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Abstract

This paper analyzes the effects of a percentage-of-revenue salary cap in a team sports league with win-maximizing clubs and flexible talent supply. It shows that a percentage-of-revenue cap produces a more balanced league and decreases aggregate salary payments. Taking into account the idiosyncrasies of European football, our paper further highlights the potential conflicts between the league and society. From the perspective of a league governing body, a percentage-of-revenue cap always enhances financial stability of win-maximizing clubs. A social planner, however, will not permit the introduction of such a cap if fans and players unduly suffer. This paper shows under which conditions the social planner accepts (rejects) a salary cap proposed by the league regulator.

Keywords: Competitive balance, regulation, salary cap, social welfare, team sports leagues

JEL Classification: D02; D60; L83

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1 Introduction

Competitive imbalance leading to boring games and the ruinous escalation of player salaries play the dominant role among the dangers cited in all attempts to regulate professional team sports since the introduction of the first professional leagues in the USA. Throughout their history, American professional team sports have employed a wide array of regulations against these dangers. Reserve clauses limiting free agency of players were the most prominent example in this context.[1] The reserve clause dissolved in the 1970s, because of players' unions, and the anti-trust threats. The latest state of development in this struggle for cost controls and the promotion of competitive balance is known under the heading of salary caps.

A salary cap limits the total amount of salaries paid by a club to all its players. All four North American major team sports leagues have introduced some variant of a salary cap mechanism in the meantime.[2] In contrast to earlier regulations imposed by the team owners on players, salary caps are now an integral part of the system of labour relations in the league. The maximum (and sometimes minimum) amount of league revenues which should be devoted to player salaries is negotiated between the players' unions and the team owners and is fixed in Collective Bargaining Agreements (CBAs). Therefore, salary caps are not subject to anti-trust actions as earlier regulations affecting the player market used to be.

Although in the last decade European club football has achieved an economic and financial potential comparable to that of the North American major leagues, it has not yet followed those league's example of introducing salary cap mechanisms. Presumably, this reluctance is not caused by the dangers of competitive imbalance and financial instability being unknown among the stakeholders of European football. Rather, the opposite seems to be the case. The recently published Independent European Sports Review (Arnaut, 2006), an expert report based on a process of intensive consultation with the most important stakeholder groups of European football, leaves no doubt that the general perception is that competitive balance in European club football is declining and that a large number of clubs have stumbled into a massive financial crisis and are accumulating ever-increasing debt. The reasons for the past inactivity of European club football to introduce salary cap mechanisms are structural, as will be outlined in the next section.

The sports economics literature concerning the influence of salary caps in professional team sports leagues is mainly focused on the impact on competitive balance and club

[1] Szymanski and Ross (2007) argue that the reserve clause which is "normally characterized as a horizontal restraint, also possesses the character of a vertical restraint in the sense that it restricts the movement of players between hierarchical levels of the sport."

[2] Major League Baseball claims not to have a salary cap so far. However, Major League Baseball has a luxury tax mechanism, which requires the definition of a threshold for the application of the tax. The threshold can be interpreted as an absolute ceiling cap. For an analysis of luxury taxes, see Marburger (1997).

profits. Staudohar (1998) gives a historical overview of the development of salary caps in the North American major leagues. Quirk and Fort (1992) suggest that salary caps may improve competitive balance because they prevent large-market clubs from bidding the full marginal value for additional talent. This effect allows small-market clubs to keep their star players. Fort and Quirk (1995) consider an enforceable salary cap as the only effective device to maintain financial viability and improve competitive balance. Their theoretical model predicts a decrease in the standard deviation of win percentage. Vrooman (1995, 2000) argues that salary caps are a collusive effort by clubs to maximize league revenues by controlling labor costs at the expense of less competitive balance within the league. Késenne (2000) develops a two-team model consisting of a large- and a small-market club and shows that a National Basketball Association (NBA) type of salary cap, defined as a fixed percentage of total league revenues in the previous season divided by the number of teams, will improve competitive balance as well as the distribution of player salaries within the league. Moreover, he shows that the profits of both the small- and the large-market club will increase. Késenne (2003) compares the salary cap as it has been introduced in some North American major leagues with the salary cap proposed by the G-14 for the European football leagues. He shows that the impact of these two types of salary caps can be very different and depends on the cost structure of the small- and large-market clubs. Dietl, Lang and Rathke (2009) analyze the impact of an exogenously determined salary cap on social welfare in a league with profit-maximizing clubs. In contrast to Dietl, Lang and Rathke (2009), we consider win-maximizing clubs and a salary cap that is endogenously calculated as a percentage of current revenues.

The literature is not well adapted to the relevant institutional parameters of the European situation. From the perspective of European football, the crucial question is whether a percentage-of-revenue salary cap applied in a league context with win-maximizing clubs has the potential to increase social welfare because its introduction depends on the approval of EU institutions. As recent events in European sports history have shown, it is a priori unclear whether a salary cap mechanism in European football falls under the margin of discretion granted by the state authorities to the sport associations.

In this paper, we try to provide an initial answer to these questions based on a game-theoretic model of a team sports league with win-maximizing clubs and flexible talent supply. We assume that a league regulator sets a percentage-of-revenue salary cap subject to appeasing a social planner who takes all participants in the regulatory scheme into account. Our analysis shows that such a salary cap increases competitive balance and decreases the overall salary payments in the league. We further show that social welfare can increase if the fans have a relatively high preference for aggregate talent because this translates into an overly unbalanced unregulated league. In this case, the social planner will approve the introduction of a salary cap. If the fans have a relatively high preference for competitive balance, implying a well-balanced unregulated league, the

salary cap will reduce social welfare by unnecessarily balancing the league further, while lowering the aggregate level of talent. Nevertheless, the league regulator will propose to introduce a salary cap if the concern about the financial stability of the league is sufficiently high. However, in this case the social planner will not approve the proposal of the league regulator.

