Instability of Small Scale Professional Sports Leagues

Wolfgang Höchtl and Alexander Konovalov*

May 2007

Abstract

We introduce a modified version of the classical sports leagues model of El Hodiri and Quirk (1971) to analyze the issue of stability in a "small scale professional sports league" consisting of financially inhomogenous teams that maximize wins rather than profits. The teams competing in such a league are characterized by dependency on local revenue generation and price taking on the market for talent. If an equilibrium exists it can be unstable so that after a shock the financially weak teams cease to participate. Such a collapse of the league can be problematic as the remaining strong teams might be considered too few to make up a league of satisfactory size. We show that the introduction of a payroll cap can eliminate this problem .

JEL: L 19, L 83

Keywords: sports leagues, competitive balance, instability

*all authors Faculty of Economics and Statistics, University of Innsbruck, Universitätsstrasse 15, 6020 Innsbruck/Austria. Corresponding author Wolfgang Höchtl (wolfgang.hoechtl@uibk.ac.at)

1 Introduction

Professional sports leagues are a complex and delicate economic environment with properties different to those of normal industries. In a sports league the product (the games) is jointly supplied by the member teams. Despite competition between the teams on the playing field it is not necessarily beneficial for the teams if another one ceases to operate as it is the case for firms competing in a market. In the most extreme case of a monopoly it is trivially clear that this is worse than any other situation as for the single active team there is no one left to play against. Concerning the demand for the games it is assumed in the literature that it is subject to the playing strengths of both teams involved. More precisely, the sports economics literature models the demand for games primarily depending on the unpredictability of the results, or in other words on competitive balance of the league. Apart from this issue which is a central part of the seminal model of sport leagues (El Hodiri and Quirk 1971) other important properties of real world sports leagues are not that unambiguous. For instance it is quite debated what objectives the decision makers pursue. Furthermore the institutional design of sports leagues has a broad range of differences across disciplines and or countries. In this context the literature often refers to two different archetypes: north American and European sports leagues. In north American professional sports teams are more considered to be profit maximizers whereas their European counterparts are often referred to as win or utility maximizers (see Zimbalist 2003 for a discussion of this issue). Apart from, or probably as a consequence of this, North American and European sports leagues differ in various aspects: European leagues are mostly open, they apply a system of promotion and relegation of teams between leagues on different hierarchical levels of the system, whereas North American leagues are mostly closed (see Szymanski and Ross 2001, Szymanski et al. 2003). North American leagues usually have institutions such as revenue sharing and entry drafts thought to enhance competitive balance whereas European leagues commonly allocate central revenues positively depending on performance and thus strengthen the incentives to win (Palomino and Rigotti 2001). Within the wide field of differently working leagues we focus on the special topic of leagues which we call "small scale professional sports leagues". In general we thereby refer to sports leagues for which at least some of the following characteristics are true:

- small number of potential participants (the league can hardly reach a number of participating teams which consumers find optimal[1])
- limited pool of available players
- weak central governing body
- only local revenue generation (e.g.: no league wide TV contracts, league sponsors,...). This point implies that the teams may differ greatly in terms of their revenue generation potential and that there is hardly a way to mitigate these differences. Teams in "hotbeds" of the given sport or in big cities have better opportunities than those in small or new markets.
- the league's teams are price takers on the market for players

To complete our approach we focus on leagues whose member teams maximize the probability to win (under the constraint of covering their costs) rather than profits. For many European sports leagues this is evident as in the typical case the teams in such leagues are operated by clubs or associations that by their legal status are not allowed to make profits[2]. Such

[1] Therby we assume that spectators also have a taste for not watching their team take on the same few opponents week after week but like to have a certain variety in the competition which essentially means that there is a sufficient number of teams in the league.

