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ANALYTICAL MODEL AND AN EMPIRICAL TEST**

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**IMPACT ON COMPETITIVE BALANCE FROM ALLOWING FOREIGN PLAYERS IN A
SPORTS LEAGUE: AN ANALYTICAL MODEL AND AN EMPIRICAL TEST**

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Abstract

Different theoretical frameworks have yielded different predictions concerning the impact on competitive balance of widening the pool of players from which clubs in a sports league are permitted to recruit. We identify that one reason for differences in prediction is that models may represent clubs as hiring from the pool of talent either simultaneously or in a leader-follower fashion (such that strong clubs have first pick of players). With the former assumption, we show that a two team league model predicts no effect on competitive balance; but, with the latter, there is an effect, the sign depending on how many extra talented players are admitted to the pool. Whether balance is modified favourably or unfavourably if, for example, foreign players are introduced is therefore an empirical matter. In our empirical analysis, we test for effects from the liberalisation of football player labour markets associated with the Bosman Ruling. In the context of Spain, results derived from tables of aggregated seasonal performance indicate some weakening of dominance by top teams. We propose an alternative approach to measuring competitive balance, employing data disaggregated to the match level. It also reveals a tendency after Bosman for there to be less dominance of weak clubs by strong clubs, at least when the latter play away. This is despite other changes in the environment that might have been expected to worsen balance.

IMPACT ON COMPETITIVE BALANCE FROM ALLOWING FOREIGN PLAYERS IN A SPORTS LEAGUE: AN ANALYTICAL MODEL AND AN EMPIRICAL TEST

1. Background

The globalisation of the player labour market is both one of the most striking and one of the most controversial of developments in contemporary professional team sports. Its effects are observed in American sports as clubs draw on players from, for example, Mexico and the Caribbean. But its most visible manifestation is in European football (soccer) where lifting of restrictions on imported players by the governing body, UEFA, following the judgement in the Bosman case at the European Court of Justice in 1995¹, has led to several leagues (the English Premier League is one) being staffed by a clear majority of foreign players. This has troubled UEFA sufficiently for it to lobby the European Commission for adjustment of the legal framework that would permit it, as it proposes to do, to introduce minimum numbers of domestic players who would have to be fielded by clubs. In other words, partial reversal is proposed of measures that effectively created a single market in player services.

Whether objections expressed to large number of foreign players are in fact mainly aesthetic is a matter for debate. But economic analysis can explore ways in which introducing foreign players impacts in more tangible ways on the welfare of supporters. A number of potential effects could be examined, for example that on the performance of the national team.² However, in this paper, we focus on the dimension of supporter welfare that has been most central in the development of sports economics, the degree of competitive balance in a league. We ask whether permitting international trade in player services will have any effect on balance in domestic leagues. So far, a consensus has failed to emerge on this question as different models yield different predictions.

The analysis in this paper can be deemed as an experimental field to test the effect of labor market globalization on industries that use skill and scarce labor force in their production process such as high technological sectors and research production in general. In these types of sectors, firms compete for hiring the best workers and also the performance of the different firms can be affected by their selection of workers.

At least two important reasons can be mentioned to support the use of sport economics in order to run these types of tests. First, whereas definition of industrial economic sectors are usually blurred and based on ad-hoc definitions, the market and the number of competitors are well defined in our problem: teams playing in the first division of the Spanish Football League. The second reason is that, in our analysis the

¹ For a discussion of the Bosman case, see Antonioni and Cubbin (2000).

² Effects here are evaluated in Baur and Lehmann (2007) for football and Alvarez et al. (2008) for basketball.

objective function of each firm is clearly defined (winning matches) and the performance of the difference teams can be observed with a high frequency while this information cannot be easily obtain in general for economic firms.

Haan et al. (2002) develop a framework derived from the pioneering El-Hodiri and Fort (1971) model of a two team sports league. They predict that moving from autarky to free trade in player services will not result in any change in competitive balance. They offer there, and in Haan et al. (2007), some empirical support for this prediction, employing standard summary indicators of balance that show little variation in European football as between the pre- and post Bosman eras.

On the other hand, Schmidt and Berri (2003) and Berri et al. (2005) adopt a different theoretical perspective and it yields contrary predictions. They posit that a fixed number of places on professional teams is to be filled from an eligible playing population. Recruitment will be from the right tail of the distribution of talent. The strong clubs will hire the most talented players on the extreme right and the weaker clubs the next best. If the population is small, there is liable to be a significant difference in ability between the best players and the remainder who are successful in becoming professionals. This is what generates competitive imbalance. However, if the pool from which players are selected is increased, the difference between the best and the next best becomes less pronounced. The gap in level of talent between clubs is then smaller and competitive balance improves. Schmidt and Berri demonstrate that there were indeed historically significant improvements in Major League Baseball when the sport was racially integrated and, later, when foreign players were introduced. On this view of the world, a change from autarky to free trade in player services should change competitive balance, and favourably (at least in countries which import players).

