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Revenue sharing and owner profits in professional team sports

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Revenue Sharing and Owner Profits In Professional Team Sports

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1. Introduction

In the sports economics literature, many authors have analysed and discussed the impact of revenue sharing among clubs on the competitive balance in a sports league. What can be concluded, so far, is that the impact depends, among other variables, on the club objectives, the spectator preferences, the variables affecting club revenue, the talent supply conditions, the internalization of the external effects, the specifics of the sharing arrangements, etc For an overview of the main results, see Fort and Quirk (1995), Marburger (1997), Kesenne (2000, 2005), Szymanski (2003), Szymanski and Kesenne (2004). Comparably, little attention has been paid to the impact of revenue sharing on owner profits. It seems obvious that revenue sharing increases the profits of the low-budget clubs in a league, as well as total league profits, but it is unclear

how the profits of the large-budget clubs are affected (Fort and Quirk, 1995). Large-budget clubs see their season revenue reduced by most sharing arrangements but, at the same time, the player labour cost is expected to come down. Profit maximizing clubs lower their demand for talent if they have to share the marginal revenue of talent with their opponents in the league. With a given supply of talent, this will reduce the market clearing salary level in a competitive player market. Nevertheless, most large-budget clubs don't like to share, they expect both their playing strength and their profits to come down, because sharing lowers their revenue, but they cannot be sure if, when, and by how much the sharing arrangement will lower the player cost. Moreover, in many European sports, the best teams have to compete on two levels: the own national championship and the European Championships. The best clubs in the small European countries are often too strong for their national league and too weak for the European league.

The aim of this paper is to investigate how revenue sharing affects owner profits in theory and to compare these results for the two basic models in the literature: the Walrasian-equilibrium approach, better known as the Rottenberg (1956) or Quirk and Fort (1992) model, leading to the well-known invariance proposition, and the Nash-Cournot equilibrium model as in Szymanski and Kesenne (2004), which challenges the invariance proposition and shows that revenue sharing can worsen the competitive balance. Section 2 presents the simplest possible model specification for the professional team sports industry. In section 3, the impact of revenue sharing on profits is analysed in a Walrasian-equilibrium approach. Section 4 considers the impact on profits if revenues are shared in a Nash-Cournot equilibrium approach. Section 5 concludes.

2. The model

The model we start from describes an n -club league with season revenue functions that are increasing, but concave in the team's own winning percentage. A club's season revenue is also affected by its market size (or the drawing potential of the team) and the total number of talents playing in the league. We assume that the size of the market increases club revenue, but this variable cannot be controlled by club management. The total number of talents employed determines the absolute playing

quality of the league and has a positive effect on club revenue. This simple model can then be written as:

$$R_i = R_i[m_i, w_i, s] \quad (1)$$

where R_i is the season revenue of club i , m_i is its market size and s is the sum of all talents in the league, i.e. $s = \sum_{j=1}^n t_j$. The clubs winning percentage, or the relative quality of a team, depends on its relative playing strength, and is assumed to equal $n/2$ times the ratio of its number of talents t_i to the sum of all talents in the league:

$$w_i = \frac{n}{2} \frac{t_i}{\sum_{j=1}^n t_j} \quad (2)$$

The sum of the winning percentages of all teams does not equal unity but half the number of teams in the league.

The total cost of a team consists of a fixed capital cost c_i^0 , and the labour cost which is equal to the number of the team's talents multiplied by the unit cost of talent c_i :

$$C = c_i t_i + c_i^0 \quad (3)$$

The specific revenue sharing arrangement that is considered in this model is the sharing of all revenue, including gate receipts, television and commercial revenue. A fixed percentage of all club revenue is collected and pooled by the league and equally distributed among all clubs.

If a star indicates the after-sharing values, and μ is the share parameter ($0 < \mu < 1$), this sharing system can be written as:

$$R_i^* = (1 - \mu)R_i + \mu \bar{R} \quad (4)$$

where \bar{R} is the average club revenue in the league. Notice that in this formulation, a higher value of μ means more sharing. Assuming that club managers know the sharing arrangement, they will take it into account when deciding on the hiring of talent. It is a well-known result that revenue sharing can affect both the talent demand and the unit cost of talent of a club, so that revenue and cost are affected.

