Quantification of competitive balance in European football; development of specially designed indices

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The common competitive balance indices have not been designed to fully account for the complex structure of European football leagues. Domestic championships are multi-prize tournaments since, in addition to the competition for the championship, the best teams also compete to qualify for the lucrative European tournaments, whereas the worst teams struggle to avoid relegation. This article introduces a new measure, the Special Concentration Ratio (SCR_K^I *) which captures the degree of competition for winning any of the important prizes awarded in the league. This approach not only leads to a new perspective for the overall level competitive balance but it also enables us to identify its ingredient sources.*

Keywords: competitive balance; concentration ratio; European football; English Premier League.

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1. Introduction

Football is the most popular team sport in the world and a thriving business; professional leagues particularly in Europe (Gerrard, 2004) but also throughout the wider world show considerable growth in both revenue and spectators. Despite such substantial growth, there are important issues that sports leagues have to address in order to ensure their long-term success. One of the key issues is *competitive balance*, which is reflected by the uncertainty of outcome in sporting events (Michie & Oughton, 2004). The excitement generated by the uncertainty of the event's outcome generates fan interest and thus leads to greater demand for attending and viewing sport events (Rottenberg, 1956).

Due to its prominent importance for professional team sports, the measurement of competitive balance has become an important topic of discussion among researchers in sport economics. A wide variety of approaches have been introduced, each of which attempt to provide a better and more efficient quantification of competitive balance. As Zimbalist (2002) observes, "there are almost as many ways to measure competitive balance as there to quantify money supply" (see p. 112). Nevertheless, none of them has been designed to fully account for the complex structure of multi-prize European football leagues as opposed to the single-prize leagues more commonly found in North America (Kringstad & Gerrard, 2007). More specifically, in addition to the competition for the championship, the best teams also compete to qualify for the lucrative European tournaments (Champions League and Europa League), whereas the worst teams struggle to avoid relegation. To a large extent then, the overall competitive balance is determined by the corresponding levels of uncertainty involved in the pursuit of the various league objectives. Therefore, a new approach to measuring competitive balance is required to account for this special characteristic of multi-prize leagues.

Although the present paper focuses on the seasonal dimension, a similar methodology may be easily implemented for the between-seasons dimension (Szymanski & Zimbalist, 2005). The article proceeds with Section 2 which outlines the three levels of competiveness and briefly discusses existing indices as well as the implications associated with their application to European football. In Section 3, a set of specially designed indices is introduced followed by an application to the English Premier League in Section 4[1]. Lastly, Section 5 concludes with a summary of the main points.

2. Structure in European football leagues and existing competitive balance indices

The structure of European football leagues is complex and sophisticated offering multiple prizes to participating teams. Essentially, domestic European championships can be regarded as three-level tournaments in which teams compete for the corresponding ordered sets of prizes or punishments as follows:

a) The first level refers to the competition for the championship title which is considered the most prestigious prize in any league.
b) The second level refers to the qualifying places for European tournaments of the following season. Currently, there are two such tournaments: the lucrative Champions League and the recently restructured Europa League. Those tournaments, especially the Champions League, offer reputation and, most importantly, high monetary prizes and bonuses for both participation and successful results. Therefore, over and above the championship title, teams also compete for any of the remaining pre-determined top places.
c) Finally, the third level draws attention to the relegation places. Given that European leagues are open, teams that, due to their poor performance, occupy the last league positions, are relegated to lower leagues (divisions). Such a demotion has serious repercussions for both the financial status and the prestige of the relegated team. Consequently, teams strive to avoid relegation and view succeeding in this objective as success in its own right.

The use of this three-level tournament structure by European leagues has been partly motivated by the desire to maximise the fans' demand for attending or watching as many games of increased importance as possible. However, there is evidence that domestic leagues are dominated by a small number of teams at an escalating rate (Goossens, 2006, Michie & Oughton, 2004). In a complex tournament structure, domination

[1] The English Premier League is the highest football league in England.