Two different theoretical approaches therefore yield conflicting implications. The present paper aims partially to reconcile the two approaches. In Haan et al. (2002), it is assumed that the two clubs act simultaneously in hiring players whereas in Schmidt and Berri (2003) the implicit assumption is of a leader-follower relationship where the very best talent chooses to talk to the stronger club first and the weaker club has to select from what is left. We view this as a potentially more realistic scenario since large market clubs may offer superior opportunities in terms of media exposure, product endorsement opportunities and selection for international teams. In Section 2, we therefore rework the Haan et al. model. We demonstrate that it is in fact a special case of a more general model. The more general model would encompass the possibility that clubs act in a leader-follower fashion as in the Stackelberg framework. When we adapt the Haan et al. analysis to this framework, predictions change such that there can now be an impact from introducing foreign players. The sign of the impact depends on the number of foreign players.

Given we then have ambiguity in the implications of opening up player labour markets, we go on to treat the issue as one that can be settled only empirically. We offer empirical evidence from the top division of Spanish football. This can be argued to be the strongest league in football (one of its clubs, Real Madrid, has been European champion more often than any other) and therefore fully capable of attracting the highest levels of international talent. In Section 3, we test for structural breaks around the time of Bosman in time series of standard measures of balance. However, in Sections 4 and 5, we suggest that traditional measures fail to capture adequately dimensions of balance of interest to median supporters. We argue for a new approach that exploits more disaggregated data and has the further advantage that it relates more closely to the theoretical models. With either the standard or our new approach, a case can be demonstrated that competitive balance in Spain did improve following the Bosman Ruling.

2. A Simple Theoretical Model

In this section we develop analysis about the way in which the Bosman ruling could have had an effect on competitive balance. Our starting point is a model similar to the one proposed by Haan et al. (2002). They show that competitive balance does not depend on the size of the market but only on the magnitude of the differences between clubs in what they term ‘drawing power’. This power is likely to be associated with factors such as the size of the population of the city, the size of the stadium and the history of past success. It is exogenously given in the model.

In the framework Haan et al. employed, the outcome of permitting imported players does not have any effect on competitive balance. The same prediction is generated by Késenne (2007) who developed a model related to that of Haan et al. but who assumed that clubs were win maximisers (subject to a profit constraint) rather than profit maximisers. However, here we show that the Haan et al. model is a special case the results of which depend on some strong assumptions. Specifically, they, like Késenne, suppose that teams in a football league can acquire talented players simultaneously. But it appears as reasonable to assume that not all teams have the same bargaining power. For example, talented players could prefer to negotiate first with a leader team and go to the second best team only if they are not accepted by the leader. Again, talented players could be a scarce factor of production. We show that when talented players are scarce and teams’ decisions to acquire these players are sequential, then the removal of restrictions on importing players could have an effect on the competitive balance in a league although the sign of this effect depends on the total quantity of new players introduced to the market. If the total quantity of new talented players is insufficient, these players will go to the leader team, which causes deterioration in competitive balance. On the other hand, if the number is sufficiently high, some will end up in the follower team, increasing the level of competitive balance.

Let us then assume first a very similar framework to the one proposed by Haan et al. (2002). Similarly to them (and to the well known model of El Hodiri and Quirk, 1971) we assume there are two clubs and they hire talented players to the point where marginal revenue product equals marginal cost. We denote by α_i the quantity of talented players hired by team $i, i = 1, 2$. We also assume that the total quantity of talented players in the market is $\bar{\alpha}$, that is $\alpha_1 + \alpha_2 \leq \bar{\alpha}$. A second assumption is that there is a fixed number of players a team can have. This is a realistic assumption as the number of players on the field is fixed at eleven and also the total number of players in a squad is usually around 25 (since any extras could not be found sufficiently regular places to permit them to maintain match fitness). In our model, the fixed number of players is normalised to one, so the restriction can be formalised as $\alpha_i \leq 1, i = 1, 2$. In other words, the i th team completes its squad with a number of nonquality players equal to $1 - \alpha_i$.