If a club's season profit is the difference between season revenue and season cost, and if revenue is written as a function of the decision variables only, the after-sharing profit function is:

$$\pi_i^* = (1-\mu)R_i[t^*, s^*] + \mu\bar{R}[t^*, s^*] - c_i^*t_i^* - c_i^0 \quad (5)$$

where t^* is the n-vector of talents after sharing, s^* is the total sum of talents and c_i^* is the unit cost of talent after sharing.

In order to analyse the impact of revenue sharing on profits, the first partial derivative of the profit function with respect to μ can be calculated:

$$\frac{\partial \pi_i^*}{\partial \mu} = \bar{R}[t^*, s^*] - R_i[t^*, s^*] + \frac{\partial R_i[t^*, s^*]}{\partial \mu} + \mu \left(\frac{\partial \bar{R}[t^*, s^*]}{\partial \mu} - \frac{\partial R_i[t^*, s^*]}{\partial \mu} \right) - c_i^* \frac{\partial t_i^*}{\partial \mu} - t_i^* \frac{\partial c_i^*}{\partial \mu} \quad (6)$$

A positive sign for this equation means that more revenue sharing will enhance club profits. Starting from this general expression, the two scenarios can now be investigated to find the impact of revenue sharing on profits.

3. Profits in the Walrasian equilibrium model.

The benchmark model of a professional team sports league, as introduced by El-Hodiri and Quirk (1971), also commonly referred to as the Quirk and Fort model (1992), goes back to Rothenberg's (1956) seminal article and the well-known 'Invariance Proposition', claiming that player market regulations have little or no impact on the talent distribution among clubs. Although the Rothenberg paper concentrated on the impact of the Reserve Clause in the US major leagues, later on, the invariance proposition was also used to indicate the zero-impact of revenue sharing on competitive balance. Quirk and El-Hodiri (1974) showed that revenue

sharing among clubs does not change the competitive balance in a league that is characterized by profit maximizing clubs, operating in a competitive player market with a constant supply of playing talent. This model, with a constant s is generally accepted as an appropriate description of the closed major leagues in North-American sports.

If a club's winning percentage can be written as the ratio of its talents to the total talents in the league as in (2), the impact of talent on the own winning percentage can be derived as:

$$\frac{\partial w_i}{\partial t_i} = \frac{n}{2} \frac{\sum_{j=1}^n t_j - t_i (1 + \sum_{j \neq i}^n \frac{\partial t_j}{\partial t_i})}{(\sum_{j=1}^n t_j)^2} \quad (7)$$

If the supply of talent is constant, one can argue that one more talent in one team implies an equal loss of talent in the other teams, or $\sum_{j \neq i}^n \frac{\partial t_j}{\partial t_i} = -1$, so that (7) simplifies

to: $\frac{\partial w_i}{\partial t_i} = \frac{n}{2s}$. It follows that, apart from a constant, the winning percentage in

revenue function (1) can simply be replaced by the number of talents. It follows that a club's demand for talent is independent of the decisions made by the opponents, so that the Walrasian equilibrium can be derived.

However, this hypothesis also implies that a club, in calculating its marginal revenue of talent fully internalize the externality it causes on its opponents by substituting the constant supply of talent into the labour demand function (see Szymanski and Kesenne, 2004; Szymanski, 2003, 2004a).

In this case, revenue sharing not only leaves the talent distribution unchanged, it also lowers the competitive salary level in a Walrasian equilibrium approach, as has been shown by Quirk and El-Hodiri (1974) and others. So equation (6) simplifies to:

$$\frac{\partial \pi_i^*}{\partial \mu} = \bar{R}[t, s] - R_i[t, s] - t_i \frac{\partial c^*}{\partial \mu} = \bar{R}[t, s] - R_i[t, s] + ct_i \quad (8)$$

where c is the market clearing unit cost of talent before sharing. It can be shown¹ that its value after sharing $c^* = (1 - \mu)c$ so that $\frac{\partial c^*}{\partial \mu} = -c$.

