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Why football players may benefit from the 'shadow of the transfer system'

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Abstract Transfer restrictions have a long tradition in professional sports but came under heavy attack in recent years (e.g. Bosman ruling, Monti system). Based on a bargaining model with stochastic player productivity, we show that less restrictive transfer rules reallocate ex post bargaining power from players to clubs. This reallocation is efficient and in the ex ante self-interest of players. The right to charge transfer fees enables clubs to insure their players. The players, in turn, benefit by converting risky future income into riskless current income. Overall, player utility is higher under more than under less restrictive transfer rules.

Keywords Labour contracts · Transfer restrictions · Transfer fees · Bosman and Monti transfer system · FIFA regulations

JEL Classifications D86 · J49 · L83

1 Introduction

Employment relations in football are governed by a set of distinct institutional mechanisms: contracts between players and clubs, employment law and a regulatory

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framework known as the transfer system enforced by the football governing bodies (FIFA and the national associations).

The crucial effect of the transfer system is the creation of a unilateral property right for the clubs over the services of players. As a consequence of the transfer system the players are not able to leave their current club and sign with another club without the current club's explicit consent. The football governing bodies enjoy a certain degree of freedom to self-regulate as sport is considered to differ from other industries because of well-known peculiarities (Neale 1964). Until 1995 the football authorities were able to impose the transfer system on all employment relations in football. Players out-of-contract as well as players in-contract required the permission of their current club before signing with another club. In this sense all employment in football was governed by the 'shadow of the transfer system' and clubs only agreed to release players conditional on receiving adequate remuneration through a transfer fee.

Since 1995 the ability of the football governing bodies to apply the transfer system has been restricted in two major steps. In December 1995 the European Court of Justice issued its famous Bosman verdict,[1] which ruled that the transfer system could no longer be applied to out-of-contract players. As a consequence, players now become free agents after expiration of their contracts and their former employer has no right to demand transfer remuneration if they sign with new clubs.

Finally in 2001, the European Commission further restricted the ability of the football governing bodies to self-regulate the employment relations of football. In what is known as the 'Monti system' after Commissioner Mario Monti,[2] the football governing bodies had to adapt their regulatory framework known as the FIFA transfer rules to a whole set of new requirements.[3] The Bosman verdict changed the situation in that the transfer system remained applicable to in-contract players only. However, clubs and players were still free to deliberately place employment relations under the 'shadow of the transfer system' by excluding the advent of contract expiration through extended contract durations. By limiting contract durations the Monti system rendered this avoidance strategy more difficult.

The standard interpretation of these restrictions in the application of the transfer system stresses the increased freedom of movement for players, which translates into a relative gain in market power and therefore into higher salaries. While we do not deny the link between freedom of movement and market power, we question that the

[1] The Bosman verdict had the following background. In 1990, the contract of Jean Marc Bosman, a professional football player, with his Belgian club R.C. Liegois expired. After the club offered him a new contract worth only 25% of his former contract, Bosman wanted to transfer to the French club U.S. Dunkerque. According to the transfer system of the International Football Association, however, the Belgian Football Association had to send Bosman's registration certificate to the French Football Association before Bosman was eligible to play for U.S. Dunkerque. Since R.C. Liegois was not satisfied with the transfer payment offered by U.S. Dunkerque, the Belgian Football Association withheld Bosman's registration certificate. As a result, Bosman could not play for U.S. Dunkerque and took his case to the courts.

[2] The new FIFA transfer rules were adopted after more than 2 years of discussions between the European Commission—in particular, Commissioner Mario Monti—the European Football Association (UEFA), and FIFA.

[3] We will only focus on one aspect of the Monti system in our model, the limitation of contract durations in football to a maximum of 5 years.

salaries will ultimately be driven up by the reforms. There may be more than one channel of influence between the reforms and the salaries. Our model looks at the employment relation in football from a different perspective. We develop a model which captures an important and widely overlooked aspect of this employment relation: the allocation of risk. The basic intuition of our approach can be stated as follows. Players and clubs alike do not know how the productivity of a player will develop in future periods. Given that players perform in public and taking into account the importance of reputation effects, pride and career concerns in sport it seems unlikely that players should shirk on effort. Instead, it seems more adequate to treat productivity variations as a manifestation of risk. Moreover, on average, the career duration of a professional football player is very short compared with other labour-markets. According to Frick et al. (2007) 'more than one third of all players 'disappear' again after their first season and only one career out of 12 lasts for 10 years and more.' During this short career duration, the high performance uncertainty creates strong incentives for the player to buy insurance against income uncertainty.

If risk is the key driver behind the performance uncertainty of football players then there is an obvious potential for value creation in this industry. Risk-averse players could buy insurance against future income uncertainty when contracting with risk-neutral clubs, which have the possibility to diversify the risk of productivity variations within their portfolio of players and also through diversified ownership structures. However, if the player turns out to be more productive in the course of time than assumed when writing down the initial contract, he has incentives to renegotiate the contract. The same holds for the club if the player turns out to be a 'bad risk'.

The third institutional mechanism governing employment relations in football comes into play here, labour law. De facto labour law in most European countries makes long-term employment contracts asymmetrically incomplete since it is possible to legally bind employers to fulfil long-term contracts but it is practically impossible to bind the employee. There is no 'shadow of the law' that prevents players from accepting better job offers. Since 'good risk' players would therefore renegotiate the contract and receive wages reflecting their marginal productivity, clubs would be left with all the 'bad risks'. Given this assumption, clubs cannot offer value creating insurance services. In this context the transfer system imposed by the governing bodies of football works as a surrogate which makes insurance contracts complete.[4] 'Good risk' players know that they will have to pay for the insurance, be it through the transfer fee or by continuing to play for a salary below marginal productivity. It is the 'shadow of the transfer system' which allowed players to commit to fulfilling their contracts. It is the 'shadow of the transfer system' which enabled the efficient allocation of risk in this industry.

[4] Note that the contracts considered in our paper are related to non-standard contracts in the light of the new institutional economics by Williamson (1985, 1996). Williamson points out that 'non-standard and unfamiliar forms of contract are presumed to have efficiency rather than monopoly purposes' (Williamson 2003). He also claims that 'until recently the primary economic explanation for non-standard or unfamiliar business practices was monopoly' (Williamson 1985, p. 17) whereas 'transaction cost economics interprets contractual and organizational variety principally in economizing terms' (Williamson 2003).

The Bosman verdict restricted the 'shadow of the transfer system' to the market for in-contract players. However, it provided freedom for players and clubs to voluntarily position their transactions under the 'shadow of the transfer system' by extending the duration of contracts, which is exactly what happened in the industry.[5] The Monti system makes it more difficult to position transactions under the 'shadow of the transfer system' by limiting contract durations, thereby making the efficient allocation of risk more difficult. In our model we show that risk-averse players may lose from the reforms since they would benefit from a conversion of risky future income into risk-less current income under the 'shadow of the transfer system'.

Before proceeding with the model, we will give a short overview of the related literature: Rottenberg (1956) presents the first economic analysis of transfer restrictions in professional team sports. He describes the mandatory lifelong tie of a player to his original club in U.S. Major League Baseball combined with the club's right to demand transfer compensations from other clubs in case that the player transfers as the result of the league's market power. According to Rottenberg, these labour-market restrictions preclude players from earning salaries equal to their marginal productivity.[6] Since new clubs cannot offer an in-contract player more than his marginal productivity minus transfer compensations to the old club, the player is not able to bargain his salary up to his marginal productivity.

Our model differs from this view. We show that the existence of transfer restrictions combined with the right to demand transfer compensations does not mean that players are worse off or that any kind of market power is exerted upon them. To the contrary, our model highlights that the players' loss in ex post bargaining power is compensated by an increase in ex ante bargaining power.

According to our knowledge, Rottenberg was also the first to conclude that the right to demand transfer payments does not result in an inefficient allocation of playing talent. If football contracts are incomplete with respect to transfer fees, a player's current club can always renegotiate the transfer fee in order to maximize profits by transferring the player to the club where he is most productive. Carbonell-Nicolau and Comin (2005) recently provided empirical evidence for the claim that football contracts are incomplete with respect to transfer fees. Based on a data set with information about football contracts, transfer payments, and several measures of a players' value in the Spanish Primera Division for the three seasons from 1999/00 to 2001/02. Carbonell-Nicolau and Comin show that the player's contractually specified transfer fee has a large positive effect on the new club's total cost of hiring the player.

