frac{\partial \widetilde{x}_i^*}{\partial Q} > 0$. We can interpret the exogenously given prize Q as the secure additional income once a club has qualified for international tournaments, while the endogenous prize $R(x_1, x_2)$ still characterizes the league prize for the domestic championship. In the European football leagues the clubs compete against each other also for the right to participate in international competitions like the UEFA Champions League. For example in the "Big Five" leagues the domestic league champion automatically qualifies to participate in the Champions League which offers lucrative additional revenues. The participation in the Champions League guarantees participants a minimum number of matches at the group stage and therefore secure revenue. For example in the season 2004/05 each club received a participation premium of €3.57 million plus a variable performance-related bonus for the group stage. Additional revenue can be earned from the knockout stages dependent on the performance of the club in the competition or from the market-pool dependent on the market value of the club's country. For instance Liverpool, the winner of the 2005 Champions League, received a total sum of €30.6 million.[32]

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[31] The second order sufficiency conditions are satisfied.

[32] Figures are taken from UEFA (2005) and are converted from CHF to € using an exchange rate of 0.65€ to 1CHF.

Empirical data shows that the participation in international tournaments has become much more lucrative in the last decade, since the revenues from television rights, sponsorship deals and new media contracts generated by UEFA competitions, especially the Champions League, grew significantly. When the UEFA Champions League was created by reform of the Champion's Cup in 1992/93, broadcast and sponsorship revenues were low, they amounted to approximately €25 million.[33] However, these revenues raised up to €415 million in the season 2004/05 - an increase by more than 1600% - making the UEFA Champions League to one of the most valuable properties in club football.[34] The participating clubs directly benefit from this increase in revenues, since under the competition regulations 75% of the total revenue is distributed according to fixed amounts among the participants.

Moreover, we derive from our model that the investment level in a league which offers lucrative additional exogenous revenues is always higher than the respective level in a league which offers only an endogenous prize, since $\forall Q > 0$ holds $\widetilde{x}_i^* > x_i^* = \frac{(4\alpha-1)^2}{32c^2}$ (see equation (4) with $\gamma = 1$). The additional exogenous prize, however, has no influence on the league optimum which is given, as in the basic model in section 2, by $\bar{x}_i = \frac{1}{8c^2}$, determining the net surplus $\bar{T}$ at the league optimum as $\bar{T}(Q) = \frac{1}{4c} + Q$. We derive that due to the additional exogenous prize, the corresponding ratio of dissipation $\widetilde{D} := \frac{\bar{T}(Q)-\widetilde{T}^*}{\bar{T}(Q)}$ is higher than the ratio $D = \frac{\bar{T}-T^*}{\bar{T}}$ of a league with only an endogenous prize.[35]

We conclude that in a league which offers an additional exogenous prize like the Champions League the overinvestment problem is aggravated compared to a league which only offers an endogenous prize. The potential extra prize Q generates additional financial incentives that encourages clubs to gamble on success by overinvesting in playing talent in the hope of gaining admission to the lucrative Champions League and therefore to compensate the expenditures. Even though expected profits are non-negative, such a strategy is risky since the clubs cannot be sure of receiving the prize. Only a limited number of clubs qualify for the Champions League, while the "non-qualifiers" can experience a financial crisis leading into bankruptcy. Presently *Leeds United*, which failed to qualify for the Champions League in 2001/02, illustrates what happens if the gamble fails.

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[33] Michie and Oughton (2004).

[34] UEFA (2005), exchange rate: 0.65€ to 1CHF.

[35] It is straightforward to verify that $\widetilde{D} > D$, since $\widetilde{T}^* := R(\widetilde{x}_1^*, \widetilde{x}_2^*) - C(\widetilde{x}_1^* + \widetilde{x}_2^*)$ is a decreasing function in Q.