We also follow Haan et al. (2002) in assuming that teams have two sources of income. The first is related to the club's own supporters or other potential customers and includes merchandising, profit, media contracts, etc. The size of this income stream is a function of team success which will depend on the quantity of talented players hired. The second source of income is any prize money for winning the league. The amount of prize money is denoted by F . We specify the total profit of the i th team as

$$\pi_i = D_i \alpha_i - C_i \alpha_i^2 + F P_i, \quad i = 1, 2. \quad (1)$$

where P_i is the probability that a team i win the league, defined as

$$P_i = \frac{1}{2} + \frac{1}{2}(\alpha_i - \alpha_j). \quad (2)$$

The first term in the profit specification is the revenue a team obtains from its own supporters. Note that this revenue is not necessarily the same for the two teams because of the constant D_i that denotes the power of team i . The second term in (1) is the cost of acquiring talented players (this is assumed to be a convex function) and the third term is the expected prize a team obtains for winning the league. The convexity assumption is also made by Haan et al. (2002) and is a typical assumption in the micro literature. One plausible explanation in this context is, for example, that teams spend first their own funds and the cost of spending more than that is increasing due to frictions in the financial markets.

We initially ignore the restriction $\alpha_i \leq 1$ in order to get similar results to Haan et al. (2002). For the present, we assume that the cost of buying talented players is the same for each team, $C_1 = C_2 = C$, and consider the case that each team decides simultaneously the number of talented players it will hire. Then, the model is solved by equalising the marginal profit of each team. Thus

$$D_1 - 2C\alpha_1 + F/2 = D_2 - 2C\alpha_2 + F/2. \quad (3)$$

Imposing that the market for quality players clears, $\alpha_1 + \alpha_2 = \bar{\alpha}$, the solution to this problem is $\alpha_1 = \frac{D_1 - D_2}{4C} + \frac{1}{2}\bar{\alpha}$. We consider $D_1 > D_2$ and define competitive balance, B , as in Hann et al. (2002), as the difference in the winning probabilities of teams 1 and 2. An increase in this measure signifies deterioration in competitive balance. In equilibrium, $B = \frac{D_1 - D_2}{2C}$, that is, competitive balance does not depend on the total supply of talented players, $\bar{\alpha}$, but only on the difference in team power, $D_1 - D_2$, and the cost of buying talented players, C .

The price of talented players in equilibrium is at the level where the marginal profit of each team equals zero:

$$C = \frac{D_1 + F/2}{2\alpha_1} = \frac{D_2 + F/2}{2\alpha_2}, \quad (4)$$

Now, we investigate how results from the model can change if we replace the assumption that teams 1 and 2 take decisions simultaneously with the quite different, but still plausible, assumption that team 1 is a leader that decides first how many quality players it will take. The game is easily solved by backward induction. We also include now the restriction $\alpha_1 \leq \bar{\alpha}$. Team 2 decides on α_2 by maximising its profit function. The first order condition of this problem is

$$D_2 - 2C\alpha_2 + F/2 = 0. \quad (5)$$

Then, $\alpha_2 = \frac{F/2 + D_2}{2C}$ when $\alpha_2 \leq \min(1, \bar{\alpha} - \alpha_1)$ and $\alpha_2 = \min(1, \bar{\alpha} - \alpha_1)$ otherwise.

If $\alpha_1 = \bar{\alpha}$, team 2 cannot take any decision because all the talented players have been taken by the second team.

Then, the number of talented players finally chosen by team 2 can be written as

$$\alpha_2 = \min\left(1, \bar{\alpha} - \alpha_1, \frac{F/2 + D_2}{2C_2}\right). \quad (6)$$

Now, we turn to the leader decision. It is also straightforward to specify the problem of team 1 for each of the three possible cases.

Note that if $\alpha_2 = 1$ or $\alpha_2 = \frac{F/2 + D_2}{2C_2}$, team 1 chooses

$$\alpha_1 = \min\left(1, \bar{\alpha}, \frac{F/2 + D_1}{2C_1}\right). \quad (7)$$

However, if $\alpha_2 = \bar{\alpha} - \alpha_1$ team 1 chooses

$$\alpha_1 = \min\left(1, \bar{\alpha}, \frac{F + D_1}{2C_1}\right). \quad (8)$$

This result indicates that when team 2 is willing to buy all the remaining quality players that have not been picked by the leader team, the leader team has an incentive to buy more players in order to avoid their ending up in the follower team and therefore reducing the probability that the leader team will win the league.

Now competitive balance is not constant but depends on the size of the pool of talented players, $\bar{\alpha}$. More specifically, if we do not consider the possibility that teams can have only talented players, that is

$\frac{F/2 + D_1}{2C_1} < 1$ and $\frac{F/2 + D_2}{2C_2} < 1$, three different results are possible depending on $\bar{\alpha}$. This is a plausible

assumption as even big clubs use both talented and non talented players in their squads.