Burguet et al. (2002) show that transfer restrictions are a common feature in labour-markets in which a worker's (invariant) productivity is unknown ex ante but can be observed by outsiders after the worker has signed a contract and works for an incumbent firm. In these markets, ex post competition for workers is likely to be vigorous and outsiders can earn positive rents by signing workers with the desired productivity characteristics. Transfer restrictions allow the pair incumbent firm-worker to expropriate at least some of the outsiders' rents. In their model, transfer

[5] Feess et al. (2004) show that after the Bosman verdict the average contract length has increased considerably, e.g. in the German Bundesliga from 2.43 to 2.91 years.

[6] Similar arguments are presented by Demmert (1973) and Scully (1974).

restrictions have no efficiency effect. Without transfer restrictions no firm would be willing to sign a worker with unknown productivity characteristics. Workers would have to work without a wage before their productivity becomes common knowledge. Transfer restrictions only affect the distribution of profits between incumbent firm, worker and outsiders. This result of Burguet et al. is due to their assumption that worker productivity is invariant over time. We believe that a football player's productivity (playing strength) varies significantly during his career and, more importantly, these variations cannot be predicted. There are many players who were believed to become superstars, but were never able to meet expectations. Similarly, there are at least as many players who became much better players than initially predicted by experts. Once we introduce unknown productivity variations over a player's career, risk allocation becomes a crucial feature of welfare considerations and transfer restrictions are no longer efficiency neutral.

Based on the bargaining model of Burguet et al. (2002),[7] Feess and Muehlheusser (2003) argue that the prohibition of transfer restrictions reallocates bargaining power from a player's current club to potentially new clubs. This reallocation of bargaining power reduces the current club's incentive to invest in the player's human capital because the current club has to bear the investment costs without being able to appropriate all investment benefits if the player transfers to a new club.

Antonioni and Cubbin (2000) analyze the economic effect of the Bosman ruling. Based on empirical evidence and the theory of real options, Antonioni and Cubbin argue that the Bosman ruling had little effect on player salaries, investment in human capital and transfer activity. They attribute the rise in salaries to increasing television revenues. According to Antonioni and Cubbin, a club's incentive to invest in training players is not impaired, because the club can always exercise its option to sell a player before his contract expires. At the same time, no club will wait until the contract of a desired player has expired so that the player becomes available for free because no club will take the risk to lose the desired player to a rival club who does not wait until the contract has expired. Like Burguet et al. (2002) and Feess and Muehlheusser (2003), Antonioni and Cubbin (2000) do not analyze the effect of transfer restrictions on the allocation of risk.

The remainder of this paper is organized as follows. Section 2 specifies the model. In Sect. 3 we analyze the role of transfer restriction and distinguish two regimes: short-term contracts in and out of the 'shadow of the transfer system', respectively. Section 4 characterizes the relationship between the 'shadow of the transfer system' and the pre-Bosman, Bosman and Monti transfer system. Finally, Sect. 5 concludes.

2 Model specification

Our model consists of a representative player, who has a career horizon of two periods, and two representative clubs, club S and club L. The player is assumed to be risk-averse

[7] Burguet et al. (2002) and Feess and Muehlheusser (2002, 2003) model the bargaining process as a simultaneous Nash bargaining game in which the player simultaneously bargains with his old and his new club. The Nash bargaining solution in each individual bargaining game serves as the threat point of the other bargaining game.

whereas the clubs are assumed to be risk-neutral since they have the possibility of diversifying the risk of productivity variations within their portfolio of players and also through diversified ownership structures.[8] The utility of the player is given by his salary whereas the utility of each club corresponds to its profit. The total expected utility (i.e. expected utility over two periods) of the risk-averse player is defined as the sum of the risk-free first-period salary and the security equivalent of the risky second-period salary. The total expected utility of the risk-neutral club is defined as the sum of the expected first-period profit and the expected second-period profit.

The player's productivity in $t \in \{1,2\}$ is a random variable with Markov property denoted S_t at club S and L_t at club L. To abstract from moral hazard problems, we assume that the player's productivity in each period is exogenous.[9] It follows a stochastic process characterized by the binomial tree model presented in Fig. 1.

The player's productivity in each period either increases in club S by a fixed amount, $s > 0$, with probability $p \in (0,1)$, or decreases by the same amount with probability $(1 - p)$. For club L this fixed amount is given by $l > 0$.[10]

With probability p the player's productivity increases, leading in club S to a first-period productivity of $S_1 = e_0 + s$. With probability $(1 - p)$ the player's productivity decreases, leading in club S to a first-period productivity of $S_1 = e_0 - s$.

In the event that the player's productivity has increased (decreased) during period 1, the player's productivity will increase during period 2 with probability p, leading in club S to a second-period productivity of $S_2 = e_0 + 2s$ $(S_2 = e_0)$. With probability $(1 - p)$ the player's productivity will decrease during period 2, leading in club S to a second-period productivity of $S_2 = e_0$ $(S_2 = e_0 - 2s)$.[11]

The probability p is assumed to be common knowledge. Without loss of generality, we assume throughout this analysis that $s < l$. Hence, we can interpret club S as a 'small-market' club where variations of the player's productivity only cause a low productivity alteration. Club L then is a 'large-market' club where variations of the player's productivity cause a high productivity alteration. Moreover, we call a player with $p > 1/2$ $(p \leq 1/2)$ 'high-talented' ('low-talented').

At the beginning of each period the player and the two clubs have common expectations about the player's productivity (playing strength) in this and future periods. During each period the player and the clubs observe the player's current playing strength. From this information both will update their expectation regarding the player's productivity in future periods. The terms $E_t[S_{t+1}|S_t]$ and $E_t[L_{t+1}|L_t]$ denote the expected value of S_{t+1} and L_{t+1} based on the information available in t

[8] Our main insights still hold if the club is less risk-averse than the player. Our results will also remain valid if the club is more risk-averse than the player but can diversify most of the risk by signing contracts with many players.

[9] More realistically, a player's performance is the combined result of the player's (exogenous) talent and (endogenous) effort. Nevertheless, our abstraction can be justified with two arguments. First, players have pride and try to maximize their chance of winning by providing full effort. Second, since performance of football players is perfectly observable, players who do not provide full effort will be regarded as less talented than they actually are.

[10] We refer to the time-span between $t = 0$ and $t = 1$ as 'period 1' and between $t = 1$ and $t = 2$ as 'period 2'.

[11] Analogous for club L with l instead of s.

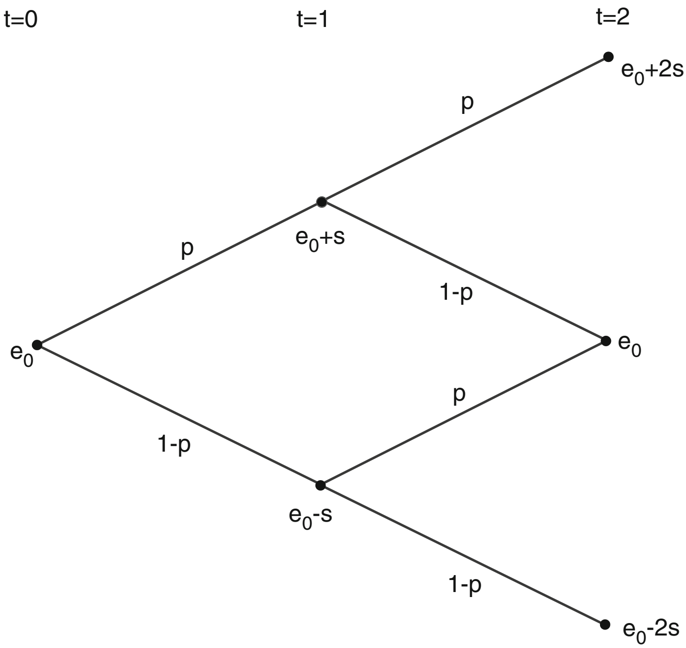

Fig. 1 Development of the player's productivity in club S

(before S_{t+1} and L_{t+1} are revealed) conditional on the player's productivity S_t and L_t.[12] In $t = 0$, the player's productivity is assumed to be common knowledge and given for both clubs by $e_0 > 0$, i.e. $S_0 = L_0 = e_0$.[13]

In $t = 0$, the player's expected first-period productivities $E_0[S_1]$ in club S and $E_0[L_1]$ in club L are computed as

$$E_0[S_1] = e_0 + s(2p - 1) \quad \text{and} \quad E_0[L_1] = e_0 + l(2p - 1).$$

Moreover, in $t = 0$ both clubs have expectations about the player's second-period productivity, denoted $E_0[S_2]$ for club S and $E_0[L_2]$ for club L, which are given by

$$E_0[S_2] = e_0 + 2s(2p - 1) \quad \text{and} \quad E_0[L_2] = e_0 + 2l(2p - 1).$$

With $s < l$ and $p < 1/2$ it gives: $E_0[S_1] > E_0[L_1]$ and $E_0[S_2] > E_0[L_2]$. Hence, in $t = 0$ a low-talented player is expected to be more productive in both periods in the small-market club S than in the large-market club L. The reverse is true for a high-talented player.