4 A league model with promotion and relegation

The European football leagues are organized hierarchically in ascending divisions, offering a system of promotion and relegation. At the end of each season the worst performing clubs in each division are relegated to the next lower division and are replaced by the best performing clubs from that division. In order to analyze how a system of promotion and relegation affects the investment behavior of football clubs, we will incorporate such a system in our league model by considering an open winner-takes-all league, i.e. a league without a revenue-sharing agreement but which is open to promotion and relegation. Our dynamic model covers two periods and consists of two divisions denoted division A and division B, with each division containing two clubs denoted $i \in I = \{1, 2, 3, 4\}$. The time dimension becomes relevant now, because current investment behavior depends on the expected future profits as well as current profits. In other words, the prospect of promotion and relegation affects the first-period investments in playing talent. For the sake of simplicity, we assume that the revenue of each division is exogenously given with R_A and R_B denoting the prize of division A and B, respectively. Division A is considered as the top-flight division which offers a higher prize than the second division B, i.e. $R_A > R_B$.

We assume that club 1 and club 2 start in period one in division A competing for the first division prize R_A. The first-period champion receives the prize R_A, remains in division A and competes in period two against the promoted club from division B. The defeated club from division A gets nothing, is relegated to the second division and competes in the second period against the defeated club from division B. Club 3 and club 4 start in the first period in division B and compete for the second division prize R_B. The first-period champion receives the prize R_B, is promoted to division A and competes in period two against the first-period champion of division A. The defeated club from division B gets nothing, remains in the division and competes in the second period against the relegated club from division A.

The investments in playing talent of club $\mu \in I$ in period $t \in \{1, 2\}$ are denoted $x_{\mu,t}$ generating costs $C_\mu(x_{\mu,t}) = x_{\mu,t}\ \forall \mu \in I$, i.e. marginal costs are normalized to one. Expected profits of club μ, if this club competes in division k against club ν in period t, are denoted $E(\Pi^{t,k}_{\mu,\nu})$, with $\mu, \nu \in I$. Again, we assume that the discriminatory power γ of the CSF in our dynamic model amounts to one. Hence, the probability that club $\mu \in I$ wins against club $\nu \in I$ in period t is given by:

$$P^t_{\mu,\nu}(x_{\mu,t}, x_{\nu,t}) = \frac{x_{\mu,t}}{x_{\mu,t} + x_{\nu,t}}$$

Since it is assumed that the division prize R_k is won by one of the two clubs in the corresponding division $k \in \{A, B\}$ with certainty, it must be the case that $P^t_{\mu,\nu} = (1 - P^t_{\nu,\mu})$.

In the top-flight division A, expected first-period profits $E(\Pi^{1,A}_{i,j})$ of club i and j can be written as:[36]

$$E(\Pi^{1,A}_{i,j}) = P^1_{i,j}(R_A + E(\Pi^{2,A}_{i,r})) + (1 - P^1_{i,j})E(\Pi^{2,B}_{i,s}) - C_i(x_{i,1}) \qquad (8)$$

With probability $P^1_{i,j}$ club i wins against club j in period one and obtains the first division prize R_A. Club i then remains in division A, competes in period two against the promoted club r from division B and receives an expected second-period payoff of $E(\Pi^{2,A}_{i,r})$. With probability $(1-P^1_{i,j})$ club i loses against club j and is relegated to division B without receiving a prize in period one. Then, club i competes in the second period against the defeated club s of division B, obtaining an expected second-period payoff of $E(\Pi^{2,B}_{i,s})$.

In the second division expected first-period profits $E(\Pi^{1,B}_{r,s})$ of club r and s are given by:

$$E(\Pi^{1,B}_{r,s}) = P^1_{r,s}(R_B + E(\Pi^{2,A}_{r,i})) + (1 - P^1_{r,s})E(\Pi^{2,B}_{r,j}) - C_r(x_{r,1}) \qquad (9)$$

With probability $P^1_{r,s}$ club r is successful against club s in period one and receives the division B prize R_B. Club r is then promoted to division A, obtaining an expected payoff of $E(\Pi^{2,A}_{r,i})$ in period two. With probability $(1 - P^1_{r,s})$ club r loses against club s and stays in division B, receiving in period two an expected payoff of $E(\Pi^{2,B}_{r,j})$.

