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Value-maximizing football clubs

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Abstract

In this paper, football clubs are modeled as value-maximizing enterprises. With a long-term perspective in this framework, players are not only factors of production, but also assets of the club. It is shown that talent investment is higher with value-maximization than with profit maximization for homogeneous football clubs. Club heterogeneity is then modeled by different time-horizons regarding future profits, which leads to asymmetric levels of talent investment. Teams with longer time-horizons demand more talent and tilt the competition to their favor. Increases in transfer prices for players worsen the competitive balance, while higher player wages improve it.

KEYWORDS

football, players as assets, Tobin's q , value-maximization

1 | INTRODUCTION

Professional team sports, and in particular European club football, provide a unique framework for studying the essence of economic behavior. The league structure can be interpreted as a market in which teams compete with each other by creating high-level entertainment in a kind of “cooperative competition”. The most crucial factors of production are the athletes who play the game, in combination with the respective club managers.

Several aspects of football economics have already been analyzed in the literature. These include profit-maximization versus winning-percentage maximization (see e.g., Garcia-del-Barrio & Szymanski, 2009), the effects of salary caps (Késenne, 2000a), revenue sharing (Grossmann et al., 2010; Késenne, 2000b, 2004), as well as the combination of revenue sharing and salary caps (Dietl, Grossmann, et al., 2011; Dietl, Lang, et al., 2011),

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and luxury taxes (van der Burg & Prinz, 2005; Dietl et al., 2010). In particular, Franck (2014) analyzes the impact on the competitive balance of a league, as well as the UEFA's so-called "Financial Fair Play" rules. The latter has been and still is influenced by the fear on the part of some clubs of overinvestment in players, referred to as also the "sugar daddy" syndrome (Lang et al., 2011), as well as by the problems associated with a possible competitive bias between clubs.

It is well-known theoretically that winning-percentage-maximization entails higher investments in player talents than profit-maximization (Fort & Quirk, 2004). One of the main reasons is that the current budget constraint of a club is decisive for the level of talent a club can buy when it attempts to maximize its winnings. A club that is able to run huge deficits, for instance, can buy more talent than a club that is confronted with a zero-budget constraint, that is, cannot sustain deficits. With profit-maximization, a club will buy only that amount of talent which equates its marginal revenue with marginal cost. Overinvestments are generally not compatible with profit maximization.

However, clubs may attempt not only to maximize profits or winning percentages. As suggested by Jensen (2001), the objective function of firms may be best characterized as maximizing the firm value. This view is long-term, in contrast to profit- and winning-maximization that are short-term goals. In a long-term perspective, assets of the firm, created via investments, play a crucial role in the behavior of the firm. Since professional football clubs are enterprises, as legally specified by the European Court of Justice in the well-known Bosman-ruling, it seems reasonable to assume that professional football clubs behave like other enterprises. Moreover, like other businesses, professional football clubs presumably want to survive, which requires a long-term strategy. Hence, value-maximization seems to be a suitable goal for such enterprises.

The contributions to the literature of this paper are firstly the modeling of football clubs as value-maximizing firms and secondly, the incorporation of heterogeneous club-ownership into the model. For value-maximizing clubs, players are not only considered as variable factors of production but also as assets of the clubs with an option value (Antonioni & Cubbin, 2000). The latter gains support from the accounting practice by means of which players who are bought on the market are capitalized in the balance sheet at their transfer value (PwC, 2018). Not only from an accounting viewpoint are players assets, but also from an economic one. Football players are traded for a transfer payment between clubs if they are contractually bound to the selling club. Expressed differently, these players are assets that a club may buy and sell (Kuper & Szymanski, 2018, p. 111), if and when the respective player agrees. Since value-maximization is a long-term objective, the economic implications of ownership heterogeneity can be considered via different discount factors. As is well-known from firms in other sectors of the economy, ownership concentration may change the time-horizon for investments (see, for instance, Baysinger et al., 1991). In effect, more diverse investment strategies are possible in a non-finite, value-maximizing framework for football clubs than in short-term models that prevail in sports economics. As an indicator of the clubs' investment strategies, the application of Tobin's (average) q is suggested in this paper.

A first important result of football clubs as value-maximizing enterprises with talented players as assets is that such clubs invest more in talent than profit-maximizing clubs. Moreover, it is argued that this investment differential need not be considered as "overinvestment", because it is a result of the long-term oriented behavior of clubs. For example, after Roman Abramovich bought Chelsea Football Club in 2003 for about £140 million, he subsequently invested more than £1.1 billion in the club up to 2019 (Baker et al., 2019). The club was worth over £2.032 billion (£2.58 billion according to Forbes, 2019) in 2019, which would have resulted in a net profit of over 60 million (adjusted for inflation) from selling at this price.¹

Further relevant results are derived for heterogeneous club ownership. A higher discount factor implies a higher demand for talent in a steady-state equilibrium, and a marginal increase in the clubs' own discount factors leads to a higher talent demand as well. Therefore, the competitive balance is tilted in favor of a club whose

¹We assumed that all investments were made in 2003, and calculated an inflation rate of 59% for the UK from 2003 to 2019 (Bank of England, 2020).

time-horizon for the payoff of its talent investments is longer. However, if the time-horizon of the respective opponent club increases, an asymmetrical response occurs; the club with the longer time-horizon increases its talent demand, whereas the club with the shorter time-horizon decreases it. In addition, a higher price for a unit of talent in the transfer market worsens the competitive balance between clubs. In contrast, higher player wages improve the competitive balance. Furthermore, in professional football, Tobin's (average) q is defined as the sum of discounted future profits, divided by the book value of players. The latter is equivalent to the transfer price that the clubs paid for their players. It is shown in the paper that a longer time-horizon for investments does not only imply a higher level of talent investment by the respective club, but also a lower value of Tobin's q .

The remainder of this paper is structured as follows. Section 2 contains a review of the relevant literature, and the model of value-maximizing clubs is developed in Section 3. Section 4 then presents the results with heterogeneous owners. Extensions of the basic model are shown in Section 5, with Section 6 concluding.