The remainder of the paper is organized as follows. The next section lays out the institutional characteristics of the European football leagues. Section 3 presents the model of a team sports league with win-maximizing clubs and a percentage-of-revenue salary cap. In the subsequent three sections, we present the basic model set-up, analyze the problem of the clubs and consider the problem of the governing league body. Finally, Section 4 summarizes the key findings and concludes.

2 Characteristics of European Football Leagues

In this section, we outline the institutional characteristics of the European football leagues that are embedded in association structures (see Dietl, Franck, Hasan and Lang, 2009). Every national football association governs a system of leagues that is open through promotion and relegation from the amateur level to the top national division of professional football. At the top of the national league pyramid, the UEFA, an association of national associations, organizes European club competitions like the Champions League and the European League for teams meeting certain sportive qualification criteria. All football associations are conceived as democratic governing bodies that aim to integrate all important stakeholders of football in a certain geographic region including the players and representatives of amateur football. At the European level, the different political and market conditions of every football-playing nation create additional stakeholder diversity. It follows that the decision-making processes concerning the introduction of salary caps are complicated in the European association-governed football pyramid because the interests of various stakeholders need to be properly balanced. In particular, the diversity of European stakeholders leads to the following specific institutional characteristics.

First, a salary cap system has to take into account the significant market heterogeneity within the European football pyramid. An absolute capped salary amount applicable to all clubs is unsuitable in the European football pyramid because, for example, a typical Belgian first division club will earn approximately 13% of the revenues of the typical English Premiership club. A workable solution in the European context seems to be a percentage-of-revenue salary cap. In fact, all discussions among the stakeholders of European football focus on this relative capping strategy (Arnaut, 2006, p. 83). For example, a small fraction of European football clubs, known as G-14 and established as an interest group of 18 prominent clubs of European football, raised the issue of salary cost controls in 2004. The members of G-14 planned to limit their salary expenditures at

70% of audited club turnover beginning in the 2005/2006 season. At the same time, the minimum allowable amount for each club's total staff costs was set at 30 million Euros. According to the G-14 plan, verification of the clubs' compliance with these principles would be carried out by their statutory auditors. However, the G-14 plan was never put into practice and G-14 dissolved in January 2008, when the new European Club Association was founded under the auspices of UEFA.

Second, the hermetic North American major leagues operating independently of association structures implemented salary caps as an integral part of a labor relations approach. The players' union and the owners represent the two sides of the relevant labor market and the state accepts the outcome of their bargaining as it is stated in CBAs. This labor market model is not compatible with the European association model. Associations do not represent one side of a labor market. Instead, they are sports governing bodies. Representing all of the important stakeholders in sports, they perform regulatory functions normally reserved for the state. European states have to a great extent left the regulation of sports to sports governing bodies. This self-regulation of sports is seen as an important expression of European civil society (Arnaut, 2006).

However, the scope for autonomous regulatory activity of the sports governing bodies is limited. Recently, the European Court of Justice and the European Commission have acted in a way that the associations have found it difficult to judge whether new measures would be in accordance with EU law. The Bosman ruling of the EU Court of Justice is the most prominent case in which a regulation issued by the football associations, the player transfer system, was found to violate EU law, in particular, the principle of freedom of movement in the labor market.[3]

In this context, it is a priori unclear whether a salary cap mechanism in European football falls under the margin of discretion granted to the sport associations to perform their duties. In any case, the football governing bodies will have to prove that their proposal of a salary control system is doing more than, for example, improving the financial situations of clubs. As the previous interferences of EU institutions into the regulatory activities of sports associations show, a much broader welfare perspective including the view of consumers is generally applied. The EU institutions will only grant discretion to the football governing bodies if the latter can prove that the new system of salary cost controls is not detrimental from a social welfare perspective.

[3]In its famous Bosman ruling, the European Court of Justice abolished the existing transfer system and the so-called 3+2 rule, which limited the number of foreign players a club could field. For analyses concerning the implications of the Bosman ruling, see, e.g., Simmons (1997), Feess and Muehlheusser (2003), and Frick (2007, 2009).

3 Model of a Team Sports League

This section develops a simple model of a team sports league to study the impact of salary caps. We assume that n (an even number) clubs try to maximize their success on the field. In the sports economics literature, clubs are normally treated either as win-maximizers or as profit-maximizers (Sloane, 1971; Hoehn and Szymanski, 1999; Zimbalist, 2003; Késenne, 2006; Dietl, Lang, Rathke, 2011).[4] Although no unequivocal consensus on the appropriate objective function of clubs has emerged so far, we adopt the assumption of win-maximizers as has been done in several papers in the context of European clubs (e.g., Késenne and Jeanrenaud, 1999; Késenne, 2000; 2006).[5]

In addition, there is a league governing body that distributes league revenues to the clubs and decides whether to implement a percentage-of-revenue salary cap. When setting the salary cap, the league regulator (league governing body) has to ensure that a minimum level of welfare is retained that appeases a social planner (legal authorities). We use a two-stage setup:

Stage 1: The governing body of the league sets the salary cap to maximize its objective function subject to appeasing a social planner.

Stage 2: The clubs independently invest in playing talent to maximize their own level of talent subject to the salary cap set by the league regulator, which is defined as a percentage of the club's revenues. Clubs receive a certain share of the total league revenues that depends on their market size. We assume that there are two types of clubs: large-market and small-market clubs, which differ in the shares they receive of total league revenues.