Following the logic of backward induction, we first determine expected profits $E(\Pi^{2,k}_{i,s})$ for club i and expected profits $E(\Pi^{2,k}_{r,j})$ for club r in division k of the subgame beginning in period two. Since clubs are assumed to be symmetric, it is irrelevant for the division A club i against which division B club r it will compete in the second period in division k and vice versa, i.e. it must be the case that $E(\Pi^{2,k}_{i,3}) = E(\Pi^{2,k}_{i,4})$ and $E(\Pi^{2,k}_{r,1}) = E(\Pi^{2,k}_{r,2})$, respectively. Therefore, expected payoffs in period two are given by:

$$E(\Pi^{2,k}_{i,s}) = P^2_{i,s}R_k - x_{i,2} \quad \text{and} \quad E(\Pi^{2,k}_{r,j}) = P^2_{r,j}R_k - x_{r,2}$$

By deriving the respective FOCs and solving the system of reaction functions, we determine the equilibrium investment levels $x^O_{i,2}$ and $x^O_{r,2}$ besides the equilibrium payoffs $E^O(\Pi^{2,k}_{i,s})$ and $E^O(\Pi^{2,k}_{r,j})$ in the second period for club i and club r, respectively, as:

$$x^O_{i,2} = x^O_{r,2} = \frac{R_k}{4} \quad \text{and} \quad E^O(\Pi^{2,k}_{i,s}) = E^O(\Pi^{2,k}_{r,j}) = \frac{R_k}{4}$$

[36] For notational sake, we exclusively use the subscripts $i, j \in \{1, 2\}$ to characterize the division A clubs 1 and 2, while the subscripts $r, s \in \{3, 4\}$ stand for the division B clubs 3 and 4. The superscript k denotes the division, with $k \in \{A, B\}$ and t stands for the period, with $t \in \{1, 2\}$.

In an open league, each of the four clubs invests in period two $\frac{R_k}{4}$ in playing talent and receives an expected payoff of $\frac{R_k}{4}$, dependent in which division k it competes. Plugging the second-period expected payoffs $E^O(\Pi_{i,s}^{2,k})$ and $E^O(\Pi_{r,j}^{2,k})$ into the first-period profit functions (8) and (9), respectively, yields:

$$E(\Pi_{i,j}^{1,A}) = P_{i,j}^1(R_A + \frac{R_A}{4}) + (1 - P_{i,j}^1)\frac{R_B}{4} - x_{i,1}$$
$$E(\Pi_{r,s}^{1,B}) = P_{r,s}^1(R_B + \frac{R_A}{4}) + (1 - P_{r,s}^1)\frac{R_B}{4} - x_{r,1}$$

By deriving the corresponding FOCs and solving the system of reaction functions it is straightforward to derive the profit maximizing talent investments $x_{i,1}^O$ and $x_{r,1}^O$ besides the expected profits $E^O(\Pi_{i,j}^{1,A})$ and $E^O(\Pi_{r,s}^{1,B})$ for club i and club r, respectively, in period one:

$$x_{i,1}^O = \frac{1}{16}(5R_A - R_B) \quad \text{and} \quad E^O(\Pi_{i,j}^{1,A}) = \frac{1}{16}(5R_A + 3R_B) \tag{10}$$
$$x_{r,1}^O = \frac{1}{16}(R_A + 3R_B) \quad \text{and} \quad E^O(\Pi_{r,s}^{1,B}) = \frac{1}{16}(R_A + 7R_B) \tag{11}$$

The division A clubs 1 and 2 spend more on playing talent in the first period than the division B clubs 3 and 4. But, they also receive a higher expected payoff. [37]