Because the right-hand side of equation (8) is clearly positive for all clubs that have a pre-sharing budget that is smaller or equal to the average budget in the league, revenue sharing increases the profit of the small and mid-sized clubs. Only for teams that have budgets that are so large, compared with the other teams, that $R_i[t, s] - ct_i = \pi_i > \bar{R}[t, s]$, that is: their profits are higher than the average budget in the league, revenue sharing will lower profits. It follows that, although it is most likely that most clubs' profits increase by revenue sharing, it is possible that the profits of the relatively rich and very profitable clubs come down. Also notice that the size of the share parameter μ does not affect this result, even the most modest sharing arrangement can lower the profits of the very dominant clubs.

Obviously, the impact of revenue sharing on league-wide profits is unambiguously positive; total league revenue is not altered and the total player cost is coming down. From equation (5), total profits after sharing can be written as:

$$\sum_{i=1}^n \pi_i^* = \sum_{i=1}^n R_i[t^*, s^*] - \sum_{i=1}^n (c_i^* t_i^* + c_i^0) \quad (9)$$

Because sharing does not change the talent distribution and the supply of talent is constant, its impact on league-wide profits can be found as:

$$\frac{\partial \sum_{i=1}^n \pi_i^*}{\partial \mu} = \sum_{i=1}^n ct_i^* = cs > 0 \quad (10)$$

A simplified example of a 2-club league with quadratic revenue functions shows that, whatever the value of share parameter, revenue sharing increases the poor club's

¹ Sharing arrangement (1) can also be rewritten as: $R_i^* = \frac{n(1-\mu) + \mu}{n} R_i + \frac{\mu}{n} \sum_{j \neq i} R_j$, so that the

marginal revenue is: $MR_i^* = \frac{n(1-\mu) + \mu}{n} MR_i + \frac{\mu}{n} \sum_{j \neq i} MR_j \left(\frac{-1}{n-1} \right)$. In the Walrasian market equilibrium $MR_i = c$ for all i , so that $MR_i^* = (1-\mu)c = c^*$.

profits and decreases the rich club's profits if that club's profits are large than the average budget in the league. Assume that x is the large-budget team with a market size of 14 and y is the low-budget team with a market size of 6, and that the clubs' revenue functions are:

$$R_x = 14w_x - w_x^2 = 14t_x - t_x^2 \quad \text{and} \quad R_y = 6w_y - w_y^2 = 6t_y - t_y^2 \quad (11)$$

with a constant supply of talent of 8 and no capital cost.

Table 1 shows the results of this model for increasing values of the share parameter, starting from no sharing. As can be seen, the distribution of talent, or the competitive balance, before sharing ($\mu=0$) is 6 to 2, and is not changed by revenue sharing in accordance with the invariance proposition. The initial budgets of the large and the small club are 48 and 8, so that the average budget is 28. The initial unit cost of talent is 2 and the player cost of the large club is 12. It follows that the large-budget club's profit is 36, which is larger than the average budget.

Table 1. Walrasian Equilibrium, numerical example

μ	t_x/t_y	R_x	R_y	\bar{R}	c	C_x	C_y	π_x	π_y	π
0	6/2	48	8	28	2	12	4	36	4	40
0.5	6/2	38	18	28	1	6	2	32	16	48
1	6/2	28	28	28	0	0	0	28	28	56

As shown by equation (8), revenue sharing will lower the large club's profits. With a share parameter of $\mu=0.5$, which means that the large club keeps 75% of its revenue and receives 25% of the small clubs' revenue, the large club's revenue decreases and the small club's revenue increases, keeping total league revenue unchanged. Because the unit cost of talent decreases from 2 to 1, both clubs' player costs are coming down. The large-budget club's reduction in both revenue and cost lower its profit from 36 to 32. As expected, the profits of the low-budget club go up from 4 to 16. Also, total league profits are raised by revenue sharing. If $\mu=1$, which means equal sharing, all

clubs' revenues and profits are equal, and the market clearing unit cost of talent is zero; clubs are no longer willing to pay for talent.