2 | LITERATURE REVIEW

As early as 1993, Whitney (1993) explained how competition in professional team sports might be seriously damaged or even destroyed by bidding for talent. Since, in a long season, slightly higher talent may make all the difference, successful clubs must often pay so much to their stars that competing clubs may no longer be financially able to acquire star players. The respective bidding for star players might ruin clubs and even lead to the collapse of the league. However, institutional and contractual arrangements may prevent the collapse of teams and leagues through such measures as constraints on the period required before players can be transferred between teams. Moreover, a longer-term objective of clubs may also protect clubs from paying too much for star players. In this paper, the club's value is considered as the economic objective for its decision on hiring and selling talent.

Dietl et al. (2008) show that investment in talent in a professional sports league is higher in a profit-maximizing non-cooperative league than in a cooperative league with joint profit-maximization. The higher talent investment volume is referred to as "overinvestment", although it is only a consequence of the comparison between a cooperative and a non-cooperative league. More important for this paper is the fact that clubs maximize short-term profits and players' talent is an input factor, but not an asset.

Although Lang et al. (2011) assume that football clubs are profit-maximizers, they add private investors who have a (linear) preference for winning. In effect, this changes the structure of the model from a profit-maximizing to a winning-percentage maximizing model. It is well-known that investment in talent is larger in winning-maximizing than in profit-maximizing models (see, for instance, Fort & Quirk, 2004). An investor with a preference for winning instead of profits may buy more talent and change the allocation of talent in a league. The remaining teams may react to this strategy by also looking for such investors. In a certain sense, the competition for talent is complemented by competition for additional investors. The normative critique implied by the notion "sugar daddy" seems not appropriate as profit-maximization is replaced by winning-maximization. However, from the perspective of this paper, it can be stated that the biased talent investment in the paper of Lang et al. (2011) relies on winning-maximization. Neither are clubs assumed to be value-maximizers and nor are players modeled as assets.

Franck and Lang (2014) show that "money injections of benefactors [sugar daddies (SD)]" (Franck & Lang, 2014, p. 430) induce football clubs to apply riskier strategies with investments that might well fail. In addition, they argue that a "too big to fail" situation might occur where private or public investors are forced to put additional financial resources into those clubs. This argument ignores the fact that players may be sold in such critical situations. Whether fire sales may constitute an issue in such circumstances cannot be answered in general. Nevertheless, it could be argued that it would not be a crucial issue as only a few clubs may be in a financially critical situation. In such a case, the consideration of players as assets is required for a comprehensive analysis of the "too big to fail" risk.

Nonetheless, the above-mentioned papers shed some light on football club investing. As pointed out by Rohde and Breuer (2017), there are new developments in football club investing: “strategic investors” in Germany, “private majority investors” in France, and “foreign investors” in England. This seems to show that investments in football clubs – that is, in star players and star teams – are considered economically attractive. This development is interpreted in the presented paper as an indication that there is long-term investor interest in the value of football clubs and their players as assets.

In this context, by considering furthermore the Financial Fair Play rules, Franck (2018) diagnoses a “significant financial recovery and further polarization” (Franck, 2018, p. 1) in European football. Sass (2016) argues that since success is path-dependent as clubs with a long history have a larger fan base with higher revenue, “sugar daddies” may even be necessary to stop a further concentration of club power. Since Financial Fair Play is intended to end such “sugar daddy” support, an even more concentrated club structure could result.

The controversial views of Financial Fair Play, the question of “overinvestment” and the long-term fate of football clubs and football leagues render it necessary to analyze football clubs as value-maximizers with the players as assets.

3 | THE MODEL OF VALUE-MAXIMIZING CLUBS

3.1 | Model specification

In this section, the model of football clubs as value-maximizers is developed. Consider an open league with two clubs. Each Club $i \in \{1, 2\}$ has a revenue function, $R_i(t_i, t_j)$, that depends on the level of talent of its own team, t_i , and the talent level of the opponent, t_j . It is specified as follows:

$$R_i(t_i, t_j) = m_i \cdot \frac{t_i}{t_i + t_j}. \quad (1)$$

Here, revenue depends only on the value of the logit contest-success function (CSF), $\frac{t_i}{t_i + t_j}$, which assigns a winning probability for each team, dependent on the level of talent of both teams (for a sophisticated analysis of the role of the CSF in team sports economics, see Fort & Winfree, 2009, as well as Runkel, 2011), and a scale factor, m_i . The latter can be interpreted as the market size of Club i . Since we are not interested in the effects of different market sizes, we set $m_i = m_j = m$ throughout the paper. Moreover, we model a linear relationship between revenue and the winning probability. This approach is consistent with models used in the sports economics literature (see e.g., Szymanski & Késenne, 2004, or Grossmann et al., 2010). Although the assumptions on the CSF as well as on the linearity between revenues and winnings seem to be simple, the results derived should also be compared with those of other revenue functions, as we emphasize the cost side of football clubs, in contrast to most studies in this area that focus on the revenue side.

Following the sports economics literature, it is assumed that the wage per unit of talent and year, w , is constant and the same for all clubs. This implies that the talent supply function is completely wage-elastic. That means that there is no restriction on the number of talent units available at wage w per unit and transfer price p per unit. Furthermore, all players are assumed to have long-term contracts.² Nonetheless, the existence of a transfer market is assumed in which clubs can buy and sell players at a price p per unit of talent. Although players have long-term contracts, the optimal allocation of players to teams requires such a market.

²The assumption regarding long-term contracts should not influence our results. Although players in the era of free agency or post-Bosman with expiring contracts may be acquired for free, the players (instead of the ceding club) will receive a signing bonus to the amount of the transfer price.

For the sake of simplicity, the players' wage per unit of talent, w , as well as the transfer price per unit of talent, p , are given exogenously. This implies that the league considered here is small in relation to the "rest of the world". Otherwise, the league under consideration would influence both, w and p . Put differently, wages and transfer prices would be endogenously determined variables if the league's clubs could exert an influence on them.

Furthermore, the Nash-conjectures in non-cooperative games $\frac{dt_i}{dt_j} = 0$ automatically hold in this setup.