As a reference point, we now calculate the respective investment levels and payoffs in a closed league, i.e. in a league where it is not possible to be promoted or relegated from one division to another. In such a league, the division k clubs μ and ν have the following first-period expected profits:

$$E(\Pi_{\mu,\nu}^{1,k}) = P_{\mu,\nu}^1(R_k + E(\Pi_{\mu,\nu}^{2,k})) + (1 - P_{\mu,\nu}^1)E(\Pi_{\mu,\nu}^{2,k}) - C_\mu(x_{\mu,1}) \tag{12}$$

With $k = A$ if $\mu, \nu \in \{1, 2\}$ and $k = B$ if $\mu, \nu \in \{3, 4\}$. With probability $P_{\mu,\nu}^1$ the division k club μ wins against club ν in period one, obtains the division k prize R_k and competes in period two again with club ν for the prize R_k, receiving an expected payoff of $E(\Pi_{\mu,\nu}^{2,k})$. With probability $(1 - P_{\mu,\nu}^1)$ club μ is defeated by club ν in period one, receives nothing and plays in the second period again against club ν in division k, obtaining an expected payoff of $E(\Pi_{\mu,\nu}^{2,k})$.

For the subgame beginning in period two, expected profits $E(\Pi_{i,j}^{2,A})$ for the division A clubs 1 and 2 and expected profits $E(\Pi_{r,s}^{2,B})$ for the division B clubs 3 and 4, respectively, are given by

$$E(\Pi_{i,j}^{2,A}) = P_{i,j}^2 R_A - x_{i,2} \quad \text{and} \quad E(\Pi_{r,s}^{2,B}) = P_{r,s}^2 R_B - x_{r,2}$$

[37] $x_{i,1}^O > x_{r,1}^O \Leftrightarrow R_A > R_B$ and $E^O(\Pi_{i,j}^{1,A}) > E^O(\Pi_{r,s}^{1,B}) \Leftrightarrow R_A > R_B$.

yielding the following second-period equilibrium investments and payoffs in division A and B respectively:

$$x_{i,2}^C = \frac{R_A}{4},\ E^C(\Pi_{i,j}^{2,A}) = \frac{R_A}{4} \quad \text{and} \quad x_{r,2}^C = \frac{R_B}{4},\ E^C(\Pi_{r,s}^{2,B}) = \frac{R_B}{4}$$

By plugging the equilibrium payoffs $E^C(\Pi_{i,j}^{2,A})$ and $E^C(\Pi_{r,s}^{2,B})$ into (12) and computing the corresponding FOCs, it is straightforward to derive the first-period equilibrium investments and payoffs in division A and B:

$$x_{i,1}^C = \frac{R_A}{4} \quad \text{and} \quad E^C(\Pi_{i,j}^{1,A}) = \frac{R_A}{2} \tag{13}$$

$$x_{r,1}^C = \frac{R_B}{4} \quad \text{and} \quad E^C(\Pi_{r,s}^{1,B}) = \frac{R_B}{2} \tag{14}$$

If we compare the first-period investment levels (10) with (13) in division A and (11) with (14) in division B, respectively, we observe in our model an increase of talent investments in an open league compared to a closed league. In an open league the division A clubs 1 and 2 realize an investment level of $x_{1,1}^O = x_{2,1}^O = \frac{1}{16}(5R_A - R_B)$ in the first period, which lays above the first-period investment level $x_{1,1}^C = x_{2,1}^C = \frac{R_A}{4}$ of the respective clubs in a closed league, since we assumed that $R_A > R_B$. The same holds true for the division B clubs 3 and 4. The first-period talent investments $x_{3,1}^O = x_{4,1}^O = \frac{1}{16}(R_A + 3R_B)$ in an open league are higher than the respective investment levels $x_{3,1}^C = x_{4,1}^C = \frac{R_B}{4}$ in a closed league. Hence, the first-period aggregate investment level in both divisions is higher in an open league than the respective level in a closed league. In other words, clubs compete more intensively in an open league in the first period than in a closed league. However, in the second period the investment levels in an open league and in a closed league are equal in both divisions, i.e. $x_{\mu,2}^O = x_{\mu,2}^C\ \forall \mu \in I$.