4. Profits in the Nash-Cournot equilibrium model.

Since Rottenberg's (1956) article, the invariance proposition has been seriously challenged. Several variants of the original model have been considered, as mentioned in the introduction. The variant, discussed in this section, starts from exactly the same model as described in section 2, but assumes that the supply of talent is flexible (see: Szymanski and Kesenne, 2004). The flexible-supply model is more appropriate for professional sports in Europe with its multiple national leagues, operating in a European competitive player market since the Bosman² verdict. Given the increased international mobility of players, the talent supply can no longer be considered as a constant in each national league. It follows that in equation (7): $\sum_{j \neq i}^n \frac{\partial t_j}{\partial t_i} = 0$ so that the impact of talent on winning percentage and revenue becomes:

$$\frac{\partial R_i}{\partial t_i} = \frac{\partial R_i}{\partial w_i} \frac{\partial w_i}{\partial t_i} = \frac{\partial R_i}{\partial w_i} \frac{n}{2} \frac{\sum_{j \neq i}^n t_j}{(\sum_{j=1}^n t_j)^2} \quad (12)$$

Contrary to the previous model, the important consequence is that the marginal revenue of talent of a team, or its hiring strategy, depends on the hiring strategy of all other teams in the league, which turns the model into a game.

In this game, all teams are wage takers on the open European labour market, so the marginal unit cost of talent for every team in each national championship has to be considered as a constant. It follows that in equation (6) $c_i^* = c$ and $t_i^* \frac{\partial c_i^*}{\partial \mu} = 0$.

Under these hypotheses, Szymanski and Kesenne (2004) and Kesenne (2005) have shown that, after revenue sharing, the non-cooperative Nash-Cournot Equilibrium will

² The Bosman verdict by the European Court of Justice in December 1995 abolished the retain and transfer system in Europe, as well as the so-called 3+2-rule, with limited the number of foreign (European) players in a team.

not only show a decrease in the demand for talent of each team, but also a worsening of the competitive balance. This implies that in equation (6) $-c \frac{\partial t_i^*}{\partial \mu}$ is positive for all clubs, and that, for a given value of s , $\frac{\partial R_i[t^*, s]}{\partial \mu}$ is positive for the large-budget clubs, but negative for the low-budget clubs, because of the changes in their winning percentages. However, in this flexible-supply model with an given unit cost of talent, total talent employment s is no longer a given constant. Because all clubs reduce their demand for talent, the absolute quality of the league championship is lower which has a negative effect on all clubs' revenue. It follows that the sign of $\frac{\partial R_i[t^*, s^*]}{\partial \mu}$ is theoretically indeterminate for the large-budget clubs, and even more negative for a low-budget club. The reduction in absolute quality of the league also implies that the sign of $\frac{\partial \bar{R}[t^*, s^*]}{\partial \mu}$ is negative.³

Finally, it is obvious that the sign of $\bar{R}[t^*, s^*] - R_i[t^*, s^*]$ is negative for the large-budget clubs and positive for the low-budget clubs.

In order to derive the impact of sharing on profits, the sign of expression (6) has to be investigated. In table 2, the expected signs of the terms are given in the columns without parentheses for the low, the average and the high budget clubs. Although the terms in equation (6) show opposite signs for low-, average- and the large-budget clubs, the low-budget clubs will experience a profit increase. It is only their lower winning percentage, in combination with a lower absolute quality in the league, that will reduce their season revenue, but this effect is clearly not strong enough to outbalance the other three favourable effects on profits. Moreover, Kesenne (2005)