[2] This is at least true for the Austrian icehockey league. The history of this league over the past 15 years serves as an example to motivate the research question and the model of this paper. A number of other European countries have a similar structure of ice hockey leagues among them for example France, Italy, Denmark and Slovenia. But

associations can engage in any sort of economic activity, they can hire employees sell tickets for games and so on, but there is no owner who can claim the difference between revenue and costs of the club's economic activities. Instead a surplus has either to be saved as a reserve or reinvested according to the association's goal as stated in it's statute. In many leagues characterized by the properties listed above bankruptcies of teams have been observed to occur relatively often which leads to fluctuation of the league size. Put together, our line of argumentation is that with win maximizing of financially inhomogeneous teams a failure of competitive balance, which is the prime source of demand for the games, may lead to a situation where clubs with low revenue generation potential are not able to finance the costs of a sufficiently talented team and drop out of the league. In a country where the number of high revenue teams is so small that a league only consisting of such hardly meets the spectators' preferences for variety in competition this issue constitutes a viable problem. In the next section we briefly line out the history of the highest Austrian icehockey league as an example for a small scale sports league with a clearly visible pattern of repeatedly occurred collapses. To motivate our paper we restrict to the Austrian case as it is archetypical for our approach but it is a fact that this is not the only example of instability plagued sports leagues. For example, the icehockey leagues in Italy, Great Britain, France and also Germany had similar problems in the past[3]. Section 3 contains the model, section 4 concludes.

even in countries where ice hockey is a high profile sport like Finland, Czech Republic or Slovakia there are top flight teams run by non-profit associations.

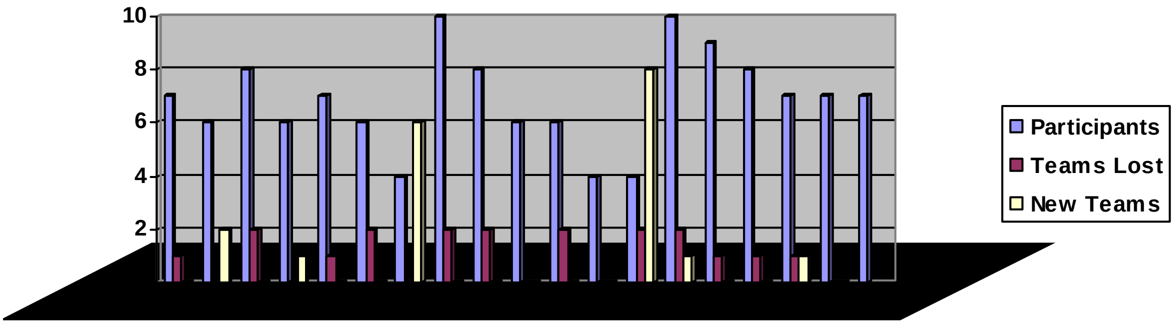
[3]It is not by chance that instable sports leagues can be found so often in the discipline of icehockey. This sport involves very high fixed costs even on grass root level, facilities are much rarer than those necessary in other team sports (few potential participants), the training of talent is complicated like in few other sports (restricted player pool) and in only very few countries the sport is popular with a wider public outside a devout fan base.

2 Instability of small sports leagues - the case of Austrian icehockey

The top Austrian icehockey league, which is run by the Austrian icehockey federation (ÖEHV, the official governing body of this sport in Austria) was founded in the late sixties and was for the first 15 to 20 years of its existence operating almost entirely on an amateur basis. After an initial build up phase for much of the first 20 years there were mostly six participating teams. Due to the lack of suitable facilities the number of potential locations for teams was not much bigger. In the eighties, however, the teams in the league gradually shifted to professionalism. Today the players in the league are almost exclusively professionals, but still most of the characteristics for a small scale sports league lined out above apply. Despite the small scale status we assert to this league it should be mentioned that after soccer icehockey is the second most popular team sport (by attendance of top league games) in Austria. Currently the average attendance is around 3000 spectators per game with single game tickets sold for around 15 Euro. So judging by the revealed willingness to pay and the often observed passion of many fans it can be said that the stakes involved are not negligible. Returning to the characterization of the league it is most important that in the past as well as in the present the teams have to rely almost entirely on locally generated revenues (ticket sales and merchandising, sponsorship deals) to cover their costs as the money teams get from the league sponsor and the TV rights holder is not substantial.[4]. While the emergence of professionalism, which was made possible by increasing demand and willingness to pay of spectators and sponsors, brought a significant upswing in the level of play and also more games per season there was also a negative effect: the league became instable in terms of the number of participating teams. Figure 1 below shows the