in the first level may be less worrying if there is satisfactory competitiveness for the other two levels. For instance, championship domination by a particular team (first level) may be compensated for by an adequate degree of competition both for qualification to European tournaments and avoidance of relegation to a lower division. Intuitively, in a complex tournament structure, the overall competitive balance is determined by the corresponding degrees in the three aforementioned levels. Evidently, such an approach has to account for the relative importance of levels or ranking places. It is realistic to assume that the competition for the championship title is more important than that for relegation. Additionally, a higher ranking place is advantageous when participating in European tournaments; thus, the top qualifying places in the second level have to be rated accordingly. From our perspective, the weighting scheme for ranking places when measuring the overall competitive balance in European football should meet the following criteria:

a) The first place (first level) receives the highest weight.
b) The qualifying places for European tournaments (second level) receive lower weights than the corresponding ones for the first place. These weights must be decreasing as the ranking positions increase.
c) The relegation places (third level), receive even lower weights than the corresponding ones for the qualifying places and higher than the corresponding weights for the remaining ranking positions in the middle of the league.

The most widely used competitive balance index is the *Ratio of Standard Deviation* (*RSD*) -which was introduced by Noll (1988) and Scully (1989)- and is defined as the ratio of the observed standard deviation of winning percentages (*STD*) over the idealised standard deviation. Goossens (2006) proposes an alternative ratio to account for the variability in league size, the so-called *National Measure of Seasonal Imbalance* (*NAMSI*). In contrast to *RSD*, *NAMSI* compares *STD* with the standard deviation in the case of a completely unbalanced league (i.e. the most undesirable one). Further indices have been adopted from the industrial organisation literature, since competitive balance is essentially concerned with inequalities among teams. For instance, Owen *et al.* (2007) introduce a normalised version of the *Herfindahl-Hirschman Index* (*HHI**) and Utt and Fort (2002) adjust the traditional index of inequity, that is, *Gini Coefficient* (*Gini*), to the sports context. In an effort to improve the quantification of competitive balance, a variety of innovative approaches has been further introduced in the area, including the *Surprise Index* (*S*) developed by Groot and Groot (2003) based on the assumption that fans become excited when a lower ranking team wins against a top team. Additionally, Haan *et al.* (2002) present the standard deviation of teams' qualities which is estimated as a competitive balance index via a simple econometric model.

Essentially, most of the existing indices quantify the dispersion between the strength of the competing teams using different units of measurement as a proxy; however, none of them account for the special characteristics for the complex structure of European football leagues. For instance, *RSD* and *NAMSI* equally treat teams at the top and the bottom of the ladder while *HHI** rates teams according to their winning share. Therefore, the design of special indices using a suitable weighting pattern is required when measuring competitive balance in European football. In our view, Kringstad and Gerrard (2007) implied this in writing about "the need to move beyond competitive balance" (see p.170). Thus, a new conceptual approach has to be adopted for the development of alternative indices which will take into consideration the competition at each level and rate them accordingly.

3. **Development of specially designed indices**

The design of special indices, our objective in this paper, is inspired by the necessity to quantify the competitiveness at each distinct inter-divisional level separately and weight each ranking position according to their importance. For the development of such indices, we adopt the *Normalised Concentration Ratio* (NCR_K) introduced by (Manasis *et al.*, 2011) which is a normalisation of the widely used CR_K index (Koning, 2000). It essentially measures the strength of the top K teams in comparison to the remaining ones. Using as a benchmark the number of points that can be maximally attributed to the top K teams in a perfectly balanced league [equal to $2K(N-1)$] and also considering the range of the possible points that can be earned by these teams [$2K(N-K)$], NCR_K is defined as[2]:

$$NCR_K = \frac{\sum_{i=1}^{K} P_i - 2K(N-1)}{2K(N-K)} = \frac{1}{2(N-K)}\left(\frac{1}{K}\sum_{i=1}^{K} P_i\right) - \frac{N-1}{N-K}, \tag{1}$$

where N is the total number of teams participating in the league, K is the total number of top league positions considered for this index, and P_i is the number of points collected by the i^{th} ranked team. The selection of the NCR_K index (over other competing indices) is based on the following three features:

a) It has a straightforward interpretation since it measures level of domination by the top K teams.
b) It is relatively robust to the variation of N and/or K and its range is well defined from zero to one (for further details, see Manasis *et al.*, 2011). The index approaches zero in the case of a perfectly balanced league and unity in case the league is completely dominated by the top K teams.
c) Due to its mathematical definition, it can be adjusted to capture the degree of competition in any of the levels mentioned in Section 2.