In $t = 1$, the player, club S, and club L observe the player's current productivity and update their expectation regarding his productivity in period 2. If the player's

[12] For notational clarity we write in the subsequent analysis $E_t[S_{t+1}]$ and $E_t[L_{t+1}]$ instead of $E_t[S_{t+1}|S_t]$ and $E_t[L_{t+1}|L_t]$.

[13] The information set at $t = 0$ does not have to be empty. Before starting a professional career a player usually played in minor or youth leagues. The market can form its expectation regarding a rookie player's productivity based on the player's past performance.

productivity has increased during period 1 we denote the expected second-period productivity in $t = 1$ at club S with $E_1[S_2^+]$ and at club L with $E_1[L_2^+]$. In the other case, we write $E_1[S_2^-]$ and $E_1[L_2^-]$. The expected second-period productivities are computed as

$$E_1[S_2^+] = e_0 + 2sp \quad \text{and} \quad E_1[L_2^+] = e_0 + 2lp,$$
$$E_1[S_2^-] = e_0 + 2s(p-1) \quad \text{and} \quad E_1[L_2^-] = e_0 + 2l(p-1).$$

In order to guarantee a positive expected second-period productivity for all $p \in (0,1)$ we assume: $e_0 > 2l(p-1)$.

If the player's productivity has increased (decreased) during period 1, then in $t = 1$, each type of player is expected to be more productive at club L (club S) than at club S (club L). Formally,

$$E_1[S_2^+] < E_1[L_2^+] \text{ and } E_1[S_2^-] > E_1[L_2^-] \forall p \in (0,1). \tag{1}$$

The clubs compete for the player by offering contracts which specify the number of periods the player will play for the club and the salary paid by the club to the player in each of the respective periods. We distinguish two regimes:

In Sect. 3.1 we consider short-term contracts in a restricted transfer system where all employment is governed by the 'shadow of the transfer system'. We assume that the contract between the player and his initial club expires after period 1, but the player cannot transfer to a new club without the permission of his initial club. In this case, the initial club has the right to demand an unlimited transfer fee from the other club for the player. If the initial club is not satisfied with the amount offered by the other club, the initial club has the right to prevent the player from transferring to the other club. This right gives the initial club strong bargaining power, because it enables this club to prevent a transfer by demanding an exorbitantly high transfer fee. The other club, however, cannot be forced to pay any amount demanded by the initial club. The new club is free to withdraw its offer if it cannot reach an agreement with the initial club regarding the transfer fee and with the player regarding the player's second-period salary.

In Sect. 3.2 we consider short-term contracts in an unrestricted transfer system, i.e. without the 'shadow of the transfer system'. The contract between the player and his initial club expires after period 1 and the player is free to sign a contract with another club without the permission of his initial club. Moreover, the initial club does not receive any transfer fee.

3 The role of transfer restrictions

3.1 Short-term contracts in the 'shadow of the transfer system'

We model the bargaining process in $t = 0$ between the player and the clubs concerning the player's first-period salary as a pair of simultaneous negotiations in Nash bargaining fashion: one for each club vis-à-vis the player, using as threat points in each negotiation what each expects from the other.[14] This bargaining

[14] Note that this approach is similar to Burguet et al. (2002).

model captures the cooperative situation between the clubs and the player on the one hand and the non-cooperative situation between the two clubs on the other hand (both clubs compete against each other by offering contracts to the player). Moreover, the two clubs and the player take into account that the 'shadow of the transfer system' prevents the out-of-contract player from signing a valid contract with another club without the permission of his current club. Besides the relevant threat points, we have to compute the player's and club's total expected utility.

Formally, we have to distinguish two cases: (a) the player signs a short-term contract with club S in $t = 0$ and (b) the player signs a short-term contract with club L in $t = 0$.[15]

We proceed by assuming that the player has signed a short-term contract which specifies a first-period salary of $\underline{w}^S_{r,1}$ with club S in $t = 0$:[16]

(i) If the player's productivity has increased during period 1 (which happens with probability p), we know by Eq. 1 that each type of player will achieve a higher expected second-period productivity at the large-market club L compared with the small-market club S. According to the Coase theorem, the player will transfer to club L since the player is then allocated efficiently.

But how will the (expected) productivity gain that is generated through the transfer be divided between the player, club S and club L?

In contrast with the bargaining game in $t = 0$, where a solution concept which captured the partial non-cooperative nature of the game was needed, we now have a cooperative bargaining situation between all three parties since we know ex ante that the grand coalition will form. Thus, we need now a solution concept that captures the cooperative nature of the bargaining game between the three parties. The Shapley value is a appropriate solution concept in this case since it describes a reasonable or fair way to allocate the gains realized by cooperation between three or more parties. Each party then receives its contribution from the (expected) productivity gain obtained by the grand coalition.

In the following lemma we determine each party's contribution to the player's transfer from club S to club L in $t = 1$:

Lemma 1 The Shapley values determine the outcome of the cooperative bargaining game as follows: $\frac{1}{6}E_1[S_2^+] + \frac{1}{3}E_1[L_2^+]$ (player), $\frac{1}{6}E_1[S_2^+] + \frac{1}{3}E_1[L_2^+]$ (club S) and $\frac{1}{3}(E_1[L_2^+] - E_1[S_2^+])$ (club L).

Proof See Appendix. □

According to the lemma the player will receive at club L a second-period salary of

$$\underline{w}^{L+}_{r,2} = \frac{1}{6}E_1[S_2^+] + \frac{1}{3}E_1[L_2^+].$$

Club S receives as a transfer fee T^S its contribution to the coalition determined by its Shapley value and therefore realizes an expected second-period profit of

[15] In this section we will only analyze case (a). The other case (b) is postponed to the Appendix.

[16] Note that the subscript r stands for 'restricted' transfer system.

$E_1[\pi^{S+}_{r,2}] = \frac{1}{6}E_1[S^+_2] + \frac{1}{3}E_1[L^+_2] = T^S$. Analogously, club L receives its Shapley value and realizes an expected second-period profit of $E_1[\pi^{L+}_{r,2}] = \frac{1}{3}(E_1[L^+_2] - E_1[S^+_2])$.

(ii) If the player's productivity has decreased during period 1 (which happens with probability $(1 - p)$), we know by Eq. 1 that each type of player will achieve a higher expected second-period productivity at his initial club S compared with the other club L. Hence, in $t = 1$ club L will not place any offer for the player since it knows that it cannot reach an agreement with club S regarding the transfer fee and with the player regarding the player's salary. Without a competing offer from club L, the player will stay at club S in $t = 1$ and the player's reservation wage falls to zero. The player's second-period salary $\underline{w}^{S-}_{r,2}$ is now determined by the negotiations only between club S and the player. It is appropriate, therefore, to apply the Nash bargaining solution to derive the outcome of this bargaining process. Club S's utility is given by its expected second-period profit $E_1[S^-_2] - \underline{w}^{S-}_{r,2}$ whereas the player's utility is given by the salary $\underline{w}^{S-}_{r,2}$ he will receive at club S. The threat points of club S and the player both amount to zero. Formally, we compute:

$$\underline{w}^{S-}_{r,2} = \arg\max_{\underline{w}^{S-}_{r,2}} \left\{ (E_1[S^-_2] - \underline{w}^{S-}_{r,2} - 0)(\underline{w}^{S-}_{r,2} - 0) \right\} = \frac{1}{2}E_1[S^-_2].$$

Hence, the player will earn a second-period salary of $\underline{w}^{S-}_{r,2} = \frac{1}{2}E_1[S^-_2]$, club S expects a second-period profit of $E_1[\pi^{S-}_{r,2}] = E_1[S^-_2] - \underline{w}^{S-}_{r,2} = \frac{1}{2}E_1[S^-_2]$ and club L will earn $E_1[\pi^{L-}_{r,2}] = 0$.