In an open league the prospect of promotion as an additional reward for clubs in the second division and the threat of relegation for clubs in the top division both induce an increase of talent investments in the first period, compared to a closed league. Empirical data confirms these findings: by comparing the expenditures in player salaries in the closed US *Major League Baseball* (MLB) with the open English *Premier League* in the season 1998/99[38] we consider the financial data consistent with our theoretical analysis. In the closed MLB the clubs spend on average 54% of total revenues on player salaries, whereas in the open Premier League this figure is significantly higher, with a club spending on average 60% of total revenues on wages. The Premier League club *Blackburn Rovers* even invested more than 100% of its income in player

[38] In terms of profit and average franchise value the Premier League and the MLB are comparable according to Noll (2002).

salaries in the season 1998/99 in which this club was relegated.[39] Moreover, from the season 2000/01 up to the season 2002/03 the wages to turnover ratio in the open *Serie A* and *Primera Division* clearly laid above the 70% level. In 2001/02 the Italian clubs even spent 90% of their income on player salaries.[40] We conclude that under a system of promotion and relegation the incentives to improve team quality by investing a higher amount in playing talent are enhanced, since clubs obtain financial benefits from promotion and suffer financial penalties from relegation.

Moreover, we derive from our model that the larger the difference between division A and division B in terms of revenues, i.e. the bigger the spread between division prize R_A and division prize R_B, the bigger the difference between the first-period investments in an open and a closed league. Formally, the difference between the first-period investments in playing talent in an open and a closed league is given for both divisions by $x^O_{\mu,1} - x^C_{\mu,1} = \frac{1}{16}(R_A - R_B) \forall \mu \in I$. The difference $x^O_{\mu,1} - x^C_{\mu,1}$ becomes larger, if the spread between the division prize R_A and R_B increases. Hence, each club will spend more on playing talent in an open league, if the promotion from division B to division A becomes more lucrative and the relegation from A to B more "costly" (in terms of reduced revenues). Empirical data confirms that the "financial gap" between the first and second division in European football leagues has increased in the last decade. For instance in England, the difference in terms of average revenue per club between the *Premier League* and the second division, the so-called *Division One,* increased over the last decade. The average Premier League club generated a revenue of €31.3 million in the season 1996/97 which was 4.2 times greater than the respective revenue (€7.4 million) generated by the average Division One club. This difference in revenue increased significantly, since in the season 2003/04 the average Premier League club earned a revenue of €94.4 million, which was over six times greater than the respective revenue (€15.7 million) of its Division One counterpart.[41]

5 Conclusions

The recent paradox of raising revenues and declining profits in professional team sports leagues gives reason to examine sources of rent dissipation within those leagues. We have presented a theoretical league model in which profit maximizing clubs interact and compete for a certain league prize. Our analysis

[39] Szymanski and Valletti (2003).
[40] Deloitte (2004).
[41] Deloitte (2004), exchange rates: 1.35€ to 1 GBP (1997); 1.42€ to 1 GBP (2004).

has shown that the tendency to overinvest in playing talent, which is a direct consequence of the ruinous competition between the clubs, leads to dissipation of the league's revenue. There are a set of factors responsible for enhancing the incentives to overinvest in playing talent and therefore to dissipate league's revenue:

- a stronger correlation between talent investments and league performance.
- a more unequal distribution of the league's revenue.
- an additional exogenous prize (e.g. Champions League) awarded to the winner of the domestic championship.
- a system of promotion and relegation.
- an increased inequality between first and second division of a domestic league.

The findings in our paper are consistent with real life observations. Empirical data suggests that money buys field success more easily in all European football leagues in the last decade. Furthermore, we observe a widening of the revenue gap between the strongest and weakest teams in all European football leagues, i.e. we perceive a development to less revenue-sharing. Empirical data also shows that the revenues generated by UEFA competitions, especially the Champions League, have grown significantly in the last decade. Further, we observe that the clubs competing in open leagues spend a higher proportion of their revenues on player wages than their counterparts in closed leagues. Finally, the gap between the first and second division in the European football leagues has increased.

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