1) When $\bar{\alpha} \geq \frac{F + D_2}{2C_1} + \frac{F/2 + D_2}{2C_2}$

$$\alpha_1 = \frac{F/2 + D_1}{2C_1}$$

$$\alpha_2 = \frac{F/2 + D_2}{2C_2}$$

$$B = \frac{F/2 + D_1}{2C_1} - \frac{F/2 + D_2}{2C_2}$$

2) When $\frac{F + D_2}{2C_1} \leq \bar{\alpha} < \frac{F + D_1}{2C_1} - \frac{F/2 + D_2}{2C_2}$

$$\alpha_1 = \frac{F + D_1}{2C_1}$$

$$\alpha_2 = \bar{\alpha} - \alpha_1$$

$$B = \frac{F + D_1}{C_1} - \bar{\alpha}$$

3) When $\bar{\alpha} < \frac{F+D_1}{2C_1}$

$$\alpha_1 = \bar{\alpha}$$

$$\alpha_2 = 0$$

$$B = \bar{\alpha}$$

Figure 1 shows how the size of the pool of talented players affects competitive balance. Note that the size of the pool matters but its effect on competitive balance is not monotonic. Thus, when the size of the pool is very small, increasing the number of talented players in the market makes the competition less balanced because the extra players go to the powerful team. However, when there are enough talented players for both teams, an increase in market size increases the degree of competition as some of the new players go the weaker team. In this case, the leader team can act strategically, hiring talented players in order to prevent their playing for the follower team. If there are more talented players than the leader and the follower need, they are satisfied and increasing the number of talented players in the market does not have any effect on competitive balance.

Notice that although the model is based in some specific simplifying assumptions, main results should not be affected if we alter some of them. For example, we would get similar results by extend the model to more than two teams. Indeed, it is possible to think that each team in the model represents a group of teams with the same features. Also, allowing the revenue and cost of hiring players to be a function of the proportion of players sign of each team would not have an important effect on the results of the model. The model is also robust to any other specification of the convex cost of acquiring players and to a different definition of probabilities on the condition that they are bounded on the interval $[0,1]$ and that they are monotonic on the difference of talented players between team 1 and 2.

Given these results, it is clear that the effect on competitive balance of easing or eliminating restrictions on employment of foreign players in a sports league is unlikely to be neutral. However, the sign of the effect is not clear and empirical investigation of particular cases of interest is needed.

3. Impact of Bosman on competitive balance in Spanish football

As in Haan et al. (2002, 2007), the focus for our empirical tests is the impact on competitive balance of the liberalisation of the soccer player labour market that followed the Bosman Ruling in the European Court of Justice in December, 1995. In this section, for the particular case of Spain, we investigate, as they did, whether the regime change was associated with any variation in standard measures of competitive balance.

The measures of competitive balance considered, as in Haan et al., were as follows.

(i) *Concentration ratio* is a measure also employed by Koning (2000). For any season t , this represents the number of points obtained by the top k teams in the final standings as a proportion of the maximum number of points those teams could have obtained. It is calculated as

$CR_{kt} = \left(\sum_{i=1}^k P_i \right) / Wk(2N - k - 1)$ where P_i is the number of points awarded during the season to the club that ended in position i , W is the number of points awarded for a win and N is the number of clubs in the division. We computed this measure for $k = 2$, $k = 4$ and $k = 8$.

ii) *DN* is intended to capture the dynamics in a national soccer league. It measures mobility in the final league standings between one season and the next and is calculated as $DN_t = (2/N^2) (\sum |r_{i,t} - r_{i,t-1}|)$ where r_i refers to the final ranking of club i in a season (with $i = 1$ signifying top place). Clubs that were not present in the division in both years in question are omitted from the calculation.

Comentario [A1]: Need to say, probable in a footnote, how the calculation allowed for change in membership through promotion and relegation.

For each of these measures, we took a standard event study approach, testing for a structural break in the time series at the time the Bosman regime took effect. Of course, it is not always obvious when an “event” should be defined to have occurred. The Bosman Ruling was at the end of 1995. UEFA amended its rules in time for the 1996-7 season but it is not reasonable to expect that clubs would have adapted to the new environment immediately or that there would be a shift to a new equilibrium distribution of talent immediately. Clubs had to evaluate and experiment with new sources of talent. Accordingly, we define the pre-Bosman regime as applying from the start of our data set (season 1986-7) until season 1995-6 and the post-Bosman regime as applying from season 1998-9 to the end our data period, 2005-6. Data from the two intervening seasons are excluded from the data used in the statistical analysis This was partly to allow for a transition period; but an additional reason for excluding 1996-7 and 1997-8 was that these were highly atypical years in Spanish football as they were seasons in the period when the league we study (the top division) had 22 rather than twenty members.³ This would be expected to affect measured competitive balance, distorting pre- and post-Bosman comparisons.