3.2 | Value-maximizing clubs

Conventionally in the sports economics literature, football clubs either maximize profits or winnings (see, for instance, Késenne, 2007). In addition, there are several studies analyzing clubs maximizing utility (e.g., Dietl, Grossmann, et al., 2011; Dietl, Lang, et al., 2011; Madden & Robinson, 2012; see Prinz, 2019, for a dynamic analysis) as well as fan welfare (Madden, 2012). However, these approaches do not take into account that the success and even the survival of a club depend on more than a single time period. The same is true for all enterprises that are not exclusively seasonal endeavors. This is the main reason for the suggestion of Jensen (2001) to consider (longer-term) value-maximization as the appropriate objective of firms. Below, it is assumed that club owners are not only interested in the profit of a single season, but in the overall value of the club.

The value V_i of Club i is defined as the sum of all discounted (expected) future profits. This approach is similar to the evaluation of stock prices of companies that are usually modeled as the sum of all discounted dividends. By maximizing the sum of discounted future profits, it does not matter whether the profits come from being sportively successful or from buying and selling players. It might even be a business model to buy so far now unknown players, to develop them into top players and subsequently sell them at a substantial surplus. In short-term profit-maximization models, as well as in short-term winning-maximization approaches, such a strategy cannot be viably integrated. In a certain sense, a much longer time period makes much more diverse investment strategies possible as a way to earn money.

In a value-maximization model, players change from pure input factors that produce club income via sportive success, to assets that may be valuable in the future. As a consequence, in our model, talent bought in previous periods can also be employed in the current ones. However, we assume that a team loses a certain percentage $\theta \in (0, 1)$ of its talent stock after each period. Similar to Grossmann et al. (2010), we consider each period $s \in \{0, \dots, \infty\}$ as one season. The talent accumulation $t_{i,s}$ of team i in season s must be equal to the sum of the depreciated talent from the last season, and activities $\tau_{i,s}$ at the transfer market before the season. Note that the value $\tau_{i,s}$ can either be positive or negative, depending on the buying and/or selling of talent on the transfer market. Players may be bought and sold in the transfer market at an exogenously determined price p per unit of talent. Talent accumulation $t_{i,s}$ is given by:

$$t_{i,s} = (1 - \theta) \cdot t_{i,s-1} + \tau_{i,s} \quad \text{for all } s \in \mathbb{N}. \quad (2)$$

The club value function then reads as follows:

$$\begin{aligned} V_i((t_{i,-1}, t_{i,0}, t_{i,1}, \dots), (t_{j,-1}, t_{j,0}, t_{j,1}, \dots)) &:= \sum_{s=0}^{\infty} \pi_{i,s} \cdot \beta_i^s \\ &= \sum_{s=0}^{\infty} (R_i(t_{i,s}, t_{j,s}) - w \cdot t_{i,s} - p \cdot \tau_{i,s}) \cdot \beta_i^s \\ &= \sum_{s=0}^{\infty} (R_i(t_{i,s}, t_{j,s}) - w \cdot t_{i,s} - p \cdot (t_{i,s} - (1 - \theta) \cdot t_{i,s-1})) \cdot \beta_i^s \end{aligned} \quad (3)$$



This value function sums all profits, without a predefined end of the time-horizon.³ However, the profits $\pi_{i,s}$ are discounted with the factor $\beta_i \in [0, 1)$, with $\beta_i := \frac{1}{1 + \rho_i}$, where ρ_i is the respective discount rate. The discount factor

is not necessarily the same for all clubs, as clubs may value future profits differently. For example, Club i with a value $\beta_i = 0$ represents a profit-maximizer, because only profits in the respective present period matter in the maximization. By contrast, the value-maximizing club faces a dynamic maximization problem, because its investment decision not only includes the present period, but also all future periods. This motivates the following definition.

Definition 1 A strategy of Club i consists of the vector of talent demand in period $s = 0$ and in all future periods $s > 0$ and is defined by $t_i := \{t_{i,0}, t_{i,1}, \dots\}$.

Given the above assumptions, the value-maximization program implies the following dynamic structure described in Proposition 1.

Proposition 1 (i) An optimal strategy t_i^* is independent of the initial endowment $t_{i,-1}$.

$$t_i^*(t_{i,-1}) = t_i^* \quad \text{for all } t_{i,-1} \in \mathbb{R}_+. \quad (4)$$

(ii) There is a unique optimal solution t_i^* in which the talent demand is the same in each period.

$$t_{i,0}^* = t_{i,s}^* \quad \text{for all } s \in \mathbb{N}. \quad (5)$$

Proof See Appendix.

Proposition 1 states that there is no dynamic trajectory into a steady-state since the clubs will “jump” already to the equilibrium in the first period. Next, we will use the Euler equation, which is derived in the proof of Proposition 1 in the Appendix (Equation (19)):

$$\frac{\partial R_i(t_{i,0}, t_{j,0})}{\partial t_{i,0}} = w + p - \beta_i \cdot p \cdot (1 - \theta) = w + p \cdot (1 - \beta_i \cdot (1 - \theta)). \quad (6)$$

This equation can be rearranged to:

$$p = \frac{\left(\frac{\partial R_i(t_{i,0}, t_{j,0})}{\partial t_{i,0}} - w - \beta_i \cdot \theta \cdot p \right)}{1 - \beta} = \sum_{s=0}^{\infty} \left(\frac{\partial R_i(t_{i,0}, t_{j,0})}{\partial t_{i,0}} - w - \beta_i \cdot \theta \cdot p \right) \cdot \beta_i^s. \quad (7)$$

The equation states that, in optimum, the marginal cost of the investment is equal to the sum of all (discounted) future marginal profits (see also Grossmann et al., 2010). The optimal talent demand of Club i as a value-maximizer is denoted by t_i^* . Using the Euler Equation (19), the best-response function for a value-maximizing club, $t_i^*(t_j)$, is given by:

$$t_i^*(t_j) = \sqrt{\frac{\beta \cdot t_j}{w + p - \delta \cdot p \cdot (1 - \theta)}} - t_j. \quad (8)$$

³The variable θ can be interpreted in two ways in this model: Either players lose value by becoming less productive on average, or the value of a player to a certain club decreases after one season, due to a shorter contract length, if one allows for short-term contracts in the model.

