

Norbäck, Pehr-Johan; Olsson, Martin; Persson, Lars

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IFN Working Paper No. 1126, 2016

# **The Emergence of a Market for Football Stars: Talent Development and Competitive Balance in European Football**

Pehr-Johan Norbäck, Martin Olsson and Lars  
Persson

# The Emergence of a Market for Football Stars: Talent Development and Competitive Balance in European Football \*

Pehr-Johan Norbäck

Research Institute of Industrial Economics

Martin Olsson

Research Institute of Industrial Economics and IFAU

Lars Persson

Research Institute of Industrial Economics and CEPR

## Abstract

We analyze how the Bosman ruling affected the market for star players and talent development in the European football market. We develop a model with sports competition and endogenous ownership of star players in which we show how the stiffer bidding competition over star players after the Bosman ruling has spurred talent development foremost in EU nations lacking established top clubs. This has a positive impact on their national teams' performance. However, the stiffer bidding competition has also led to less competition in the Champions League, as non-established clubs prefer to sell their star players instead of challenging the top clubs. We provide empirical evidence consistent with these findings.

*Keywords:* Sports industry, star players, Champions League, Bosman ruling  
*JEL classification:* J44, L50, L83

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\*The authors can be reached at [pehr-johan.norback@ifn.se](mailto:pehr-johan.norback@ifn.se), [martin.olsson@ifn.se](mailto:martin.olsson@ifn.se) and [lars.persson@ifn.se](mailto:lars.persson@ifn.se). We are grateful to the Marianne and Marcus Wallenberg Foundation and Tom Hedelius' and Jan Wallander's Research Foundation for financial support. We have greatly benefitted from comments from Magnus Henrekson and Henrik Horn.

# 1 Introduction

By banning restrictions on the number of players from other EU countries on football teams in the EU and by allowing players to move freely at the end of a contract, the 1995 Bosman ruling inaugurated a market for buying and selling football stars.<sup>1</sup> This integrated market and the expansion of the UEFA Champions League, which generates substantial revenues for successful clubs, has created stiff competition for star players among top European clubs.<sup>2</sup>

In this paper, we analyze how the emergence of a market for football stars affects competitive balance and talent development in European football. To this end, we first develop a theoretical model with the following characteristics: There is a Champions League tournament with incumbent top clubs in possession of star players (e.g., Barcelona, Bayern Munich, Juventus, Manchester United and Real Madrid)<sup>3</sup> from large countries (e.g., England, Germany, Italy and Spain). There are several outside clubs (e.g., RSC Anderlecht, FC Copenhagen, or Malmö FF) from smaller countries (e.g., Belgium, Denmark and Sweden), including a nursery football club that has the skill to discover and develop talents into star players. In Stage 1, clubs exert effort to discover a star player. If a club discovers a star, it can offer the player a contract. In Stage 2, the nursery club, if it has discovered a star player, decides whether to retain the star and challenge the incumbent clubs in the Champions League or sell the star to one of the incumbent clubs. The nursery club enters if no established club submits a bid higher than the nursery club's reservation price, which is the value of entry into the Champions League. However, if it enters, the nursery club, needs to invest in facilities, marketing and complementary players to be able to compete with the incumbent clubs. In Stage 3, commercial market competition takes place whereby football clubs maximize their commercial value by selling tickets, broadcasting rights, advertising and club products. In Stage 4, the Champions League tournament is played; the club with the star player will have a larger expected winning percentage.<sup>4</sup>

Our analysis indicates that the emergence of a European market for football stars has created a vertically organized market with few incumbent top clubs and nursery clubs acting as suppliers

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<sup>1</sup>Ichniowski and Preston (2014) report that approximately 35% of the players in the top five European leagues were foreign in 2010, compared to approximately 15% just before the Bosman ruling. The top five leagues are found in England, France, Germany, Italy and Spain.

<sup>2</sup>The UEFA Champions League is a European football cup for the champions in each country (runners up are allowed for the top leagues), and the tournament is covered on television worldwide with hundreds of millions of viewers. In the 2013/2014 tournament, 32 clubs shared €904.6 million in prize money.

<sup>3</sup>See, for instance, Richelieu, Lopez and Desbordes (2009). The advantage that these clubs have typical originates in their large local fan base. However, in the contemporary internationalized European football market, their advantage lies not only in the possession of star players but also in their brand names, which have created an international fan base. Clubs seeking to challenge these top clubs thus need to invest in star players and marketing to overcome their fan disadvantage. For instance, the "newcomers" Manchester City and Paris Saint Germain have invested heavily in both star players and marketing, for instance by playing friendly games in Asia, to attract new supporters.

<sup>4</sup>The theoretical model builds on the model developed in Norbäck and Persson (2014) to understand how the entry-sale pattern of entrepreneurs depends on the intensity of product market competition.

of star players. The Bosman ruling, higher prize sums and the expansion of the Champions League are all important drivers of this development. The basic mechanism is that the relative reward for nursery clubs from selling talent versus challenging incumbents with that talent has increased.

We show that the fear that the Bosman ruling would dampen nursery clubs' incentives to develop players, as players were allowed to move freely in the EU after completing a contract, does not appear well founded. The reason is that EU clubs were also allowed to have more players from other EU states on their squads. Among incumbent clubs, this leads to an increased willingness to pay for star players to preempt rival clubs from acquiring them. If the increased total willingness to pay for star players is sufficiently large, then the nursery clubs, despite obtaining a smaller share of the total sales revenue from a weaker bargaining position vis-a-vis players, will receive larger proceeds. This has created a vertically organized market with a few incumbent clubs and many outside clubs, which decreases the competitive balance in the Champions League. However, the stiffer bidding competition among incumbent clubs tends to benefit talent development most in countries where such clubs are not present. The reason is that nursery clubs in these countries now can sell their talented players at much higher prices. This has a positive effect on the competitive balance at the national team level.

We provide empirical support for our model. We first show that the Champions League has become less competitively balanced since the Bosman ruling.<sup>5</sup> In the period before the 1995 Bosman ruling, approximately 30% of the clubs that reached the round of 16 in one year also did so in the next year. Since 1995, that share has increased and is currently approximately 50%. In addition, we show that the competitive balance among EU15 countries in World Cup tournaments has increased since the Bosman ruling. Here, we focus on match performance instead of the ranking of countries, such as the UEFA and ELO rankings, to ensure that all teams are playing at their absolute top level.<sup>6</sup> Our analysis shows that the performance gap between the top and the bottom nations in the EU15 that was present before the Bosman ruling disappears thereafter.

There are several studies on how the Bosman ruling has affected the European football market through the abolition of transfer fees after the contract period and on the influx of foreign players into the domestic leagues. Ericson (2000) shows that abolition of transfer fees and ownership rights creates a free rider problem in talent development that can force smaller clubs to sell

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<sup>5</sup>Note that the Champions League replaced the European Cup in 1992, and a group stage was also added. Increased concentration in the round of 16 in the Champions League is also reported by Schokkaert and Swinnen (2016).

<sup>6</sup>In addition, the UEFA and ELO rankings depend on all matches, irrespective of the opponent. This means that when comparing top and bottom nations in EU15, the rankings will partly depend on the number of matches played within the group of top/bottom nations. Moreover, when the UEFA ranking is calculated, a friendly match is given a lower point total but an equal weight as a competitive match. This means that the UEFA ranking depends partly on a country's propensity to play friendly matches; a country that plays numerous friendlies, instead of competitive matches, will, all else being equal, obtain a lower rank. As we analyze match performance in World Cup tournaments, we avoid these issues.

their talented players before the end of the contract, which will damage player quality in smaller markets. Thus, transfer fees are needed to cover the training costs and incentivize small-market clubs to develop talent. However, Terviö (2006) argues that transfer fees to compensate smaller clubs for their training costs is an insufficient argument - the costs are too small relative to the fees. Instead, Terviö (2006) shows that transfer fees are needed to efficiently allocate competitive playing time between players of different ability. Without transfer fees a club only obtains revenue from a player's current output because if the player turns out to be better than expected, he will leave. This will reduce the incentive to hire young talent. Other studies have focused on how the Bosman ruling has affected the competitive balance via the migration of players. Berlinschi and Swinnen (2013) find that the migration of football players can improve the performance of the national team, particularly for countries with lower-quality clubs. However, Binder and Findlay (2012) find that the influx of foreign players into European leagues after the Bosman ruling has strengthened the top clubs in the Champions League while the ELO rankings for both low- and high-ranked European nations have decreased in the long run. We contribute to this literature by showing that stiffer bidding competition, and not just transfer fees and migration per se, are important for understanding how the Bosman ruling affected talent development for young players and the competitive balance in European football. In particular, we show that the Bosman ruling created such stiff bidding competition over talent that nursery clubs, despite receiving a smaller share of the total sales revenue, can receive larger proceeds from talent development than in the absence of the Bosman ruling. We also provide empirical evidence consistent with the Bosman ruling not having hampered talent development in nursery clubs in small EU countries: the performance gap between the top and the bottom EU15 nations in the World Cup that was present before the Bosman ruling disappeared thereafter.

Our paper also contributes to the literature on the economics of the European "promotion and relegation" organizational form of leagues and the development of the Champions League.<sup>7</sup> Noll (2003) examines the incentive structure and efficiency of different organizational structures of leagues. Noll concludes that the European system of promotion and relegation is superior to the closed structure of North American leagues. The reason is that it distributes teams across locations in a manner that delivers greater consumer benefits than does a system of fixed memberships and by ensuring stable competition among teams in a city and among leagues in a nation. However, Buzzacchi, Szymanski, and Valletti (2003) compare the European open football leagues, which permit entry by the process of promotion and relegation, to the closed leagues of North America, which have no automatic right of entry. They find that the open leagues are less balanced, dynamically, than closed leagues. Hoehn and Szymanski (1999) examine the effect of whether teams play in both national and international leagues (Champions League) and argue in favor of the creation of a European Superleague and against teams playing both

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<sup>7</sup>The European Commission (2007) describes the "promotion and relegation principle" as one of the key features of the European model of sport. It is the principle whereby the worst-performing teams at a given level of league are demoted at the end of the season to play in the immediately junior league and are replaced by the best performing teams from the latter league.

in the Superleague and in national leagues. Szymanski (2003) examines a model in which the outcome may be either too little or too much competitive balance. Implications for European football in general and the Champions League in particular are then discussed. Vrooman (2007) examines the effects of the development of the Champions League and documents an intra-league and inter-league polarization of talent and wealth and proposes a Super League based on the National Football League. Peeters (2011) finds that the Champions League has had a negative effect on the competitive balance in European leagues. Schokkaert and Swinnen (2016) compare the competitive balance in the Champions League and in the European Cup and document a decreased competitive balance in lower rounds of the Champions League but an increased competitive balance in higher rounds. We extend these findings by identifying incumbency (sunk costs) as a driver of clubs' success in league competition and argue that incumbency advantages have become more important in the more integrated European football market. This in turn implies that the goals of competitive championship balance in European football is less likely to be realized in the future.

## 2 The model

Consider the following *stylized* model of the Champions League. There are  $C$  profit-maximizing clubs in Europe that compete for  $m$  seats in the Champions League, where  $m < C$ .<sup>8</sup> Clubs are of two types: There are  $I < m$  *incumbent* football clubs (e.g., Barcelona, Bayern Munich, Juventus and Manchester United). Incumbent clubs have reached their position over time, for example, by having high local demand or support from wealthy owners, and have been able to invest heavily in players. These player assets are labelled  $k_0$ , and the investment cost  $F$  associated with generating these player assets is sunk. For simplicity, we assume that the possession of these  $k_0$  assets implies that incumbent clubs reach the Champions League with certainty.<sup>9</sup>

The remaining  $C - I > 0$  clubs are "outside" clubs (e.g., RSC Anderlecht, FC Copenhagen, or Malmö FF). Outside clubs have inferior player assets,  $\kappa < k_0$ , and have to qualify in competition with other outside clubs for the  $m - I > 0$  remaining seats in the Champions League. We assume that, at the outset, the investment cost  $F$  is sufficiently high that none of the outside clubs will find it profitable to upgrade assets from  $\kappa$  to  $k_0$  to reach the Champions League with certainty.  $C - I > m - I > 0$  outside clubs will not qualify.

One of the  $C - I$  outside clubs is a *nursery* club (n). The nursery club is endowed with the skill - or potential - to discover and develop talented players that can become star players, i.e., players of exceptional quality. The nursery club can challenge the incumbent clubs in the Champions League, provided that it succeeds in developing a talented player into a star player. However, to seriously challenge the incumbent clubs in the Champions League, the nursery club

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<sup>8</sup>In our model, entering the Champions League is equivalent to reaching the group stage. Presently, there are  $m = 32$  seats in the group stage.)

<sup>9</sup>With possession of  $k_0$ , they reach the top position in their respective national leagues, which grants them a seat in the Champions League.

also needs to upgrade its player squad quality from  $\kappa$  to  $k_0$  at the fixed cost  $F$ .

The details are as follows:

- In Stage 1, the nursery club makes a costly investment in talent scouting and development, which increases the probability of finding and delivering a star player. If successful, the nursery club and the potential star player signs an initial contract at a low wage. Nature then draws the talented player's true quality. After the quality of the talented player is revealed, the contract is renegotiated; the player is given a fixed wage cost if the contract is prolonged. In short, the new contract balances the star player's option to try his luck as a free agent against insurance in the event of injury (in which case his career ends). If signing the renewed contract, the star player must play for the nursery club in the national league and, later, in the Champions League in Stage 4, unless the player is sold to an incumbent club in Stage 2. The national league, which we do not model in detail, also serves as a verification device for the star player's quality, as incumbent clubs can observe the player in a competitive environment. To keep the main analysis tractable, we initially abstract from talent investments by incumbent clubs, an assumption that is relaxed in Section 3.3.
- In Stage 2, provided that it has succeeded in delivering and contracting a star player, the nursery club first makes a choice between retaining the star player and selling him (by means of a first-price perfect information auction), where the  $I$  incumbent clubs are the potential buyers. If the nursery club sells the star player, it will abstain from upgrading its player assets  $\kappa$  and will need to go through uncertain qualifying rounds to reach the Champions League. If the nursery club declines the incumbent clubs' bids on the star player and upgrades its player squad quality to  $k_0$ , it will qualify for the tournament with certainty. Recall that we have assumed that incumbent clubs reach the Champions League with certainty.
- In Stage 3, whether the clubs have succeeded or not to reach the Champions League, the clubs compete in the commercial market, selling tickets, broadcasting rights, and advertising and marketing products.
- In Stage 4, the Champions League is played out, where clubs win matches in proportion to their share of total player assets.

We solve the game via backward induction.

## 2.1 Stage 4: Champions League is played out

We begin with the match interaction in the Champions League. Suppose that the nursery club ( $n$ ) has succeeded in finding a star player in Stage 1. The *set of possible owners of the star player* in the tournament is then  $\mathcal{L} = \mathcal{I} \times n$ , where  $\mathcal{I} = \{1, 2, \dots, i, \dots, I\}$  is the set of the incumbent clubs



and  $n$  the nursery club. Let  $l \in \mathcal{L}$  denote the identity of the club with the star player  $k$  (given from the acquisition game in period 2).

As incumbent football clubs are symmetric, there are only two types of ownership of the star player; *nursery* ownership ( $l = n$ ) and *incumbent* ownership ( $l = i$ ). In addition, we have the outcome in which the nursery club fails to find the star player ( $l = 0$ ). We then have *four* types of clubs to track,  $h = \{E, A, NA, O\}$ , i.e., the "entering" nursery club ( $E$ ), an *acquiring incumbent club* ( $A$ ), a *non-acquiring incumbent club* ( $NA$ ) and, finally, an *outside club* ( $O$ ), which succeeded in uncertain qualifying rounds.