3.1 *Model Setup*

The derivation of total league revenues for a league of a certain quality follows Falconieri et al. (2004) and Dietl and Lang (2008). The league maximizes total revenues subject to a league demand function derived from fans' preferences. As shown in the appendix, this results in a simple formulation of total league revenues, denoted by LR, which depends only on the quality of the league:

$$LR(x_1, .., x_n) = \frac{1}{4} q(x_1, .., x_n).$$

Following Szymanski (2003) and Dietl, Lang and Rathke (2009), we assume that league quality depends on the overall level of competition, as well as the suspense associ-

[4] Mixed objectives are also considered, see e.g., Dietl, Lang and Werner (2009).

[5] Moreover, Garcia-del Barrio and Szymanski (2009) provided statistical evidence that the behavior of football clubs in the Spanish and English leagues is better approximated by win maximization (subject to a zero profit budget constraint) rather than profit maximization. In contrast, Fort (2000) questions that win maximization is the objective in European sports.

ated with a close competition (competitive balance). Both depend on the vector of talent investments (salary payments) of the n clubs, where x_i denotes the talent investment of club i. We assume that the supply of talent is perfectly elastic such that we can normalize the unit cost/price of talent to one. It follows that the talent investments of the clubs are equal to their salary payments: we will therefore use the two terms interchangeably. Note that in contrast to the North American major leagues, where the supply of talent is constant in the short-run, the European football leagues operate in an open player market, especially after the Bosman verdict in 1995.

League quality is now defined as

$$q(x_1, .., x_n) = \theta T(x_1, .., x_n) + CB(x_1, .., x_n), \tag{1}$$

where $\theta > 0$ allows the relative importance of the two components of league quality to shift. Thus, θ can be interpreted as reflecting the fans' relative preference for aggregate talent.

The total level of the competition T is measured by the aggregate talent within the n club league:

$$T(x_1, .., x_n) = \sum_{j=1}^{n} x_j.$$

Competitive balance CB is measured as minus the variance of salary payments:[6]

$$CB(x_1, .., x_n) = -\frac{1}{n} \sum_{j=1}^{n} (x_j - \overline{x}_n)^2 \text{ with } \overline{x}_n = \frac{1}{n} \sum_{j=1}^{n} x_j.$$

Note that a lower variance of salary payments by the n clubs implies closer competition and therefore a higher degree of competitive balance.

Fans are willing to pay more for both higher aggregate talent (major vs. minor leagues) and a more balanced league. This means that for a given amount of aggregate talent, league quality will increase if talent is distributed more evenly among clubs. If, on the other hand, all clubs increase their level of talent by the same amount, the level of the competition increases, while competitive balance remains unchanged. It follows that league quality increases. Furthermore, given aggregate salaries $\sum_{j=1, j\neq i}^{n} x_j$ of the other $(n-1)$ clubs, league quality increases in club i's salary payment x_i only until a threshold value $x_i^*(\theta) = \frac{n^2}{2(n-1)}\theta + \frac{1}{n-1}\sum_{j\neq i} x_j$. After this threshold, quality starts to decline as the league becomes overly unbalanced.

League revenues are split between the two types of clubs according to their market shares. For the sake of simplicity, we assume that half of the n clubs are large-market

[6] Obviously, there are different potential measures for competitive balance. We use the variance because this measure has the advantage of giving nice closed-form solutions as compared to other measures (e.g., coefficient of variation).

clubs, which receive a greater share of league revenues than the small-market clubs. Each of the large clubs receives a fraction $\frac{m_l}{n/2}$ of league revenues LR and each of the small clubs receives a fraction $\frac{m_s}{n/2}$ of league revenues LR, with

$$m_l > m_s \text{ and } m_l + m_s = 1.$$

We denote I_l and I_s as the set of large-market and small-market clubs, respectively, i.e., $I = \{1, .., n\} = I_l \cup I_s$.

We solve the model by following the logic of backward induction. The next subsection deals with the problem of the clubs conditional on the choice of the league authorities.

3.2 *The Problem of the Clubs*

First, we solve the problem of the clubs in Stage 2. Each club chooses independently a level of talent in order to maximize the level of own talents subject to the salary cap constraint set in Stage 1.[7]

The revenue function $R_i(x_1, .., x_n)$ of club $i \in I$ is given by

$$R_i(x_1, .., x_n) = \frac{m_\phi}{2n} q(x_1, .., x_n) = \frac{m_\phi}{2n} \left(\theta \sum_{j=1}^{n} x_j - \frac{1}{n} \sum_{j=1}^{n} (x_j - \overline{x}_n)^2 \right),$$

with $\phi = l$ for $i \in I_l$ and $\phi = s$ for $i \in I_s$.

As discussed in the introduction, we assume that the salary cap fixes a maximum wage/turnover ratio for each club. This maximum amount is defined for each club as a percentage of own revenues.[8] That is, each club faces a club-specific endogenously determined salary cap, given for club $i \in I$ by $cap_i = \delta R_i$ with $\delta \in (0, 1]$.

In Stage 2, the maximization problem for club $i \in I$ is therefore to maximize talent investments subject to its individual salary cap constraint. Formally, the problem is given by

$$(2) \qquad \max_{x_i \geq 0} \; x_i \qquad \text{subject to:} \qquad x_i \leq \delta R_i(x_1, .., x_n).$$

It follows that each club will spend the highest admissible amount on talent such that the first-order conditions for this maximization problem result in

$$\begin{aligned} 1 - \lambda_i \left[1 - \frac{\partial(\delta R_i)}{\partial x_i} \right] &\leq 0, \; x_i \left(1 - \lambda_i \left[1 - \frac{\partial(\delta R_i)}{\partial x_i} \right] \right) = 0, \\ \delta R_i - x_i &\geq 0, \; \lambda_i \left(\delta R_i - x_i \right) = 0, \end{aligned}$$

[7] This approach to model win-maximizing clubs is consistent with the approach adopted in the literature (see, e.g., Késenne, 2006; Vrooman, 2007; Dietl, Lang and Werner, 2009).