For each measure of competitive balance (cb) in turn, we estimated the equation

$$cb_t = a + bBOSMAN + \varepsilon \quad (9)$$

where *BOSMAN* takes the value one for observations from 1998-9 to 2005-6 and zero during 1986-7 to 1995-6; a and b are parameters to be estimated. Results are shown in Table 1. Main conclusions of the analysis are not altered when when we allow for only one year of transition period, i.e. *BOSMAN* takes

³ Two clubs, Sevilla and Celta de Vigo, had been allocated the relegation places at the end of season 1995-6 for violation of financial rules. Riots in the two cities were followed by the reprieve of the clubs and the division therefore expanded temporarily.

the value only from observations 1997-8 to 2005-6 and zero during 1986-7 to 1995-6. However, these last results are not reported here for the sake of brevity.

The results are mixed. There is no statistically significant evidence of change in the dynamic measure which captures clubs moving position within the standings from season to season.⁴ This is consistent with the results in the pan European study of Haan et al. and with findings from Vrooman (2007) who offered a measure of season-to-season competitive balance based on the extent to which a club's win percent in one year successfully predicted its win percent in the next. For Spain, Vrooman reported that there was no significant difference in this measure as between the ten years before and after Bosman.

The result for our measure of seasonal competitive balance is, however, different. In the equations for concentration ratio, the dummy variable attracts a significant negative coefficient. This indicates decreased dominance by the top clubs under the post Bosman regime.

Of course, an event study is a blunt instrument because one cannot know the counter-factual. The world may have changed in other ways between the 'policy off' and 'policy on' sub-periods and these changes, rather than the 'event' itself, may be the source of any apparent structural break observed, in this case in the time series of the concentration ratios. In fact, two other major developments relevant to dominance by top teams did occur. First, individual, as opposed to collective, selling of television rights was introduced in 1996-7 and permitted the biggest clubs to claim very large shares of broadcasting income.⁵ Second, the UEFA Champions League had been introduced in 1990 and, by the second half of the decade, was delivering substantially increased revenue to the clubs that qualified (which, almost invariably, included Real Madrid and Barcelona). But both of these developments would have been expected to increase dominance by the large market clubs within each season whereas we find that dominance decreased. This gives some credibility to the proposition that the liberalisation in the labour market indeed promoted a more balanced league.

In contrast to our results for Spain, Haan et al. (2002, 2007), in a study based on a panel of European countries, found no change in concentration ratios in the post-Bosman years; but their data set ended at

⁴ These findings were robust to treating only 1996-7 as a transition year and estimating with 1997-8 restored to the data set. Further, results also remained almost identical if estimated without the observation for 1986-7, the only other year when the number of teams was different from twenty (in this case, eighteen).

⁵ For example, by 2005-6, Real Madrid and Barcelona claimed 46% of the league's broadcasting revenue (Deloitte, 2007).

1999-2000, which may have been too soon after the Ruling had begun to have practical effects for any impact to be detectable. Further, our model suggests that there could be different implications from the liberalisation of player labour markets in different countries, for example, some will be importers and some exporters of talented players. Again, speed of response to new conditions might differ across countries. These considerations introduce the risk that heterogeneous impacts will be aggregated away when using a panel of countries and make it more appropriate instead to look at countries on a case-by-case basis. Our result is for a country which imported talented players after Bosman.

4. Measuring the power of clubs

That we have found that one measure of competitive balance in Spain (the concentration ratio) changed between the pre- and post-Bosman sub-periods while another (*DN*) was stable is not necessarily in itself a cause for concern. Different measures are constructed to capture different dimensions of balance, such as the closeness of contest in a single year's competition or the mobility of teams between positions from season to season, and these could be affected in contrasting ways by a given exogenous event or events. However, we are not convinced that such conventional measures as we considered above in fact capture what is most relevant to football supporters given how the sport has developed. Nor is every measure suitable for testing the theoretical framework. For example, we have followed Haan et al. (2002, 2007), and Vrooman (2007) by examining a measure of mobility across seasons. But their, and our, theoretical model is concerned with the gap in ability and performance between clubs with different degrees of drawing power. It has no dynamic dimension and it is not a direct test of its predictions to evaluate the behaviour of a mobility measure over time.

We sought an alternative framework for examining the impact of Bosman on competitive balance that was both more closely related to the theoretical models and more relevant to what we perceive to be of concern to the football audience. We discuss fan preferences in Section 5 below but first we consider how to operationalise the concept of drawing power (or market size) that has been at the heart of theoretical models from El Hodiri and Quirk (1971) on. How can we measure the intuitive concept of clubs being 'big' or 'small', 'powerful' or 'weak'?