The outcome of the Champions League in terms of the winning percentage of matches played is determined from a logit contest success function:<sup>10</sup>

**Assumption 1.** *Let  $k_h(l)$  be the amount of total player assets in possession of a club of type  $h$  in the Champions League when ownership of the star player  $k$  is  $l$ . The winning percentage of matches  $z_h(l)$  of a club of type  $h$  is defined by the logit contest success function:  $z_h(l) = \frac{k_h(l)}{K(l)}$ , where  $K(l) = \sum_h k_h(l)$  is the total amount of club assets.*

We can think of the share of matches won, or the winning percentage,  $z_h(l)$ , as a proxy for the outcome of the Champions League. While not capturing the details of how clubs proceed from the group stages to the ensuing finals, we would argue that Assumption 2.1 captures the outcome of Champions League competition in a reasonable way.<sup>11</sup>

### 2.1.1 Absent star player ( $l = 0$ )

It is convenient to define  $K$  as the amount of player assets, or aggregated player quality, as a benchmark when the nursery club fails to find a star player,

$$K = \underbrace{Ik_0}_{\text{Incumbents' player/assets}} + \underbrace{(m-I)\kappa}_{\text{Outside clubs' player/assets}}, \quad (1)$$

where, again,  $I$  is the number of incumbent clubs in the Champions League and  $m - I$  is the number of outside clubs that reach the tournament through qualifying rounds.

Thus, if the nursery club fails to find a star player ( $l = 0$ ), the share of matches won in the Champions League by a (non-acquiring) incumbent (NA) and an outside club (O) that has qualified are

$$z_{NA}(0) = \frac{k_0}{K} > z_O(0) = \frac{\kappa}{K} > 0, \quad (2)$$

Note that the winning percentage of an incumbent exceeds that of an outside club, as the former has player assets of higher quality,  $k_0 > \kappa$ .

<sup>10</sup>See, Szymanski (2003).

<sup>11</sup>In reality, there is a lottery that allocates the clubs in the group stage (based on ranking) and in later stages of the tournament. Ex ante, the clubs do not know which clubs are assigned to the different groups. All else equal, if the aggregate quality increases, the expected winning percentage for an individual club would decline, which is captured here in reduced form.

### 2.1.2 The nursery club retains the star player ( $l = n$ )

What if the nursery club has succeeded in finding and developing a talent into a star player in Stage 1? Choosing to retain the star player ( $l = n$ ) and upgrading complementary player assets from  $\kappa$  to  $k_0$  in Stage 2, the winning percentage of the entering nursery club (E), the non-acquiring incumbent clubs (NA) and the qualifying outside clubs (O) fulfill the following:

$$z_E(n) = \frac{k+k_0}{K+k+(k_0-\kappa)} > z_{NA}(n) = \frac{k_0}{K+k+(k_0-\kappa)} > z_O(n) = \frac{\kappa}{K+k+(k_0-\kappa)}. \quad (3)$$

Note how  $k + (k_0 - \kappa)$  is the addition of player assets in the Champions League compared with the benchmark  $K$ , arising from the presence of the star player and by upgraded player assets in the nursery club. From possessing the star player, the entering nursery club wins a higher share of its matches than incumbent clubs do. Incumbent clubs win a higher share than outside clubs that have qualified without any star player.

### 2.1.3 The nursery club sells the star player to an incumbent club ( $l = n$ )

What if the nursery club has succeeded in delivering a star player in Stage 1 but sold him to an incumbent in Stage 2 ( $l = i$ )? The winning percentages of the acquiring incumbent (A), the non-acquiring incumbents (NA) and qualifying outside clubs (O) (one of which is the nursery club) are now

$$z_A(i) = \frac{k+k_0}{K+k} > z_{NA}(i) = \frac{k_0}{K+k} > z_O(i) = \frac{\kappa}{K+k} > 0. \quad (4)$$

Note how  $k$  is now the only addition in player assets relative to the benchmark,  $K$ . Hence, the competition between clubs for winning matches is less intense under an incumbent acquisition than when the nursery club goes for the Champions League. To see this, note that when selling the star player, the nursery club cannot upgrade its initial player assets, and total player assets in the tournament are lower under a sale,  $K(i) = K + k < K(n) = K + k + (k_0 - \kappa)$ .

We will assume that incumbent clubs always win a larger share of their matches than qualifying outside clubs do,  $z_{NA}(n) > z_O(0)$ . This holds if outside clubs' initial player quality  $\kappa$  is sufficiently small. Using (2)-(4), it then directly follows that

$$\underbrace{z_A(i) > z_E(n)}_{\text{Possessor of star player}} > \underbrace{z_{NA}(0) > z_{NA}(i) > z_{NA}(n)}_{\text{Incumbent without star player}} > \underbrace{z_O(0) > z_O(i) > z_O(n)}_{\text{Qualifying outside club}} > 0. \quad (5)$$

Possession of the star player gives a club the highest winning percentage. An incumbent with the star player will win a higher share of matches than the nursery club would when in possession of the star player ( $z_A(i) > z_E(n)$ ). This occurs because entry by the nursery club stiffens the competition among clubs (compare the denominator in Equations 3 and 4). Moreover, a non-acquiring incumbent club will win a higher share of its matches when there is no star player present,  $z_{NA}(0) > z_{NA}(l)$ . Moreover, conditional on a star player in the Champions League, the share of matches won by a non-acquiring incumbent is lower when the nursery club has the star

player,  $z_{NA}(i) > z_{NA}(n)$ . Similarly, outside clubs are better off without the star player in the tournament,  $z_O(0) > z_O(l)$ . Their worst-case scenario is that the nursery club is strengthened by the presence of the star player and complementary players,  $z_0(i) > z_0(n)$ .

To introduce the impact of prize sums  $P$  in the Champions League in a simple way, we assume that the amount of prize money earned by each club  $P_h$  is proportional to the share of matches won in the tournament

$$P_h = z_h(l)P, \quad (6)$$

where  $P$  is the *total prize sum* in the Champions League. To simplify further, we assume that no prize money is generated by clubs outside the Champions League.<sup>12</sup>

## 2.2 Stage 3: Commercial competition among clubs

It is straightforward to model strategic interaction among clubs in the product market by defining a strategic variable,  $x_h$ , representing the sales of tickets, broadcasting rights, advertising or merchandise for a club of type  $h$  and then deriving a Nash equilibrium in quantities or prices in the usual way. We show this in the Appendix A.5, where we also provide a specific example using a differentiated Cournot model. In that model, as in many other oligopoly models, the Nash equilibrium in the product market will - ultimately - depend on how successful fans, media and the market believe that clubs will be in the competition, in our case, in the Champions League. For instance, in the Cournot model in the Appendix A.5.1, a club that has bought the star player will be expected to win a larger share of its matches, which will increase the demand for its commercial products and TV broadcasts. From this "demand effect", the club will be able to commit to larger sales, forcing rival clubs to reduce their sales, increasing the product market profits of the possessing club and reducing the product market profits of its rivals.

For ease of exposition, however, we will simply assume that the revenues from the commercial interaction  $R_h$  are a linear function of a club's winning percentage in the tournament ( $z_h(l)$ ) given in (5)

$$R_h = z_h(l)R \quad (7)$$

where  $R$  is the total amount of revenues generated in the product market. Note that the revenues from the product market increase if the club is expected to be more successful in the competition, while it decreases if the club is expected to be less successful. For simplicity, we assume that no revenues from the product market are generated by clubs outside the Champions League.

## 2.3 Stage 2: Selling or retaining the star player?

Suppose now that the nursery club has developed and contracted a star player in Stage 1. Then, in Stage 2, there is first an acquisition game in which the nursery club chooses between retaining or selling the star player,  $k$ .

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<sup>12</sup>The results will not change as long as the main source of prize money or other revenues stems from the Champions League.

### 2.3.1 Qualifying for the Champions League

If the nursery club sells the star player, then it will not find it profitable to upgrade its players from  $\kappa$  to  $k_0$ .<sup>13</sup> The nursery club's way into Champions League is then through uncertain qualifying rounds, where the probability of participating in the tournament is as follows:

$$\lambda_O = \frac{m - I}{C - I} \in (0, 1), \quad (8)$$

where, again,  $m$  is the number of seats in the Champions League,  $I$  is the number of incumbent clubs and  $C$  is the total number of clubs that can potentially enter the tournament, where  $C - I > m - I > 0$  implies a risk of being outside the Champions League.

What if the nursery club does not sell the star player,  $k$ ? Provided that the nursery club invests in complementary players to  $k_0$ , it will pass the qualifying rounds with certainty, assuming that the quality of the star player is sufficiently high, which we capture as follows.

**Assumption 2.** (i) Let  $\lambda_E(n) = 1$  for  $k = k^{\min} \geq 0$ . (ii) Star player quality fulfills  $k \geq k^{\min}$ .

Given the qualification process to the Champions League, we can now turn to the nursery club's choice between retaining or selling the star player.

### 2.3.2 The auction

If the nursery club decides to sell the star player, the selling process is depicted as an auction in which the  $I$  incumbent clubs simultaneously post bids, and the nursery club then either accepts or rejects these bids. Each established club announces a bid,  $b_i$ , for the star player.  $b = (b_1, \dots, b_m) \in R^m$  is the vector of these bids. Following the announcement of  $b$ , the star player may be sold to one of the incumbent clubs at the bid price or remain in the possession of the nursery club  $n$ . If the nursery club rejects these bids, it will enter the Champions League. If more than one bid is accepted, the bidder with the highest bid obtains the star player. If there is more than one club with such a bid, each club obtains the star player with equal probability. The acquisition is solved for Nash equilibria in undominated pure strategies. There is a minimum amount  $\varepsilon$  chosen such that all inequalities are preserved if  $\varepsilon$  is added or subtracted. The acquisition price is denoted  $S$ .

There are three different valuations of the star player:

- $v_n$  in (9) is the reservation price of the nursery club.<sup>14</sup> It is the value for the nursery club of retaining the star player and entering the Champions League with certainty, relative

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<sup>13</sup>Intuitively, the nursery club comes from a league without direct access to the Champions League. Therefore, the increase in the probability of qualifying with assets  $k_0$  (rather than assets  $\kappa$ ) is not sufficient to cover the fixed cost  $F$ .

<sup>14</sup>Note that the valuation of the nursery club coincides with that of an outside club buying the star player. For simplicity, we assume that outside clubs are not part of the auction.

to selling the star player and enter uncertain qualifying rounds to reach the tournament. Using (6) and (7), we obtain

$$v_n = \underbrace{[z_E(n) - \lambda_O z_O(i)]}_{(+)} \times [R + P] - F, \quad (9)$$

where  $F$  is the cost of upgrading complementary players from  $\kappa$  to  $k_0$ .<sup>15</sup> From (3), (4) and (8),  $z_E(n) - \lambda_O z_O(i) > 0$  represents the (expected) increase in the share of matches won with the star player, relative to share of matches won without the star player - adjusted for uncertain entry through qualifying. Hence,  $[z_E(n) - \lambda_O z_O(i)] \times [R + P]$  represents the expected increase in revenues from retaining the star player, where  $R + P$  is the sum of total commercial value and prize money in the Champions League.

- $v_{ie}$  in (10) is the entry-detering value of obtaining the star player for an incumbent club, when otherwise the nursery would retain the star player and enter the Champions League.

$$v_{ie} = \underbrace{[z_A(i) - z_{NA}(n)]}_{(+)} \times [R + P] - T, \quad (10)$$

where  $T$  is a transaction cost incurred by the incumbent club when buying the star player. From (3) and (4),  $[z_A(i) - z_{NA}(n)] \times [R + P]$  is the expected increase in revenues when buying the star player, relative to facing competition from the nursery club in possession of the star player. An incumbent club's willingness to pay for the star player stems from the increase in the share of games won with the star player,  $z_A(i) - z_{NA}(n) > 0$ , allowing it to take a larger share of prize money in the Champions League and the commercial revenues,  $R + P$ .

- $v_{ii}$  in (11) is the preemptive value of obtaining the star player for an incumbent club, when otherwise a rival incumbent club would obtain him. This valuation is similar to the entry-detering value, the difference being that the increase in the share of matches won with the star player is derived from the alternative being that a rival incumbent club would otherwise seize him.

$$v_{ii} = \underbrace{[z_A(i) - z_{NA}(i)]}_{(+)} \times [R + P] - T. \quad (11)$$

Three remarks are useful for solving for the equilibrium business strategy of the nursery club.

**Remark 1: The contract with the star player** Note that the star player has a contract with the nursery club at the beginning of Stage 2. The contract between the nursery club and the star player does not affect the sale decision. As we will show in the next section, the reason

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<sup>15</sup>Recall that we have assumed that the nursery club makes no revenues if it does not qualify for the Champions League.

is that the contract involves fixed payments that are pre-determined in Stage 1 and are the same regardless of the club's commercialization strategy. Note also that the payments to the player can be spread out over the different stages: for instance, if a sale occurs, some of these payments may be taken over by the buying incumbent.

**Remark 2: Ranking incumbents' valuations** Second, note that an incumbent's entry-detering valuation  $v_{ie}$  must exceed its preemptive valuation  $v_{ii}$ ,

$$v_{ie} > v_{ii}. \quad (12)$$

because  $z_{NA}(n) < z_A(i)$  from (5). Intuitively, incumbent clubs are more willing to pay for the star player when the alternative is that the star player stays with the nursery club than when the star is acquired by a rival incumbent. The reason is the stronger competition under entry by the nursery club arising from the latter club's upgrading of complementary players from  $\kappa$  to  $k_0$ .<sup>16</sup>

**Remark 3: Incumbents' net valuations** It is finally useful to define incumbents' net valuations, i.e., the difference in their valuations of the star player  $v_{ii}$  and the nursery club's reservation price  $v_n$ . Using (9), (10) and (11), we have

$$v_{il} - v_n = \underbrace{\left\{ \underbrace{[z_A(i) - z_{NA}(l)]}_{(+)} - \underbrace{[z_E(n) - \lambda_O z_O(i)]}_{(+)} \right\}}_{(-)} \times [R + P] + [F - T]. \quad (13)$$

In Appendix A.2, we show that the first (large) bracketed term in (13) is negative. That is, the nursery club obtains a larger increase in its winning percentage from retaining the star player than an incumbent club obtains from buying him:  $z_A(i) - z_{NA}(l) < z_E(n) - \lambda_O z_O(i)$ . From (5), it follows that the reason for this must be that the nursery club faces a worse situation without the star player than the incumbent club does without him,  $z_{NA}(l) > \lambda_O(i)z_O(i)$ . While an incumbent club from a major league has a direct seat in the Champions League, the nursery club coming from a minor league faces uncertain qualification rounds,  $\lambda_O \in (0, 1)$ . Moreover, because the nursery club's initial player assets are of lower quality than those of an incumbent,  $\kappa < k_0$ , the nursery club will perform worse without the star player in the Champions League,  $z_O(i) < z_{NA}(l)$ . The precarious situation without the star player creates a higher gross value of the star player for the nursery club.

### 2.3.3 Why nursery clubs sell their best star player

We will now examine how the business strategy of the nursery club – upgrading initial player assets to complement the star player in the Champions League versus selling the star player and

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<sup>16</sup>This result is not crucial for our results, although it makes the exposition simpler.

gambling for entry into the tournament with weaker players – is related to the quality of the star player,  $k$ . One might think that the nursery club would always choose to go for the Champions League with the star player. In this section, however, we will show that a higher quality  $k$  of a star player will induce the nursery club to pursue a sale. Moreover, a higher quality of the star player will induce fierce bidding competition among incumbent clubs, making a sale potentially very lucrative.

Formally, let  $k^{ED}$  be the quality level at which the entry-detering motive for an incumbent acquisition of the star player just matches the nursery club's reservation price,  $v_{in} = v_n$ . Let  $k^{PE}$  be the quality level at which the preemptive motive for an incumbent acquisition is equal to the nursery club's reservation price,  $v_{in} = v_n$ .