[4]Since the 2001/2002 season there is a league sponsor and also a TV contract, but still local revenues are the main source of financing the teams.

development of the league size from 1988 to the present[5].



Number of active teams (grey colum), drop outs (black colum) and entrants (white colum) per year

Three cycles of league erosion are clearly visible. The first cycle ends in 1994 with only four teams left after there were eight in 1990. The following season six teams from the second league joined in resulting in a league with ten participants. From then on teams retreated over the course of the next seasons until by the end of the 2000 season only the two teams from the region where hockey has the strongest roots were left. Again there was a league reform which merged these two remaining teams from the first league with the eight teams of the second league to a new ten team competition. Within three years the number dropped to seven where it remained until the present[6]. To fit the picture into our model it has to be mentioned that the first two cycles of erosion happened under the regime of a more or less totally opened player market (no import restriction for foreign players) which

[5]We focus on the Austrian league although during the 90ies the country's best clubs also took part in an international league of varying format (Alpenliga) which also included teams from Slovenia and Italy. The fluctuations of participation in the Austrian league affected Alpenliga directly as the sets of clubs participating in both competitions were more or less identical for a given season.

[6]This is true for Austrian clubs. For the 2006/07 season the top club from Slovenia joined the league which now consists of eight teams.

is part of our model by the assumption of the clubs being price takers on the market for talent. Under import player regulation the situation gets different as the scarce domestic players' wages are then determined by the demand of the domestic clubs. The stability problem under such a regime can still be existent as the economic forces behind them (a failure of competitive balance due to financial inhomogeneity) are still the same but it will come under different symptoms[7].

3 Model

The model is a simple non-atomic version of El Hodiri and Quirk (1971). For analytical simplicity we assume that there is a continuum of teams $L = [0, 1]$. There are two kinds of teams: weak and strong. These attributes refer to the revenue generation potential. The share of weak teams is λ, $1/2 < \lambda < 1$, and the share of strong teams is of course $1 - \lambda$. Further notations used in the paper are as follows: t_H - the level of talent of a strong team; t_L - the level of talent of a weak team; (we consider only symmetric outcomes - such that all teams that are initially symmetric have the same strength), w - price of a unit of talent. We assume that w is fixed, thus restricting ourselves to the case of a small league;

We consider a simple piecewise linear single-peaked revenue function of a strong team. This function corresponds to the revenue from a single game against an opponent whose strength is t'.

We model the revenue the home team collects from a game (denoted by F_H for strong or high revenue teams) as a function of its own talent level and that of the opposing team so that the revenue is maximal for a certain (positive) difference of the talent levels. Departing from this optimal difference the revenue diminishes in both directions. To the left of the maximum because

[7] We are currently working on a model to analyse the consequences the artificial scarcening on the player market introduced by an import restriction brings for small scale leagues. There are arguments that the competitive balance of a league as specified in this paper is non monotonic in the import quota.

the home team is weaker than optimal (smaller difference), to the right of the maximum because the home team is stronger than optimal. We use this shape of the revenue function to model demand for the game by consumers who on the one hand like to see their team win but on the other hand also enjoy the thrill produced by the ex ante uncertainty of the game's outcome. The first source of utility calls for a high as possible talent level of the home team, whereas the latter puts up a restriction on the home team's strength in order to keep the unpredictability of the result. There is obviously a trade off between two counteracting effects - the consumers find it optimal if their team is stronger than the other but they do not want it to be too strong.