4 | RESULTS WITH HETEROGENEOUS CLUB OWNERS

In contrast to football club managers, club owners can or even must develop a more long-term investment strategy for their clubs, since they are interested in long-term sportive and economic success. Moreover, in contrast to football managers who are only temporarily employed with a club, they own the club for an unspecified time frame. Therefore, we argue that teams with different ownership structures (for example large stakeholders versus small stakeholders or single owner versus club members) value future profits differently and that teams with one or few owners have higher discount factors. This view is supported by empirical evidence showing that firms invest more in R&D projects which can be seen as long-term investments, with a higher concentration of ownership (Baysinger et al., 1991; Hill & Shell, 1988). These results are explained by higher incentives of stakeholders with large stakes to monitor managers, and more power over the management (Alchian & Demsetz, 1972; Baysinger et al., 1991).

In contrast to the previous literature that usually distinguishes teams by market size, we model the heterogeneity of teams in terms of different long-term strategies and hence, by different parameters for the discount factors, β_i and β_j and by same parameters for the market sizes, $m = m_i = m_j$. Without loss of generality, we assume that $\beta_i > \beta_j$. Applying the best-response function from Equation (8) to calculate the optimal demand of talent for both teams yields:

$$\begin{aligned} t_i^* &= \frac{m \cdot (w + p - \beta_j \cdot p \cdot (1 - \theta))}{(2w + 2p - p \cdot (1 - \theta) \cdot (\beta_i + \beta_j))^2} \quad \text{and} \\ t_j^* &= \frac{m \cdot (w + p - \beta_i \cdot p \cdot (1 - \theta))}{(2w + 2p - p \cdot (1 - \theta) \cdot (\beta_i + \beta_j))^2}. \end{aligned} \quad (9)$$

Proposition 2 *Let be $\beta_i > \beta_j$. The demand of Club i is then larger than that of Club j in steady-state. Furthermore, a marginal increase in the discount factor β increases a team's own optimal talent demand:*

$$\begin{aligned} \text{(i)} \quad & t_i^* > t_j^* \\ \text{(ii)} \quad & \frac{\partial t_i^*}{\partial \beta_i} > 0 \quad \text{and} \quad \frac{\partial t_j^*}{\partial \beta_j} > 0. \end{aligned}$$

Proof See Appendix.

The results of Proposition 2 are not surprising, as a club with a higher discount factor values the future higher and is willing to invest more in talent. Furthermore, the results of this proposition show that clubs owned by so-called “sugar daddies”, who might have increased a club's preference for future profits, do not overinvest in talent in this case since, for instance, they may follow a different objective function than clubs that maximize profits. A long-term investment strategy cannot be blamed for being “unfair”, in whatever sense. Rather, this kind of behavior seems to be economically sound.

Proposition 3 *Let $\beta_i > \beta_j$. The optimal changes of talent demand to a marginal increase in the opponent's discount factor are then as follows:*

$$\begin{aligned} \text{(i)} \quad & \frac{\partial t_i^*}{\partial \beta_j} > 0 \\ \text{(ii)} \quad & \frac{\partial t_j^*}{\partial \beta_i} < 0. \end{aligned}$$



Proof See Appendix.

The results from Proposition 3 show that clubs react differently to a marginal change of the opponent's discount factor. Club j that already demands less talent, reduces its optimal talent demand, if Club i 's discount factor increases. On the other hand, Club i increases its talent demand in order to maintain its competitive advantage when Club j 's discount factor increased.

As demonstrated in Proposition 2 above, a marginal increase in a club's own discount factor increases the optimal talent demand of Clubs i and j . The results of Propositions 2 and 3 imply that those changes of the respective discount factors may have an effect on a league's competitive balance (CB). This is considered next.

Definition 2 The competitive balance (CB) in the two-team league is defined as follows:

$$CB(w_i, w_j) := \frac{w_i}{w_j} = \frac{t_i}{t_j} \quad (10)$$

With this definition, the effect of a marginal change in the discount factors on the competitive balance in the steady-state can be calculated. Note that a negative sign of the CB's derivative implies an improvement in the league's competitive balance, since the competitive balance in the above definition is greater than unity, due to the assumed higher discount factor of Club i .

Proposition 4 Let $\beta_i > \beta_j$. A marginal change in the respective club's discount factor then has the following effect on the competitive balance:

$$(i) \quad \frac{\partial CB^*}{\partial \beta_i} > 0$$

$$(ii) \quad \frac{\partial CB^*}{\partial \beta_j} < 0.$$

Proof See Appendix.

To understand this proposition, note first that the discount factor of only one club changes. Secondly, both clubs benefit if the present value of their profits increases with a higher discount factor β , as the competitive balance tilts in their favor. Due to the increase in their value of future profits, teams expand their talent demand (see Proposition 2), which gives this team an advantage and hence, a more favorable competitive balance. Since by assumption $\beta_i > \beta_j$, a marginal increase in β_i leads to a higher talent investment of Club i . Because this club already has a competitive advantage, the competitive balance deteriorates due to the longer time-horizon of the investment. This is different if the discount factor of Club j increases marginally. The talent investment of Club j increases, while the investment of Club i remains constant, so that the competitive balance improves.

Proposition 5 Let $\beta_i > \beta_j$. The derivatives of the competitive balance in the steady-state with respect to the wage w and the transfer price p are as follows:

$$(i) \quad \frac{\partial CB^*}{\partial w} < 0$$

$$(ii) \quad \frac{\partial CB^*}{\partial p} > 0.$$

Proof See Appendix.

Club i benefits from a higher value of the ratio of the transfer price to the wage, since it is to its economic advantage. Accordingly, it is not surprising that a marginal increase in the transfer price p reduces the competitive balance, since a higher transfer price p increases this advantage further. On the other hand, higher wages improve the competitive balance, as they lower Club's i economic advantage.