[8] Note that a percentage-of-revenue cap is in line with the proposed "relative capping strategy" in the recently published Independent European Sports Review (Arnaut, 2006).

where $\lambda_i \geq 0$ denotes the Lagrange multiplier for club $i \in I$ with $\phi = l$ for $i \in I_l$ and $\phi = s$ for $i \in I_s$. The equations show that the marginal revenue from talent is smaller than the marginal cost for club i, which is a well-known result in leagues with win-maximizing clubs. Moreover, a club's demand curve for talent is given by the average revenue curve $\delta R_i / x_i$ (taking into account the salary cap).

The solution of this system of equations yields the talent investments (salary payments) in the Nash equilibrium which is given in the next lemma.

Lemma 1 *In Stage 2, the equilibrium salary payments of the clubs are given by*

$$\begin{aligned} x_i^*(\delta) &= \frac{2m_l n(\theta\delta - 4)}{\delta(m_l - m_s)^2} \equiv x_l^* \ \forall i \in I_l, \\ x_j^*(\delta) &= \frac{2m_s n(\theta\delta - 4)}{\delta(m_l - m_s)^2} \equiv x_s^* \ \forall j \in I_s. \end{aligned} \tag{3}$$

Proof. See Appendix. ■

In the following, we assume that

$$\delta > \delta^{\min} \equiv \frac{4}{\theta}. \tag{4}$$

For $\delta \leq \delta^{\min}$, the salary cap is so restrictive that the clubs decide not to invest in talent at all. As this scenario cannot be optimal from a league regulator's point of view, we rule out this possibility in advance. Moreover, to assure that $\delta^{\min}$ is smaller than unity, condition (4) implies that

$$\theta > \theta^{\min} \equiv 4. \tag{5}$$

The equilibrium salary payments (3) show that all large-market (small-market) clubs choose the same salary level x_l^* (x_s^*). Moreover, the large-market clubs invest more in salaries than the small-market clubs because the marginal revenue of talent investments is higher for these clubs.[9]

In a league where the league organization has set a salary cap, the level of aggregate salary payments $T^*(\delta)$ and competitive balance $CB^*(\delta)$ in equilibrium are given by

$$T^*(\delta) = \frac{n^2(\theta\delta - 4)}{\delta(m_l - m_s)^2} \text{ and } CB^*(\delta) = -\left(\frac{n(\theta\delta - 4)}{\delta(m_l - m_s)}\right)^2.$$

In the next proposition, we show how variations of the salary cap parameter δ affect the clubs' optimal choice of salary payments.

[9] Lang et al. (2011) show that in a model of a sports league with utility-maximizing clubs, it is possible that the small-market club invests more than the large-market club.

Proposition 1 *A more restrictive salary cap, that is, a lower value of δ decreases aggregate salary payments and increases competitive balance.*

Proof. Straightforward and therefore omitted. ■

The proposition posits that a percentage-of-revenue salary cap increases competitive balance $CB^*(\delta)$ and decreases overall salary payments $T^*(\delta)$ in the league, therefore contributing to financial stability and a more balanced league. A more restrictive salary cap induces both types of clubs to decrease their salary payments in equilibrium (see equation (3)). The large-market clubs, however, decrease their salary payments in equilibrium more than the small-market clubs and hence the league becomes more balanced. Moreover, we find that higher fans' valuation of aggregate talent θ implies higher salary payments and lower competitive balance.

The league quality in equilibrium depends on the salary cap parameter δ and is given by

$$q^*(\delta) = \frac{4n^2(\theta\delta - 4)}{\delta^2(m_l - m_s)^2}. \tag{6}$$

We derive that league quality is maximized for

$$\delta^q = \begin{cases} \frac{8}{\theta} & \text{for } \theta > \theta' \equiv 8, \\ 1 & \text{for } \theta \in (\theta^{\min}, \theta']. \end{cases} \tag{7}$$

This result shows that a binding salary cap increases league quality until the maximal league quality is achieved if fans have a relatively high preference for aggregate talent ($\theta > \theta'$) even though the salary cap reduces aggregate talent. In contrast, if fans have a relatively low preference for aggregate talent ($\theta < \theta'$) and hence a relatively high preference for competitive balance, the salary cap will reduce league quality even though the salary cap will result in a more balanced league. The intuition for this result is that a high fan preference θ for aggregate talent leads, in the absence of a salary cap, to an overall high level of competition but to a relatively unbalanced league. In this case, a salary cap increases the quality of the league by increasing competitive balance – the marginal benefit of increased competitive balance compensates for the marginal loss due to a decrease in aggregate talent. If the fans' preference for aggregate talent is relatively low, then the league without a salary cap is already very balanced. In this case, the introduction of a binding salary cap $\delta < 1$ will reduce the league quality because the loss in aggregate talent outweighs the gains from a more balanced competition.[10]

[10] See also Dietl, Lang and Rathke (2009).