We can now determine the total expected utility in $t = 0$ of club S and the player, respectively:

Total expected utility $E_0[u^S_r]$ of the risk-neutral club S is given by the expected first-period profit $E_0[\pi^S_{r,1}]$ plus the expected second-period profit $pE_1[\pi^{S+}_{r,2}] + (1 - p)E_1[\pi^{S-}_{r,2}]$. We compute

$$E_0[u^S_r] = (E_0[S_1] - \underline{w}^S_{r,1}) + pT^S + (1-p)\frac{1}{2}E_1[S^-_2].$$

Total expected utility $E_0[\underline{u}^P_r]$ of the risk-averse player is given by

$$E_0[\underline{u}^P_r] = \underline{w}^S_{r,1} + E_0[\underline{w}_{r,2}] - \frac{1}{2}\tau V[\underline{w}_{r,2}], \tag{2}$$

where τ measures the degree of the player's risk-aversion. The higher τ, the more risk-averse is the player. In the first period the player receives $\underline{w}^S_{r,1}$ with certainty. Since the second-period salary is risky, we use the security equivalent as the player's expected second-period utility, where the expected second-period salary $E_0[\underline{w}_{r,2}]$ and the variance $V[\underline{w}_{r,2}]$ of the second-period salary are given by

$$E_0[\underline{w}_{r,2}] = p\underline{w}^{L+}_{r,2} + (1-p)\underline{w}^{S-}_{r,2} = p\left(\frac{1}{6}E_1[S^+_2] + \frac{1}{3}E_1[L^+_2]\right) + (1-p)\left(\frac{1}{2}E_1[S^-_2]\right),$$

$$V[\underline{w}_{r,2}] = p(\underline{w}^{L+}_{r,2})^2 + (1-p)(\underline{w}^{S-}_{r,2})^2 - (E_0[\underline{w}_{r,2}])^2.$$

The threat points of the simultaneous negotiations in Nash bargaining fashion in $t = 0$ are derived as follows: with probability $(1 - p)$ each type of player will achieve a higher expected second-period productivity at the small-market club S. In the case where the player has signed a short-term contract with club L in $t = 0$ he will transfer to club S in $t = 1$. Club S will then receive its contribution to the coalition determined by its Shapley value. Thus the threat point of club S, denoted d^S, is given by $(1-p)\frac{1}{3}(E_1[S_2^-] - E_1[L_2^-])$. The player's threat point, denoted $\overline{d}^P$, is determined by the player's total expected utility $E_0[\overline{u}_r^P]$ that he could achieve by playing at club L.

The pair of simultaneous negotiations in Nash bargaining fashion in $t = 0$ concerning the player's first-period salary, denoted $(\underline{w}_{r,1}^S, \overline{w}_{r,1}^L)$, are formally given by:[17]

$$\begin{aligned} \underline{w}_{r,1}^S &= \arg\max\left\{(E_0[u_r^S] - d^S)(E_0[\underline{u}_r^P] - \overline{d}^P)\right\} \\ \overline{w}_{r,1}^L &= \arg\max\left\{(E_0[u_r^L] - d^L)(E_0[\overline{u}_r^P] - \underline{d}^P)\right\} \end{aligned} \tag{3}$$

All relevant information is available to solve this problem and to specify the player's first-period salary $\underline{w}_{r,1}^S$ at club S and $\overline{w}_{r,1}^L$ at club L:

Lemma 2 The first-period salaries $\underline{w}_{r,1}^S$ and $\overline{w}_{r,1}^L$ of the player are computed as

$$\begin{aligned} \underline{w}_{r,1}^S =& \frac{2}{3}E_0[S_1] + \frac{1}{3}E_0[L_1] + pT^S \\ &+ (1-p)(T^L - \frac{1}{2}E_1[\pi_{r,2}^{S-}]) + \frac{\tau}{6}(V[\underline{w}_{r,2}] - V[\overline{w}_{r,2}]), \end{aligned} \tag{4}$$

$$\begin{aligned} \overline{w}_{r,1}^L =& \frac{1}{3}E_0[S_1] + \frac{2}{3}E_0[L_1] + (1-p)T^L \\ &+ p\left(T^S - \frac{1}{2}E_1[\pi_{r,2}^{L+}]\right) + \frac{\tau}{6}(V[\overline{w}_{r,2}] - V[\underline{w}_{r,2}]). \end{aligned} \tag{5}$$

Proof See Appendix. □

In $t = 0$, the risk-averse player will sign a contract with the club where he maximizes his total expected utility:

Corollary 1

(i) A low-talented player will sign a contract with the small-market club S independent of his degree of risk-aversion, i.e. if $p \le \frac{1}{2}$ then $E_0[\underline{u}_r^P] > E_0[\overline{u}_r^P] \forall \tau > 0$.

(ii) A high-talented player will sign a contract with the large-market club L if his risk-aversion is sufficiently low and with the small-market club S if his risk-aversion is sufficiently high, i.e. if $p > \frac{1}{2}$ then $E_0[\underline{u}_r^P] < E_0[\overline{u}_r^P] \forall \tau < \tilde{\tau}(p, s, l)$.

[17] See the Appendix for a detailed derivation of the player's total expected utility $E_0[\overline{u}_r^P]$, club L's total expected utility $E_0[u_r^L]$ and the relevant threat points d^L and $\underline{d}^P$.

Proof See Appendix. □

The corollary shows that a low-talented, risk-averse player maximizes his total expected utility at the small-market club S independent of his degree of risk-aversion whereas a high-talented player only maximizes his total expected utility at the large-market club L if his risk-aversion is sufficiently low. Intuitively this is clear: A low-talented player will play for the club where variations of his productivity only generate a low productivity alteration (club S), whereas a high-talented player will play for the club where variations of his productivity generate a high productivity alteration (club L). If, however, the risk-aversion of a high-talented player becomes sufficiently high, then this player will also prefer to play for the club where variations of his productivity only generate a low productivity alteration.

3.2 Short-term contracts without the 'shadow of the transfer system'

Similar to $t = 0$ in Sect. 3.1, the bargaining process concerning the player's salary in each of the respective periods is modelled via a pair of simultaneous negotiations, one for each club vis-à-vis the player, using as threat points in each negotiation what each expects from the other. Without the 'shadow of the transfer system' the initial club, however, *cannot* be sure either to hold the player in period 2 and obtain the player's second-period productivity or to transfer the player and receive a transfer fee. The club's expectations in $t = 0$ regarding the player's second-period productivity therefore amount to zero. Similarly, the player *cannot* be sure to either stay in period 2 at his initial club and receive a second-period salary from this club or to be transferred and obtain his Shapley value as a second-period salary from the new club. These circumstances influence the bargaining process in $t = 0$ insofar as now the player's and the club's expected utilities in the Nash product of the Nash bargaining solution only involve the first period. We now determine the player's and club's expected utilities in each period:

If the player signs a contract with club $Z \in \{S,L\}$ in $t \in \{0,1\}$, which specifies a salary of $w^Z_{u,t+1}$, the expected utility in $t \in \{0,1\}$ of the risk-neutral club is given by[18]

$$E_t[u^S_{u,t+1}] = E_t[S_{t+1}] - w^S_{u,t+1} (\text{for club } S),$$
$$E_t[u^L_{u,t+1}] = E_t[L_{t+1}] - w^L_{u,t+1} (\text{for club } L).$$

The player's expected one-period utility in $t \in \{0,1\}$ is given by

$$E_t[\underline{u}^P_{u,t+1}] = w^S_{u,t+1} \text{ and } E_t[\overline{u}^P_{u,t+1}] = w^L_{u,t+1}.$$

We derive the relevant threat points as follows: In $t \in \{0,1\}$, club S 's threat point is zero, whereas the threat point of the player is determined by the expected one-period utility $E_t[\overline{u}^P_{u,t+1}]$ that he could achieve at club L. Analogously for the other Nash bargaining solution.

[18] Note that the subscript u stands for 'unrestricted' transfer system.