5 | PLAYERS AS ASSETS

5.1 | Alienability of players

The model presented in the previous sections is deterministic, which rendered it possible to show that value-maximizing clubs will demand the same amount of talent in each period. Although players in such a model are assets in the sense that a stock of talent is held as a (fixed) portfolio over an infinite period, they are salable assets, but not sold. Moreover, in contrast to the human capital of ordinary firms,⁴ players are alienable. Similarly, Antonioni and Cubbin (2000) determine theoretically the change in the option value of players in the aftermath of the so-called Bosman-ruling of the European Court of Justice. To model players' alienability, we change the model from a deterministic approach to a stochastic one. Accordingly, we add a stochastic variable $\Phi_{i,s}$ to our model that changes the talent stock $t_{i,s}$ randomly after each season for both clubs. Let the random variable be uniformly distributed, $\Phi_{i,s} : U(-\alpha, \alpha)$, with an expected value of zero. In addition, we assume that all random variables $\Phi_{i,s}$ are identical and independently distributed (i.i.d.) and that the realization $\phi_{i,s}$ of the random variable $\Phi_{i,s}$ is publicly known before the start of the next season, $s + 1$. The stock of talent in each season is then given by:

$$\begin{aligned} t_{i,s} &= (1 - \theta) \cdot t_{i,s-1} + \phi_{i,s-1} \cdot t_{i,s-1} + \tau_{i,s} \\ &= (1 - \theta + \phi_{i,s-1}) \cdot t_{i,s-1} + \tau_{i,s}. \end{aligned} \quad (11)$$

The clubs maximize their expected club values as follows:

$$\begin{aligned} \mathbb{E}[V_i((t_{i,-1}, t_{i,0}, t_{i,1}, \dots), (t_{j,-1}, t_{j,0}, t_{j,1}, \dots))] &:= \sum_{s=0}^{\infty} \mathbb{E}[\pi_{i,s}] \cdot \beta_i^s \\ &= \sum_{s=0}^{\infty} (R_i(t_{i,s}, t_{j,s}) - w \cdot t_{i,s} - p \cdot (t_{i,s} - \underbrace{(1 - \theta + \mathbb{E}[\Phi_{i,s-1}])}_{=0} \cdot t_{i,s-1})) \cdot \beta_i^s \\ &= \sum_{s=0}^{\infty} (R_i(t_{i,s}, t_{j,s}) - w \cdot t_{i,s} - p \cdot (t_{i,s} - (1 - \theta) \cdot t_{i,s-1})) \cdot \beta_i^s. \end{aligned} \quad (12)$$

As the expected value of $\Phi_{i,s}$ is zero, the maximization problem is not changed by the introduction of the stochastic effect on talent. Therefore, clubs will still demand the same amount of talent $t_{i,s}^*$, according to Equation (6). However, their activities in the transfer market, $\tau_{i,s}$ ($\phi_{i,s-1}$), now depend on the realization of the random variable.

If it is additionally assumed that $\alpha > \theta$, the probability $\mathbb{P}(\Phi_{i,s} > \theta)$ is $\frac{1}{2} \left(1 - \frac{\theta}{\alpha}\right)$. Under these circumstances, clubs will

use players as salable assets, because their talent stock before the season is greater than its demand $t_{i,s}^*$. Hence, they will sell some units of talent, i.e., players, at the (exogenously given and constant) transfer price p .

⁴See Hart and Moore (1994) for a theory of debt, based on the inalienability of human capital.



5.2 | Tobin's q and the value of football clubs

In the so-called q -theory of investment, a firm equalizes the marginal cost of investment and the marginal value of its capital (Abel et al., 1996; see also Abel, 1983). In this respect, Tobin's (average) q is defined as the ratio of the market value of installed capital and its book value, whereby the latter can be interpreted as the replacement cost. Oi (1962) explained theoretically that fixed employment cost may give labor "an element of capital" (Oi, 1962, p. 539). Following this theory on the subject of this paper, we regard the value players as the (human) capital of a club. As players are the only input factors, this value can also be interpreted as the book value or the replacement cost of a club. In our model, the market value is then the sum of the discounted profits and the book value is the club's transfer payment for this stock of talent. Moreover, instead of applying the respective club's discount factor, β_i and β_j , we define an exogenous parameter, β , as the discount factor of the financial market. The reason is that these discount factors might differ, since the time preferences of club owners and outside investors may vary.

Definition 3 We define Tobin's (average) q as the ratio of the market value of installed talent to the replacement cost of a club's talent (book value):

$$q_i(t_i^*, t_j^*) := \frac{\sum_{s=0}^{\infty} \left(R(t_i^*, t_j^*) - w \cdot t_i^* - \beta \cdot \theta \cdot p \cdot t_i^* \right) \cdot \beta^s}{p \cdot t_i^*} \quad (13)$$

Although Tobin's q is a macroeconomic parameter (Abel et al., 1996), it can also shed some light on the future investment decisions of firms. For example, a value of q greater than unity indicates that the market value (measured in terms of current and future profits) reflects some unobserved asset values. These could lie in the brand itself or revenue generated through path-dependency. In this case, a club can sell some of its shares, either to realize an economic profit or to reinvest the proceeds in talent. Clubs like Bayern Munich or Manchester City indeed did so in the past (Jackson, 2019; Taylor, 2014). By contrast, clubs with a q -value smaller than one may sell some of their players in order to increase their productivity and profits.

One of the advantages of Tobin's q is its practical usefulness. Market values of clubs (for example, annually calculated by Forbes, 2019), as well as book values (Transfermarkt, 2020, calculates the book value for each player annually)⁵ are available, rendering it possible to calculate q -values for all clubs. In addition, it may even be possible to detect various investment strategies of clubs through an analysis of clubs' Tobin's q -values. The following Proposition 6 shows the effect of a marginal change in a club's discount factor on the q -value (see also Section 4 for the assumption of heterogeneous owners).

Proposition 6 *The derivative of Tobin's q in the steady-state with respect to a club's discount factor is negative.*

$$\frac{\partial q_i(t_i^*(\beta_i), t_j^*(\beta_j))}{\partial \beta_i} < 0. \quad (14)$$

Proof See Appendix.

Hence, an increase in the discount factor of a club decreases its average q . The intuition behind the result of this proposition is that clubs increase their talent demand if they value future profits higher. As a consequence,

⁵We assume, as discussed in footnote 2, that the book value is indeed the cost that a club has to pay to acquire a certain player (independent e.g. of the contract length).