We then have the following proposition:

**Proposition 1** *The nursery club will (i) go for Champions League if the quality of the star player is sufficiently low,  $k \in (k^{\min}, k^{ED})$ , (ii) sell the star player at sales price  $S^* = v_n$  and attempt to reach Champions League through qualifying rounds if the quality of the player is intermediate,  $k \in [k^{ED}, k^{PE})$ , and (iii) sell the star player at sales price  $S^* = v_{ii}$  and attempt to reach the Champions League through qualifying rounds if the quality of the player is sufficiently high,  $k \in [k^{PE}, k^{\max})$ .*

Let us explore an increase in the quality of the star player. From Definition 2.1 and (9), the reservation price of the nursery club  $v_n$  must be increasing in the quality of the star player:

$$v'_{n,k} = \left[ \frac{dz_E(n)}{dk} - \lambda_O \frac{dz_O(i)}{dk} \right] \times [R + P] > 0, \quad (14)$$

$\begin{matrix} (+) & & (-) \end{matrix}$

where we use  $v'_k$  as the notation for the derivative,  $\frac{dv}{dk}$ . Intuitively, the entry value for the nursery club is increasing in  $k$ , as a better star player enables the club to win a larger share of its matches,  $\frac{dz_E(n)}{dk} > 0$ . However, the entry value is also decreasing in  $k$  because if the nursery club sells the star player to an incumbent club, a better star player makes it more difficult for the nursery club to win matches given successful qualification for the Champions League,  $\frac{dz_O(i)}{dk} < 0$ .

How do then incumbents react? From (10) and (11), we have

$$v'_{il,k} = \left[ \frac{dz_A(i)}{dk} - \frac{dz_{NA}(l)}{dk} \right] \times [R + P] > 0. \quad (15)$$

$\begin{matrix} (+) & & (-) \end{matrix}$

Similarly, incumbents' willingness to pay for the star player is driven by the difference in performance when having the star player and not having the star player. Incumbents are willing to pay more for higher player quality because when in possession of the player, they win more matches ( $\frac{dz_A(i)}{dk} > 0$ ). However, they are also willing to pay more for a star player to avoid facing that player in a rival club; recall that the incumbent's winning percentage declines with star player quality if he is playing for the nursery club or a rival incumbent club ( $\frac{dz_{NA}(l)}{dk} < 0$ ).

Which of these valuations increase the most? Using (14) and (15) and rearranging,

$$v'_{il,k} - v'_{n,k} = \underbrace{\left\{ \underbrace{\left[ \frac{dz_A(i)}{dk} - \frac{dz_E(n)}{dk} \right]}_{(-)} - \underbrace{\left[ \frac{dz_{NA}(l)}{dk} - \lambda_O \frac{dz_O(i)}{dk} \right]}_{(-)} \right\}}_{(+)} \times [R + P] > 0, \quad (16)$$

whith proofs relegated to Appendix A.1.

Thus, the entry-detering valuation,  $v_{in}$ , and the preemptive valuation of an incumbent club,  $v_{ii}$ , increases more than the nursery club's value of entry,  $v_n$ , when the quality of the star player increases. Inspecting (16), it is clear that the reason is that the winning percentage in the Champions League for a non-acquiring incumbent club deteriorates faster in star player quality than does the nursery's expected winning percentage when being an outside club (i.e., when selling the star player), i.e.,  $\frac{dz_{NA}(n)}{dk} < \lambda_O \frac{dz_O(i)}{dk} < 0$ . Put simply, due to its incumbent position, a non-acquiring incumbent club stands to loose more from meeting a better star player in a rival club: this is the reason that incumbents' valuations increase more swiftly in star player quality than does the nursery club's reservation price,  $v'_{in,k} > v'_{n,k}$ .

It is now straightforward to derive Proposition 1. Figure 1, Panel (i) depicts the nursery club's reservation price,  $v_n$ , the entry-detering valuation of an incumbent club,  $v_{in}$ , and the preemptive valuation of an incumbent club,  $v_{ii}$ , all as function of star player quality,  $k$ . These are all strictly concave functions of  $k$  from Definition 2.1. Suppose that the entry cost  $F$  in (13) is not too high. We then know that the entry value must exceed incumbents' entry-detering valuation at lower star player quality,  $v_n > v_{in} > v_{ii}$ . Thus, entry into the Champions League for the nursery club ( $l^* = n$ ) is chosen in the region  $k \in (k^{\min}, k^{ED})$ , as depicted in panels (i) and (ii) in Figure 1. Because the entry-detering valuation will increase more strongly than the nursery club's reservation price,  $v'_{in,k} - v'_{n,k} > 0$ , an *entry-detering acquisition* by an incumbent at acquisition price  $S^* = v_e$  must occur at  $k = k^{ED}$ , as shown in Panel (ii) in Figure 1. Other incumbent clubs will not preempt a rival acquisition of the star player in the region  $k \in [k^{ED}, k^{PE})$ , as the preemptive value will be lower than the reservation price,  $v_{ii} - v_n < 0$ .<sup>17</sup> From (5), when the quality of the star player is not too high, non-acquiring incumbent clubs predominantly benefit from obtaining a higher winning percentage under a rival acquisition,  $z_{NA}(i) > z_{NA}(e)$  (giving weak incentives to challenge an acquisition undertaken by a rival). Thus, as shown in Panel (ii) in Figure 1, the nursery club sells the star player ( $l^* = i$ ) at price  $S^* = v_n$ .

From (16), we also know that the preemptive valuation increases more strongly than the nursery club's reservation price,  $v'_{ii,k} - v'_{n,k} > 0$ . As shown in Panel (i) in Figure 1, when increasing star player quality into the region  $k \in (k^{PE}, k^{\max})$ , the incumbent clubs' preemptive valuation then becomes strictly higher than the nursery club's reservation price,  $v_{ii} > v_e$ . This

<sup>17</sup>From (12),  $v_{ie} > v_n$ . As shown in Figure 1, there must then exit a region near  $k^{ED}$  where  $v_{ii} < v_n$ .



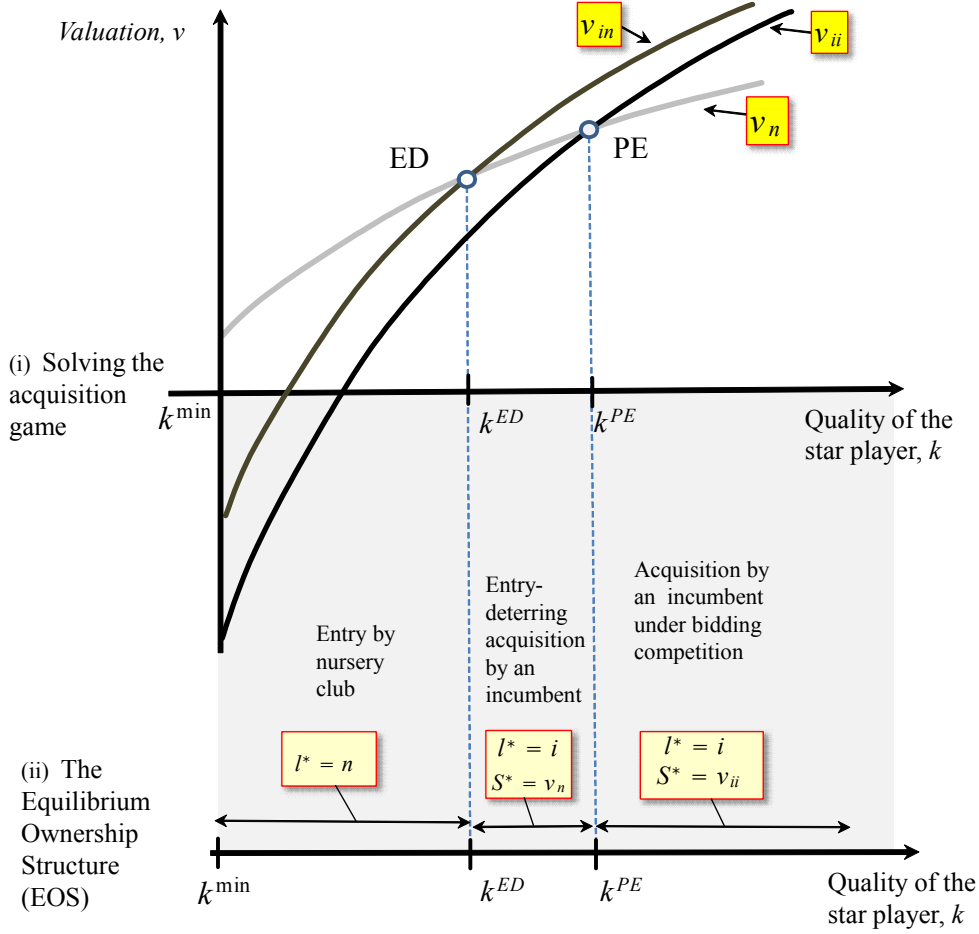


Figure 1: Solving the nursery club's decision to keep or sell the star player,  $k$ .

induces a bidding war between incumbent clubs, driving the equilibrium sales price of the star player above the entry value or reservation price for the nursery club,  $S^* = v_{ii} > v_e$ . The nursery club will now sell the star player ( $l^* = i$ ) at sales price  $S^* = v_{ii}$  in this region. Note that when preemptive acquisitions occur, the nursery club will earn a premium from selling under bidding competition because the buying incumbent pays an acquisition price that is higher than the nursery club's reservation price,  $S^* = v_{ii} > v_n$ . However, when selling without bidding competition in the region  $k \in (k^{ED}, k^{PE})$ , the nursery club only receives the reservation price,  $S^* = v_n$ .

## 2.4 Stage 1: The nursery club's search for talent

In Stage 1, the nursery club first invests in talent search at an amount  $\rho_E$ . For simplicity, we assume that the probability of successfully finding talent is simply the effort,  $\rho_E \in [0, 1]$ , and a quadratic effort cost,  $y(\rho) = \frac{\mu}{2} \times (\rho_E)^2$ . If the nursery club succeeds in finding a talented player,

the true quality of the player is as yet uncertain. To capture this uncertainty, we assume that the quality of the talented player  $k$  is drawn by nature from a cumulative distribution  $G(k)$  with density  $g(k)$  over  $[k^{\min}, k^{\max}]$ .

Upon discovery, the talented player is first hired under an initial contract at low pay,  $w_0$ , which we normalize to zero. When the draw by nature is revealed, his contract is renegotiated. Why would star player renew his contract with the nursery club? The reason is as follows:<sup>18</sup> Prior to the interaction in the Champions League, the star plays matches in the national league for the nursery club. These matches verify the star player's true quality to incumbent clubs. The star player would otherwise be subject to Akerlof's lemons problem, as incumbents would only be willing to pay for his average quality.<sup>19</sup> However, playing matches before the Champions League also involves a risk of injury (in which case the star player's career ends). Assuming that player is risk averse, he then has an incentive to renew the contract with the nursery club at a wage that is lower than he would receive by rejecting contract renewal and instead attempt to exploit future bidding competition among the nursery club, other outside clubs and the incumbent clubs as a free agent.

To see this, first apply Proposition 1 to find the wage  $\omega$  that the star player could obtain as a free agent prior to the Champions League:

$$\omega = \begin{cases} v_n, & \text{for } k \in (k^{\min}, k^{ED}), \\ v_n, & \text{for } k \in [k^{ED}, k^{PE}), \\ v_{ii}, & \text{for } k \in [k^{PE}, k^{\max}), \end{cases} \quad (17)$$

The risk of injury in national competition implies that the player will only realize payoff  $\omega$  with probability  $p \in (0, 1)$ . This can be exploited by the nursery club. Let the utility of the star player be  $U(w) = w^\beta$  for  $\beta \in (0, 1)$ . The nursery club can offer a wage  $w^*$  given from  $(w^*)^\beta = p\omega^\beta$ , at which the star player is indifferent between renewal with the nursery club or (after playing in the national league) leaving as a free agent. By calculation,

$$w^* = p^{\frac{1}{\beta}}\omega \quad (18)$$

Thus,  $p^{\frac{1}{\beta}} \in (0, 1)$  can be interpreted as the share of the revenues as a free agent  $\omega$  that the star player receives as a (certain) salary from renewing with the nursery club.<sup>20</sup> Assuming that the nursery club is risk neutral, let  $\xi_E(l)$  be the nursery club's reward from renewing the contract, paying the star player  $w^*$  in (18) and then making its decision to sell or retain the star player

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<sup>18</sup>Spaniel (2012) shows how the renewal of baseball contracts has these characteristics. His model, however, does not contain the element of asymmetric information and verification, nor does he model the sports competition and equilibrium ownership.

<sup>19</sup>Without seeing the star player play in competitive games, they would estimate his quality using the expected quality  $E[k] = \int_{k^{\min}}^{k^{\max}} kg(k)dk$ . The nursery club would then only be willing to sell the star player if he were of below-average quality, which would reduce incumbents' expected quality further. Without matches in the national league prior to the Champions League, the market for the star player breaks down.

<sup>20</sup>Note that  $p^{\frac{1}{\beta}} < 1$  because this inequality implies  $p < 1^\beta = 1$ .

according to Proposition 1

$$\xi_E(l) = \begin{cases} \phi p v_n + \lambda_O [(1-p)z_O(0) + p z_O(i)] \times [R+P], & \text{for } k \in (k^{\min}, k^{ED}), \\ \phi p v_n + \lambda_O [(1-p)z_O(0) + p z_O(i)] \times [R+P], & \text{for } k \in [k^{ED}, k^{PE}), \\ \phi p v_{ii} + \lambda_O [(1-p)z_O(0) + p z_O(i)] \times [R+P], & \text{for } k \in [k^{PE}, k^{\max}), \end{cases} \quad (19)$$

In (19),  $\lambda_O [(1-p)z_O(0) + p z_O(i)] \times [R+P]$  is the expected profit of reaching the payoff without the star player. Importantly,  $\phi = 1 - p^{\frac{1-\beta}{\beta}} \in (0, 1)$  can be regarded as the share of the expected free agent revenue,  $p\omega$ , that now accrues to the nursery club. From (19), it is clear that the nursery club is better off from signing the contract (18),  $\xi_E(l) > 0$ .

It then follows that the nursery club's expected net reward  $\bar{\xi}_E$  from succeeding in finding a talented player is

$$\begin{aligned} \bar{\xi}_E = & \underbrace{\lambda_O \int_{k^{\min}}^{k^{\max}} [(1-p)z_O(0) + p z_O(i)] \times [R+P] g(k) dk}_{\text{Expected profit without the star player (sale or injury)}} + \\ & \underbrace{\phi p \left[ \int_{k^{\min}}^{k^{ED}} v_n g(k) dk + \int_{k^{ED}}^{k^{PE}} v_n g(k) dk + \int_{k^{PE}}^{k^{\max}} v_{ii} g(k) dk \right]}_{\text{Expected profit from star player without injury (entry or sale)}} \end{aligned} \quad (20)$$

Let  $\bar{\Pi}_E = \rho_E \bar{\xi}_E + (1 - \rho_E) \xi(0) - y(\rho_E)$  be the expected net profit for the nursery club, where  $\xi(0) = \lambda_O z_O(0) \times [R+P]$  is the expected reward when failing to find a talented player and the expected reward from finding a talented player in (20). Solving for the optimal effort  $\rho_E^*$  from the first-order condition,  $\frac{d\bar{\Pi}_E}{d\rho_E} = 0$ , we obtain

$$\rho_E^* = \frac{\bar{\xi}_E - \xi(0)}{\mu} \in (0, 1), \quad (21)$$

where  $\mu$  is assumed to be sufficiently large to have  $\rho_E^*(l) < 1$ .

### 3 The Bosman ruling

By appealing to the fundamental principle of the free movement of workers in the European Union, the 1995 Bosman ruling fundamentally changed the European football market. The Bosman ruling had two major implications: (i) pre-Bosman, clubs could - more or less - keep players on their squads indefinitely. Even if a contract had expired, as long as the club paid a wage to a player, the player could not move freely to a new club unless a transfer fee was paid. (ii) International transfers of players between clubs in different countries were less common, as UEFA rules restricted the use of foreign players (only three foreign players could be used in a match). The European Court of Justice ruled that these restrictions contradicted the free movement of labor - one of the cornerstones of the European Union project to integrate Europe. After 1995, these two restrictions were no longer in place.