Formally, the pair of simultaneous negotiations in $t \in \{0,1\}$ is given by

$$w^S_{u,t+1} = \arg\max\left\{(E_t[u^S_{u,t+1}] - 0)(E_t[\underline{u}^P_{u,t+1}] - E_t[\overline{u}^P_{u,t+1}])\right\},$$
$$w^L_{u,t+1} = \arg\max\left\{(E_t[u^L_{u,t+1}] - 0)(E_t[\overline{u}^P_{u,t+1}] - E_t[\underline{u}^P_{u,t+1}])\right\}. \quad (6)$$

The solution to this problem is derived in the following lemma:

Lemma 3 The player's salary $w^S_{u,t+1}$ and $w^L_{u,t+1}$ in $t \in \{0,1\}$ are computed as

$$w^S_{u,t+1} = \frac{2}{3}E_t[S_{t+1}] + \frac{1}{3}E_t[L_{t+1}] \text{ and } w^L_{u,t+1} = \frac{1}{3}E_t[S_{t+1}] + \frac{2}{3}E_t[L_{t+1}]. \quad (7)$$

Proof Straightforward. □

We derive $w^S_{u,1} > w^L_{u,1}$ for all $p \in (0, \frac{1}{2}]$ and $w^S_{u,1} < w^L_{u,1}$ for all $p \in (\frac{1}{2}, 1)$.[19] As a consequence, a low (high) talented player will sign a short-term contract with the small-market (large-market) club in $t = 0$. The intuition is similar to that of Corollary 1. According to Lemma 3 the low-talented player then receives a first-period salary of

$$\underline{w}^S_{u,1} = \frac{2}{3}E_0[S_1] + \frac{1}{3}E_0[L_1].$$

whereas, the high-talented player receives a first-period salary of

$$\overline{w}^L_{u,1} = \frac{1}{3}E_0[S_1] + \frac{2}{3}E_0[L_1].$$

We now analyze the situation in $t = 1$:

If the player's productivity has decreased during period 1, then according to Eq. 1 each type of player will achieve a higher second-period productivity at the small-market club S, i.e. $E_1[S_2^-] > E_1[L_2^-]$, which implies $w^S_{u,2} > w^L_{u,2}$. The player will therefore sign a short-term contract with club S and receive, according to Lemma 3, a second-period salary of[20]

$$w^{S-}_{u,2} = \frac{2}{3}E_1[S_2^-] + \frac{1}{3}E_1[L_2^-].$$

If the player's productivity has increased during period 1, then in $t = 1$ each type of player will sign a short-term contract with club L and receive according to Lemma 3 a second-period salary of

$$w^{L+}_{u,2} = \frac{1}{3}E_1[S_2^+] + \frac{2}{3}E_1[L_2^+].$$

Under short-term contracts without the 'shadow of the transfer system,' the player cannot be sure in $t = 0$ either to stay in period 2 at his initial club and receive a second-period salary from this club or to be transferred and obtain his Shapley

[19] It holds: $w^S_{u,1} > w^L_{u,1} \Leftrightarrow E_0[S_1] > E_0[L_1]$. Since $l > s$, we derive $E_0[S_1] > E_0[L_1] \Leftrightarrow p \in (0, \frac{1}{2})$ and $E_0[S_1] < E_0[L_1] \Leftrightarrow p \in (\frac{1}{2}, 1)$. Without loss of generality, we assume that the small-market club S contracts a low-talented player with $p = \frac{1}{2}$.

[20] We can omit the underline and the upperline, since the second-period salary is equal for each type of player.

value as a second-period salary from the new club. Nevertheless, the player can form expectations in $t = 0$ about his utility over the two periods. Depending on his type, the player will receive $w^S_{u,1}$ or $w^L_{u,1}$ in the first period with certainty. With probability p, the (low- and high-talented) player will sign a contract in $t = 1$ at club L and receive $w^{L+}_{u,2}$. With probability $(1 - p)$ the (low- and high-talented) player will sign a contract in $t = 1$ at club S and receive $w^{S-}_{u,2}$. Hence, the player's expected second-period salary $E_0[w_{u,2}]$ and the variance $V[w_{u,2}]$ of the second-period salary are determined by[21]

$$\begin{aligned} E_0[w_{u,2}] &= pw^{L+}_{u,2} + (1-p)w^{S-}_{u,2} \\ &= p\left(\frac{1}{3}E_1[S^+_2] + \frac{2}{3}E_1[L^+_2]\right) + (1-p)\left(\frac{2}{3}E_1[S^-_2] + \frac{1}{3}E_1[L^-_2]\right), \\ V[w_{u,2}] &= p(w^{L+}_{u,2})^2 + (1-p)(w^{S-}_{u,2})^2 - (E_1[w_{u,2}])^2. \end{aligned}$$

In $t = 0$, total expected utility, denoted $E_0[\underline{u}^P_u]$ for a low-talented player and $E_0[\overline{u}^P_u]$ for a high-talented player, is analogous to Sect. 3.1 computed as

$$\begin{aligned} E_0[\underline{u}^P_u] &= w^S_{u,1} + E_0[w_{u,2}] - \frac{1}{2}\tau V[w_{u,2}], \\ E_0[\overline{u}^P_u] &= w^L_{u,1} + E_0[w_{u,2}] - \frac{1}{2}\tau V[w_{u,2}]. \end{aligned}$$

3.3 In versus out of the 'shadow of the transfer system'

In this section we compare the player's salary under a short-term contract in the 'shadow of the transfer system' with the respective salary under a short-term contract without the 'shadow of the transfer system'. Moreover, we show that a risk-averse player benefits from the 'shadow of the transfer system'.

Proposition 1 Under a short-term contract in the 'shadow of the transfer system' a high-talented, risk-averse player receives a higher first-period salary combined with a lower (expected) second-period salary compared with a short-term contract without the 'shadow of the transfer system'. The same holds true for a low-talented player whose risk-aversion is sufficiently low. Formally,

$$\begin{aligned} &\text{(i) Low-talented player:} \quad \underline{w}^S_{r,1} > \underline{w}^S_{u,1} \forall \tau < \tau^* \text{ and } E_0[\underline{w}_{r,2}] < E_0[w_{u,2}], \\ &\text{(ii) High-talented player:} \quad \overline{w}^L_{r,1} > \overline{w}^L_{u,1} \forall \tau > 0 \text{ and } E_0[\overline{w}_{r,2}] < E_0[w_{u,2}]. \end{aligned}$$

Proof See Appendix. □

The proposition shows that for a high-talented player and a low-talented player (whose risk-aversion is sufficiently low), the risk-free first-period salary under a short-term contract in the 'shadow of the transfer system' is higher than the respective salary without the 'shadow of the transfer system'. The opposite holds true for the expected second-period salary of a (low- or high-talented) player since it

[21] Note that the expected second-period salary and variance are equal for a low- and a high-talented player.

is higher without the 'shadow of the transfer system'. The intuition behind this result is as follows: The 'shadow of the transfer system' gives the player an instrument to commit himself successfully not to renege on the insurance deal since the club can be sure that the player only leaves its portfolio in $t = 1$ if the transfer fee exceeds the expected profit that the player could achieve by staying at the club in period 2. As a consequence a risk-neutral club can partially insure its risk-averse player against income uncertainty by transforming a part of the player's risky future (second-period) salary in risk-free current (first period) salary.

In the next proposition we show that a risk-averse player benefits from the 'shadow of the transfer system' and therefore from a more restrictive transfer system:

Proposition 2 Total expected utility of a low- and high-talented, risk-averse player is higher under a short-term contract in the 'shadow of the transfer system' than under a short-term contract without the 'shadow of the transfer system'. Formally,

$$\begin{array}{ll} (i)\, Low\text{–talented player}: & E_0[\underline{u}_r^P] > E_0[\underline{u}_u^P] \forall \tau > 0, \\ (ii)\, High\text{–talented player}: & E_0[\overline{u}_r^P] > E_0[\overline{u}_u^P] \forall \tau > 0. \end{array}$$

Proof See Appendix. □

The above proposition shows that a risk-averse player benefits from the 'shadow of the transfer system' since a risk-averse player prefers a higher current salary combined with a lower (expected) future salary to a lower current salary combined with a higher but uncertain future salary.