An obvious candidate for a measure of power is the club 'budget', the amount spent on player wages. However, using this measure in empirical analysis would raise problems. First, it is unreliable because teams and players often hide information, for example, to avoid taxation or simply because the incentive system to players is too complex for each club to yield a single summary figure that can be compared with those from other clubs. Second, consistent with our model, budget could underestimate the gaps in talent between big and small teams if talented players are willing to play for lower wages at a big club

than a small club (i.e. there may be less glory and less access to other sources of income such as from media appearances).

Given these problems, we considered the following alternative variables that could capture the power of the different teams in the competition. All of them are likely to influence the ability of a club to attract talent either because they increase market size or they represent proxies for historical status that will affect where the best players choose to play.

(i) A weighted measure of how successful each team has been in the domestic league in the last five or ten years (denoted by $ci5$ and $ci10$).⁶ The weights applied are $(1/t^2)$, where t is 1 for last season, 2 for the season before, and so on.⁷ Success is measured according to a variable that takes the value 20 for the team that finished in first position, 19 for the team that finished in second position, and so on; teams are given a value of zero for any season where they played below the level of the first division. Then, for each team, $ci5$ and $ci10$ were defined as the weighted sum of this variable over five or ten years, as appropriate. This is similar to the variable termed 'reputation' employed by Czarnitzki and Stadtmann (2002) in their study of the determinants of match attendance in German football.

(ii) A weighted sum of team rankings according to goals scored in the last five or ten years (denoted by $g5$ and $g10$). This variable is defined similarly to the previous one. For example, for each year we define a variable that takes the value 20 for the team which scored most goals, 19 for the second best, and so on.

(iii) A weighted sum of the number of international competitions in which the club has played in the last five years (denoted by pe). This was constructed by assigning a dummy variable the value one if the team had been involved in an international competition in a given season and zero otherwise; pe is then a weighted sum of this dummy variable for the five years previous to this season.

(iv) A weighted sum of the number of national trophies won in the last five years (denoted by tn).

(v) A weighted sum of the number of international trophies won in the last five years (denoted by te).

(vi) Stadium capacity (CAP).

(vii) Size of the city where the team plays (POP)⁸

All these variables were calculated for each team for each season within the data analysis period, which extended from 1986-87 to 2005-06.

⁶ The relevant data, and all football data used in our analysis below, was sourced at the website of La Liga de Fútbol Profesional Española, <http://www.lfp.es>.

⁷ Similar weights are applied in measures (ii) to (vi) below.

⁸ This was obtained from Instituto Nacional de Estadística de España at <http://www.ine.es>.

A practical problem is that all the measures contribute plausibly to the question of whether a club would be considered 'big' or 'small'. They tend to be highly correlated but it is unclear which would be the most appropriate to use in examining the predictions of theoretical models where the framework is built around teams possessing different degrees of drawing power.

We therefore employed principal components analysis in order to reduce the dimension of the problem.⁹ The fundamental insight of the technique is that this is made feasible by generating a small number of common factors that can explain a sufficiently high percentage of the variability of the information.

We denote by $x(j)$ each of the nine variables considered to measure market power, $j = 1, \dots, 9$. The aim of principal components analysis is to find new variables, denoted by $y(k)$, that are linear combinations of the original variables $x(j)$ such that the following two conditions are fulfilled:

$$y(k) = \sum_{j=1}^p w_{jk} x(j), \quad k = 1, \dots, 9. \quad (10)$$

and

$y(k)$ is orthogonal to $y(m)$, for $m \neq k$.

The weights w_{jk} are the eigenvectors of the correlation matrix of the variables $x(j)$, $j = 1, \dots, 9$, and they can be sorted from the highest to the lowest variability depending on the magnitude of the corresponding eigenvalue.

When this analysis was applied to our data, we found that the first principal component explained 64% of the variability of the variables. Moreover, unlike the remaining components, all the weights given to the different variables were positive and this allows us to interpret this combination as a weighted average of the different variables that might proxy power. Accordingly, as a measure of power, we employ a combination of the variables with the weights shown in Table 2. This power index ranges between 0.3 and 51.4 in our data set. The lowest values relate to clubs that were new to the first division while the highest value for a season always accrues to either Real Madrid or Barcelona. Valencia attracted values close to 45 after 2000. We use this measure of power to evaluate whether there was a change in the extent to which the strong dominated the weak following the liberalisation of the player labour market associated with the Bosman ruling.

⁹ See Anderson (1984) and Muirhead (1982) for detailed explanations of this procedure.