$$F_H = \begin{cases} M_H + \alpha_H(t_H - t'), & \text{if } t_H < At', \\ M_H + \alpha_H[(2A-1)t' - t_H], & \text{if } t_H \geq At'. \end{cases}$$

For a weak team a similar function for the revenue (denoted by F_L) is given as follows

$$F_L = M_L + \alpha_L(t_L - t').$$

Since a weak team never finds itself out on the downward sloping side of a revenue curve, we assume without loss of generality that its revenue function is monotonic. Here $M_H > M_L > 0$ are exogenous parameters, which correspond to the revenue received from a match against an equal opponent, $\alpha_H > \alpha_L > 0$ are the marginal revenues of a good and a bad team. Throughout the paper we assume that $w > \alpha_H > \alpha_L$[8]. $A > 1$ is an exogenous variable which determines the location of the peak. A represents the preference of the consumers concerning the superiority of their team. If A is close to 1 the consumers have a stronger preference for thrill than for winning, if A gets larger this shifts and the consumers have a stronger preference for seeing their team win than having a balanced game.

[8] This assumption shall reflect that in the league we model demand is so weak that the marginal cost of talent is bigger than the marginal revenue. The consequence of relaxing this assumption would be that (if w is sufficiently small) only downslide equilibria exist. Furthermore, the condition stated in Theorem 1 would be sufficient for the existence of an equilibrium.

In the league a double round robin series of games is played (each team plays twice against each other, once at home and once on the road). The total annual revenue of a strong team is then

$$Y_H(t_H, t_L) = \int_L F_H(t_H, t')dt' = \begin{cases} M_H + \lambda\alpha_H(t_H - t_L), & \text{if } t_H < At_L, \\ M_H + \lambda\alpha_H[(2A-1)t_L - \alpha_H t_H], & \text{if } t_H \geq At_L. \end{cases}$$

The annual revenue of a weak team is

$$Y_L(t_H, t_L) = \int_L F_L(t_L, t')dt' = M_L + \sigma\alpha_L(t_L - t_H).$$

We assume that teams are maximizing probability to win, which is a strictly increasing function of a team's talent level. This implies that teams spend all their revenues on purchasing talent.

$$Y_H(t_H, t_L) = wt_H, \tag{1}$$

$$Y_L(t_H, t_L) = wt_L. \tag{2}$$

Definition 1 *A (symmetric) equilibrium is a pair* (t_L, t_H) *satisfying equations (1)-(2).*

The assumption we made implies that for the equilibrium talent levels (t_L^*, t_H^*) it is always the case that $t_H^* > t_L^*$. We distinguish between downslide and upslide equilibria. The former are such that $t_H^* \geq At_L^*$, the latter are such that the opposite is true. In a downslide equilibrium the difference between the talent levels of strong and weak teams is so big that the strong teams find themselves on the downward sloping side of the revenue function. In an upslide equilibrium the talent levels are closer to each other so that the strong teams revenue is still on the upward sloping side of the revenue function.

Theorem 1 *A symmetric equilibrium exists if and only if*

$$\frac{M_H}{w + \lambda\alpha_H} \leq \frac{M_L}{(1-\lambda)\alpha_L}. \tag{3}$$

If it exists, it is also a unique symmetric equilibrium. Moreover, if the following inequality is satisfied

$$\frac{M_H}{wA - \lambda\alpha_H(A-1)} \geq \frac{M_L}{w + (1-\lambda)\alpha_L(A-1)}, \tag{4}$$

then the equilibrium is downslide. Otherwise, it is upslide.

Condition (3) is relatively mild. It is satisfied, for instance, if w is significantly larger than α_L. As for condition (4), it is easy to see that the denominator of the left hand side is strictly larger than that of the right hand side. Therefore, for inequality (4) to be satisfied M_H should be significantly larger than M_L. Put together, the equilibrium is downslide if the financial inhomogeneity of the clubs results in such a big difference of the weak and strong teams' talent levels that the strong teams find themselves on the downward sloping side of the revenue function.