4 The 'shadow of the transfer system' in the pre-Bosman, Bosman and Monti transfer system

As a point of departure we have to take into account the fact that labour law cannot be employed in reality to prevent an employee from accepting superior alternative job offers. In addition to this let us assume a situation where the 'shadow of the transfer system' does not exist. This means that the weak or inexistent 'shadow of the law' is supplemented by an inexistent 'shadow of the transfer system'. Will a Pareto efficient contract that creates value by enabling risk-averse players to buy insurance against future income uncertainty from risk-neutral clubs be feasible in this setting?

Given the inexistent (or at least very weak) external enforcement system, the insurance deal between player and club will only work if the contract written down in period one is time-consistent. The insurance deal is to be regarded as a series of one-period contracts. After each period the parties re-calculate the terms of the next one-period contract taking into account the information available at the beginning of the respective period. In the absence of both the 'shadow of the transfer system' and the 'shadow of the law' a Pareto efficient contract enabling risk-averse players to buy insurance from risk-neutral clubs is unlikely to be achieved. Nothing prevents a 'good risk' player whose productivity turns out to be underestimated in the course of his career to use external offers in order to bid his salary to a level reflecting marginal productivity. Why should a 'good risk' player still agree to pay the 'insurance fee' established in the original contract in this setting? Why should clubs offer value-creating insurance services if they are not able to appropriate any of this value because of a regulatory environment leaving them with all the 'bad risks?'

How does the 'shadow of the transfer system' change this situation?

Let us first assume the pre-Bosman world. All employment relations in football are governed by the 'shadow of the transfer system' in this world. Players out-of-contract as well as players in-contract require the permission of their current club in order to be able to sign with another club. The 'shadow of the transfer system' works as a surrogate which makes insurance contracts complete. Let a 'good risk' player whose productivity has been underestimated receive an external transfer offer. Player and club will of course re-calculate their deal taking into account the new information available. However the 'good risk' player cannot defect on the insurance deal. As was shown in Sect. 3.1 the club can be sure that the player only leaves its portfolio at the beginning of the next period if the transfer fee exceeds the expected profit that the player could contribute by staying with the club in the future. In the 'shadow of the transfer system' the Pareto efficient contract is time-consistent. Although contracts may be renegotiated every period in the pre-Bosman world on the basis of new information available, these renegotiations cannot be used to defect on the insurance deal. Enabling the player to commit to the insurance deal the 'shadow of the transfer system' allows clubs to transfer risky future income in risk-less current income and make risk-averse players better off as has been shown in Sect. 3.3. Seen from this insurance perspective, contract duration is not important in the pre-Bosman world since the 'shadow of the transfer system' effectively links one-period contracts to a time-consistent series. Even if the actual contract of the player expires at the end of the current period his promise not to use an external offer in order to defect on the 'insurance fee' remains perfectly credible in the 'shadow of the transfer system'.

The Bosman verdict transforms the potential promise of a player not to defect on the insurance deal after the expiration of his contract into cheap talk. The 'shadow of the transfer system' only continues to provide credibility to player promises given within the time-span of valid contracts. Contract duration becomes a crucial variable for the functioning of the insurance market. By expanding contract duration employment relationships can be deliberately taken under the 'shadow of the transfer system' where commitments to honor the insurance deals work. This is exactly what happened between clubs and players on a perfectly voluntary basis. Despite the fact that the players had the choice to become free agents outside the 'shadow of the transfer system' and the clubs had the choice to sign these free agents, the bulk of all transfer activity took place within the 'shadow of the transfer system'. Clubs and players restored the pre-Bosman situation on the insurance market by expanding contract durations. In terms of the model this intuition is captured by switching from Sect. 3.2 back to Sect. 3.1.[22] A long-term contract which covers the player's career horizon of two periods specifies a salary for each period, given by (w_1, w_2). In our model, a long-term contract is equivalent to the short-term contract in the 'shadow of the transfer system' described in Sect. 3.1, where the first-period salary w_1 is given by $w_1 = \underline{w}^S_{r,1}$ or $w_1 = \overline{w}^L_{r,1}$, dependent of the player's type. The second-period salary w_2 is given for a

[22] In other words, in our model the Bosman transfer system can always resemble the pre-Bosman world by adjusting the contract length accordingly. Note that this does not hold the other way round.

low-talented player by $w_2 = \underline{w}^{S-}_{r,2}$ or $w_2 = \underline{w}^{L+}_{r,2}$ (for a high-talented player by $w_2 = \overline{w}^{S-}_{r,2}$ or $w_2 = \overline{w}^{L+}_{r,2}$), dependent on the development of the player's productivity during period 1. By signing a long-term contract, the club can be sure to either hold the player and obtain the player's second-period productivity or to transfer the player and receive a transfer fee. This expected second-period productivity increases the player's productivity in $t = 0$ and should also be incorporated in the contractually specified first-period salary of a long-term contract. The calculation of the player's first-period salary in Sect. 3.1 effectively incorporates the player's expected second-period productivity. Furthermore, the second-period salary of a long-term should reflect the player's expected development during period 1, which is the case in Sect. 3.1.

The Monti system limits the voluntary attempt of clubs and players to take employment relations under the 'shadow of the transfer system'. The maximum duration of contracts is 5 years. Contracts that are signed up the 28th birthday of the player are protected against unilateral breach for the first 3 years. Contracts that are signed thereafter are only protected for 2 years.[23] The 'shadow of the transfer system' will only work for these three respectively 2 years. After the 'protected period' only a 'scattered shadow of the transfer system' will be effective. The transfer fee for players-in-contact shall reflect whether contracts are broken in the 'protected period'. No transfer fee can be charged for players out-of-contract. Our model captures the intuition behind the changes from the Bosman to the Monti world by a switch from Sect. 3.1 to 3.2. Risk-averse players will find it more difficult to put up insurance deals with clubs. Clubs will face greater problems to convert risky future income in risk-less current income in a world where players cannot make longer-term commitments to honor insurance deals. Outside the remaining small 'shadow of the transfer system' their promises are bound to be cheap talk.

5 Conclusion

Transfer restrictions have a long tradition in professional football, but came under heavy attack in recent years. In this paper we have analyzed whether a risk-averse player really benefits from less restrictive transfer systems. Given that the player's productivity varies significantly during his career and taking into account that these variations cannot be predicted, the allocation of risk becomes a crucial feature. Our model, which captures this important aspect of employment relations in football, has revealed that a risk-averse player benefits from 'the shadow of the transfer system' and therefore from a more restrictive transfer system. Under the pre-Bosman

[23] The Monti system, however, did not clearly specify the compensation for transfers after the protected period. The current club could retain a strong bargaining position by charging high transfer fees for in-contract players who wanted to transfer after the protected period. In January 2008, the Court of Arbitration for Sport (CAS) based in Lausanne, Switzerland, effectively limited the bargaining power of a player's current club for transfers after the protected period with its ruling on the Webster case. This case was brought before the CAS after the Scottish football player Webster decided to leave his Scottish club Heart of Midlothian in 2006 in order to move to the English club Wigan 1 year before his contract ended, but after the protected period. The CAS decided that Webster had to pay his residual value to Heart of Midlothian. More importantly, the CAS also ruled that this residual value is not based on the player's market value, but is equal to the player's salary for the remainder of his contract.

transfer system, clubs could partially insure their players against income uncertainty by transforming a part of the player's risky future salary in risk-free current income. A risk-averse player prefers a higher current salary combined with a lower (expected) future salary to a lower current salary combined with a higher but uncertain future salary. The Bosman transfer system, which is equivalent to the pre-Bosman transfer system in terms of our model, did not change this situation since clubs and players voluntary restored the pre-Bosman world by expanding contract durations. However, by limiting the maximal contract duration to 5 years the insurance deal does not work anymore in the new Monti transfer system. As a consequence, the Monti transfer system can be considered as an impediment to Pareto efficient risk-allocation in the football industry. If risk can be considered as the basic source of productivity variations in football, the failure of the insurance market imposed by the free movement philosophy of the European institutions might impose a high price to be paid by the labour force in this industry.

Appendix

Proof of Lemma 1

We will show how the (expected) productivity gain that is generated through the player's transfer from club S to club L in $t = 1$ will be divided between the player, club S and club L:

The Shapley value gives each member i of a coalition C her expected contribution, where the expectation is taken over all coalitions to which i might belong. Formally, party i's share of the pie is given by

$$\sum_{C|i\in C} \frac{(c-1)!(n-c)!}{n!}(v(C) - v(C/\{i\}),$$

where $c = |C|$ is the number of parties in coalition C, n is the total number of parties bargaining, $v(C)$ is the surplus produced by coalition C , and $v(C/\{i\})$ is the surplus produced by coalition C without party i.