³ In a recent paper, Szymanski (2004b) have shown empirically that revenue sharing can possibly enhance total league revenue because spectators seem to prefer a more unequal competitive balance than the one emerging from the non-cooperative equilibrium. In equation (6) this would imply that $\frac{\partial R[t^*, s^*]}{\partial \mu}$ is indeterminate. However, this finding is still controversial. Most empirical research

shows that the competitive balance in a league does not have a significant effect on attendances (see Borland and Macdonald, 2003). Also, the competitive balance in a league can be approached and measured in very different ways (see Szymanski, 2003). So we assume here that spectators are more or less indifferent for marginal changes in competitive balance.

has shown that the Nash-Cournot equilibrium approaches the Walrasian competitive equilibrium if the number of clubs in a league increases, so that, with 18 or 20 clubs in a league, the impact of revenue sharing on the distribution of talent is relatively small. It follows that the only negative effect of revenue sharing on the small clubs' profits comes from the lower absolute quality in the league.

Table 2. Expected signs of the terms of equation (6)

Budget	Low		Average		High	
$\bar{R}[t^*, s^*] - R_i[t^*, s^*]$	+	(+)	0	(0)	-	(-)
$\frac{\partial R_i[t^*, s^*]}{\partial \mu}$	-	(-)	-	(0)	?	(+)
$\mu \left(\frac{\partial \bar{R}[t^*, s^*]}{\partial \mu} - \frac{\partial R_i[t^*, s^*]}{\partial \mu} \right)$	+	(+)	0	(0)	-	(-)
$-c_i^* \frac{\partial t_i^*}{\partial \mu}$	+	(+)	+	(0)	+	(-)
$-t_i^* \frac{\partial c_i^*}{\partial \mu}$	0	(+)	0	(+)	0	(+)

For the mid-sized clubs, with a budget close to the league average, table 2 shows that equation (6) simplifies to:

$$\frac{\partial \pi_i^*}{\partial \mu} = \frac{\partial R_i[t^*, s^*]}{\partial \mu} - c_i^* \frac{\partial t_i^*}{\partial \mu} \quad (13)$$

Because their winning percentage will not be affected by revenue sharing, even in a league with a limited number of teams, the negativity of the first term in (13) is only caused by the loss of absolute quality in the league. So, although theoretically indeterminate, expression (13) can be expected to be positive, because these clubs profit from the reduction in talent hiring at a fixed unit cost of talent.

Also the high budget clubs profit from a reduction in player labour cost, but the impact of revenue sharing on their profits can be negative depending on the relative size of their budget and on the size of the share parameter μ . Also the reduction in absolute quality in the league can be expected to have a stronger negative effect on the large clubs' budget, outbalancing the expected small positive effect of a higher winning percentage, so that the theoretically undetermined term in table 2 can also be negative.

Remark

An important remark is that in the fixed-supply model of section 3, it was assumed that a club completely internalizes the externalities it causes on their opponents by strengthening its team. However, one can also consider a fixed-supply market-clearing model without the internalization of the externalities, or, in other words, a Nash-Cournot equilibrium model with a constant talent supply.

With a constant supply of talent equal to s , equation (12) can be written as:

$$\frac{\partial R_i}{\partial t_i} = \frac{\partial R_i}{\partial w_i} \frac{\partial w_i}{\partial t_i} = \frac{\partial R_i}{\partial w_i} \frac{n}{2s^2} \sum_{j \neq i}^n t_j = \frac{\partial R_i}{\partial w_i} \frac{n(s - t_i)}{2s^2} \quad (14)$$

Compared with the flexible-supply scenario in this section, revenue sharing will now lower the unit cost of talent, given the downward shift of the market demand for talent and the fixed supply of talent. It follows that in equation (6), the last term: $t_i^* \frac{\partial c_i^*}{\partial \mu}$ is no longer equal to zero. Because of this adjustment to a new market equilibrium, large-budget clubs will have increased and low-budget clubs will have reduced their hiring of talent, compared with the pre-sharing situation (see Szymanski, 2004a). The competitive balance has worsened and the absolute playing quality in the league is the same as before ($s^* = s$).