3.3 *The Problem of the League Governing Body*

As outlined in Section 2, the EU institutions will assess a salary control system from a social welfare perspective. We incorporate this specific European perspective into our model by assuming that the social planner must approve any regulation proposed by the league regulator taking into account the effect of a salary cap on all parties in the regulatory scheme: that is, clubs, fans and players. Hence, social welfare depends on the sum of aggregate consumer (fan) surplus, aggregate player salaries, and club surplus. As clubs are assumed to be win-maximizers, club surplus depends on the respective win percentages of the clubs. The clubs' wins represent a zero-sum game and therefore enter the objective function of the social planner only as a constant. As a result, we define the objective function of the social planner (social welfare) as the sum of player salaries PS and consumer surplus CS:

$$W(x_1, .., x_n) = PS(x_1, .., x_n) + CS(x_1, .., x_n). \tag{8}$$

As already mentioned, we assume that the decision of the league regulator is subjected to approval of the social planner in order to reflect the situation in European football.[11] The social planner will accept a salary cap proposed by the league regulator only if its introduction does not negatively affect social welfare compared to a benchmark case. We choose an unregulated league as the benchmark, that is, a league without a salary cap ($\delta = 1$). The benchmark represents the current situation in European soccer, where no salary caps exist and the UEFA demands a balanced budget.[12] Note that clubs will spend their whole revenues on player salaries PS in an unregulated league such that

$$PS(x_1, .., x_n) = \sum_{i=1}^{n} x_i = \frac{1}{4} q(x_1, .., x_n).$$

Aggregate consumer (fan) surplus corresponds to the integral of the demand function $d(p, q)$ from the equilibrium price $p^* = q/2$ to the maximal price $\overline{p} = q$ which fans are willing to pay for quality q,

$$CS(x_1, .., x_n) = \int_{p^*}^{\overline{p}} d(p, q(x_1, .., x_n))dp = \frac{1}{8} q(x_1, .., x_n). \tag{9}$$

[11] Note that the social planner behaves only passively in our model. One could also imagine a scenario in which the social planner actively tries to influence the level of social welfare. However, European institutions have never proposed any specific salary regulation on their own, but have only intervened if they regarded the regulations proposed by sports authorities as inappropriate. Therefore, we assume that the social planner will only approve or reject the regulation suggested by the league regulator.

[12] A cornerstone of the recently approved financial fair play concept is the break-even rule. Beginning in the 2012/2013 season, clubs will have to balance their books and operate within their financial means. The new obligation for clubs to break even over a period of time means that they cannot repeatedly spend more than their generated revenues. For the first time in European football, clubs that repeatedly spend more than 100% of their revenues will be sanctioned.

Substituting equilibrium investments (3) into the welfare function (8) and setting $\delta = 1$, the benchmark level of social welfare in an unregulated league is given by

$$\widehat{W} = \frac{3n^2(\theta - 4)}{2(m_l - m_s)^2}. \tag{10}$$

We now turn our attention to the problem of the league governing body. We assume that the objective function of the league regulator depends not only on aggregate consumer (fan) surplus, aggregate player salaries and club surplus, but also on aggregate club profits, reflecting the league's concern for financial sustainability. The integration of club profits is motivated by the growing evidence cited by the UEFA of a financial crisis spreading throughout the European football leagues. Many European clubs face serious financial difficulties – some have even gone bankrupt. The UEFA has repeatedly argued that sound club finances play an important role in avoiding incomplete seasons and maintaining the integrity of football. Clubs operating on the verge of bankruptcy are more inclined to engage in illegal practices such as money laundering, match fixing and tax fraud, which harm the image of the whole industry.

It follows that the league regulator has the same objectives as the social planner but in addition has a concern for financial stability in the league. We define the objective function of the league regulator as

$$L(\delta) = PS(\delta) + CS(\delta) + \gamma\Pi(\delta) = W(\delta) + \gamma\Pi(\delta), \tag{11}$$

where $\gamma \geq 0$ denotes the weight that the league authority puts on club profits. This weight depends on the financial situation of the league and increases with the degree of financial distress. The degree of financial distress could be measured, for instance, by the ratio of total league debt to aggregate league revenues.[13] In the case that the league regulator is not concerned with financial stability, i.e., $\gamma = 0$, the objective functions of the league regulator and the social planner coincide.[14]

Given the optimal choice of the clubs according to (3), consumer surplus amounts to $CS(\delta) = q(\delta)/4$. Note that the value of δ maximizing consumer surplus is the same that maximizes the quality function: that is, the salary cap has to be set according to (7).

From the clubs' maximization problem, we know that, facing the salary cap constraint, clubs will choose the maximal amount of talent $x_i = \delta R_i$ which they are allowed to invest in equilibrium. As a result, aggregate player salaries are given by $PS(\delta) = \frac{\delta}{4}q(\delta)$. Even if a tighter salary cap increases quality (in case of a high θ), the decrease in δ compensates for

[13] This ratio indicates 2.43 Euros of debt for each Euro of revenue in the Spanish Primera Division, while for the English Premier League, and the Italian Serie A, the ratios are 1.49 and 1.43, respectively. The German Bundesliga exhibits a comparable low debt-to-revenue ratio of 0.36 (the ratios are calculated from Deloitte and Touche, 2009 and UEFA, 2009).

[14] However, the objective function of the social planner is defined over the talent investments x_i directly, while the league regulator's objective function is defined over the values of the policy instrument δ.

the increase in quality and hence always results in a decrease in aggregate player salaries. It follows that players always suffer from the introduction of a salary cap through lower salaries.

In equilibrium, social welfare depending on the choice of the league regulator is given by

$$W(\delta) = \frac{n^2(1+2\delta)(\theta\delta-4)}{2\delta^2(m_l-m_s)^2}, \tag{12}$$

while aggregate club profits are given by league revenues minus aggregate player salaries

$$\Pi(\delta) = \sum_{i=1}^{n}(1-\delta)R_i(\delta) = \frac{(1-\delta)}{4}q(\delta). \tag{13}$$

Note that club profits always increase through the introduction of a salary cap and that the league regulator can maximize club profits by setting a salary cap of $\delta^{\Pi} = \frac{8}{4+\theta} < 1$, which is a tighter salary cap than maximizing consumer surplus would call for. We analyze the effect of a salary cap on social welfare in Lemma 2 below.