In this section, we will explore how the Bosman ruling affected the nursery club's decision to retain or sell the star player and, more important, how it affected the nursery club's incentive to search for and develop star players. To capture the Bosman ruling in our model, we make the following assumption:

**Assumption 3.** *Pre-Bosman: (i) The nursery club keeps the full reward from developing the star player, i.e.,  $\alpha = 1$ . (ii) The restrictions on the use of foreign players implied that a buying incumbent has  $b(k_0 + k) < k_0 + k$  in effective player assets, where  $b \in (\frac{k_0}{k_0+k}, 1)$ .*

### 3.1 How Bosman created a market for star players

Consider the situation before the Bosman ruling and suppose that the nursery clubs has contracted with the star player. Part (ii) in Assumption A3 implies that the incumbent clubs have reached the cap on the number foreign players through their investment in  $k_0$ . Hence, when buying the star player, an acquiring incumbent club cannot make full use of its squad. The share of matches won under an incumbent acquisition then fulfills the following:

$$z_A(i) = \frac{b(k+k_0)}{K+b(k+k_0)-k_0} > z_{NA}(i) = \frac{k_0}{K+b(k+k_0)-k_0} > z_O(i) = \frac{\kappa}{K+b(k+k_0)-k_0} > 0. \quad (22)$$

The nursery club, however, is not restricted in its use of the star player  $k$  because the player is native. The nursery club can then proceed to buy the same number of foreign players as the incumbents  $k_0$ , and hence the winning percentages when the nursery club retains the star player are still given from (3). Hence, the pre-Bosman reservation price is still  $v_n$  from (9). Substituting (22) into (10) and (11) and relabeling the incumbents' entry-detering and the preemptive valuation as  $v_{in}^{PRE}$  and  $v_{ii}^{PRE}$ , the following Lemma is straightforward and proved in the Appendix 2.

**Lemma 2** *There exists a unique  $b^* \in (\frac{k_0}{(k+k_0)}, 1)$  such that for  $b = b^*$ ,  $\frac{d(v_{ii}^{PRE} - v_n)}{dk} = 0$ .*

We then have the following proposition:

**Proposition 3** *Suppose that  $b = b^*$  holds pre-Bosman, such that star players are never sold and transferred. Then, as the Bosman ruling lifts the restriction on the use of foreign players ( $b = 1$ ), a market for star players is created post-Bosman, for which the equilibrium ownership of the star player is given from Proposition 1.*

Figure 2 illustrates the impact of the Bosman ruling on the European football market. Pre-Bosman, the cap on the usage on foreign players ( $b = b^* < 1$ ) dampens the incumbent clubs' interest in acquiring the star player. This is shown in panel (i), where the pre-Bosman entry-detering and preemptive valuations,  $v_{in}^{PRE}$  and  $v_{ii}^{PRE}$ , are depressed and not increasing in the quality of the star player to a sufficient degree to match the increase in the reservation price  $v_n$ . As shown in panel (iii), the nursery club retains the star player because the incumbents'

willingness to pay is too low. However, post-Bosman, the restriction on foreign players is lifted ( $b = 1$ ). This shifts the entry-detering valuation and the preemptive valuation from their pre-Bosman levels,  $v_{in}^{PRE}$  and  $v_{ii}^{PRE}$ , up to their post-Bosman levels,  $v_{in}$  and  $v_{ii}$ , and a market for star players is created. As shown in panel (ii), the star player is again sold at the reservation price  $S^* = v_n$  for medium quality the region  $k \in (k^{ED}, k^{PE})$ , while for very high quality in the region  $k \in (k^{PE}, k^{\max})$ , bidding competition occurs and the price for the star player is driven all the way up to  $S^* = v_{ii} > v_n$ .

### 3.2 Why Bosman may have promoted talent development

How then did the Bosman ruling affect a nursery club's incentives to find and develop star players? At first glance, one might believe that the Bosman ruling must have deteriorated nursery clubs' incentives to find and develop new football players. This is because, by Assumption A3(i), the nursery club will need to leave a large portion of the future revenues to the player, as the star player's bargaining position is significantly improved from the possibility of playing clubs against one another other by acting as a free agent.

For exposition, again make the simplifying assumption in Proposition 3 that star players were not sold prior to the Bosman ruling. Capturing the "slavery contracts" in place before the Bosman ruling, Assumption A3(i) implies that the nursery club will not need to share revenues with the star player pre-Bosman (apart from paying a low wage to uphold the contract, which we have normalized to zero). It then follows that the reward for the nursery club from succeeding in finding and developing a talented in the pre-Bosman era can be written as

$$\xi_E^{\text{Pre}} = pv_n + \lambda_O[(1-p)z_O(0) + pz_O(i)] \times [R+P] \quad (23)$$

Let  $\bar{\xi}_E^{\text{Pre}} = \int_{k^{\min}}^{k^{\max}} \xi_E^{\text{Pre}} g(k) dk$ . Assuming that the nursery club maximizes its net expected payoff  $\bar{\Pi}_E^{\text{Pre}} = \rho_E \bar{\xi}_E^{\text{Pre}} + (1 - \rho_E)\xi(0) - y(\rho_E)$ , the optimal search effort in the pre-Bosman environment is

$$\rho_E^{\text{pre}} = \frac{\bar{\xi}_E^{\text{Pre}} - \xi(0)}{\mu} \in (0, 1), \quad (24)$$

where, again,  $\xi(0) = \lambda_O z_O(0) \times [R+P]$  and  $\mu$  is assumed to be sufficiently large to have  $\rho_E^{\text{Pre}} < 1$ .

We can now compare the search efforts by the nursery club pre and post Bosman. We first have the following Lemma:

**Lemma 4** *If the star player is risk averse and the risk of injury is sufficiently high (i.e., if  $\phi \equiv 1 - p^{\frac{1-\beta}{\beta}}$  sufficiently high), there exists a unique superstar quality,  $k^{PE'} > k^{PE}$ , such that  $\phi pv_{ii} = pv_n$ .*

Lemma 4 is illustrated in Figure 3. When the star player is risk averse and the risk of injury is sufficiently high, he will demand a lower share of the revenues created by a future sale to incumbent clubs. This leaves a larger share of the expected revenues to the nursery club. As shown in the diagram, there must exist a star player quality  $k^{PE'}$  at which the share of the

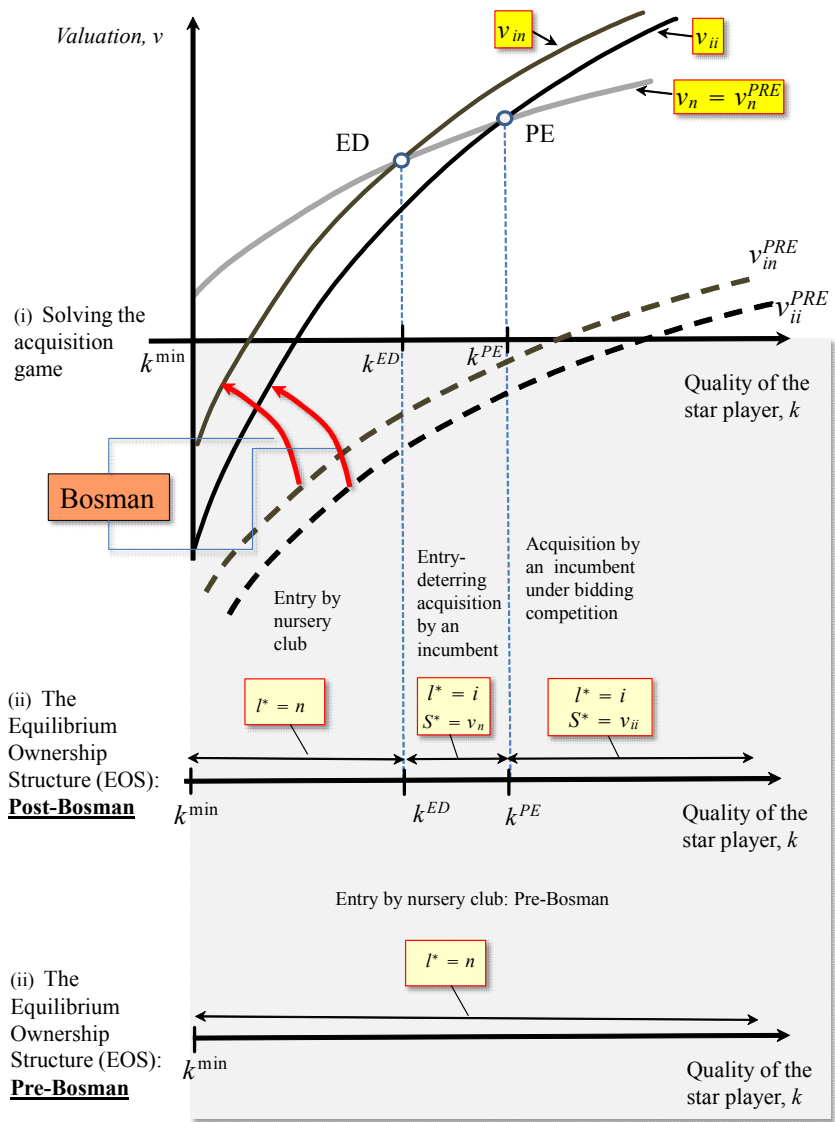


Figure 2

expected sales price that goes to the nursery club  $\phi p v_{ii}$  will be higher than the expected value of entering the Champions League  $p v_n$ . Because, as discussed in Remark 1, the fixed wage of the star player does not affect the decision to sell or retain the star player, it must be that the threshold  $k^{PE'}$  exceeds  $k^{PE}$  (at which  $v_{ii} = v_n$ ).

We can then examine how the Bosman ruling - captured by Assumption A3 - affects the search for talent in the nursery club. Using (21) and (24)

$$\rho_E^* - \rho_E^{\text{Pre}} = \frac{p}{\mu} \left( - \int_{k^{\min}}^{k^{PE}} (1 - \phi) v_n g(k) dk + \int_{k^{PE}}^{k^{PE'}} \underbrace{[\phi v_{ii} - v_n]}_{(-)} g(k) + \int_{k^{PE'}}^{k^{\max}} \underbrace{[\phi v_{ii} - v_n]}_{(+)} g(k) dk \right) \quad (25)$$

The first negative expression within the parentheses in (25) simply reflects that when the nursery club enters the Champions League after Bosman, it needs to share these entry revenues with the star player. Intuitively, this gives a lower incentive to search for a star player of lower quality, as shown in Figure 3.

The second expression in the parentheses in (25) compares the revenues given star player quality that is sufficiently high to generate bidding competition among incumbents. As seen in Figure 3, the nursery club still incurs a reduction in revenue after Bosman. However, as shown by the third term in (25), when the player reaches sufficiently high quality, the bidding competition when the restriction on the usage of foreign players is lifted becomes so intense that the nursery club's revenues will exceed the pre-Bosman level - even when the revenues are shared with the star player. If the last term in (25) is sufficiently large, the incentive for the nursery club to develop talent can increase even post-Bosman.

**Proposition 5** *The impact of the Bosman ruling on the nursery club's incentive to search for and develop talent into star players is ambiguous. However, if the gain from selling star players  $k > k^{PE'}$  is sufficiently high, the nursery club's incentive to find and develop talent may increase after Bosman,  $\rho_E^* > \rho_E^{\text{Pre}}$ .*

### 3.3 Extension: Rivalry between established and nursery clubs in talent search

In the model, we have ignored the possibility of incumbent clubs discovering and developing star players. This may be a reasonable assumption because the probability of finding and developing a talented player into a star player is presumably very small. Thus, for established clubs to obtain star players, they need to buy them rather than foster them themselves. How would our results change if we allowed for incumbent search and development of star players? Having incumbent clubs simultaneously searching for star players, will of course decrease the incentive for the nursery club to find new talent. However, while the nursery club will experience a significantly higher incentive to search for a star player when it can sell the player under bidding

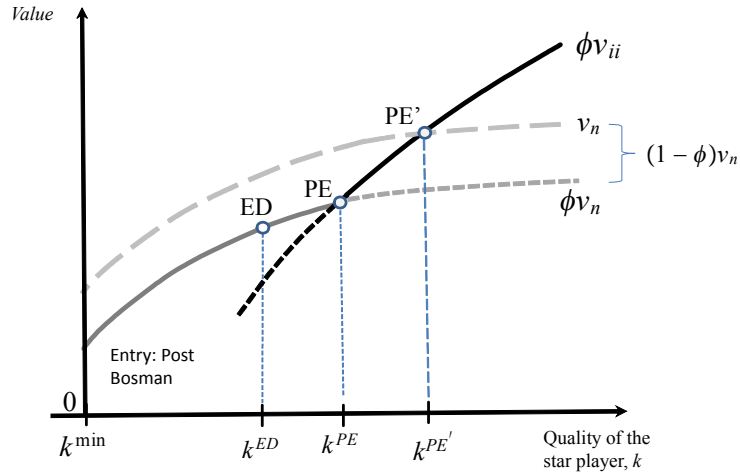


Figure 3: This figure illustrates how the Bosman ruling, by lifting the restrictions on the use of foreign players, increases incumbent clubs' valuations for star players, creating a market for star players.

competition to incumbents, rather than pursuing entry into the Champions League, incumbents may not react with higher search efforts when realizing that the nursery club will attempt to sell the player under bidding competition. Essentially, this implies that the results that we obtained above on how selling the star player under bidding competition increases the nursery club's search ambitions may not be strongly affected by allowing incumbents to search for superstars. Appendix A.6 illustrates this somewhat surprising result.

### 3.4 Empirical predictions

We now use our model to derive specific predictions on how the competitive balance in the Champions League has been affected by the Bosman ruling. We also derive specific predictions on how the development of the Champions League has affected the competitive balance between national teams in the European Union.

#### 3.4.1 European championship competitive balance

To derive testable prediction on the European championship's competitive balance from the emergence of a market for football stars, we make use of the following definition:

**Definition 1** *European championship competitive balance increases if the nursery club retains the star player and enters the Champions League and thereby challenges the incumbent clubs.*

Definition 1 implies that the competitive balance will increase when the nursery club enters. Let us calculate the probability of entry by the nursery club after Bosman. The distribution over star player quality is  $g(k)$ . Then, noting that  $\rho_E^*$  is the probability that the nursery club succeeds



in finding a talented player and that  $G(k^{ED}) = \int_{k^{\min}}^{k^{ED}} g(k)dk$  is the cumulative probability of then drawing a player quality that leads to securing entry in the Champions League, we have

$$\Pr(l^* = n) = \lambda_O(0) + \rho_E^* \times p \times \underbrace{[G(k^{ED}) - \lambda_O(0)]}_{(+)}, \quad (26)$$

where  $\rho_E^*$  is the probability that the nursery club finds a talented player,  $p$  is the probability that the star player is not injured, and we make the natural assumption that  $G(k^{ED}) > \lambda_O(0)$ . That is, conditional on succeeding with the star player, the cumulative probability of obtaining a player quality that leads to entry in the Champions League  $G(k^{ED})$  is higher than the probability of reaching the Champions League without a star player in the qualification rounds,  $\lambda_O(0)$ .

The corresponding pre-Bosman entry probability is

$$\Pr(l^{\text{Pre}} = n) = \lambda_O(0) + \rho_E^{\text{pre}} \times p \times \underbrace{[1 - \lambda_O(i)]}_{(+)}, \quad (27)$$

under the assumption that a sale does not occur pre-Bosman. Note that given that the nursery club succeeds in finding a talented player, the probability of entry is always higher, as  $G(k^{ED}) < 1$ .<sup>21</sup> An ambiguity arises however because if increased bidding competition post-Bosman induces the nursery club to search harder for talent, the probability of finding a talented player may be higher after the Bosman ruling (because  $\rho_E^*$  may exceed  $\rho_E^{\text{pre}}$ , as shown in Proposition 5).