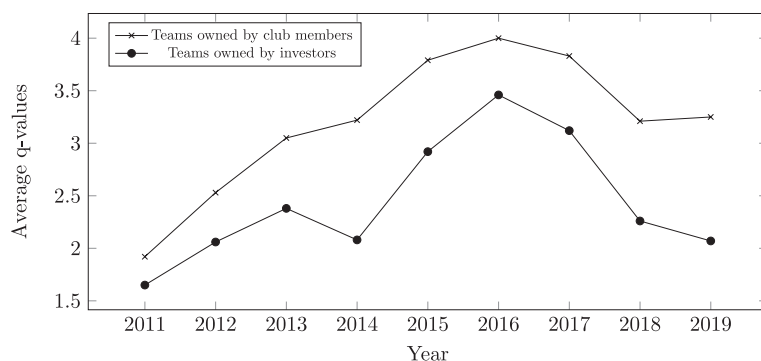


FIGURE 1 Average Tobin's q values of the 14 most valuable European football clubs. This figure shows the average Tobin's q values of the 14 most valuable European football over time, for which data is available for all seasons. Forbes (2019) calculates the 20 most valuable clubs annually. As some teams were not on the list every year, these clubs were removed to improve comparability. Categorization as to whether a team is owned by investors or by club members, is based on Forbes (2019). In Table B1 in the Appendix, the corresponding q -values are presented for each club separately for the year 2019. Sources: Own calculations based on Forbes (2019) and Transfermarkt (2020)

the average productivity and profit per talent decrease, due to the concave revenue function, and hence so too, the average market value per unit of book value, which is measured by Tobin's q -value. Following these findings, we expect clubs to have a lower Tobin's q -value with a concentration of ownership. The following Figure 1 shows the average q -values for the 14 most valuable European football clubs over the course of nine seasons, separated according to whether the teams are owned by club members or investors. Although the figure only shows descriptive statistics, it is an indication that clubs might have different investment strategies due to different ownership structures, as clubs owned by investors indeed have a lower average Tobin's q -value in our sample.

Furthermore, almost all clubs had a Tobin's q -value greater than one in each season, so that it is fair to argue from an economic perspective that these clubs did not “overinvest” in this time period, as future profits (market value) always exceeded the cost of replacement (book value). Two of the four exceptions are Manchester City's seasons in 2011 and 2012, when the q -values were below one.⁶ That might be an indication that the club indeed overspent on talent at that time. However, since 2011, the market value of Manchester City increased almost tenfold (from \$291 million in 2011 to \$2.61 billion in 2019) according to Forbes (2019), so today's market value might be a reflection of extremely good past investment decisions.

6 | CONCLUSION

The clearly dominant assumptions in the sports economics literature on clubs in leagues are profit-maximization and winning-maximization. Profit-maximization is applied mostly in one-period models. As a consequence, the timeframe for the amortization of investments in talented players is just one period. This reduces players to variable inputs for the production of sportive success and the entertainment of spectators. By contrast, the amount of talent a football club will demand in a winning-maximization model depends on the willingness and financial ability of owners or investors to bear deficits and debt. The latter is one of the reasons why the transfer prices in the players' labor market are often criticized, as well as the investments of clubs in star players. In this respect, the investors are dubbed “sugar daddies” and the UEFA has introduced respective rules for a Financial Fair Play.

⁶The other two exemptions are Inter Milan in 2011 with a q -value of 0.87 and AC Milan in 2019 with 0.98.



In contrast to the literature, this paper introduces a new objective of professional football clubs, which is analyzed comprehensively. In addition, within the framework of value-maximization, heterogeneous ownership of football clubs is studied with respect to its implications for talent-investment strategies. The time-horizon of football clubs is enlarged to a non-finite horizon so that there is no final period for the football enterprises. This makes it possible to apply the well-known concept of value-maximization as the objective of the club. With this concept, players are not only variable input factors, but to a certain extent alienable (human) capital. The accounting practice for balancing transfer payments for football players indicates that players are to this extent part of the club's capital stock. This is relevant for the economics of football clubs, as these investments can be used for a longer timeframe. To take account of this in a model, a multiperiod structure is required.

With value-maximization as a long-term objective, the economic implications of ownership heterogeneity can be considered via different time-horizons. In effect, more diverse investment strategies are possible in a non-finite, value-maximizing framework than in short-term models. As an indicator of the clubs' investment strategies, Tobin's (average) q is suggested in this paper.

The first important result of the paper is that value-maximizing clubs invest more in talent than profit-maximizing ones. It is argued that this investment differential need not be considered as "overinvestment", because it is a result of the long-term oriented behavior of clubs and sound economic decisions. Moreover, the notions of "overinvestment" as well as "sugar daddies" are clearly value-laden. Further relevant results of this paper are derived for heterogeneous club ownership. A longer time-horizon implies a higher demand for talent in a steady-state equilibrium, and a marginal increase in a club's own discount factor leads to a higher talent demand as well. Therefore, the competitive balance is tilted in favor of the club with a longer time-horizon. However, if the time-horizon of the respective opponent club increases, an asymmetrical response occurs; the club with the longer investment horizon increases its talent demand, whereas the club with the shorter horizon decreases it. In addition, a higher price for a unit of talent in the transfer market worsens the competitive balance. In contrast, a higher player wage improves the competitive balance among clubs. Furthermore, in professional football, Tobin's (average) q is defined as the sum of discounted future profits, divided by the book value of players. The latter is equivalent to the transfer payments the clubs paid for the players. It is shown in the paper that a longer time-horizon for investments implies a higher level of talent investment by the respective club and a lower value of Tobin's q .

Of course, a value-maximizing club may also run large debts to finance the transfer cost of talent in the first period. Afterward, by virtue of the uncertain nature of sports, the club might not be able to repay the debts and, therefore, goes insolvent. However, even in this case, credit financing is the real problem and not necessarily "overinvestment" in talent. Moreover, players may be sold quite easily to another club via the transfer market. Hence, there is no clear evidence that this should result in a financial stability problem for the league.⁷ This might explain the fact that since 1992, there were only five insolvencies in the first football leagues of France, England, and Germany (Szymanski & Weimar, 2019). Indeed, insolvencies create greater problems for lower leagues in which the values of players (and, therefore, their trade value) are considerably lower. This underlines the fact that the asset-value of players is a crucial factor, as debt-collateral in professional football.