In this article, we consider round robin tournaments (every team plays twice against all others). For simplification and comparison reasons, we use the older 2-1-0 point system to ensure that the indices are comparable between European leagues with different point systems. For the modern point system (3-1-0), a variety of different combinations of championships can be derived with different numbers of total points (depending on the wins/draws ratio) when assuming perfect balance. This creates a further complication in the definition of our proposed index, which we would like to lie in the (0,1) interval. A possible solution for handling this ambiguity can be obtained by converting the points awarded for all wins from three to two and multiply by $(2w+1)/2$ the total number of points that can be obtained by the top K teams in a perfectly balanced league [equal to $2K(N-1)$]; where w stands for the ratio of the observed total number of wins over the total number of games in the league under investigation.

3.1 *First level*

Obviously, NCR_1 effectively captures the competitiveness for the first level and it can be interpreted as the domination degree of the champion. Following the calculation of NCR_K, the *Normalised Concentration Ratio for the Champion* (NCR_1) is given by:

$$NCR_1 = \frac{1}{2(N-1)} P_1 - 1, \tag{2}$$

where P_1 stands for the number of points collected by the champion. The range of the index is from zero to one: zero when the champion collects 50% of the maximum attainable points, unity in the case of complete domination, in which the champion collects the maximum attainable number of points.

3.2 *First & second levels*

The design of an index for the second level is a rather complicated issue since the performance of each team depends also on the champion's performance. To overcome this difficulty, a joint calculation of the first and second level is attempted via a single index. Therefore, the *Adjusted Concentration Ratio* (ACR_K) is introduced capturing both levels. The development of ACR_K is grounded on the assumption that higher ranking places are more interesting and motivating for the fans; thus, ranking places must be weighted accordingly. For example, let us consider a league of ten teams in which only the first two participate in European tournaments. The champion (first place) and the runner up (second place) qualify. The competition for the championship corresponds to the first level, whereas that for the second place corresponds to the second level. Although NCR_1 effectively captures the competition for the first level, NCR_2 alone cannot

[2] In a perfectly balanced league, each of the top K teams gathers the minimum number of points; that is, 50% of the maximum points. The feasible range of points is given by the difference between the maximum and the minimum number of points that can be attributed to the top K teams. The maximum number of points equals $2K(2N-K-1)$ and corresponds to leagues completely dominated by the top K teams, in which a top K team always wins any lower ranking team.

capture each level, since it rates them equally, thus rendering the development of an index which accounts for the relative significance of each level very useful. The champion is more important than the second team, although both participate in European tournaments, and this should be taken into consideration when measuring competitive balance. By intuition, the relative significance of the two levels (or positions) is effectively captured by employing the average of the NCR_1 and NCR_2 indices. The resultant average index captures the competition between the two levels, as it is illustrated in the simple hypothetical scenario presented in Table 1.

TABLE 1. Average of the NCR_1 and NCR_2

Team Ranking	*League A:*	*League B:*
1	36	30
2	24	30
3	20	20
4	18	18
5	16	16
6	16	16
7	14	14
8	14	14
9	12	12
10	10	10
$\boldsymbol{NCR_1}$	*1*	*0.667*
$\boldsymbol{NCR_2}$	*0.75*	*0.75*
Average ($\boldsymbol{NCR_1}$, $\boldsymbol{NCR_2}$)	*0.875*	*0.708*

From third place down, Leagues *A* and *B* display identical results though there is a considerable point difference between the champion and the second team. The NCR_1 and NCR_2 effectively demonstrate the degree of domination by the champion and by the top two teams respectively. However, NCR_2 does not account for the relative importance of those teams nor the degree of competition between the top two teams. Arguably, *League B* is more balanced than *League A*, although that cannot be concluded from NCR_2. Consequently, the average of the two indices provides an enhanced estimation of competitive balance. Obviously, this process may be generalised for any number in the top *K* positions provided that their value is unequally rated. Thus, the ACR_K is derived by adjusting for the relative significance of the top *K* positions, which effectively captures both the first and the second level. Following the calculation of NCR_K in equation (1), ACR_K is defined as:

$$ACR_K = \frac{\sum_{i=1}^{K} NCR_i}{K} = \frac{1}{K}\left[\sum_{i=1}^{K} w_i P_i - C_K\right], \tag{3}$$

where C_K is a constant term given by:

$$C_K = \sum_{i=1}^{K} \frac{N-1}{N-i}, \tag{4}$$

and w_i stands for the weight attached to the i^{th} team given by

$$w_i = \sum_{j=i}^{K} \frac{1}{2j(N-j)}, \text{ for } i<K<N/2\ . \tag{5}$$

ACR_K ranges from zero to one. It is zero in the absence of domination in which each of the top *K* teams collects 50% of the maximum attainable points. In that case, the league is in a perfectly balanced state since all teams equally share points. This index is unity for both complete domination by the *K* teams and complete imbalance among the *K* teams. In particular, the upper bound is obtained when: a) the top *K* teams collectively gather the maximum attainable number of points and b) within the group of *K* top teams, any of them always wins any weaker team. Since component indices are robust to the variation in *N* and *K* as described previously, then ACR_K will also have a similar behaviour.

The index measures two different qualities: a) the degree of domination by the top K teams, and b) the degree of competition among the K teams. A limitation of ACR_K is that it does not provide any information for the competition introduced by teams after the K^{th} position. However, such a limitation is to be expected based on the design of the index. ACR_K is distinguished from the other indices as a result of two important features:

a) K simpler indices are employed for the calculation of the index. Consequently, ACR_K can be decomposed into its various components and, therefore, the ingredient sources of the overall competitive balance may be determined. Hence important observations may be drawn from the degree of competition in any of the component indices.
b) ACR_K rates the top K teams at a decreasing function of their ranking position. As a result, the employed averaging approach naturally offers a weighting pattern according to the criteria set in Section 2.

In particular, the weight w_i (eq. 5) which is attached to the ith team is derived from the partial sum of the harmonic series with first term 1/[2(N-1)] and last term 1/[2K(N-K)]. Then, w_i forms a sequence of the partial sums given as follows:

$$\begin{aligned}
w_1 &= \frac{1}{2(N-1)} + \frac{1}{4(N-2)} + \frac{1}{6(N-3)} + \dots + \frac{1}{2K(N-K)} \\
w_2 &= \frac{1}{4(N-2)} + \frac{1}{6(N-3)} + \dots + \frac{1}{2K(N-K)} \\
w_3 &= \frac{1}{6(N-3)} + \dots + \frac{1}{2K(N-K)} \\
&\cdots \\
w_K &= \frac{1}{2K(N-K)} .
\end{aligned} \tag{6}$$

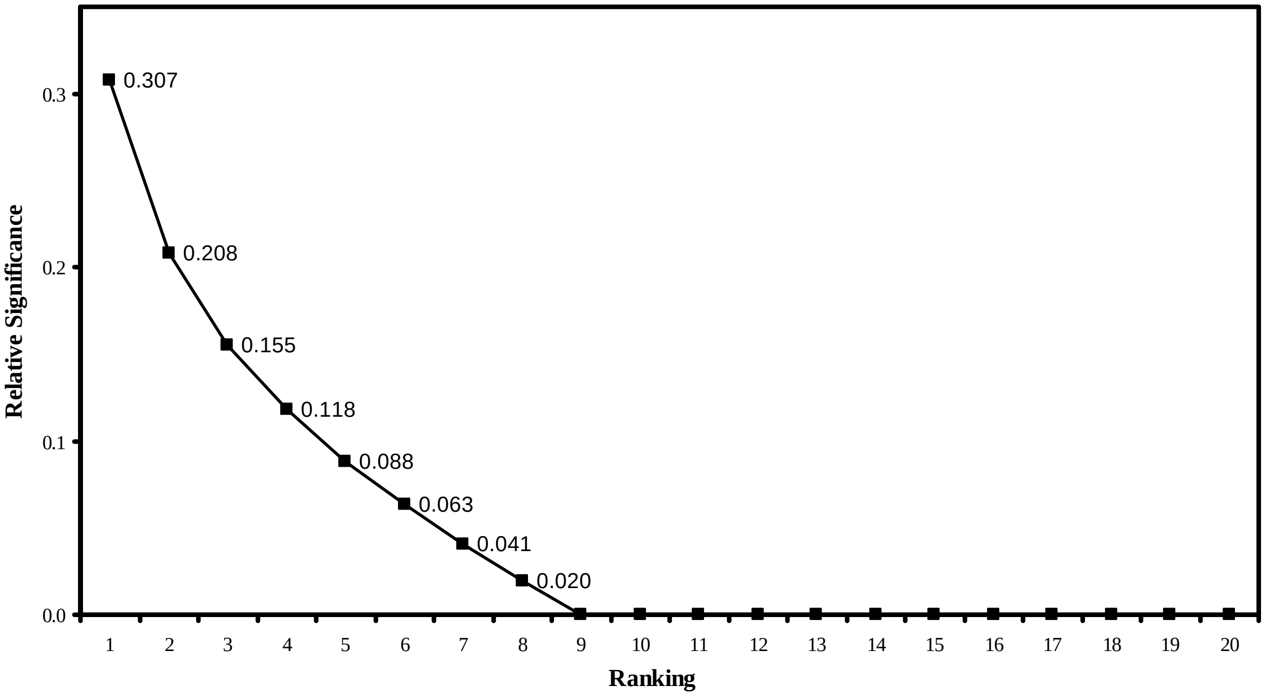
The first weight w_1 includes all the terms, the second all except the first one and so on concluding with the last weight w_K which is equal to the last term of the sum given in equation (5). Each weight w_i is an increasing and a decreasing function of K and N respectively. More importantly, from sequence (6) it can be derived that w_i is a decreasing function of the ranking position, which is denoted here by index i. This is reasonable since the higher the ranking position (i.e. the lower i), the greater the interest from the fans' perspective. Furthermore, for a given K, the rate of this decrease in w_i is an increasing function of N which is also reasonable, since the champion is rated higher in a 20-team rather than in a 10-team league.