Substituting social welfare (12) and club profits (13) into the league regulator's objective function (11) results in

$$L(\delta) = \frac{n^2\left[2\delta(1-\gamma)+2\gamma+1\right](\theta\delta-4)}{2\delta^2(m_l-m_s)^2}. \tag{14}$$

The problem of the league regulator consists of maximizing (14) under the constraint that social welfare is not lower than in the benchmark without a salary cap. Formally, the league regulator solves the maximization problem

$$\max_{\delta\in[\delta^{\min},1]} L(\delta) \text{ s.t. } W(\delta) \geq \widehat{W}. \tag{15}$$

In the next lemma, we derive the condition for which social welfare (12) increases through a salary cap and we then determine the salary cap that maximizes the league regulator's objective function (11).

Lemma 2 *(i) The league regulator can only increase social welfare through a percentage-of-revenue salary cap if the fans' relative preference for aggregate talent is sufficiently large with* $\theta > \theta'' \equiv 16$.

(ii) The objective function of the league regulator always increases through a percentage-of-revenue salary cap if the weight on aggregate club profits is sufficiently high with

$$\gamma > \gamma^{\min} \equiv \frac{16-\theta}{2(\theta-4)}.$$

As a result, the league regulator would set the salary cap in Stage 1 in the absence of the welfare constraint according to

$$\delta^{LP} = \begin{cases} \frac{8(2\gamma+1)}{8(\gamma-1)+\theta(2\gamma+1)} & \textit{for } \gamma \geq \gamma^{\min}, \\ 1 & \textit{for } \gamma \in [0, \gamma^{\min}]. \end{cases}$$

Proof. Straightforward and therefore omitted. ■

Part (i) of the lemma shows that a salary cap can only improve social welfare if $\theta > \theta''$. Recall that social welfare depends on consumer surplus and player salaries. Moreover, aggregate player salaries always decrease through a tighter salary cap, while the respective effect on consumer surplus depends on the fans' preference for aggregate talent. If fans have a relatively low preference for aggregate talent with $\theta \in (\theta^{\min}, \theta')$, we know from equation (7) that quality and hence also consumer surplus decrease through the implementation of a salary cap. If the fans' preference for aggregate talent increases above θ', i.e., $\theta \in (\theta', \theta'')$, then quality and therefore also consumer surplus will increase. Recall that a higher parameter θ implies a more unbalanced unregulated league, increasing the gains in league quality from more competitive balance. The increase in quality, however, does not compensate for the loss in player salaries as long as $\theta < \theta''$. If θ increases above θ'', the increase in consumer surplus due to improved competitive balance compensates for the loss in player salaries, implying a higher level of social welfare through a percentage-of-revenue salary cap.

To derive the intuition behind part (ii) of the lemma, recall that the objective function of the league governing body additionally includes club profits, which always increase through a tighter salary cap. From the discussion above we know that the sum of consumer and player salaries (social welfare) decreases as long as the preference for talent is low, i.e., $\theta \in (\theta^{\min}, \theta'')$. In this case, the weight γ in the objective function of the league regulator attached to club profits must be sufficiently high ($\gamma > \gamma^{\min}$) to guarantee that the objective function of the league regulator increases due to higher profits. Notice that the critical weight $\gamma^{\min}$ decreases in θ. If the fans' preference for aggregate talent increases above θ'', then the increase in consumer surplus outweighs the decrease in aggregate player salaries such that social welfare and club profits increase. As a result, the objective function of the league regulator increases irrespective of the weight attached to club profits.[15]

To sum up, the lemma shows that the social planner is against the implementation of a salary cap if the fans' preference for aggregate talent is low. Conversely, it is always possible to increase the objective function of the league regulator through a salary cap if the weight attached to club profits is sufficiently large. In any case, an effective salary cap proposed by the league regulator will always be tighter than social welfare maximization

[15] Notice that $\gamma^{\min}$ is negative in this case.

would call for, i.e., $\delta^{LP} < \delta^{W}$. This holds true because the league regulator additionally takes the positive effect on club profits into consideration.

Under which conditions is the salary cap proposed by the league regulator also within the interval of salary caps that appease the social planner? By analyzing the constraint maximization problem (15) of the league regulator in Stage 1, we derive the following results.

Proposition 2 *(i) If the fans' preference for aggregate talent is low with $\theta \in [\theta^{\min}, \theta'']$, then no salary cap will be implemented, that is, $\delta^* = 1$.*

(ii) If the fans' preference for talent is sufficiently high with $\theta > \theta''$, then a salary cap will be implemented according to

$$\delta^* = \begin{cases} \frac{4}{\theta - 12} & \text{if} \quad \theta \in (\theta'', \theta''') \quad \text{and} \quad \gamma > \gamma', \\ \delta^{LP} & \text{otherwise,} \end{cases}$$

with $\gamma' \equiv \frac{16-\theta}{2(\theta-28)}$ and $\theta''' \equiv 28$.

Proof. See Appendix. ■

Part (i) of the proposition posits that the social planner will never approve a salary cap set by the league regulator if the fans have a relatively low preference for aggregate talent, i.e., $\theta < \theta''$. As shown in Lemma 2, a salary cap would inevitably lower social welfare. In this situation, the beneficial impact of the salary cap on competitive balance will result in a loss in player salaries and potentially in a loss in consumer surplus, as the unrestricted league is already rather balanced. Nevertheless, the league regulator would propose a salary cap if financial distress is severe enough, that is, the weight γ on aggregate club profits is sufficiently high with $\gamma > \gamma^{\min}$. However, the social planner will always veto this proposal. That is, even though the league regulator might want to introduce a salary cap, this cap will not be tolerated by the social planner.