It seems that apart from increasing prices of TV rights and a greater spectators' willingness to pay, a shift from profit-maximization and even winning-maximization to value-maximization may be the source of higher transfer prices. The latter might indicate that commercialization has led to a much higher degree of professionalism and much better club governance in football. After all, football clubs today are large enterprises and they are starting to behave as such.

⁷A good example is the retreat of the investor Abdullah Bin Nasser Al Thani from Qatar, who bought the club Málaga CF in 2010 and sold it a couple of years later. Although this created financial difficulties for the club, it was able to save itself by selling three of its best players (Train, 2012).



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APPENDIX

Proposition 1 (i) An optimal strategy t_i^* is independent of the initial endowment t_{i-1} .

$$t_i^*(t_{i-1}) = t_i^* \quad \text{for all } t_{i-1} \in \mathbb{R}_+. \quad (4)$$

(ii) There is a unique optimal solution t_i^* in which the talent demand is the same in each period.

$$t_{i,0}^* = t_{i,s}^* \quad \text{for all } s \in \mathbb{N}. \quad (5)$$

Proof We show the validity of both parts via the Euler equation. But first, we apply the Bellman equation to rewrite the maximization problem of Equation (3):

$$V_i(t_{i,-1}) = \max_{t_{i,0}} (R(t_{i,0}, t_{j,0}) - w \cdot t_{i,0} - p \cdot (t_{i,0} - (1 - \theta) \cdot t_{i,-1}) + \beta_i \cdot V_i(t_{i,0})). \quad (15)$$

The first-order condition yields:

$$\frac{\partial V_i}{\partial t_{i,0}} = \frac{\partial R_i(t_{i,0}, t_{j,0})}{\partial t_{i,0}} - w - p + \beta_i \cdot \frac{\partial V_i(t_{i,0})}{\partial t_{i,0}} = 0. \quad (16)$$

Note that the value $V_i(t_{i,0})$ is defined as:

$$V_i(t_{i,0}) = \max_{t_{i,1}} (R(t_{i,1}, t_{j,1}) - w \cdot t_{i,1} - p \cdot (t_{i,1} - (1 - \theta) \cdot t_{i,0}) + \beta_i \cdot V_i(t_{i,1})). \quad (17)$$

Applying the envelop theorem (its assumptions are fulfilled in our case), the derivative for $V_i(t_{i,0})$ is given by:

$$\frac{\partial V_i(t_{i,0})}{\partial t_{i,0}} = p \cdot (1 - \theta). \quad (18)$$

Inserting this result into Equation (16), we obtain the Euler equation:

$$\frac{\partial R_i(t_{i,0}, t_{j,0})}{\partial t_{i,0}} = w + p - \beta_i \cdot p \cdot (1 - \theta) = w + p \cdot (1 - \beta_i \cdot (1 - \theta)). \quad (19)$$

The proof of the first part of Proposition 1 follows immediately, as according to Equation (19), the optimal talent demand $t_{i,0}^*$ does not depend on the initial talent stock $t_{i,-1}$. This is also true for all future periods, $s > 0$.

In addition, Equation (19) shows that there is a unique interior optimal solution due to the concavity of the revenue function. As a consequence, the optimal talent demand must be the same in each period.

Proposition 2 Let be $\beta_i > \beta_j$. The demand of Club i is then larger than that of Club j in steady-state. Furthermore, a marginal increase in the discount factor β increases a team's own optimal talent demand:

$$(i) \quad t_i^* > t_j^*$$

$$(ii) \quad \frac{\partial t_i^*}{\partial \beta_i} > 0 \quad \text{and} \quad \frac{\partial t_j^*}{\partial \beta_j} > 0.$$

Proof 1. It is sufficient to show that the following inequality holds: $-\beta_j \cdot p \cdot (1 - \theta) > -\beta_i \cdot p \cdot (1 - \theta)$. This is true as $\beta_i > \beta_j$.

2. The derivative of Club i 's optimal talent demand with respect to β_i reads

$$\frac{\partial t_i^*}{\partial \beta_i} = \frac{2 \cdot m \cdot (w + p - \beta_j \cdot p \cdot (1 - \theta) \cdot p \cdot (1 - \theta))}{(2w + 2p - p \cdot (1 - \theta) \cdot (\beta_i + \beta_j))^3} > 0. \quad (20)$$

The respective derivative for Club j is analogous.

Proposition 3 Let $\beta_i > \beta_j$. The optimal changes of talent demand to a marginal increase in the opponent's discount factor are then as follows:

$$(i) \quad \frac{\partial t_i^*}{\partial \beta_j} > 0$$



$$(ii) \quad \frac{\partial t_j^*}{\partial \beta_i} < 0.$$

Proof (i) First, we define $z_i = w + p - p \cdot \beta_i \cdot (1 - \theta)$ and $z_j = w + p - p \cdot \beta_j \cdot (1 - \theta)$. Then we can rewrite the optimal talent t_i^* from Equation (9),

$$t_i^* = \frac{m \cdot (w + p - \beta_j \cdot p \cdot (1 - \theta))}{(2w + 2p - p \cdot (1 - \theta) \cdot (\beta_i + \beta_j))^2} = \frac{m \cdot z_j}{(z_i + z_j)^2} \quad (21)$$

with $z_i > 0$ and $z_j > z_p$ the following inequality is true:

$$2 \cdot z_j \cdot (z_i + z_j) = z_j^2 + 2 \cdot z_j \cdot z_i + z_i^2 > z_i^2 + 2 \cdot z_i \cdot z_j + z_j^2 = (z_i + z_j)^2. \quad (23)$$

Using this result in Equation (22), it follows $\frac{\partial t_i^*}{\partial \beta_j} > 0$.

(ii) The proof is analogous to part (i).