In table 2, the expected signs of the terms of expression (6) are now given between parentheses. For the low-budget clubs, profits will go up even further now because of the lower unit cost of talent. Somewhat surprising is that the outcome for the mid-sized clubs is now unambiguously positive. On the revenue side, not only the absolute quality of the league is the same as before, also these clubs' relative quality, or their

winning percentage stays more or less the same. On the cost side, they no longer reduce their talent hiring, but they profit from the lower unit cost of talent.

For the large-budget clubs, the impact of revenue sharing on profits is still theoretically indeterminate. Compared with the flexible-supply case, the second term in table 2 is now clearly positive because of the improved winning percentage and the unchanged absolute quality in the league, but hiring more playing talent increases the labour cost in the fourth term, but the labour cost is reduced by the lower unit cost of talent in the last term in table 2.

Returning to the numerical example (11) of section 3, the Nash-Cournot equilibrium, with a fixed supply of talent, can be found by solving the following reaction functions:

$$\frac{\partial R_x}{\partial t_x} = \frac{\partial R_x}{\partial w_x} \frac{\partial w_x}{\partial t_x} = (14 - 2w_x) \frac{t_y}{s^2} = (14 - t_x / 4) \frac{t_y}{64} = c \quad (15)$$

$$\frac{\partial R_y}{\partial t_y} = \frac{\partial R_y}{\partial w_y} \frac{\partial w_y}{\partial t_y} = (6 - 2w_y) \frac{t_x}{s^2} = (6 - t_y / 4) \frac{t_x}{64} = c$$

The competitive balance turns out to be simply the ratio of the market sizes of the two

clubs or: $\frac{t_x}{t_y} = \frac{w_x}{w_y} = \frac{m_x}{m_y} = \frac{14}{6} = 2.33$ with $t_x = 5.6$ and $t_y = 2.4$. The market clearing

unit cost of talent is now 0.4725. So, we find a more equal distribution of talent and a lower average player salary level compared with the Walrasian equilibrium in section (3) where the externalities were fully internalized. This does not come as a surprise because the negative external effects that small clubs cause on large clubs are stronger than the negative effects that large clubs cause on small clubs, because large clubs have higher marginal revenues and, consequently, more to loose. Consequently, small clubs invest too much in talent which leads to a more equal distribution of talent (see Szymanski, 2004b).

Because revenue sharing worsens the competitive balance, we can derive that in the case of equal sharing, the competitive balance is the same as the in Walrasian

competitive equilibrium of section 3 (i.e. $\frac{t_x}{t_y} = 6/2$). The reason is that, by equal sharing, the effects of the externalities are neutralized, so that the same results shows up as in the scenario where the externalities are fully internalized. Not surprisingly, also the market clearing unit player cost will be zero; a profit maximizing club is not willing to invest in talent in the case of equal sharing.

5. Conclusion

This paper has shown that the impact of revenue sharing on owner profits is not as straightforward as it might seem. While it is obvious that total league profits, and the profits of the low budget clubs, are raised by revenue sharing, it is not always clear what happens to the profits of the high budget clubs. In this paper we have concentrated on two basically different models in terms of the talent supply conditions. There are only little differences between the impact of revenue sharing on profits in the Walrasian fixed-supply model compared with the Nash-Cournot approach with flexible or fixed talent supply. Small and mid-sized clubs will see their profits go up. For the large budget clubs, the case was clear in the fixed-supply Walrasian approach: if a club's pre-sharing profits are larger than the average club budget in the league, its profits will be reduced by revenue sharing. In the Nash-Cournot approach, the outcome for large-budget clubs is theoretically indeterminate, but the larger the budget, compared with the average budget in the league, the higher the chances to experience a profit reduction. One difference with the Walrasian approach is that in Nash-Cournot approach the outcome also depends on the size of the share parameter. In the Walrasian model, even a modest sharing arrangement will reduce the profits of the very dominant clubs. What happens to the large-budget clubs' profits in the Nash-Cournot approach depends on the value of several parameters in the model and is therefore an empirical question.

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