To illustrate the behaviour of w_i, we consider a 20-team league in which the top eight qualify for European tournaments. In this case, the importance weight of ACR_K for K=8 are presented in Fig. 1. From this figure, no weight is attached to teams after the eighth position, since they are not included in the calculation of the index. Additionally, the increasing relationship between the weights w_i and the ranking position i is clearly illustrated. We should point out that the definition of ACR_K using the weighting expression in (3) enables us to appropriately modify the index using alternative weighting patterns in order to capture special league characteristics such as indifference between ranking positions which lead to the same prize.

3.3 *Third level*

Assuming that the promotion-relegation rule is a significant aspect in European football leagues, this aspect of competition cannot be ignored, and, thus, the *Normalised Concentration Ratio for Relegated Teams* (NCR') is introduced to measure the degree of weakness of the I relegated teams as compared to the remaining ones. Moreover, for an appropriate development of NCR', its boundaries should be well documented. For that reason, we initially calculated the number of points the I teams can gather in both a perfectly balanced and a completely unbalanced for relegation league. These are obtained when the I teams collect the maximum or minimum number of points (I_{PB} and I_{UB}), respectively. More specifically, I_{PB} is reached when each of the I teams gathers the average number of allocated points in the league, which is equal to 2I(N-1). On the other hand, I_{UB} is reached when the I teams gather points only from the games played between them, that is, when any I team always loses from any team above the (N-I)th position.

FIG. 1: Relative significance in ACR_K for K=8 in a 20-team league



Since the total number of games among the I teams is $I(I$-1), I_{UB} equals $2I(I$-1). Given that I_{PB} and I_{UB} are a function of N and/or I, two conditions have to be met for the proper design of NCR^I:

a) A relative measurement of the observed value is required. This can be accomplished by choosing either I_{PB} or I_{UB} as a point of reference. For comparability issues, I_{PB} is chosen as a benchmark. Consequently, the subtraction of the observed value from I_{PB} provides a re-located to zero measurement. It must be noted that I_{UB} could also be chosen as a point of reference.
b) The index must be robust to the size of the league N and the number of relegated teams I. Consequently, the relative observed value has to be controlled for its feasible range (I_{PB} - I_{UB}).