First, we compute the share of the player: Without the player, neither of the two clubs can generate any surplus. Together with the player, club S can generate a surplus of $v(\{P,S\}) = E_1[S_2^+]$. The respective probability of this coalition is 1/6. The player and club L cannot generate any surplus, because they need the consent of club S, i.e. $v(\{P,L\}) = 0$. The coalition of club S and club L cannot generate any surplus, i.e. $v(\{S,L\}) = 0$. The coalition of the two clubs and the player will generate a surplus of $v(\{P,S,L\}) = E_1[L_2^+]$. The respective probability of this coalition is 1/3. As a result, the player's Shapley value is $\frac{1}{6}E_1[S_2^+] + \frac{1}{3}E_1[L_2^+]$.

Club S's situation is symmetric to the player's. Accordingly, club S's Shapley value is $\frac{1}{6}E_1[S_2^+] + \frac{1}{3}E_1[L_2^+]$.

Club L needs the grand coalition to generate a surplus of $E_1[L_2^+]$. Without club L, club S and the player can generate a surplus of only $E_1[S_2^+]$. Hence, club L's Shapley value is $(E_1[L_2^+]-E_1[S_2^+])$.

Proof of Lemma 2

The player's first-period salary $\underline{w}_{r,1}^S$ and $\overline{w}_{r,1}^L$ are determined by the simultaneous negotiations (3) which are modelled in Nash bargaining fashion, one for each club vis-à-vis the player. Deriving the corresponding FOC and solving for $\underline{w}_{r,1}^S$ and $\overline{w}_{r,1}^L$, respectively, yields

$$\underline{w}_{r,1}^S = \frac{1}{4}(2E_0[S_1] + (1-p)E_1[L_2^-] + pE_1[L_2^+] + \tau(V[\underline{w}_{r,2}] - V[\overline{w}_{r,2}]) + 2\overline{w}_{r,1}^L),$$
$$\overline{w}_{r,1}^L = \frac{1}{4}(2E_0[L_1] + (1-p)E_1[S_2^-] + pE_1[S_2^+] + \tau(V[\overline{w}_{r,2}] - V[\underline{w}_{r,2}]) + 2\underline{w}_{r,1}^S).$$

By solving this system of equations and using the fact that $E_1[\pi_{r,2}^{S+}] = \frac{1}{6}E_1[S_2^+] + \frac{1}{3}E_1[L_2^+] = T^S$, $E_1[\pi_{r,2}^{L+}] = \frac{1}{3}(E_1[L_2^+] - E_1[S_2^+])$, $E_1[\pi_{r,2}^{S-}] = \frac{1}{3}(E_1[S_2^-] - E_1[L_2^-])$ and $E_1[\pi_{r,2}^{L-}] = \frac{1}{3}E_1[S_2^-] + \frac{1}{6}E_1[L_2^-] = T^L$, we derive (4) and (5).

Proof of Corollary 1

We claim that in $t = 0$, total expected utility of a low-talented player is higher at club S than at club L. The reverse is shown to hold true for a high-talented player with a sufficiently low risk-aversion.

If the player signs a short-term contract in $t = 0$ at club S, then according to (2) the player's total expected utility is given by $E_0[\underline{u}_r^P] = \underline{w}_{r,1}^S + E_0[\underline{w}_{r,2}] - \frac{1}{2}\tau V[\underline{w}_{r,2}]$. In the other case, the player's total expected utility is given by $E_0[\overline{u}_r^P] = \overline{w}_{r,1}^L + E_0[\overline{w}_{r,2}] - \frac{1}{2}\tau V[\overline{w}_{r,2}]$ according to (8). In order to prove our claim, we have to show that $E_0[\underline{u}_r^P] > E_0[\overline{u}_r^P]$ for $p \leq \frac{1}{2}$ and $E_0[\underline{u}_r^P] < E_0[\overline{u}_r^P]$ for $p > \frac{1}{2}$. We define $f(\tau) := E_0[\underline{u}_r^P] - E_0[\overline{u}_r^P]$ and compute

$$E_0[\underline{u}_r^P] - E_0[\overline{u}_r^P] = 0 \Leftrightarrow \tau = \widetilde{\tau}(p,s,l) := \frac{18(2p-1)}{(1-p)p(s(5-4p) + l(1+4p))},$$
$$\frac{\partial(E_0[\underline{u}_r^P] - E_0[\overline{u}_r^P])}{\partial\tau} = \frac{(l-s)}{54}(1-p)p(s(5-4p) + l(1+4p)) > 0, \forall p \in (0,1).$$

We derive that if $\tau > \widetilde{\tau}(p,s,l)$, then $E_0[\underline{u}_r^P] > E_0[\overline{u}_r^P]$.

Let $p \in (0, \frac{1}{2}]$, then $\widetilde{\tau}(p,s,l) \leq 0$ and hence $E_0[\underline{u}_r^P] > E_0[\overline{u}_r^P] > 0 \forall \tau > 0$. That is, a low-talented, risk-averse player ($p \leq \frac{1}{2}$), independent of his risk-aversion, realizes a higher total expected utility by signing a contract with club S in $t = 0$. Note that $\widetilde{\tau} = 0$ for $p = \frac{1}{2}$.

Let $p \in (\frac{1}{2}, 1)$, then $\widetilde{\tau}(p,s,l) > 0$ and hence $E_0[\underline{u}_r^P] < E_0[\overline{u}_r^P]$ $\forall \tau < \widetilde{\tau}(p,s,l)$. That is, a high-talented, risk-averse player ($p > \frac{1}{2}$) with a sufficiently low risk-aversion ($\tau < \widetilde{\tau}(p,s,l)$) realizes a higher total expected utility by signing a contract with club L in $t = 0$.

Proof of Proposition 1

(i) We claim that the risk-free first-period salary under a short-term contract in the 'shadow of the transfer system' is higher than the respective salary without the 'shadow of the transfer system' for a high-talented player. The same holds true for a low-talented player whose risk-aversion is sufficiently low. Formally, we show $\underline{w}_{r,1}^S > \underline{w}_{u,1}^S$ if $\tau < \tau^*(p, e_0, s, l)$ and $\overline{w}_{r,1}^L > \overline{w}_{u,1}^L$ for all $\tau > 0$.

For a low-talented player, we derive

$$\underline{w}_{r,1}^S > \underline{w}_{u,1}^S \Leftrightarrow pT^S + (1-p)\left(T^L - \frac{1}{2}E_1[\pi_{r,2}^{S-}]\right) + \frac{\tau}{6}(V[\underline{w}_{r,2}] - V[\overline{w}_{r,2}]) > 0$$

and compute

$$\underline{w}_{r,1}^S - \underline{w}_{u,1}^S = 0 \Leftrightarrow \tau = \tau^*(p, e_0, s, l) := \frac{9(3e_0 - (1-p)(4s+2l))}{(l-s)(1-p)p(s(5-4p)+l(1+4p))}.$$

We deduce that $\tau^*(p,e_0,s,l) > 0$ since we assumed $e_0 > 2l(1-p)$ and $l > s$. Moreover,

$$\frac{\partial(\underline{w}_{r,1}^S - \underline{w}_{u,1}^S)}{\partial\tau} = -\frac{(l-s)}{54}(1-p)p(s(5-4p)+l(1+4p)) < 0.$$

Hence, if $\tau < \tau^*(p, e_0, s, l)$, then $\underline{w}_{r,1}^S > \underline{w}_{u,1}^S$. A low-talented risk-averse player whose risk-aversion is sufficiently low realizes a higher risk-free first-period salary in the 'shadow of the transfer system' than without the 'shadow of the transfer system'.

For a high-talented player, we derive

$$\overline{w}_{r,1}^L > \overline{w}_{u,1}^L \Leftrightarrow (1-p)T^L + p(T^S - \frac{1}{2}E_1[\pi_{r,2}^{L+}]) + \frac{\tau}{6}(V[\overline{w}_{r,2}] - V[\underline{w}_{r,2}])$$

and compute

$$\overline{w}_{r,1}^L - \overline{w}_{u,1}^L \Leftrightarrow \tau = -\tau^*(p, e_0, s, l) < 0,$$

$$\frac{\partial(\overline{w}_{r,1}^L - \overline{w}_{u,1}^L)}{\partial\tau} = \frac{(l-s)}{54}(1-p)p(s(5-4p)+l(1+4p)) > 0.$$

We deduce that if $\tau > 0 > \tau^*(p,e_0,s,l)$, then $\overline{w}_{r,1}^L > \overline{w}_{u,1}^L$. A high-talented, risk-averse player, independent of his risk-aversion, realizes a higher risk-free first-period salary in the 'shadow of the transfer system' than without the 'shadow of the transfer system'. This proves the claim.