Part (ii) shows that the proposal of the league regulator to introduce salary caps can pass the social welfare test if the fans' preference for talent is sufficiently high, i.e., $\theta > \theta''$. In such a situation, the competitive imbalance in the league is so high that the social planner also favors a salary cap. If the fans' preference for talent increases even more and passes another threshold, i.e., $\theta > \theta'''$, then the social planner always approves the league regulator's proposal and a salary cap $\delta^* = \delta^{LP}$ will be implemented. In this case, the optimal salary cap δ^{LP} from the point of view of the league regulator always lies in the interval of feasible salary caps that yields a higher social welfare value than in benchmark case. Hence, the objectives of the league regulator and the social planner are sufficiently aligned.

The same is true if $\theta \in (\theta'', \theta''')$ and the weight attached to club profits is small. However, if the league regulator puts too much emphasis on club profits, i.e., $\gamma > \gamma'$, the

league regulator wants to implement a salary cap that would be detrimental from a social welfare perspective as players would unduly suffer. In this case, the league regulator will only be able to introduce the strictest possible salary cap that still appeases the social planner, i.e., $\delta^* = 4/(\theta - 12)$. Even though the objective function of the league regulator increases, social welfare remains unaltered compared with the benchmark case because consumer surplus increases at the expense of player salaries.

4 Conclusion

Salary caps evolved in an organizational and legal island: the North American major leagues. The institutional and legal peculiarities of this island include collective bargaining, the absence of promotion and relegation, cooperative-like league organization, and almost complete league autonomy. European football, as with most major team sports around the world, is organized completely differently. These differences have important consequences for the feasibility of a salary cap system.

A salary cap system has to take into account the significant market heterogeneity within the European football pyramid, which encompasses all national and Pan-European competitions through a system of promotion and relegation. The American system of an absolute capped salary amount applicable to all clubs is not discussed in the European football pyramid because the revenue differentials between clubs of a certain division in different countries are significant. Taking into account that the cost of administering a specific absolute cap for every league in the European football pyramid would be prohibitive, the only workable solution in the European context seems to be a percentage-of-revenue salary cap.

In addition, the association-governed model of European football is not compatible with the American labor relations approach. Associations are not one side of a labor market, but sports governing bodies. Representing all stakeholder groups of a particular sport, they perform regulatory functions normally reserved to the state. Because the scope for autonomous regulatory activity by the sports governing bodies is limited by national and EU law, it is a priori unclear whether a particular salary cap mechanism in European football falls under the margin of discretion granted to the associations by the European Union. Judging from the previous interferences of EU institutions into the regulatory activities of FIFA and UEFA, it seems likely that the football governing bodies will have to prove that their proposal of a salary control system is not detrimental to social welfare instead of, for example, merely demonstrating that it improves the financial situation of clubs and/or players.

Taking into account the idiosyncrasies of European football, our paper highlights the potential conflicts between the league and society. In particular, we shed light on the effects of a potential introduction of a percentage-of-revenue salary cap in a league with

win-maximizing clubs. The governing body of the league distributes league revenues to the clubs and decides whether to implement a percentage-of-revenue salary cap under the restriction that the realized level of social welfare appeases the social planner. Our analysis shows that a percentage-of-revenue salary cap produces a more balanced league and decreases aggregate salary payments in the league, thereby increasing competitive balance and club profits at the expense of a lower level of aggregate talent. The effect on social welfare depends on fans' preferences because they determine the talent allocation in the unregulated league. In general, a percentage-of-revenue salary cap increases social welfare if fans have a relatively high preference for aggregate talent as this translates into an overly unbalanced unregulated league. In this case, the league regulator can successfully introduce a salary cap. If, in contrast, fans have a relatively high preference for competitive balance, implying a well-balanced unregulated league, the salary cap would reduce social welfare, making its introduction unfeasible.

The analysis in this paper shows why football governing bodies might want to introduce salary caps especially when leagues suffer from an increasing degree of financial imbalance and disorder. From a social welfare point of view, however, it is prudent not to permit the introduction of salary caps under certain conditions because consumers and players could unduly suffer.

A Appendix

A.1 *Derivation of League Revenues*

League demand depends on the quality of the league q and is derived similar to Falconieri et al. (2004). Our approach, however, differs in an important aspect. For the sake of tractability, we drop the contest theoretical part in the revenue function. Instead we use a slightly different quality function. The quality function q in Falconieri et al. (2004) is always increasing in own talent investments, i.e., $\frac{\partial q}{\partial x_i} > 0$, no matter how unbalanced the league becomes. In contrast, in our model, quality decreases if the league becomes too unbalanced.[16]

We assume a continuum of fans who differ in their willingness to pay for a league with quality q. Every fan k has a certain preference for quality that is measured by ω_k. For simplicity, we assume that these preferences are uniformly distributed in $[0, 1]$, i.e., the measure of potential fans is one. Furthermore, we assume a constant marginal utility of quality and define the net-utility of fan ω_k as $\max\{\omega_k q - p, 0\}$. At price p, which can, for example, be interpreted as the subscription fee for TV coverage of the league, the fan who is indifferent to consumption of the league product is given by $\omega^* = \frac{p}{q}$. Hence, the measure of fans who purchase at price p is $1 - \omega^* = \frac{q-p}{q}$. The league demand function is therefore given by

$$d(p, q) \equiv 1 - \frac{p}{q}.$$

Note that league demand increases in quality, albeit with a decreasing rate, i.e., $\frac{\partial d}{\partial q} > 0$ and $\frac{\partial^2 d}{\partial q^2} < 0$. By normalizing all other costs (e.g., broadcasting costs) to zero, we see that total league revenues are simply $LR = pd(p, q)$. Then, in order to maximize profits, the league will choose the price $p^* = \frac{q}{2}$. Given this price, league revenues depend solely on the quality of the league and is thus given by

$$LR(x_1, .., x_n) = \frac{1}{4} q(x_1, .., x_n). \tag{16}$$

[16] Benz et al. (2009) analyze whether the effect of competitive balance on match attendance in team sports is driven by heterogeneity in fan demand. See also Szymanski and Késenne (2004) who assume that "excessive dominance by one team can lead to a fall in revenues for the dominant team as well as the weaker team." Moreover, Chan et al. (2008) identify a class of consumer preferences which incorporates the demand for suspense in sports contests.