Comparing pre- and post-Bosman, we have the following prediction:

**Prediction 1** *The effect of the Bosman ruling on the European championship's competitive balance is ambiguous.*

### 3.4.2 National Team competitive balance

Let us now turn to how the Bosman ruling affected national team performance. Without loss of generality, assume that each club  $C$  has its own country of residence. There is also an outside country that has  $K_L$  player quality, e.g., a country in South America. Then, let  $Z_E(l) = \frac{K_E(l)}{K_L + K_E(l)}$  be the winning percentage of the national team of the nursery club's home country. Here  $K_E(l)$  is the amount of player assets in the national team when the nursery club has succeeded in obtaining the star player. It follows that  $K_E(i) = k + \kappa$  under a sale of the star player, as the star player is always available for the national team. If we make the assumption that the nursery club needs to buy players from abroad when it upgrades its players from  $\kappa$  to  $k_0$  when pursuing entry in the Champions League with the star player, it follows that  $K_E(n) = k + \kappa = K_E(i) > K(0) = \kappa$ . Intuitively, having the star player available will increase the winning percentage of the national team,

$$Z_E(l) = \frac{k + \kappa}{K_L + k + \kappa} > Z_E(0) = \frac{\kappa}{K_L + \kappa}, \quad l = \{i, n\}. \quad (28)$$

<sup>21</sup>We do not need the extreme assumption of no sale pre-Bosman. All we need is that a sale occurs for a higher player quality, which is guaranteed by Assumption A3.

Note that the expected share of matches won by the national team, conditional on the nursery club succeeding in its search for talent, is  $\bar{Z}_E = \int_{k_{\min}}^{k_{\max}} Z_E(l)g(k)dk$ . It follows that the unconditional expected share of matches won by the national team in the nursery club's country when playing against an outside country must be

$$E[Z_E] = Z_E(0) + \rho_E^* \times p \times \underbrace{[\bar{Z}_E - Z_E(0)]}_{(+)}, \quad (29)$$

We can also calculate the expected share of matches won, pre-Bosman. Because  $Z_E(i) = Z_E(n)$ , we have

$$E[Z_E^{\text{Pre}}] = Z_E(0) + \rho_E^{\text{Pre}} \times p \times \underbrace{[\bar{Z}_E - Z_E(0)]}_{(+)}, \quad (30)$$

It then follows that the difference in the share of matches won depends on the difference in the search intensity pre- and post-Bosman, i.e.,  $\rho_E^* - \rho_E^{\text{Pre}}$ . We thus have the following prediction:

**Prediction 2** *If the stronger bidding competition among incumbents post-Bosman increases the effort by the nursery club to succeed in its talent development,  $\rho_E^* > \rho_E^{\text{Pre}}$ , the share of matches won by the national team against third countries will increase post-Bosman,  $E[Z_E] > E[Z_E^{\text{Pre}}]$ .*

### 3.5 Empirical evidence

We now turn to providing empirical support for how the competitive balance in the Champions League and at the national level changed after the Bosman ruling. In particular, we will conduct a simple difference-in-differences regression analysis of the Bosman ruling on national team performance. It is important to note that after Bosman, prize money and the commercial value of the Champions League has increased steadily over, at least, the last two decades. In addition, the number of incumbent clubs in the group stage has increased. Given our simple empirical analysis, we are unable to disentangle these effects from one another in the empirical analysis. Instead, we will estimate their aggregated effects by analyzing changes before and after the Bosman ruling in 1995. In the next section, we will then discuss how these changes may impact the interpretation of results using our theoretical model.

We have shown in the former section how the Bosman ruling should have created a European football market for star players. We also showed how this market created greater incentives for nursery clubs to sell their best players to incumbent clubs, which may have led to worse competitive balance. However, this may have been counteracted by stronger incentives to develop star players (Prediction 1). That the Champions League has become more concentrated after the Bosman ruling is reflected in Figure 4. The figure displays the share of clubs that reached the round of 16 in two consecutive years for the period from 1980 to 2012.<sup>22</sup> In the period prior

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<sup>22</sup>Note that the Champions League replaced the European Cup in 1992, and a group stage was also added.

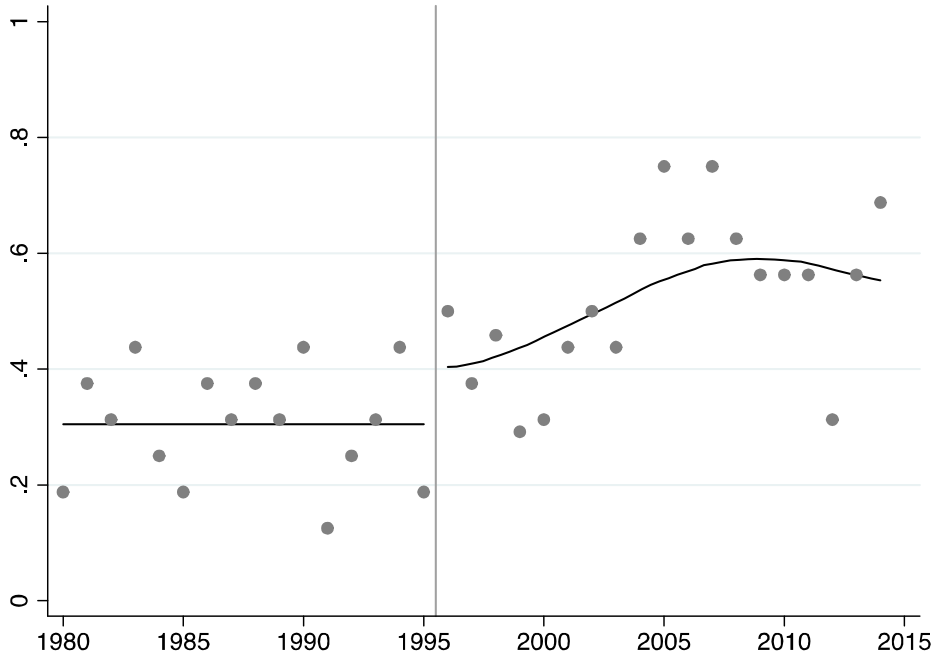


Figure 4: The share of clubs that reached the round of 16 in the Champions League in two consecutive years. Lines represent kernel-weighted local polynomial smoothing regression using the periods 1980-1995 and 1996-2014 with a Epanechnikov kernel function and optimal bandwidth. The year of the Bosman ruling is indicated by vertical line.

to 1995, approximately 30% of the clubs that reached the round of 16 did so in two consecutive years. In the period after 1995, this share increased by nearly 20 percentage points. This increase is statistically significant at the one percent level.

Next, we attempt to understand how the changes in the Champions League and the Bosman ruling have affected the competitive balance at the national level. Prediction 2 states that if the increased bidding competition for star players led to stronger incentives to find and develop players, this may spill over to better performance by the national team.

We check this prediction by comparing how the five top nations in the EU15 have performed relative the ten bottom EU15 countries in the World Cup tournaments from 1978 to 2014. The top five nations are England, Spain, Germany, Italy, and France, and the bottom EU15 countries are Austria, Belgium, Denmark, Greece, Ireland, Northern Ireland, Netherlands, Scotland, Sweden and Portugal.<sup>23</sup> The top five nations are usually referred to as the Big-5 nations and have the best domestic leagues in terms of average attendance at the games, club performance in

<sup>23</sup>For Germany, we use the performance of West Germany before the reunification of Germany in 1990.

European cups and the economic revenues the clubs generate.<sup>24</sup> During the period 1978 to 2014, 360 World Cup matches involved at least one EU15 country. However, only 42 matches were played between a top and a bottom EU15 country. By excluding these matches plus the matches between two top or two bottom nations, we can apply a difference-in-differences strategy to compare the performance of the top and bottom nations when playing a non-EU15 country. We focus on the performance in World Cup matches to ensure that all countries have incentives to perform at their absolute highest level. Analyzing match performance instead of country ranking allows us to exclude from the analysis matches in which two bottom or top EU15 countries played one another; rankings of countries based on their performance, such as the ELO and the FIFA rankings, are based on all matches independent of the opponent. Rankings also include friendly matches in which the coaches might wish to try new players or strategies instead of winning the matches. In addition, when the FIFA ranking is calculated, a friendly match is given a lower point total but an equal weight as a competitive match. This means that the FIFA ranking depends partly on a country's propensity to play friendly matches; a country that plays many friendly matches, instead of competitive matches, will, all else equal, obtain a lower rank.

Figure 2 displays the average points per match taken by the bottom and top EU15 nations in World Cup matches from 1978 to 2014.<sup>25</sup> The figure suggests that before the Bosman ruling, the top five nations took more points per game, on average, than the ten bottom nations. However, after the Bosman ruling, the bottom nations seem to perform, in relative terms, better on average than the top nations. In fact, in the 2010 and 2014 tournaments, the performance of bottom nations against non-EU15 opponents exceeded that of the top nations. To understand whether the pattern of the bottom nations becoming relatively stronger than the top nations after the Bosman ruling is statistically significant, we apply a difference-in-differences estimator and estimate the following model:

$$y_{it} = \alpha + \beta POST_t + \gamma BottomEU15_i + \delta BottomEU15_i \times POST_t + \mathbf{X}'_t \Psi + \varepsilon_{it} \quad (31)$$

where  $POST_t$  takes value one in all years after 1995, zero otherwise.  $BottomEU15_i$  takes value one if country  $i$  belongs to the bottom ten countries in the EU15. The difference-in-differences estimator is represented by the coefficient  $\delta$ , which captures the average change in performance around the Bosman ruling by the bottom EU15 countries relative to the change by the top EU15 countries. Hence, the model allows us to test whether the bottom nations tend to perform relatively better than the top nations after the Bosman ruling. Moreover, as we only analyze matches against non-EU countries, the model will also reveal how top EU countries fare relative to non-EU countries after Bosman.

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<sup>24</sup>The company Deloitte has ranked European clubs by their revenues since the 1997/98 season in its annual report "The Deloitte Football Money League". Clubs from the top five nations dominated the rankings in all years considered.

<sup>25</sup>When calculating the average number of points per game, a win is given two points, a draw is given one point and a loss is given zero points. The points are calculated after extra time but before penalties.

Table 1: The relative performance of top-EU15 and bottom-EU15 nations in World Cup tournaments 1978-2014 - all rounds.

	Average number of points per game		I[At least draw]	
	(1)	(2)	(3)	(4)
BottomEU15 $\times$ POST	0.393** (0.182)	0.394** (0.179)	0.259*** (0.076)	0.258*** (0.078)
POST	-0.002 (0.127)	-0.001 (0.134)	-0.050 (0.060)	-0.050 (0.058)
BottomEU15	-0.495*** (0.120)	-0.486*** (0.118)	-0.260*** (0.061)	-0.255*** (0.060)
WC in EU15		0.212 (0.131)		0.112* (0.057)
WC in South America		0.045 (0.105)		0.030 (0.070)
Constant	1.409*** (0.060)	1.310*** (0.077)	0.864*** (0.034)	0.810*** (0.044)
N	284	284	284	284
R2	0.06	0.07	0.05	0.08

*Note:* When calculating the average number of points per game, a win is given two points, a draw is given one point and a loss is given zero points (all points are calculated after extra time but before penalties). The dependent variable [At least draw] takes value one if a country takes at least one point in a given game, zero otherwise. Bottom-EU15 is a binary variable taking value one for the countries Austria, Belgium, Denmark, Greece, Ireland, the Netherlands, Northern Ireland, Portugal, Scotland and Sweden and zero for the countries England, France, Germany (West Germany before unification), Italy and Spain. POST is a binary variable taking value one after the year 1995, zero before. WC in EU15 is a binary variable taking value one for World Cup tournaments in a EU15 country, zero otherwise. WC in South America is a binary variable taking value one for World Cup tournaments in a South American country, zero otherwise. The sample in Panel A covers World Cup matches for EU15 against non-EU15 opponents, and the sample in Panel B covers all matches in which two top or two bottom EU15 teams do not play one another. Standard errors are clustered at the country level.

To begin, we consider the average number of points per match obtained by the bottom and top nations; see Columns 1 and 2 in Panel A, Table 1. In Column 1, the constant reveals that the top nations take, on average, approximately 1.4 points per game before the Bosman ruling. During the same period, bottom nations take, on average, 0.9 points, obtained by adding the constant and the estimate for  $BottomEU15_i$ . After the Bosman ruling, the top nations continue to take approximately 1.4 points per game (this is obtained by adding the constant and the estimate for  $POST_t$ ) while the bottom nations take nearly 1.3 points per game, i.e., 0.4 points more than before Bosman. This simple exercise suggests that the Bosman ruling has made the bottom nations relatively stronger than the top nations and that the performance gap between top and bottom nations before the Bosman ruling has nearly been closed in the years after the ruling. These results are confirmed when we examine the probability to take at least one point in a match, i.e., to at least draw. Column 3 shows that top nations before the Bosman ruling took at least one point in approximately 86% of all matches that they played compared to approximately 60% for bottom nations. However, after the Bosman ruling, top nations continue to take at least one point in approximately 86% of their matches while the bottom nations become 26% more likely to at least draw relative to the top nations, i.e., the gap between the bottom and top nations in the period before the Bosman ruling has been closed in subsequent years. The results in Table 1 refer to all rounds in the World Cup. This means that a country that goes far in a tournament will be given more weight in the regressions than a country that only survives the first group stage. Table A.1 in Appendix A.7 therefore only includes matches in the group stage of each tournament. The result that the bottom EU15 countries tend to perform better after the Bosman ruling relative to the top nations is confirmed. Moreover, the performance of the top nations is unaffected by the Bosman ruling when playing a non-EU country. As we will discuss below, this is consistent with an extended theoretical model that also assumes that incumbent clubs develop players.

In sum, our results suggest that the Champions League has become less competitive in the wake of the Bosman ruling and its expansion. However, the competition at the national level in the EU15 appears to have increased, as smaller nations with relatively weak clubs have become relatively stronger than the top five nations over the past twenty years. These two results are broadly consistent with the theory according to which the Bosman ruling created a market for star players with stronger incentives for nursery clubs to develop star players to sell them to incumbent clubs.

### **3.6 Discussion: The Champions League after Bosman**

As noted, the empirical results capture both the Bosman effect and other fundamental changes in the institutions around the Champions League. First, commercial revenues and prize sums have increased tremendously. Another significant change is that incumbents have been allowed more seats in the playoff. Finally, there are more clubs in Europe aspiring to play in the Champions League. In this section, we review how this will impact our empirical results on the incidence of

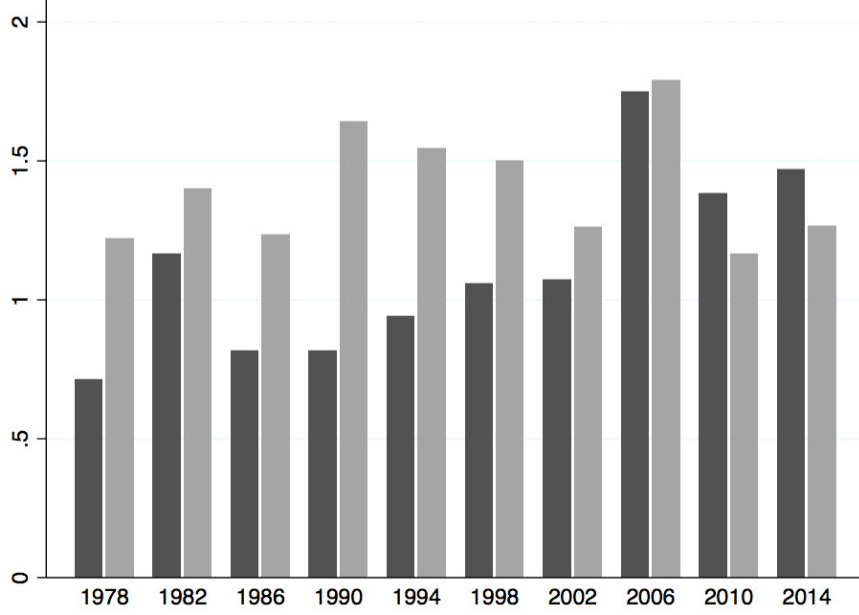


Figure 5: Average points per game in World Cup tournaments 1978-2014. The black bar represents EU-bottom and grey bar represents EU-top. When calculating average points, a victory is awarded two points, a draw one point and a loss zero points.

entry by nursery clubs and the performance of national teams.