Proof. Let us draw graphs of the teams' optimal reaction functions. In the upper triangle $\{(t_L, t_H) | t_H \geq At_L\}$ the graph of a strong team's reaction function coincides with the graph of the function

$$r_H^u(t_L) = \frac{M_H}{w + \lambda\alpha_H} + \frac{\lambda\alpha_H(2A-1)}{w + \lambda\alpha_H} t_L. \tag{5}$$

In the lower triangle $\{(t_L, t_H) | t_H < At_L\}$ the graph of a strong team's reaction function is given by the graph of the function

$$r_H^l(t_L) = \frac{M_H}{w - \lambda\alpha_H} - \frac{\lambda\alpha_H}{w - \lambda\alpha_H} t_L. \tag{6}$$

The graph of a weak team's reaction function coincides with the graph of the function

$$(r_L)^{-1}(t_L) = \frac{M_L}{(1-\lambda)\alpha_L} - \frac{w - (1-\lambda)\alpha_L}{(1-\lambda)\alpha_L} t_L. \tag{7}$$

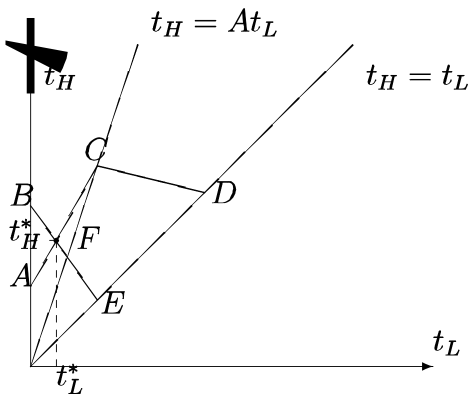


Figure 2: Reaction functions of the teams and a downslide equilibrium

Note first that the reaction function of a weak team is decreasing in a strong team's strategy. The optimal reaction of a strong team is an increasing function in the upper triangle and decreasing in the lower triangle. Moreover, in the lower triangle, the slope of the function $(r_L)^{-1}(\cdot)$ is steeper than the slope of the function $r_H^l(\cdot)$. This can be seen from

$$\frac{w-(1-\lambda)\alpha_L}{(1-\lambda)\alpha_L} > \frac{\lambda\alpha_H}{w-\lambda\alpha_H} \Leftrightarrow w > (1-\lambda)\alpha_L + \lambda\alpha_H \tag{8}$$

and has several implications. First of all, if condition (3) is violated, the graph of a strong team's reaction function lies strictly above that of a weak team's reaction function, so no equilibrium exists in this case. On the other hand, if (3) is satisfied, then the graphs of reaction functions cross — this follows from the fact that the point $D = (\frac{M_H}{w}, \frac{M_H}{w})$ lies always above the point $E = (\frac{M_L}{w}, \frac{M_L}{w})$. The relative steepness of the graph of a strong team's reaction function also implies the uniqueness of a crossing point and, hence, the uniqueness of an equilibrium. Finally, an equilibrium is downslide if the intercept of the graphs of the functions $r^u(t_L)$ and At_L (point C in the diagram) lies above the intercept of the graphs of the functions $(r_L)^{-1}(t_L)$ and At_L (point F in the diagram). This is satisfied if and only if condition (4) is satisfied. □

3.1 Stability of equilibrium

Consider the following discrete tatônnement process. Let $r_L(t_H)$ and $r_H(t_L)$ be the reaction functions of a weak team and a strong team, respectively. The process is defined by an initial point $t^0 = (t_L^0, t_H^0)$, $t_L^0 \leq t_H^0$ and a sequence of *positive* $\{t^n\}$, $n = 1, 2, \dots$ such that $t_L^n = r_L(t_H^{n-1})$ and $t_H^n = r_H(t_L^{n-1})$. An equilibrium t^* is (locally) stable if there is a neighborhood of t^* such that for any initial point in this neighborhood the sequence $\{t^n\}$ converges to t^*.