Proposition 4 Let $\beta_i > \beta_j$. A marginal change in the respective club's discount factor then has the following effect on the competitive balance:

$$(i) \quad \frac{\partial CB^*}{\partial \beta_i} > 0$$

$$(ii) \quad \frac{\partial CB^*}{\partial \beta_j} < 0.$$

Proof (i) The validity follows immediately from Proposition 4 (ii) and Proposition 3 (ii).

(ii) Using the definition of CB and the talent in the steady-state from Equation (9), we get

$$CB^* = \frac{t_i^*}{t_j^*} = \frac{w + p - p \cdot \beta_j \cdot (1 - \theta)}{w + p - p \cdot \beta_i \cdot (1 - \theta)}. \quad (24)$$

The comparative static toward β_j then is:

$$\frac{\partial CB^*}{\partial \beta_j} = - \frac{p \cdot (1 - \theta)}{w + p - p \cdot \beta_i \cdot (1 - \theta)} < 0. \quad (25)$$

Proposition 5 Let $\beta_i > \beta_j$. The derivatives of the competitive balance in the steady-state with respect to the wage w and the transfer price p are as follows:

$$(i) \quad \frac{\partial CB^*}{\partial w} < 0$$

$$(ii) \quad \frac{\partial CB^*}{\partial p} > 0.$$

Proof (i) Using CB^* from Equation (24), we obtain the following derivative with respect to the wage w :

$$\begin{aligned}\frac{\partial CB^*}{\partial w} &= \frac{w+p-p \cdot \beta_i \cdot (1-\theta) - (w+p-p \cdot \beta_j \cdot (1-\theta))}{(w+p-p \cdot \beta_j \cdot (1-\theta))^2} \\ &= \frac{p \cdot (1-\theta) \cdot (\beta_j - \beta_i)}{(w+p-p \cdot \beta_i \cdot (1-\theta))^2} < 0.\end{aligned}\quad (26)$$

(ii) The derivative of CB^* with respect to the transfer price p is the following:

$$\begin{aligned}\frac{\partial CB^*}{\partial p} &= \frac{(w+p-p \cdot \beta_i \cdot (1-\theta)) \cdot (1-\beta_j \cdot (1-\theta))}{(w+p-p \cdot \beta_j \cdot (1-\theta))^2} \\ &\quad - \frac{(w+p-p \cdot \beta_i \cdot (1-\theta))^2}{(w+p-p \cdot \beta_j \cdot (1-\theta)) \cdot (1-\beta_i \cdot (1-\theta))} \\ &= \frac{(w+p) \cdot (1-\theta) \cdot (\beta_i - \beta_j) + p \cdot (1-\theta) \cdot (\beta_j - \beta_i)}{(w+p-p \cdot \beta_i \cdot (1-\theta))^2} \\ &= \frac{w \cdot (1-\theta) \cdot (\beta_i - \beta_j)}{(w+p-p \cdot \beta_i \cdot (1-\theta))^2} > 0.\end{aligned}\quad (27)$$

Proposition 6 The derivative of Tobin's q in the steady-state with respect to a club's discount factor is negative.

$$\frac{\partial q_i(t_i^*(\beta_i), t_j^*(\beta_j))}{\partial \beta_i} < 0. \quad (14)$$

Proof Using the results from Equation (9) with respect to the optimal demand level of both Club i and j

$$\begin{aligned}t_i^* &= \frac{m \cdot (w+p-\beta_j \cdot p \cdot (1-\theta))}{(2w+2p-p \cdot (1-\theta) \cdot (\beta_i + \beta_j))^2} \quad \text{and} \\ t_j^* &= \frac{m \cdot (w+p-\beta_i \cdot p \cdot (1-\theta))}{(2w+2p-p \cdot (1-\theta) \cdot (\beta_i + \beta_j))^2},\end{aligned}\quad (28)$$

we obtain the following total demand:

$$t_i^* + t_j^* = \frac{m}{2w+2p-p \cdot (1-\theta) \cdot (\beta_i + \beta_j)}. \quad (29)$$

We then calculate Tobin's q :

$$\begin{aligned}q_i(t_i^*, t_j^*) &= \frac{\sum_{s=0}^{\infty} \left(m \cdot \frac{t_i^*}{t_i^* + t_j^*} - w \cdot t_i^* - \bar{\beta} \cdot \theta \cdot p \cdot t_i^* \right) \cdot \bar{\beta}^s}{p \cdot t_i^*} \\ &= \frac{\frac{1}{1-\bar{\beta}} \cdot \left(\frac{m}{t_i^* + t_j^*} - w - \bar{\beta} \cdot \theta \cdot p \right)}{p} \\ &\stackrel{(29)}{=} \frac{p}{(1-\bar{\beta}) \cdot p} \cdot \frac{2w+2p-p \cdot (1-\theta) \cdot (\beta_i + \beta_j) - w - \bar{\beta} \cdot \theta \cdot p}{p}\end{aligned}\quad (30)$$

The derivative with respect to β_i is then:

$$\frac{\partial q_i(t_i^*(\beta_i), t_j^*(\beta_j))}{\partial \beta_i} = -\frac{1-\theta}{1-\bar{\beta}} < 0. \quad (31)$$

**TABLE B1** Tobin's q -values of 14 European football clubs in 2019

Club	Market value (in million)	Book value (in million)	Tobin's q	Club owned by members
Real Madrid	\$4,239	\$1,080	3.92	Yes
FC Barcelona	\$4,021	\$1,321	3.04	Yes
Manchester United	\$3,808	\$909	4.19	No
Bayern Munich	\$3,024	\$864	3.49	Yes
Manchester City	\$2,688	\$1,276	2.11	No
Chelsea FC	\$2,576	\$1,093	2.36	No
FC Arsenal	\$2,267	\$720	3.15	No
FC Liverpool	\$2,183	\$1,081	2.02	No
Tottenham Hotspur	\$1,624	\$940	1.73	No
Juventus FC	\$1,512	\$875	1.73	No
Borussia Dortmund	\$896	\$674	1.33	No
Schalke 04	\$683	\$267	2.55	Yes
Inter Milan	\$672	\$623	1.08	No
AC Milan	\$583	\$593	0.98	No

Sources: Forbes (2019) and Transfermarkt (2020).