A.2 *Proof of Lemma 1*

The first-order conditions for the maximization problem (2) are given by

$$\begin{aligned}
1-\lambda_i\left[1-\frac{\partial(\delta R_i)}{\partial x_i}\right] &= 1-\lambda_i\left[1-\delta\frac{m_\phi}{2n}\left(\theta-\frac{2}{n}\left(x_i-\frac{1}{n}\sum_{j=1}^{n}x_j\right)\right)\right]\leq 0,\\
x_i\left(1-\lambda_i\left[1-\frac{\partial(\delta R_i)}{\partial x_i}\right]\right) &= x_i\left(1-\lambda_i\left[1-\delta\frac{m_\phi}{2n}\left(\theta-\frac{2}{n}\left(x_i-\frac{1}{n}\sum_{j=1}^{n}x_j\right)\right)\right]\right)=0,\\
\delta R_i-x_i &= \delta\frac{m_\phi}{2n}\left(\theta\sum_{j=1}^{n}x_j-\frac{1}{n}\sum_{j=1}^{n}\left(x_j-\overline{x}_n\right)^2\right)-x_i\geq 0,\\
\lambda_i\left(\delta R_i-x_i\right) &= \lambda_i\left(\delta\frac{m_\phi}{2n}\left(\theta\sum_{j=1}^{n}x_j-\frac{1}{n}\sum_{j=1}^{n}\left(x_j-\overline{x}_n\right)^2\right)-x_i\right)=0,
\end{aligned}$$

where $\lambda_i \geq 0$ denotes the Lagrange multiplier for club $i \in I$ with $\phi = l$ for $i \in I_l$ and $\phi = s$ for $i \in I_s$. From the first-order conditions, we see that $x_l/m_l = x_s/m_s$ and thus

$$\begin{aligned}
\delta R_l - x_l &= \delta\frac{m_l}{2n}\left(\frac{\theta n}{2}\left(x_l+x_s\right)-\frac{1}{n}\left(x_l-x_s\right)^2\right)-x_l=0,\\
\delta R_s - x_s &= \delta\frac{m_s}{2n}\left(\frac{\theta n}{2}\left(x_l+x_s\right)-\frac{1}{n}\left(x_l-x_s\right)^2\right)-x_s=0.
\end{aligned}$$

Solving this system of equations and assuming that clubs are sufficiently heterogenous,[17] we derive the following equilibrium salary payments:

$$x_i^*(\delta)=\frac{2m_l n(\theta\delta-4)}{\delta((m_l-m_s)^2)}\equiv x_l^*\forall i\in I_l \text{ and } x_j^*(\delta)=\frac{2m_s n(\theta\delta-4)}{\delta((m_l-m_s)^2)}\equiv x_s^*\forall j\in I_s.$$

This completes the proof of Lemma 1.

A.3 *Proof of Proposition 2*

Part (i) follows directly from part (i) of Lemma 2.

Part (ii). To prove the claim, we first compute the interval of feasible salary caps for which social welfare $W(\delta)$ is at least as high than in the benchmark case $\widehat{W}$ and thus the social planner approves a salary cap. The inequality $W(\delta) \geq \widehat{W}$ holds if and only if δ is within in the interval $[\underline{\delta}, \overline{\delta}] = [\frac{4}{\theta-12}, 1]$. Moreover, it always holds that $\delta^{LP} < \delta^{W}$. Thus for δ^{LP} to be in the interval of feasible salary caps it must hold that $\delta^{LP} \geq \underline{\delta}$. In this case, the social planner always approves the salary cap δ^{LP} desired by the league

[17] Note that the difference $m_l - m_s$ between the market size parameters of the clubs must be sufficiently large such that the following condition is satisfied: $\frac{2n-\theta\delta m_s}{2m_s(\theta\delta-4)} > \frac{1}{(m_l-m_s)}$.

regulator. We compute

$$\delta^{LP} \geq \underline{\delta} \Leftrightarrow \begin{cases} \text{(a) } \gamma \leq \gamma' & \text{for} \quad \theta \in (\theta'', \theta'''), \\ \text{(b) } \gamma \geq \gamma' & \text{for} \quad \theta \geq \theta''', \end{cases}$$

with $\gamma' \equiv \frac{16-\theta}{2(\theta-28)}$ and $\theta''' \equiv 28$.

ad (a): If $\theta \in (\theta'', \theta''')$ then $\gamma' > 0$ such that γ must be sufficiently low with $\gamma \leq \gamma'$ to guarantee that δ^{LP} is in the interval of feasible salary caps. If $\gamma > \gamma'$ then the the social planner will veto the league regulator's proposal δ^{LP} such that $\delta^* = \underline{\delta}$ will be implemented.

ad (b): If $\theta \geq \theta'''$ then $\gamma' \leq 0$ such that δ^{LP} is in the interval of feasible salary caps for all $\gamma \geq 0$. That is, the social planner always approves the league regulator's proposal, i.e., $\delta^* = \delta^{LP}$ will be implemented. This completes the proof of Proposition 2.

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