The condition $r_L^k(t_H^{k-1}) < 0$ for some k means that the talent level of a strong team is so high that a weak team cannot collect enough revenue to purchase any non-negative amount of talent. If this is the case, a weak team opts to quit and only strong teams continue to compete. We call such an outcome of the best response dynamic process a collapse of the league.

Theorem 2 *An upslide equilibrium is always locally stable. A downslide equilibrium is stable if and only if* $t_L^* > 0$ *and*

$$\frac{\lambda \alpha_H (2A - 1)}{w + \lambda \alpha_H} < \frac{w - (1 - \lambda)\alpha_L}{(1 - \lambda)\alpha_L} \tag{9}$$

Proof. Suppose that in the neighborhood of an equilibrium t^* the teams' best response functions are given by

$$r_H(t_L) = B_H + k_H t_L$$

and

$$r_L(t_H) = B_L + k_L t_H.$$

Let $t^n = (t_L^* + \epsilon_L^n, t_H^* + \epsilon_H^n)$, $n = 0, 1, \dots$ Then, by definition of the tatônnement process, taking into account $r_H(t_L^*) = t_H^*$ and $r_L(t_H^*) = t_L^*$

$$\epsilon_L^1 = k_L \epsilon_H^0, \quad \epsilon_H^1 = k_H \epsilon_L^0.$$

Furthermore,

$$\epsilon_L^2 = k_L \epsilon_H^1 = k_L k_H \epsilon_L^0, \quad \epsilon_H^2 = k_H \epsilon_L^1 = k_H k_L \epsilon_H^0,$$

and so on. It is clear that the process converges to the equilibrium if and only if $|k_L k_H| < 1$. Suppose first that an equilibrium is upslide. Then $k_H = -\frac{\lambda\alpha_H}{w-\lambda\alpha_H}$, $k_L = -\frac{\sigma\alpha_L}{w-\sigma\alpha_L}$ and the stability condition follows from (8).

Suppose now that an equilibrium is downslide and $t_L^* > 0$. Then $k_H = \frac{\lambda\alpha_H(2A-1)}{w+\lambda\alpha_H}$ and $k_L = -\frac{(1-\lambda)\alpha_L}{w-\sigma\alpha_L}$. Condition (9) guarantees that $|k_H k_L| < 1$ and the equilibrium is stable.

If $t_L^* = 0$ then for any $\epsilon > 0$ $r_H(t_L^* + \epsilon) > r_H(0)$ and $r_L(r_H(\epsilon)) < 0$. Therefore, the league collapses. □

Corollary 1 *If $A \leq 2$, then any equilibrium with $t_L^* > 0$ is stable.*

Proof. The condition (9) can be transformed to

$$\lambda(1-\lambda)\alpha_H\alpha_L(2A-1) < (w-(1-\lambda)\alpha_L)(w+\lambda\alpha_H),$$

which is equivalent to

$$2A\lambda(1-\lambda)\alpha_H\alpha_L < w^2 + w(\lambda\alpha_H - (1-\lambda)\alpha_L). \tag{10}$$

Since $\max \lambda\sigma = 1/4$, $\alpha_H\alpha_L < w^2$, and $\lambda\alpha_H > (1-\lambda)\alpha_L$, inequality (10) is satisfied whenever $A \leq 2$. □

It is easy to give an example of a downslide equilibrium, which is not stable. Suppose that due to some recent small changes in the parameters of the model (increase or decrease of the game popularity, athletes wages, etc.) the actual teams' talent levels do not coincide with (although may be arbitrarily close to) the equilibrium levels. If condition (9) is violated, then the best response dynamic process will inevitably come to the point, where $t_H^k = r_H(t_L^{k-1}) > (r_L)^{-1}(0)$ for some k. This means that in the next iteration of the dynamic process, the inequality $r_L(t_H^k) \geq 0$ will be violated and the league will collapse. This may explain what happened to the Austrian ice hockey league as pointed out in the previous section.