### 3.6.1 National team performance after Bosman

We begin with competitive balance at the national level. By differentiating the post-Bosman share of matches won by the national team of the nursery club in (29) with respect to a generic exogenous variable  $\varphi$ , we obtain

$$\frac{dE[Z_E]}{d\varphi} = \frac{d\rho_E^*}{d\varphi} \times p \times \underbrace{[\bar{Z}_E - Z_E(0)]}_{(+)} \quad (32)$$

Intuitively, the change in the expected share of matches won by the national team is completely driven by the change in search effort for talented players that can develop into star players helping the national team. To evaluate  $\frac{d\rho_E^*}{d\varphi}$  in (32), we can use (20) and (21) to obtain

$$\rho_E^* = \frac{p}{\mu} \left( \phi \left[ \int_{k^{\min}}^{k^{PE}} v_n g(k) dk + \int_{k^{PE}}^{k^{\max}} v_i g(k) dk \right] - \lambda_O \int_{k^{\min}}^{k^{\max}} [z_O(0) - z_O(i)] \times [R + P] g(k) dk \right) \quad (33)$$

Make the simplifying, but reasonable, assumption that the the probability of qualifying without the star player  $\lambda_O$  is low.<sup>26</sup> By definition,  $v_{ii} = v_n$  holds for  $k = k^{PE}$ . Thus, the change in the search effort  $\frac{d\rho_E^*}{d\varphi}$  can simply evaluated by examining how the reservation price  $v_n$  and the preemptive value  $v_{ii}$  change when generic exogenous variable  $\varphi$  changes

$$\frac{d\rho_E^*}{d\varphi}\Big|_{\lambda_O \approx 0} = \frac{\rho}{\mu} \phi \left[ \int_{k^{\min}}^{k^{PE}} v'_{n,\varphi} g(k) dk + \int_{k^{PE}}^{k^{\max}} v'_{ii,\varphi} g(k) dk \right]. \quad (34)$$

Consider first the increase in prize money and market value from commercial products. From (9) and (11), we know that both the reservation price  $v_n$  and the preemptive value  $v_{ii}$  increase in  $R + P$ . This leads to an increase in the search effort by the nursery club  $\rho_E^*$ , which from (32) implies that the national team's performance should improve, i.e.,  $\frac{dE[Z_E]}{d(R+P)}\Big|_{\lambda_O \approx 0} > 0$ .

The number of incumbent clubs has increased over the years, as more clubs from the major leagues have been allowed more direct seats in the Champions League. Suppose that with more direct seats in the tournament, it is profitable for additional incumbent clubs to enter, increasing  $I$ . If we assume that this also increases the total number of seats in the tournament,  $m$ , the number of incumbents  $I$  and the total number of clubs  $C$  increase by the same amount. The probability for the nursery club to qualify without the star player  $\lambda_0$  then remains unchanged from (8). Stronger competition from more incumbents (i.e., increase in  $I$  that leads to a rise in total player assets  $K$ ), leads to a reduction in the search effort by the nursery club and hence worse expected performance by the national team,  $\frac{dE[Z_E]}{dK}\Big|_{\lambda_O \approx 0} < 0$ . This is spelled out in the Appendix A.4. We show that as the number of incumbent clubs increases, it leads to a lower share of matches won:  $z_E(n)$  and  $z_O(i)$  decline, while  $z_A(i)$  is reduced more than  $z_{NA}(i)$ , which leads to a reduction of the preemptive valuation  $v_{ii}$  from (11) and the entry value (9). From (34), this implies that the nursery club will reduce its effort to find talent, which will harm national team performance,  $\frac{dE[Z_E]}{dK}\Big|_{\lambda_O \approx 0} < 0$ .

The world of football has grown. This can be captured by an increase in  $C$  holding the number of seats  $m$  and the number of incumbent clubs  $I$  fixed. Stronger competition from outside clubs makes it more difficult for the nursery club to enter the Champions League without the star player. However, an increase in  $C$ , which reduces  $\lambda_O$  from Equation 8, actually increases the incentives for the nursery club to succeed in finding talent,  $\frac{d\rho_E^*}{dC} > 0$ , thus improving expected national team performance,  $\frac{dE[Z_E]}{dC} > 0$ . This occurs because the nursery club is better off when the star player is not in the Champions League,  $z_O(0) > z_O(i)$  from (5). This effect may however be small given that the probability of succeeding at entering without the star player is likely to be low.

In summary, the major developments post-Bosman - higher commercial revenues and prize money, a greater presence of incumbents and the increase in the number of competitive clubs - all have differential impacts on the nursery club's incentive to find talent. Taken together,

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<sup>26</sup>This does not qualitatively alter the results. We would simply add the term  $\frac{d}{d\varphi} \left[ \lambda_O \int_{k^{\min}}^{k^{\max}} [z_O(0) - z_O(i)] \times [R + P] g(k) dk \right]$ .



this may imply that their joint influence on national team performance may be limited and, therefore, that our results using a simple difference-in-difference approach on the Bosman ruling may approximate the impact of the Bosman ruling on the performance of national teams.

### 3.6.2 European championship competitive balance after Bosman

Let us now turn to the European championship's competitive balance in (35). By differentiating the post-Bosman probability of entry by the nursery club (26) with respect to the generic exogenous variable  $\varphi$ , we obtain

$$\frac{d[\Pr(l^* = n)]}{d\varphi} = \underbrace{\frac{d\rho_E^*}{d\varphi} \times p \times [G(k^{ED}) - \lambda_O(i)]}_{\text{"Extensive margin"}} + \underbrace{\rho_E^* \times p \times \left[ g(k^{ED}) \times \frac{dk^{ED}}{d\varphi} - \frac{d\lambda_O(i)}{d\varphi} \right]}_{\text{"Intensive margin"}}. \quad (35)$$

The change in the probability of entry by the nursery club from altering the institutional variable  $\varphi$  consists of two effects: The first effect is the impact on the extensive margin driven by the change in search effort,  $\frac{d\rho_E^*}{d\varphi}$ , discussed above. The second effect stems from the change in the cut-off point at which the nursery club retains the star player  $\frac{dk^{ED}}{d\varphi}$  and the impact on the probability of qualifying when the star player is sold to an incumbent club,  $\frac{d\lambda_O(i)}{d\varphi}$ . The probability of entering the Champions League is thus also impacted by the intensive margin, i.e., the change in the probability of entry when the nursery club has succeeded in finding a star player. This is given from the change in the cut-off point  $k^{ED}$ . Differentiating the condition  $v_{ie} = v_n$  with respect to star player quality  $k$  and the generic exogenous variable  $\varphi$ , we obtain

$$\frac{dk^{ED}}{d\varphi} = - \frac{v'_{il,\varphi} - v'_{n,\varphi}}{\underbrace{v'_{il,k} - v'_{n,k}}_{(+)}} \quad (36)$$

where  $v'_{il,k} - v'_{n,k} > 0$  holds from (16). For interpretation, if  $\frac{dk^{ED}}{d\varphi} < 0$ , the cut-off  $k^{ED}$  shifts to the left in Figure 1(ii), which makes a sale of the star player more "likely" or "more frequent".

Increasing the prize sums and commercial revenues,  $R + P$ , will reduce the nursery club's propensity to sell the star player by increasing the cut-off point  $k^{ED}$  in (36), which increases the probability of entry by the nursery club in (35). To see this, differentiate (13) with respect to  $R + P$  to obtain

$$v'_{il,R+P} - v'_{n,R+P} = \underbrace{\left\{ \underbrace{[z_A(i) - z_{NA}(l)]}_{(+)} - \underbrace{[z_E(n) - \lambda_O z_O(i)]}_{(+)} \right\}}_{(-)} < 0. \quad (37)$$

where again Appendix A.2 shows that the first (large) bracketed term in (13) is negative.

Hence, when prize money and commercial revenues increase, the reservation price of the nursery club increases to a greater extent than incumbents' valuations. The intuition comes,

again, from incumbent clubs being relatively better off without the star player. From (13), we have that this implies that the nursery club will obtain a larger increase in revenues when retaining the star player and going for the Champions League when prize money and commercial value increase than an incumbent who buys the star player. From (36), we have  $\frac{dk^{ED}}{d(R+P)} > 0$ , which makes entry more likely in (35) through the intensive margin (as  $\frac{d\lambda_O(i)}{d(R+P)} = 0$ ). Moreover, because a larger market also increases the effort to find the star player through the extensive margin  $\frac{d\rho_E^*}{dR+P}$ , we conclude that larger commercial revenues should have promoted more entry by nursery clubs.

We can also check the effect of more incumbents being present in the Champions League. Differentiating (13) with respect to  $K$ , leaving the proof to the Appendix A.4, we have

$$v'_{il,K} - v'_{n,K} = \underbrace{\left\{ \frac{dz_A(i)}{dK} - \frac{dz_E(n)}{dK} - \underbrace{\left[ \frac{dz_{NA}(l)}{dK} - \lambda_O \frac{dz_O(i)}{dK} \right]}_{(-)} \right\}}_{(+): k \text{ limited in size}} \times [R + P] > 0. \quad (38)$$

Increasing the number of incumbents,  $I$ , will increase the nursery club's propensity to sell the star player<sup>27</sup> Intuitively, increasing the total player assets in the Champions League increases the sports competition, reducing clubs' winning percentages  $z_h(l)$ . Again, the reason is that non-acquiring incumbent clubs are more adversely affected than the nursery club without the star player, and this drives up incumbent valuations relative to the nursery club's reservation price. From (36), we have  $\frac{dk^{ED}}{dK} < 0$ , which reduces the intensive margin of entry in (35). Because the extensive margin of entry is also reduced through a lower search effort,  $\frac{d\rho_E^*}{dK} < 0$ , it follows that stronger incumbent competition will reduce the probability of nursery club entry in (35).

Stronger competition from a greater presence of outside clubs increases the reservation price  $v_n$  from (9), and hence, the reservation price will increase relative to incumbents' valuations, while incumbents' valuations are not affected by (10) and (11),

$$v'_{il,C} - v'_{n,C} = \frac{d\lambda_O}{C} z_O(i) \times [R + P] < 0. \quad (39)$$

In effect, increased competition from more outside clubs drives the nursery club to pursue full-scale entry into the tournament with the star player, such that  $\frac{dk^{ED}}{dC} > 0$  holds in (36), which increases the probability of entry by the nursery club through the intensive margin in (35). Because stronger competition also increases search effort  $\frac{d\rho_E^*}{dC} > 0$ , adding the impact from the extensive margin, we find that stronger competition from outside clubs will increase the probability of entry by the nursery club.

Again, the major developments after the Bosman ruling – higher commercial revenues and prize money, a greater presence of incumbents and the increase in the number of competitive

<sup>27</sup>The exact conditions are in the Appendix.

clubs – will also have different impacts on the probability that the nursery club will pursue entry and not sell their best player. Taken together, this may imply that the joint influence of these factors on this decision may be limited.

## 4 Conclusion

This paper indicates that the integration of the European football market has created a stable vertically organized market with few established top clubs and many nursery clubs, acting as suppliers of star players. The reason is the emergence of a liquid market for star players, where stiff bidding competition between established top clubs over star players means that the reward for smaller clubs for selling a star is so large that they prefer to sell instead of attempting to challenge established clubs. This leads to decreased competitive balance in the Champions League. However, this need not be detrimental to talent development in European football overall. Indeed, the bidding competition on the market for football stars appears to be so stiff that it spurs talent development foremost in smaller football EU15 nations, which have caught up to the top EU15 nations based on their performance in World Cup tournaments.

What will the competitive balance be in Europe in the future? UEFA has decided to increase the prize money pool to €1.257 billion for the tournaments from 2015 to 2018. Of the €1.257 billion in prize money, €482.9 million are designated to a market pool that is distributed according to the proportional market value of each TV market based on how teams from the domestic leagues have performed in the Champions League in the past. This implies that the economic differences between top clubs and other clubs in Europe are likely to be even greater in the future. Based on our model, this change should further strengthen the incumbent clubs in the Champions League and thereby decrease the competition in the tournament. However, the World Cup tournaments should remain more competitive.

We have abstracted from several important factors in our analysis that appear to be fruitful avenues for future research. Incorporating financial restrictions into the analysis should yield important insights. Up-and-coming clubs with strong financial support are likely to be able to challenge incumbent clubs and thereby break up the existing vertical structure of the European football market. Examining how different financial restrictions and revenue-sharing schemes affect the intensity of the competitive balance, at both the club and national team levels, appears to be of particular relevance. Another interesting development is external investment and ownership of potential star players. If the nursery club cannot secure with the money to retain the star player, it may obtain such financing from outside private equity owners (so-called third-party ownership).

Another area of interest would be to examine the functioning of the market for young talent and its effect on the competitive balance at both the club and national levels. One might conjecture that the early sale of young talent might be counterproductive for both the young talent and for other talented players in the same league. Could restrictions on the market for

young talent along the lines of the drafting system used by the NHL in the U.S. be beneficial for European football? Another interesting extension would be to examine how a young talented player and his family's incentives are affected by different types of regulations. How can a system balance the incentives of the individual (family) and the nursery club?

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## A Appendix

### A.1 Proof of Equation (16)

From (9), (10) and (11), by calculation:

$$v_{il} - v_n = [z_A(i) - z_{NA}(l) - (z_E(n) - \lambda_O(i)z_O(i))] \times [I + P] + F - T. \quad (\text{A.1})$$

Note that

$$\text{sign} \left[ \frac{dv_{il}}{dk} - \frac{dv_n}{dk} \right] = \text{sign} \left( \frac{d[z_A(i) - z_{NA}(l) - (z_E(n) - \lambda_O(i)z_O(i))]}{dk} \right). \quad (\text{A.2})$$

From (2)-(4), we obtain

$$\frac{d[z_A(i) - z_{NA}(i) - (z_E(n) - \lambda_O(i)z_O(i))]}{dk} = \frac{K - \lambda_O \kappa}{(K + k)^2} - \frac{K - \kappa}{(K + k - \kappa + k_0)^2} > 0 \quad (\text{A.3})$$

$$\frac{d[z_A(i) - z_{NA}(n) - (z_E(n) - \lambda_O(i)z_O(i))]}{dk} = \frac{K - \lambda_O \kappa}{(K + k)^2} - \left( \frac{K - \kappa - k_0}{(K + k + k_0 - \kappa)^2} \right) > 0 \quad (\text{A.4})$$

since  $k_0 > \kappa > 0$  and  $\lambda_O \in (0, 1)$ .

Hence, from (A.2), (A.3) and (A.4) it follows that  $\frac{dv_{il}}{dk} > \frac{dv_n}{dk}$ .

### A.2 Equation (13)

Equations (A.2) and (A.3) also allows us to prove the sign of the bracketened term in (13), i.e.

$$z_A(i) - z_{NA}(l) - (z_E(l) - \lambda_O(i)z_O(i)) < 0.$$

First, note that (A.2) and (A.3) imply that  $z_A(i) - z_{NA}(l) - (z_E(l) - \lambda_O(i)z_O(i))$  is monotonously increasing in  $k$ . Then note that

$$\lim_{k \rightarrow \infty} [z_A(i) - z_{NA}(l) - (z_E(l) - \lambda_O(i)z_O(i))] = 0 \quad (\text{A.5})$$

since  $\lim_{k \rightarrow \infty} [z_A(i)] = 1$ ,  $\lim_{k \rightarrow \infty} [z_E(n)] = 1$  and  $\lim_{k \rightarrow \infty} [z_{NA}(l)] = \lim_{k \rightarrow \infty} [z_O(i)] = 0$ .