(ii) We claim that the expected second-period salary under a short-term contract in the 'shadow of the transfer system' is lower than the respective salary without the 'shadow of the transfer system' for both, a low and a high-talented player. We derive that $E_0[\underline{w}_{r,2}] < E_0[w_{u,2}]$ and $E_0[\overline{w}_{r,2}] < E_0[w_{u,2}]$ hold if the following inequalities are fulfilled:

$$p\left(\frac{1}{6}E_1[S_2^+] + \frac{1}{3}E_1[L_2^+]\right) + (1-p)\left(\frac{1}{6}E_1[S_2^-] + \frac{1}{3}E_1[L_2^-]\right) > 0,$$

$$p\left(\frac{1}{3}E_1[S_2^+] + \frac{1}{6}E_1[L_2^+]\right) + (1-p)\left(\frac{1}{3}E_1[S_2^-] + \frac{1}{6}E_1[L_2^-]\right) > 0.$$

This proves the claim, since all terms are positive.

Proof of Proposition 2

We claim that both a low- and a high-talented, risk-averse player benefits from the 'shadow of the transfer system'. In order to prove the claim, we show that total expected utility of each type of risk-averse player is higher under a short-term contract in the 'shadow of the transfer system' than under a short-term contract without the 'shadow of the transfer system'. Formally, we show that $E_0[\underline{u}_r^P] > E_0[\underline{u}_u^P]$ and $E_0[\overline{u}_r^P] > E_0[\overline{u}_u^P]$ for all $\tau > 0$.

(i) We compute for a low-talented player:

$$E_0[\underline{u}_r^P] - E_0[\underline{u}_u^P] = 0 \Leftrightarrow \tau = 0,$$
$$\frac{\partial(E_0[\underline{u}_r^P] - E_0[\underline{u}_u^P])}{\partial\tau} = \frac{1}{54}(1-p)p(2s^2(13-8p) + 4sl(11-p) + l^2(11+20p)).$$

We derive $\frac{\partial(E_0[\underline{u}_r^P] - E_0[\underline{u}_u^P])}{\partial\tau} > 0, \forall p \in (0, 1/2]$ and thus if $\tau > 0$, then $E_0[\underline{u}_r^P] > E_0[\underline{u}_u^P]$.

(ii) We compute for a high-talented player:

$$E_0[\overline{u}_r^P] - E_0[\overline{u}_u^P] = 0 \Leftrightarrow \tau = 0,$$
$$\frac{\partial(E_0[\overline{u}_r^P] - E_0[\overline{u}_u^P])}{\partial\tau} = \frac{1}{54}(1-p)p(s^2(31-20p) + 4sl(10+p) + 2l^2(5+8p)).$$

We derive $\frac{\partial(E_0[\overline{u}_r^P] - E_0[\overline{u}_u^P])}{\partial\tau} > 0, \forall p \in (1/2, 1)$ and thus if $\tau > 0$, then $E_0[\overline{u}_r^P] > E_0[\overline{u}_u^P]$. For a high-talented player must additionally hold $\tau < \widetilde{\tau}(p, s, l)$, since in Corollary 1 we have restricted the risk-aversion of a high-talented player in order to guarantee that the player signs a contract with club L in $t = 0$. This proves the claim.

Derivation of the player's and club L's total expected utility in $t = 0$

This section of the appendix contains the derivation of the player's and club L's total expected utility for the case that the player has signed a short-term contract with club L in $t = 0$.

(i) If the player's productivity has increased during period 1 (which happens with probability p), we know by Eq. 1 that each type of player will achieve a higher expected second-period productivity at his initial club L compared with the other club S. In $t = 1$, club S will not place any offer and the player will therefore stay at club L. Without a competing offer from club S, the player will stay at club L in $t = 1$ and the player's reservation wage falls to zero. Similar to Sect. 3.1, the player's second-period salary is now determined by the negotiations only between club L and the player via Nash bargaining:

$$\overline{w}_{r,2}^{L+} = \arg\max_{\overline{w}_{r,2}^{L+}} (E_1[L_2^+] - \overline{w}_{r,2}^{L+} - 0)(\overline{w}_{r,2}^{L+} - 0) = \frac{1}{2} E_1[L_2^+].$$

Club L then expects a second-period profit of $E_1[\pi_{r,2}^{L+}] = E_1[L_2^+] - \overline{w}_{r,2}^{L+} = \frac{1}{2} E_1[L_2^+]$ and club S will earn $E_1[\pi_{r,2}^{S+}] = 0$.

(ii) If the player's productivity has decreased during period 1 (which happens with probability $(1-p)$), we know by Eq. 1 that each type of player will achieve a higher expected second-period productivity at club S compared with club L. According to the Coase theorem the player will be transferred from club L to club S. Similar to Sect. 3.1 the following lemma determines each party's contribution to the player's transfer from club L to club S in $t = 1$:

Lemma 4 The Shapley values determine the outcome of the cooperative bargaining game as follows: $\frac{1}{3} E_1[S_2^-] + \frac{1}{6} E_1[L_2^-]$ (player), $\frac{1}{3}(E_1[S_2^-] - E_1[L_2^-])$ (club S) and $\frac{1}{3} E_1[S_2^-] + \frac{1}{6} E_1[L_2^-]$ (club L).

Proof Analogous to Lemma 1. □

Thus, the player will receive at club S a second-period salary of

$$\overline{w}_{r,2}^{S-} = \frac{1}{3} E_1[S_2^-] + \frac{1}{6} E_1[L_2^-].$$

Club L receives as a transfer fee T^L and realizes an expected second-period profit of $E_1[\pi_{r,2}^{L-}] = \frac{1}{3} E_1[S_2^-] + \frac{1}{6} E_1[L_2^-] = T^L$. Club S similarly obtains its Shapley value and realizes an expected second-period profit of $E_1[\pi_{r,2}^{S-}] = \frac{1}{3}(E_1[S_2^-] - E_1[L_2^-])$.

Analogous to Sect. 3.1, in $t = 0$, club L's total expected utility, denoted $E_0[u_r^L]$, is given by

$$E_0[u_r^L] = E_0[\pi_{r,1}^L] + pE_1[\pi_{r,2}^{L+}] + (1-p)E_1[\pi_{r,2}^{L-}],$$

with an expected first-period profit of $E_0[\pi_{r,1}^L] = E_0[L_1] - \overline{w}_{r,1}^L$.

In $t = 0$, the player's total expected utility, denoted $E_0[\overline{u}_r^P]$, is given by

$$E_0[\overline{u}_r^P] = \overline{w}_{r,1}^L + E[\overline{w}_{r,2}] - \frac{1}{2}\tau V[\overline{w}_{r,2}],$$

where the expected second-period salary $E_0[\overline{w}_{r,2}]$ and the variance $V[\overline{w}_{r,2}]$ of the second-period salary are given by

$$E_0[\overline{w}_{r,2}] = p\overline{w}_{r,2}^{L+} + (1-p)\overline{w}_{r,2}^{S-},$$
$$V[\overline{w}_{r,2}] = p(\overline{w}_{r,2}^{L+})^2 + (1-p)(\overline{w}_{r,2}^{S-})^2 - (E[\overline{w}_{r,2}])^2.$$

Similar to Sect. 3.1, the threat points of the simultaneous negotiations in Nash bargaining fashion in $t = 0$ are derived as follows: with probability p each type of player will achieve a higher expected second-period productivity at the large-market club L. In case that the player has signed a short-term contract with club S in $t = 0$ he will transfer to club L in $t = 1$. Club L will then receive its contribution to the coalition determined by its Shapley value. Thus club L's threat point, denoted d^L, is given by $p\frac{1}{3}(E_1[L_2^+] - E_1[S_2^+])$. The player's threat point, denoted $\underline{d}^P$, is determined by the player's total expected utility $E_0[\underline{u}_r^P]$ that he could achieve by playing at the other club S.

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