4 Payroll caps

A payroll cap which limits the amount of money a team can spend in purchasing talent is a policy rule often used in professional sports leagues to enhance competitive balance. But as the economic literature has pointed out their introduction affects a wide range of a sports league's properties (Késenne 2000). Of course the effect of payroll caps on the distribution of revenues between players and team owners has to be mentioned. The recent dispute over the collective bargaining agreement in the NHL which ultimately led to the cancellation of the 2004/05 season can be seen in this light

In our paper we concentrate on payroll caps as an institution which we show is capable of tackling the stability problem of the league equilibrium. Due to fixed wages, introducing a payroll cap is equivalent to imposing a restriction on the amount of talent a team can own. The purpose of such restriction can be threefold: 1) improving competitive balance of the league; 2) increasing the overall talent level of the league; 3) solving the problem of equilibrium instability.

Let R be a constraint on the team's talent level. A symmetric *constrained equilibrium* is a point $t = (t_L, t_H)$ such that i) each team chooses its talent level from the set $[0, R]$ so as to maximize its probability to win, and ii) the budget conditions

$$Y_H(t_H, t_L) \geq wt_H,$$

$$Y_L(t_H, t_L) \geq wt_L$$

are satisfied. If t^* is an ordinary non-constrained equilibrium and $R \geq t^*_H$, then t^* is also a constrained equilibrium with a non-binding restriction on the talent level. If the constraint is binding only for a strong team, then it is true for a constrained equilibrium t^C that $t^C_H = R$ and (t^C_L, R), where $t^C_L = r_L(R) = \frac{M_L - \sigma\alpha_L R}{w - \sigma\alpha_L}$ (this follows from the weak team's budget equation). It makes sense to consider only such constraints that are binding for at least one type of team.

Competitive balance. Introducing a talent level constraint always improves the league's competitive balance. In the case of a constraint which is binding only for a strong team, the talent level of a strong team actually decreases if R gets smaller. At the same time, a weak team's talent level, which equals to the value of r_L at a new talent level of a strong team, increases with R, since r_L is a decreasing function. Therefore, the competitive balance of the league improves. If the constraint is binding both for a weak and a strong team, the competitive balance is perfect, since all teams in the league have equal strength.

Overall talent level. Introducing constraint R reduces the league's talent level $T = \lambda t_L + (1-\lambda)t_H$. In particular, let $t_H = R$ and $t_L = r_L(R)$, then

$$T = (1-\lambda)R + \lambda \frac{M_L - (1-\lambda)\alpha_L R}{w - (1-\lambda)\alpha_L}.$$

It is easy to see that the right hand side of this equation is increasing in R, so the more restrictive is the constraint R, the lower is the league's talent level.

Stability issue. Let us redefine the best response dynamic process using constrained reaction functions of the teams: $\tilde{r}_L(t_H) = \min\{R, r_L(t_H)\}$, $\tilde{r}_H(t_L) = \min\{R, r_H(t_L)\}$. (Everything else in the definition of the process remains the same). Let us show that a constrained equilibrium (t_L^C, R), where $R < t_H^*$, is stable (the case, when the constraint is binding for both teams is similar).

Let $t^0 = (t_L^C + \epsilon_L^0, R + \epsilon_H^0)$ be an initial point of the dynamic process. Note that ϵ_H^0 is allowed to be negative only. Then by continuity of a strong team's reaction function and provided that ϵ_L^0 is sufficiently small, $\tilde{r}_H(t_L^C + \epsilon_L^0) = R$. On the other hand, $\tilde{r}_L(R + \epsilon_H^0) = t_L^C + \epsilon_L^1$, where $\epsilon_L^1 = k_L \epsilon_H^0 > 0$. In the next iteration, $\tilde{r}_L(R) = t_L^C$ and $\tilde{r}_H(t_L^C + \epsilon_L^1) = R$, again, by continuity of $r_H(\cdot)$ and provided ϵ_L^0 is sufficiently small. Therefore, a constrained equilibrium is reached already after the second iteration of the dynamic process! The equilibrium stability is restored.