5. A new approach to measuring variation in competitive balance

In the current environment of European football, variations in a measure such as the concentration ratio are not perhaps very relevant to supporters of the median team. For example, until recently, Arsenal and Manchester United had so dominated the English Premier League that one or other had won the Championship in every season except one since the League was formed in 1992. The margin by which their season points totals tended to exceed all others was very wide and the two-team concentration ratio therefore indicated severe imbalance. Then they were joined in the ranking of possible winners by Chelsea which received a considerable and continuing boost to its budget from a wealthy benefactor. Chelsea has duly won two championships and has joined the élite which competes for the League. Such a change may decrease the two-team concentration ratio and there may also be apparent improvements in other indicators of balance, such as the variance in points across the division and our mobility variable *DN*. However, things would seem little different to supporters of other clubs outside the élite since, given their budget constraints, their teams still have virtually no chance of coming close to becoming champion. The situation is similar in many European leagues where a very small number of clubs dominates, for example Barcelona, Real Madrid and Valencia in Spain and Celtic and Rangers in Scotland.

So what would constitute a gain to supporters of non-élite clubs as a group? We argue that they may be reconciled to the championship being an unattainable goal but will become disillusioned if their team does not have a chance of overcoming a more powerful club even in individual fixtures. We therefore define a new conceptualisation of competitive balance: balance improves if outcome probabilities, seen from the perspective of a weaker club, improve in fixtures against a stronger club. In a season of thirty-eight rounds of matches, it is likely that final standings will correlate very closely with rankings of clubs by economic power. However, if the gap between ability levels is reduced, which is a possible outcome of liberalisation in permitting imports of player services, there will be more “upsets” in individual matches which then become of more interest to supporters.

A significant advantage of developing this way of measuring competitive balance is that it uses disaggregated data from the level of the match. Conventional measures employ the same data but aggregated to the level of the last league table of the season. There is potential loss of efficiency and even the risk of introducing estimation bias whenever information is lost due to aggregation (Pesaran et al., 1994) and we argue here that, to the extent that supporters are concerned with individual results as well as seasonal outcomes, this lost information is in fact particularly relevant to the debate on competitive balance.

Developing our proposed approach involved formulating a model to account for match results in which our power variable could be employed. We capture the process by which individual match results are generated with an ordered probit model. This is now standard procedure (early applications included Forrest and Simmons, 2000, Koning, 2000 and Goddard and Asimakopulos, 2004). In our case, the three ordered outcomes are coded as home win=2, draw=1 and away win=0. The model was estimated over a set of match outcomes comprising 7,088 observations from the top division of the Spanish League between 1986-7 and 2005-6. Regressors were a *trend* term (to account for the diminution in home advantage over time), the last home result of the home team (*hh*) and the last away result of the away team (*aa*) to account for form (2 for a win, 1 for a draw, 0 for a defeat),¹⁰ the indicator of power for the home club (*POWERH*) and the away club (*POWERA*) and terms (*POWERHBOS* and *POWERABOS*) in which the power variables were interacted with a dummy variable set equal to one for observations from the post Bosman sub period.¹¹ Results are displayed in Table 3.

The importance of the ‘size’ of each club, as captured by our indicator of power, is strikingly illustrated in the results. Our focus is, however, on the interaction terms which test whether the strong had a diminished probability of defeating the weak after the player labour market was liberalised. The signs are in each case consistent with weaker translation of power into outcomes in the post Bosman sub period but the coefficient is significant ($p=0.02$) only in the case of the term for the away club.¹² The interpretation is that, post Bosman, the relationship between power and away results was not as strong as before.

The magnitude of the change was decidedly non-trivial. To illustrate, consider predictions for a match where a weak club (with a power indicator one standard deviation below the mean) played host to a strong club (with a power indicator one standard deviation above the mean). With *hh* and *aa* set equal to their means and the value of *trend* set to reflect conditions at the end of the period, the probability of a win for the weak home team increased from .275 to .320 when the value of the post Bosman dummy changed from zero to one.¹³

¹⁰ The last away result of the home team and the last home result of the away team were each insignificant in preliminary estimation.

¹¹ Interaction terms for which the *POWER* variables were multiplied by *trend* were highly insignificant and were therefore excluded from the specification reported. That there was no tendency for power to become more important with time is consistent with there being no trend in the standard measures of competitive balance reported above.

¹² There was no material difference to our results when we reestimated with the Bosman era defined from 1997-8 rather than 1998-9. In particular, signs on the interaction terms were unchanged and the coefficient on *POWERABOS* remained significant at better than the 5% level.

¹³ The probability of a win for the strong away team fell from .424 to .374.

For robustness, we run different regressions not reported here where we allow for the introduction of the three points for winning the league in season 1995/6 and we consider that the Bosman ruling affects competition from season 1997/8 and from season 1998/9. However, our results always support the hypothesis of an increase in the level of competition after the Bosman ruling.