### A.3 Proof of Lemma 2

First, note that from (22), the acquiring incumbent iclub cannot increase its share of won matches compared to the case when the nursery club enters if  $b(k + k_0) = k_0$ . Hence,  $b > k_0/(k + k_0)$  introduces a natural lower bound. From (), we have

$$v_{il}^{PRE} - v_n = [z_A(i) - z_{NA}(l) - (z_E(n) - \lambda_O(i)z_O(i))] \times [I + P] + F - T \quad (\text{A.6})$$

with the share of matches  $z_h(i)$  now given from (22). Equations (A.3) and (A.4) now take the form

$$\frac{d[z_A(i) - z_{NA}(i) - (z_E(n) - \lambda_O(i)z_O(i))]}{dk} = b \frac{K - \lambda_O \kappa}{(K + bk)^2} - \frac{K - \kappa}{(K + k - \kappa + k_0)^2} \quad (\text{A.7})$$

$$\frac{d[z_A(i) - z_{NA}(n) - (z_E(n) - \lambda_O(i)z_O(i))]}{dk} = b \frac{K - \lambda_O \kappa}{(K + k)^2} - \left( \frac{K - \kappa - k_0}{(K + k + k_0 - \kappa)^2} \right) \quad (\text{A.8})$$

where it can be checked that  $\frac{d[z_A(i)-z_{NA}(i)-(z_E(n)-\lambda_O(i)z_O(i))]}{dk}\Big|_{b=k_0/(k+k_0)} = \frac{-K+\kappa}{(K+k-\kappa+k_0)^2} < 0$  and  $\frac{d[z_A(i)-z_{NA}(n)-(z_E(n)-\lambda_O(i)z_O(i))]}{dk}\Big|_{b=k_0/(k+k_0)} = \frac{-K+\kappa+k_0}{(K+k-\kappa+k_0)^2} < 0$ . Since  $\frac{dv_{il}^{PRE}}{dk} = \frac{dv_{il}}{dk} < \frac{dv_n}{dk}$  is strictly positive for  $b = 1$  from (A.3) and (A.4), there must exist a  $b^* \in (k_0/(k+k_0), 1)$  such that  $\frac{dv_{il}^{PRE}}{dk} = \frac{dv_n}{dk}$ .

## A.4 Comparative statics

### A.4.1 Proof of $\frac{dv_{ii}}{dK} < 0$

From (11), we have:

$$\text{sign}\left(\frac{dv_{ii}}{dK}\right) = \text{sign}\left[\frac{dz_A(i)}{dK} - \frac{dz_{NA}(i)}{dK}\right]. \quad (\text{A.9})$$

Then, from (4), it follows that

$$\frac{dz_A(i)}{dK} - \frac{dz_{NA}(n)}{dK} = -\frac{k+k_0}{(K+k)^2} - \left(-\frac{k_0}{(K+k)^2}\right) < 0. \quad (\text{A.10})$$

### A.4.2 Proof of $\frac{dv_n}{dK}\Big|_{\lambda_O(i)\approx 0} < 0$

From (9), we have:

$$\text{sign}\left(\frac{dv_n}{dK}\Big|_{\lambda_O(i)\approx 0}\right) = \text{sign}\left[\frac{dz_E(n)}{dK}\right]. \quad (\text{A.11})$$

Then, from (3), it follows that

$$\frac{dz_E(n)}{dK} = -\frac{k+k_0}{(K+k-\kappa+k_0)^2} < 0. \quad (\text{A.12})$$

### A.4.3 The sign of $\frac{d(v_{ii}-v_n)}{dK}$

From (11) and (9), we have

$$\text{sign}\left(\frac{d(v_{ii}-v_n)}{dK}\right) = \text{sign}\left[\frac{dz_A(i)}{dK} - \frac{dz_{NA}(i)}{dK} - \left(\frac{dz_E(n)}{dK} - \lambda_O(i)\frac{dz_O(i)}{dK}\right)\right]. \quad (\text{A.13})$$

Using (3) and (4), we get

$$\Psi_{ii} = \frac{dz_A(i)}{dK} - \frac{dz_{NA}(i)}{dK} - \left(\frac{dz_E(n)}{dK} - \lambda_O(i)\frac{dz_O(i)}{dK}\right) = \frac{k+\kappa+k_0-\kappa}{(K+k+k_0-\kappa)^2} - \frac{k+\lambda_O\kappa}{(K+k)^2} \quad (\text{A.14})$$

To evaluate the sign of  $\Psi_{ii}$  defined in (A.14), let  $\Delta = k_0 - \kappa$ . This gives

$$\Psi_{ii} = \frac{k+\kappa+\Delta}{(K+k+\Delta)^2} - \frac{k+\lambda_O\kappa}{(K+k)^2} \quad (\text{A.15})$$

Note that since  $\lambda_O \in (0, 1)$ , we must have:

$$\Psi_{ii}|_{\Delta=0} = \frac{k + \kappa}{(K + k)^2} - \frac{k + \lambda_O \kappa}{(K + k)^2} > 0 \quad (\text{A.16})$$

Then, check the term  $\frac{k + \kappa + \Delta}{(K + k + \Delta)^2}$  in (A.14). Using that  $K = Ik_0 + (C - I)\kappa$  and  $\Delta = k_0 - \kappa$ , we get

$$\begin{aligned} \frac{d\Psi_{ii}}{d\Delta} &= \frac{(K - k - \Delta - 2\kappa)}{(K + k + \Delta)^3} \\ &= \frac{Ik_0 + (C - I)\kappa - k - k_0 + \kappa - 2\kappa}{(K + k + \Delta)^3} \\ &= \frac{(I - 1)k_0 + (C - I)\kappa - k - \kappa}{(K + k + \Delta)^3} \end{aligned} \quad (\text{A.17})$$

From (A.17) it now follows that  $\frac{d(v_{ii} - v_n)}{dK} > 0$  holds if quality of the star player is not too large, which is the assumption in the text:

$$\text{sign} \left( \frac{d(v_{ii} - v_n)}{dK} \right) = \text{sign}(\Psi_{ii}) = \begin{cases} > 0, & \text{if } \underbrace{k + k_0 - \kappa}_{\text{Nursery under entry}} < Ik_0 + (C - (I + 1))\kappa \\ < 0, & \text{if } \underbrace{k + k_0 - \kappa}_{\text{Nursery under entry}} > Ik_0 + (C - (I + 1))\kappa \end{cases} \quad (\text{A.18})$$

#### A.4.4 The sign of $\frac{d(v_{in} - v_n)}{dK}$

From (9) and (10), we have

$$\text{sign} \left( \frac{d(v_{in} - v_n)}{dK} \right) = \text{sign} \left[ \frac{dz_A(i)}{dK} - \frac{dz_{NA}(n)}{dK} - \left( \frac{dz_E(n)}{dK} - \lambda_O(i) \frac{dz_O(i)}{dK} \right) \right]. \quad (\text{A.19})$$

Using (3) and the definition  $\Delta = k_0 - \kappa$ , we have

$$\Psi_{in} = \frac{dz_A(i)}{dK} - \frac{dz_{NA}(n)}{dK} - \left( \frac{dz_E(n)}{dK} - \lambda_O(i) \frac{dz_O(i)}{dK} \right) = \frac{k + k_0 + \kappa + \Delta}{(K + k + \Delta)^2} - \frac{k + \lambda_O \kappa}{(K + k)^2}. \quad (\text{A.20})$$

Note that since  $\lambda_O \in (0, 1)$ , we must have:

$$\Psi_{in}|_{\Delta=0} = \frac{k + k_0 + \kappa}{(K + k)^2} - \frac{k + \lambda_O \kappa}{(K + k)^2} > 0 \quad (\text{A.21})$$

Then, note that

$$\begin{aligned} \frac{d\Psi_{ii}}{d\Delta} &= \frac{K - k - \Delta - 2\kappa - 2k_0}{(K + k + \Delta)^3} \\ &= \frac{Ik_0 + (C - I)\kappa - k - (k_0 - \kappa) - 2\kappa - 2k_0}{(K + k + \Delta)^3} \end{aligned} \quad (\text{A.22})$$



From (A.22), it now follows that  $\frac{d(v_{in}-v_n)}{dK} > 0$  holds if the quality of the star player is not too large, which is the assumption in the text:

$$\text{sign} \left( \frac{d(v_{in} - v_n)}{dK} \right) = \text{sign}(\Psi_{in}) = \begin{cases} > 0, & \underbrace{k + k_0 - \kappa}_{\text{Nursery under entry}} < (I - 2)k_0 + (C - (I + 2))\kappa \\ < 0, & \underbrace{k + k_0 - \kappa}_{\text{Nursery under entry}} > (I - 2)k_0 + (C - (I + 2))\kappa \end{cases} \quad (\text{A.23})$$

## A.5 Modeling product market interaction

This section models the product market interaction in detail. We make the following assumptions:

**Assumption A1:** (i)  $\frac{\partial R_h}{\partial x_h} > 0$  and  $\frac{\partial R_h}{\partial x_{-h}} < 0$ , (iii)  $\frac{\partial^2 R_h}{\partial x_h \partial x_{-h}} < 0$ , (iv)  $\frac{\partial R_h}{\partial z_h} > 0$  and  $\frac{\partial R_h}{\partial z_{-h}} < 0$ .

Hence, we assume that more sales increases a club's profits,  $\frac{\partial R_h}{\partial x_h} > 0$ , whereas more sales by rival clubs decrease its profits,  $\frac{\partial R_h}{\partial x_{-h}} < 0$ . We also make the assumption of strategic substitutes, so that the marginal profit of selling more tickets or broadcasting rights is declining in rival sales,  $\frac{\partial^2 R_h}{\partial x_h \partial x_{-h}} < 0$ . Finally, we assume that  $\frac{\partial R_h}{\partial z_h} > 0$  and  $\frac{\partial R_h}{\partial z_{-h}} < 0$ , i.e. a higher own expected winning percentage in the finals implies an increase in commercial profits, whereas a higher expected winning percentages in the finals for rivals implies a decrease in commercial profits. This will occur if, for instance, a higher winning percentage increases consumers willingness to pay for tickets or merchandise.

The maximand of the owner of sport club  $j$  can be written  $R_h(x_h, x_{-h}, z_h(l), l)$ . Then, the Nash-Equilibrium,  $\mathbf{x}^*(l) = \{x_h^*(l), x_{-h}^*(l)\}$ , in the commercial market competition is given from the first-order conditions:

$$\frac{\partial R_h(x_h^*, x_{-h}^* : z_h(l), l)}{\partial x_h} = 0, \quad \forall x_h \in R^+, \quad (\text{A.24})$$

where we assume that the second order conditions are fulfilled and that  $\mathbf{x}^*(l)$  is stable

Define the reduced-form profits as  $R_h(l) \equiv R_h(x_h^*(l), x_{-h}^*(l), z_h(l), l)$ . From the symmetry of the winning percentages of matches in the finals in stage 4 in (5), we will have symmetry also in the reduced form profits of the clubs. That is, an incumbent club and the nursery club (after investing in complementary assets and players  $k_0$ ) will have the same commercial value of the star player  $k$ ,  $R_A(i) = R_E(n)$ . This symmetry, in turn, implies that non-possessing established clubs' revenues do not depend on the type of ownership of the star player,  $R_{NA}(i) = R_{NA}(n)$ .

How does the quality of the star player then affect reduced-form profits? Lemma 6 states that quality of the star player increases the revenues of the possessor while decreasing the profits of non-possessing clubs.

**Lemma 6** *When the quality of the star player increases, (i) the revenues of the club where the star player plays increases  $\frac{dR_A(i)}{dk} = \frac{R_E(n)}{dk} > 0$  and (ii) the revenues of the rival clubs decline,  $\frac{dR_{NA}(i)}{dk} = \frac{R_{NA}(n)}{dk} < 0$ .*

Differentiating reduced-form profits  $R_h(l) \equiv R_h(x_h^*(l), x_{-h}^*(l), z_h(l), l)$  and using (A.24), we obtain

$$\frac{dR_h(l)}{dk} = \left[ \frac{\partial R_h}{\partial x_{-h}} \frac{dx_{-h}^*}{dz_h} + \frac{\partial R_h}{\partial z_h} \right] \frac{dz_h}{dk} > 0, \quad h = \{A, E\}, \quad (\text{A.25})$$

$$\frac{dR_{NA}(l)}{dk} = \left[ \frac{\partial R_{NA}}{\partial x_{-NA}} \frac{dx_{-NA}^*}{dz_{NA}} + \frac{\partial R_{NA}}{\partial z_{NA}} \right] \frac{dz_{NA}}{dk} < 0. \quad (\text{A.26})$$

From (3), we know that by increasing the star player's quality, the possessing club's (the acquiring incumbent or the nursery club,  $h = \{A, E\}$ ) winning percentage in the Champions League in stage 4 increases,  $\frac{dz_h}{dk} > 0$ . For the club in possession of the star player, a higher winning percentage of matches won has a direct increase in profits for this club,  $\frac{\partial R_h}{\partial z_h} > 0$ , say, due to higher willingness to pay for souvenirs or broadcasting rights (see the example below). For its rivals, this has the opposite effects as fans and TV-stations are willing to pay less for their items or broadcasting rights,  $\frac{\partial R_{NA}}{\partial z_h} < 0$ . From our assumption of sale being strategic substitutes, one can show that the club in possession of the star player will be able to commit to be more aggressive in product market,  $\frac{dx_{-h}^*}{dz_h} > 0$ : as a higher winning percentage increases its sales, rival will contract their sales  $\frac{dx_{-h}^*}{dz_h} < 0$ , which will increase the profit of the possessing club,  $\frac{\partial R_h}{\partial x_{-h}} \frac{dx_{-h}^*}{dz_h} > 0$ . In contrast, a more aggressive possessing club will make its rivals worse off,  $\frac{\partial R_{NA}}{\partial x_{-NA}} \frac{dx_{-NA}^*}{dz_{NA}} < 0$ .<sup>28</sup>

### A.5.1 The differentiated Cournot model

As an example, we model the commercial market competition, stage 3, as a Cournot model with differentiated products (DPC-model), where established clubs (or the established clubs and the nursery club) face inverse demand

$$p_j = a + z_j(l) - x_j - \gamma x_{-j}, \quad (\text{A.27})$$

where again  $x_j$  is a club's sales of tickets, broadcasting rights, advertising and merchandises, and again  $x_{-j} = \sum_{i \neq j} x_i$  denote rivals' sales of these items. Note that  $\gamma \in (0, 1]$  is the (inverse) level of product differentiation between all products sold by clubs (a larger  $\gamma$  gives more homogenous products). Note also that a higher winning percentage in the Champions League ( $z_j(l)$ ), increases consumers willingness to pay; since we know from (3) that possession of the star player increases winning percentage,  $z_j(j) > z_j(i)$ , fans of the club with the star player will - all else equal - pay more for the possessing club's items. Let  $R_j = [p_j - c]x_j$  be the direct profit function where  $c$  is the (symmetric) marginal cost. Using (A.24) and (A.27), the first order conditions determining the

<sup>28</sup>Here, we are assuming that the possessing club becomes so aggressive, that the increase in sales is so large that this makes up for non-acquiring rivals shrinking their sales. This holds in the Cournot-model in the next section.