Policy recommendations. In the case when an equilibrium is downslide and the stability condition (9) is violated, it makes sense to introduce a payroll cap which amounts to a restriction on a team's talent level. Such restriction should be only slightly below a strong team's equilibrium talent level[9] t^*_C. The lower is such a restriction, the more resilient to the shocks is the constrained equilibrium. However, the lower values of R also correspond to lower values of the league's total talent level. So there is a trade-off between stability and level of play involved.

5 Conclusion

In our model we have shown, that in a league of financially inhomogeneous win maximizing teams there can be equilibria which are not stable in the sense that after a shock weak teams will drop out of the league. Whether the league's equilibrium is stable or not depends on the exogenous parameters of the model. Instability is problematic as the share of strong teams can be small so that a league in which only strong teams are active can then be interpreted as being unsatisfactory in terms of size. The introduction of a payroll cap can eliminate the instability problem and keep the league with both strong and weak teams taking part. This stability however comes at the cost of a lower talent level of the league and furthermore a payroll cap is maybe due to sidepayments not perfectly enforceable. Also the right setting of the cap is not trivial as it should not to be too low in order not to put up an unnecssary obstacle in the teams' hiring activities. As mentioned above concerning further research it seems interesting to look at the question of import player regulation. Import player regulation usually puts a upper bound on the number of non-domestic players a team is allowed to

[9] The current top icehockey league in Great Britain (British Elite Icehockey League) for example employs a quite rigid payroll cap to tackle the stability problems which troubled it's predecessor. The Elite League was founded 2004 as the successor of the Icehockey Superleague which was started in the mid nineties as an ambitious project and after permanent stability problems and strong fluctuations in participation finally collapsed in 2003.

sign. Although in contradiction to European Union rules such restrictions are very common in small European sports leagues[10] and the effects on the properties of competition by separating the player markets and giving more weight on the domestic market (on which talent is most likely more scarce) seem not to be unambiguous. There are good arguments that the policy instrument of import player regulation can (in a similar way as a payroll cap), if well designed, be used to enhance competitive balance in a league and thus contribute to stability and attractiveness.

[10]Such restrictions have to work as unanymously agreed on gentlemens' agreements that could be rendered obsolete by unilateral deviation of every club. The persistent existence of such rules is a strong hint that they in fact bring a benefit for the clubs that agree on them.

References

[1] Buzzacchi L., Szymanski S. and Valletti T. (2003), "Equality of opportunity and equality of outcome: open leagues, closed leagues and competitive balance", *Journal of Industry Competition and Trade* 3, 167–186.

[2] El Hodiri, M. and Quirk, J. (1971), "An economic model of a professional sports league", *Journal of Political Economy* 79, 1302-1319.

[3] Kesenne, S., (2000), "The Impact of Salary Caps in Professional Team Sports," *Scottish Journal of Political Economy* 47/4, 422-30.

[4] Palomino, F. and Rigotti, L., 2000. "The sport league's dilemma : competitive balance versus incentives to win," *Discussion Paper* 109, Tilburg University, Center for Economic Research.

[5] Szymanski S. and Kesenne S. (2004), "Competitive balance and gate revenue sharing in team sports", *Journal of Industrial Economics* 52, 165–13.

[6] Szymanski S. (2003), "The economic design of sporting contests", *Journal of Economic Literature*, 41, 1137 – 51.

[7] Vrooman J. (1995), "A General Theory of Professional Sports Leagues", *Southern Economic Journal*, 61/4, 971-90.

[8] Zimbalist A. (2003), "Sport as Business",*Oxford Review of Economic Policy*, 19/4, 503-511.