Our approach yields therefore a finding that, in the post Bosman era, there was improvement in at least one dimension of competitive balance, with some improvement in the prospects of a club hosting strong visitors: 'power' was not as decisive as before in the determination of individual match outcomes. This result occurs despite the other changes in Spanish football (individual selling of television rights and increased income for certain clubs from the UEFA Champions League) that might have been expected to change things in the opposite direction (since they will have made resources a steeper function of club power than before). In terms of our theoretic model, it appears likely therefore that the number of talented players made available to as prestigious a league as that of Spain was sufficiently great for some of them to join weaker teams, with a consequent improvement of the prospects of the latter in individual fixtures.

6. Conclusions

The existing literature produces conflicting predictions concerning the implications for competitive balance when a sports league is opened to foreign players. We identified a key source of differences between models: some represent strong and weak clubs as hiring personnel simultaneously but an alternative is to posit a leader-follower relationship such that strong clubs have first pick of talent. With the latter assumption, we build a model that yields the possibility that liberalisation will improve competitive balance, depending on numbers of foreign players joining the pool from which talent may be recruited.

We investigated the effect of one of the best known examples of liberalisation, that which followed the Bosman Ruling. Adopting standard measures of competitive balance, we found some evidence, from one measure, of a 'favourable' impact having followed from the Ruling in the case of the top division of the Spanish football league. However, we argued for a new framework for evaluation of competitive balance that employs disaggregated match data. Given this framework that emphasises match level competitive balance, there was again some indication that there was an improvement in the relative position of weaker clubs once the influx of foreign players was permitted. This would make the Spanish football case similar to that reported for baseball following expansion of the racial and geographical scope of player recruitment in that sport and indeed consistent with the general prediction in economics that globalisation promotes greater competition in local markets.

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Table 1. Regression results for standard measures of competitive balance

	CR ₂	CR ₄	CR ₈	DN
constant	0.75 (61.99)	0.74 (81.02)	0.75 (116.03)	0.22 (12.36)
<i>BOSMAN</i>	-0.09 (5.04)	-0.07 (5.70)	-0.06 (6.55)	0.03 (1.30)

absolute values of t- statistics are shown in parentheses; number of observations is 18

Table 2. Weights from Principal Component Analysis

<i>ci10</i>	<i>ci5</i>	<i>CAP</i>	<i>g10</i>	<i>g5</i>	<i>pe</i>	<i>POP</i>	<i>te</i>	<i>tn</i>
0.39	0.39	0.34	0.39	0.39	0.34	0.24	0.18	0.27

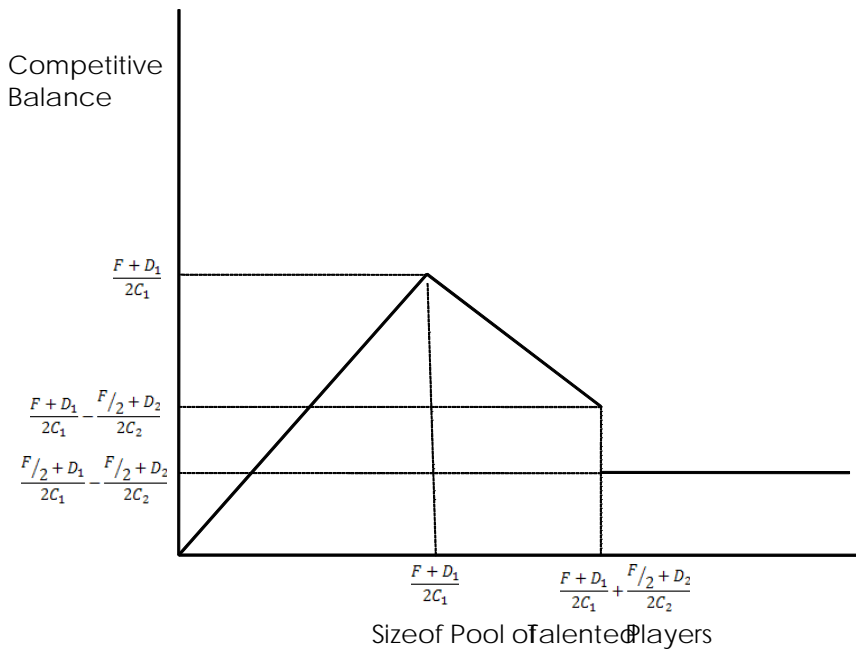
Table 3. Ordered Probit Regression Result

home win=2, draw=1, away win=0

<i>Trend</i>	-0.014 (3.40)
<i>Hh</i>	0.042 (2.41)
<i>Aa</i>	-0.043 (2.48)
<i>POWERH</i>	0.015 (12.38)
<i>POWERA</i>	-0.015 (12.87)
<i>POWERHBOS</i>	-0.002 (1.00)
<i>POWERABOS</i>	0.004 (2.32)

absolute values of t- statistics are shown in parentheses; number of observations is 7,088

Figure 1. Competitive balance and the number of talented players



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