Nash-quantities in the product becomes market interaction  $\mathbf{x}^*(l) = \{x_j^*(l, k), x_{-j}^*(l, k)\}$  become  $p_j - c = x_j^*(l)$ . It follows that  $R_j(l) = [x_j^*(l)]^2$  is the reduced-form profit of club  $j$ , where again  $l$  indicates which club owns the star player  $k$ . It can also be shown that  $x_j^*(j) = \frac{s(\Lambda+z_j(j))-\gamma X^*(j)}{2-\gamma}$  and  $x_i^*(j) = \frac{s(\Lambda+z_i(j))-\gamma X^*(j)}{2-\gamma}$ , where  $X^*(j) = s \frac{n\Lambda+1}{2-\gamma+n\gamma}$  is total output of items where  $\Lambda = a - c$ . It follows that Example A.5.1 fulfills lemma 6.

## A.6 Allowing for incumbent talent search

Consider a setting where the nursery club and only one of the incumbent clubs search for potential star players. In stage 1, the clubs invests in player development  $\rho_E$  to scout star talent  $k$ . For simplicity, assume that the probability of succeeding with a star player is the investment level, i.e.  $\rho \in [0, 1]$ , and that investment is associated with an increasing and strictly convex cost  $y(\rho) = \frac{\mu}{2}\rho^2$ . To simplify further, we assume that if both the nursery club and the incumbent club find the star player, the player will sign for the incumbent club. A reason for this is that the incumbent club have more financial resources, contacts and reputation giving the incumbent club the upper hand in this situation. Finally, for expositional reasons, we assume that the quality of a talent is known. We show that under mild conditions, we can extend the interaction to a setting where talent quality is not known in advance.

The expected profits for the nursery club and the incumbent club can be written:<sup>29</sup>

$$\begin{aligned} \Pi_E &= (1 - \rho_i) \left( \underbrace{\underbrace{\rho_E \xi_E(l)}_{\text{Nursery succeeds}} + \underbrace{(1 - \rho_E) \lambda_O(i) z_O(0) \times [R + P]}_{\text{Nursery succeeds}}}_{\text{Incumbent club fails}} \right) - y(\rho_E) \quad (\text{A.28}) \\ \Pi_i &= \left( \underbrace{\underbrace{\rho_i z_A(i)}_{\text{Incumb. succeeds}} + \underbrace{(1 - \rho_i) \{ \underbrace{\rho_E z_{NA}(i)}_{\text{Nursery succeeds}} + \underbrace{(1 - \rho_E) z_{NA}(0)}_{\text{Nursery fails}} \}}_{\text{Incumbent fails}}}_{\text{Incumbent fails}} \right) \times [R + P] - y(\rho_i) \quad (\text{A.29}) \end{aligned}$$

As shown in (A.28) the nursery club can only sign the star player when it succeeds and the incumbent club fails. This occurs with probability  $(1 - \rho_i) \rho_E$  in which case the nursery club receives the reward  $\xi_E(l)$  which depends on whether or not it keeps or sells its star player in stage 2 - as shown in (19). As shown in (A.29), the incumbent club obtains the same product market profit as an acquiring incumbent club,  $z_A(i) [R + P]$  if it succeeds, which occurs with probability  $\rho_i$ . If the incumbent club fails, which occurs with probability  $1 - \rho_i$ , it obtains an expected profit as non acquirer,  $[\rho_E z_{NA}(l) + (1 - \rho_E) z_{NA}(0)] \times [R + P]$ , where  $\rho_E z_{NA}(l) \times [R + P]$  is the established club's expected profit if the nursery club succeeds and  $(1 - \rho_E) z_{NA}(0) \times [R + P]$  is the expected

<sup>29</sup> We drop the index of the identity of the established clubs.

profit if the nursery club fails. Each club chooses effort (i.e. the success probability) to maximize its expected net profit, taking as given the effort of the rivals. The first-order conditions are

$$(1 - \rho_i^*(l)) \{ \xi_E(l) - \lambda_O(i) z_O(0) \times [R + P] \} = \mu \rho_E^*(l), \quad (\text{A.30})$$

$$\left[ z_A(i) - \underbrace{\{ \rho_E z_{NA}(l) + (1 - \rho_E) z_{NA}(0) \}}_{\text{(Replacement effect)}} \right] \times [R + P] = \mu \rho_i^*(l), \quad (\text{A.31})$$

where we assume that the effort cost  $y(\cdot)$  is sufficiently convex so that the second order conditions are fulfilled. The left hand side (LHS) in each equation is the marginal benefit associated with choosing a marginally higher search effort (i.e. success probability), while the right hand side (RHS) is the marginal cost.

To illustrate how bidding competition affects incentives, suppose that the quality of the star player is sufficiently high to generate bidding competition if a sale occurs, i.e.  $k > k^{PE}$ . From (19), the reward is  $\xi_E(i) = v_{ii} + \lambda_O(i) z_O(i) \times [R + P]$ . If a sale of the star player is not viable, - for instance if the transaction costs are very high - the reward in (A.30) is the entry value  $\xi_E(e) = z_E(n) \times [R + P] - F$ . Now consider the clubs' actions. If entry with the star player is the only option for the nursery club, the Nash-equilibrium in search efforts  $(\rho_E^{Entry*}, \rho_{i1}^{Entry*})$  is shown at the point labelled Entry\* in Panel (ii) of Figure A.1 at the intersection the clubs' reaction functions. Note that the reaction function of the nursery club, labelled  $\mathcal{R}_E^{Entry}$  (representing the nursery club's optimal search effort for a given choice of the incumbent club), is downward-sloping in the  $\rho_E - \rho_{i1}$  space in Panel (ii), so that the nursery club will choose a lower effort when the incumbent club chooses a higher effort. This follows since a higher effort by the incumbent club  $\rho_{i1}$  reduces the nursery club's marginal expected benefit from succeeding (the LHS in Equation A.30), while the marginal cost is not affected (the RHS in Equation A.30). The nursery club then chooses its highest effort when  $\rho_i = 0$ , labelled  $\rho_E^{Entry}$ . In contrast, the incumbent club's reaction function labelled  $\mathcal{R}_i^{Entry}$  is upward sloping in the  $\rho_E - \rho_{i1}$  space, as shown in Panel (ii) of Figure A.1. Thus, the incumbent club's response to higher search effort by the nursery club is also to choose a higher search effort. To see why, note that the marginal benefit of succeeding in (A.31) first consists out of the profit or revenues with the star player,  $z_A(i) \times [R + P]$ . The marginal benefit from succeeding is, however, reduced by the second term which mirrors a "replacement": when the incumbent club succeeds it replaces the profits that the club would obtain when failing. More specifically, the replacement effect,  $[\rho_E z_{NA}(n) + (1 - \rho_E) z_{NA}(0)] \times [R + P]$ , is the established club's expected profit as non-acquirer, where the first term is the expected profit when the nursery club succeeds and the second is the profit when the nursery club fails. Rewrite the replacement effect as  $R + P - \rho_E [z_{NA}(0) - z_{NA}(n)] \times [R + P]$ , where  $z_{NA}(0) > z_{NA}(n)$  from (5). Note that if the nursery club chooses a higher search effort,  $\rho_E$ , the expected loss from entry,  $\rho_E [z_{NA}(0) - z_{NA}(n)] \times [R + P]$ , will increase, which, in turn, reduces the whole replacement effect,  $R + P - \rho_E [z_{NA}(0) - z_{NA}(n)] \times [R + P]$ . Thus, since an increased search effort by the nursery club  $\rho_E$  reduces the expected loss from replaced profits, the incumbent club will choose a higher success probability,  $\rho_i$ .

Let us now examine how the equilibrium search efforts by the clubs are affected if commercialization by sale becomes viable, which we can do by assuming that the transaction cost is reduced. The Nash-equilibrium given future sale, labelled  $Sale^*$  in Panel (ii) of Figure A.1, is obtained by first substituting  $\xi_E(i) = v_{ii} + \lambda_O(i)z_O(i) \times [R+P]$  from (19) into the first-order condition (A.30). Turning to the incumbent club, we note that sale under preemptive bidding competition must leave all established clubs with same net profit  $z_A(i) \times [R+P] - T - v_{ii} = z_{NA}(i) \times [R+P]$ . Hence, we can merely replace the winning percentage  $z_{NA}(n)$  in (A.31) with  $z_{NA}(i)$ . From Lemma 1 and as shown in Figure 1(iii), we know that a sale of the star player under preemptive bidding competition gives the nursery club a higher reward than under entry,  $\xi_E(i) - \xi_E(e) = v_{ii} - v_n > 0$ . For a given effort by the incumbent club, it then follows that the nursery club will always choose a higher search effort under sale. Hence, the nursery club's reaction function under a sale ( $\mathcal{R}_E^{Sale}$ ) must be located to the right of the reaction function under entry ( $\mathcal{R}_E^{Entry}$ ). How does the incumbent club react? First, from (5) a non-acquiring incumbent club will have a higher winning percentage under a rival acquisition than under certain entry by the nursery club,  $z_{NA}(i) > z_{NA}(n)$ , since competition is less intense. This implies that the replacement effect in (A.31) is larger under sale. With a larger expected profit being replaced under sale, the incumbent club will therefore choose a lower search effort under sale, and the reaction function for the incumbent club will shift down from  $\mathcal{R}_i^{Entry}$  to  $\mathcal{R}_i^{Sale}$  in Panel (ii) in Figure A.1(ii). Comparing the Nash-equilibria under entry and sale,  $Entry^*$  and  $Sale^*$  in Panel (ii), it is then clear that sale in stage 2 will increase the equilibrium search effort by the nursery club, while the research effort by the incumbent may even decrease.

We have the following result:

**Proposition 7** *Suppose that the transaction cost ( $T$ ) is initially very high, so that the nursery club - when it is successful in its search for a star player,  $k > k^{PE}$  - keeps the star player in order to go for the Champions League. Then, there is a significant fall in the transaction cost, so that if the nursery club succeeds in finding the star player, it will sell it under bidding competition to an incumbent club. This will (i) increase the search effort of the nursery club,  $\rho_E^{Sale} > \rho_E^{Entry}$ , while the change in the search effort of the incumbent club cannot be signed,  $\rho_i^{Sale} \gtrless \rho_i^{Entry}$ . If the replacement effect is sufficiently strong, the incumbent's search effort might even decrease.*

## A.7 Empirical robustness test

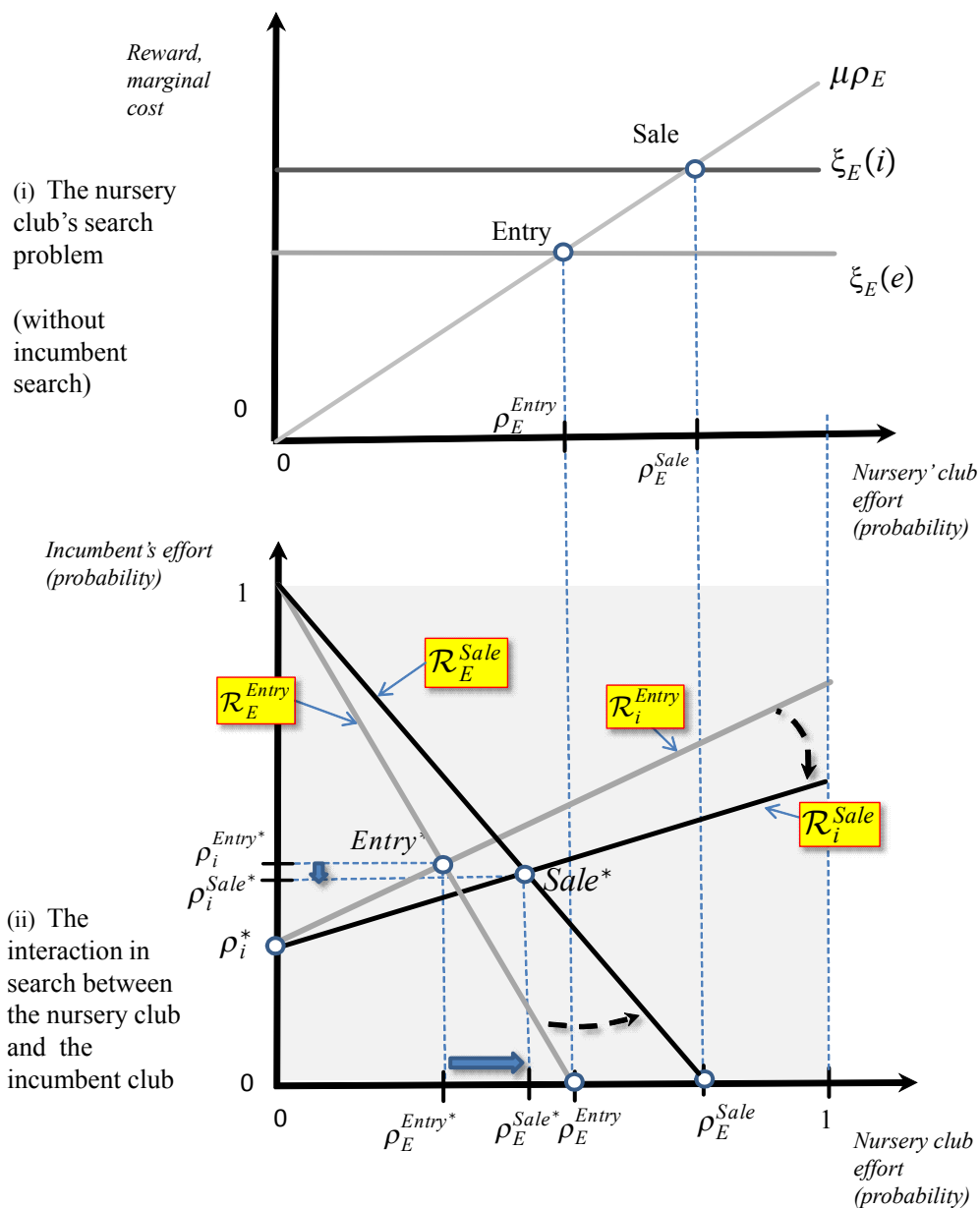


Figure A.1: Panel (i) shows the search choice in stage 1 by the nursery club without incumbent search. Panel (ii) shows the strategic interaction in stage 1 between the nursery club and one incumbent club and how this depends on the anticipated outcome in stage 2.

Table A.1: The relative performance of EU-top and EU-bottom in World Cup tournaments 1978-2014 - group stage.

	Average number of points per game		I[At least draw]	
	(1)	(2)	(3)	(4)
BottomEU15 $\times$ POST	0.514*** (0.167)	0.521*** (0.163)	0.337*** (0.060)	0.340*** (0.064)
POST	-0.139 (0.127)	-0.135 (0.125)	-0.131** (0.049)	-0.130** (0.048)
BottomEU15	-0.520*** (0.120)	-0.517*** (0.178)	-0.294*** (0.084)	-0.292*** (0.085)
WC in EU15		0.233 (0.141)		0.120 (0.084)
WC in South America		0.025 (0.141)		0.007 (0.078)
Constant	1.477*** (0.064)	1.372*** (0.100)	0.932*** (0.028)	0.879*** (0.057)
N	207	207	207	207
R2	0.06	0.07	0.05	0.08

*Note:* When calculating the average number of points per game a win is given two points, a draw is given one point and a loss is given zero points (all points given after extra time but before penalties). The dependent variable I[At least draw] takes the value one if a country takes at least one point in a given game, zero otherwise. Bottom-EU15 is a binary variable taking the value one for the countries Austria, Belgium, Denmark, Greece, Ireland, Netherlands, Northern Ireland, Portugal, Scotland and Sweden and zero for the countries England, France, Germany (West Germany before the unification), Italy and Spain. POST is a binary variable taking the value one after the year 1995, and zero before. WC in EU15 is a binary variable taking the value one for World Cup tournaments in a EU15 country, zero otherwise. WC in South America is a binary variable taking the value one for World Cup tournaments in a South American country, zero otherwise. The sample in Panel A covers World Cup matches for EU15 against non-EU15 opponents and the sample in Panel B covers all matches where not two top or two bottom EU15 teams meet each other. Standard errors clustered at the country level.