Therefore, the ratio of the above two conditions provides the formula of NCR^I as[3]:

$$NCR^I = \frac{I_{PB} - \sum_{i=N-I+1}^{N} P_i}{I_{PB} - I_{UB}} = \frac{2I(N-1) - \sum_{i=N-I+1}^{N} P_i}{2I(N-1) - 2I(I-1)} = \frac{N-1}{N-I} - \frac{1}{2(N-I)}\left(\frac{1}{I}\sum_{i=N-I+1}^{N} P_i\right), \text{ for } I<N/2. \quad (7)$$

Similarly to NCR_K, NCR^I ranges from zero to one and it reaches its lower bound, if the I teams are strong enough to collect the maximum attainable number of points. In that case, the league is in a perfectly balanced state, since all teams share the total number of points equally and, thus, the I teams are not weak. As NCR^I increases, the I teams become relatively weaker and as NCR^I approaches its upper value (one), the I teams become even weaker in relation to the rest. In that case, the weakness of the I teams obviously reaches its maximum and, thus, they gather points only from other relegated teams; alternatively, there is no competition for relegation. NCR^I does not provide any information either for the behaviour of the remaining (N-I) teams or for the degree of competition among the I teams. The former is a limitation which may be explained by the design of the index, whereas the latter is not considered to be particularly important from a spectator's perspective.

[3]Similarly to NCR_K, for the proper application of NCR^I to the modern 3-1-0 point system, one solution is to convert the points awarded to all wins from three to two and multiply by $[(2w+1)/2]$ the maximum number of points that are obtained by the I teams in a perfectly balanced league (I_{PB}), where w stands for ratio of the total number of observed wins over the total number of games in the league.

3.4 *Combining information from all levels*

Lastly, the *Special Concentration Ratio* (SCR_K^I) is introduced, which captures all the three levels embodied in the European multi-prized leagues. SCR_K^I rates levels and ranking positions according to their significance and can be considered as a custom-built index, which can be easily adapted according to the particular interest generated by a league. For the development of SCR_K^I , the ACR_K and NCR' indices are employed capturing the first two and the third levels respectively. The calculation of SCR_K^I is relatively simple, since its component indices have similar features and capture different aspects of competitive balance. Essentially, the design of SCR_K^I is based on the procedure followed for ACR_K. This can be simply accomplished, if NCR' is considered to be a component index of ACR_K. Therefore, following equations (3) and (7), SCR_K^I is given by:

$$SCR_K^I = \frac{\sum_{i=1}^{K} NCR_i + NCR^I}{K+1} = \frac{1}{K+1}\left[\sum_{i=1}^{K} w_i P_i - \sum_{i=N-I+1}^{N} w_I P_i - C_K + C_I\right], \text{ for } I<K<N/2, \qquad (8)$$

where w_I stands for the weight attached to the relegated teams and C_I is a constant term derived from NCR^I and is given by $(N\text{-}1)/(N\text{-}I)$. Similarly to the previous measures, SCR_K^I ranges from zero to one. The lower bound of the index is obtained in the case where all teams share the same number of points and corresponds to a perfectly balanced league in which the indices measuring all levels of competitiveness will be constrained to their minimum values. On the other hand, the upper bound of the index is obtained when all the following conditions are simultaneously true: a) the top K teams collectively gather the maximum attainable number of points, b) within the group of K, any team always wins against any weaker and loses from any stronger, and c) the I teams collect points only from the between games. The upper bound stands for a completely unbalanced league where the indices for all levels of competitiveness will reach their maximum values. A major advantage of SCR_K^I , which is derived from the robustness of its components ACR_K and NCR', is that it provides a reliable estimation for the competitive balance for various N, K, and I. What is more, the existence of robustness is crucial given the variability in N, K, and I across European football leagues, as is presented in Table 2. Depending on which particular domestic league we are interested in, SCR_K^I can be adjusted accordingly. The variation in N enables an analysis of competitive balance across leagues and/or seasons. Additionally, the variation in K and/or I allows for various adjustments according to the league's specific structure.

TABLE 2. Values of N, K, and I in European football leagues from 1999 to 2008 (10 seasons)

		ENG	GER	FRA	ITA	BEL	GRE	SWE	NOR
N:	14						1	9	**10**
	16						**8**	**1**	
	18		**10**	3	5	**10**	1		
	20	**10**		**7**	**5**				
K:	3-4					7	2	**8**	4
	5-6	1	**1**	**3**		**3**	**8**	2	**6**
	7-9	**9**	9	7	**10**				
I:	1-2			1		9		1	**1**
	3	**10**	**10**	**9**	**5**		**8**	**8**	9
	4				5	**1**	2	1	

In bold: values of N, K, and I for the last season (2008-09) of the dataset under consideration.
The number of I relegated teams includes teams participating in play-out games.
Only in Sweden for the season 2007-08 there is one relegated team.

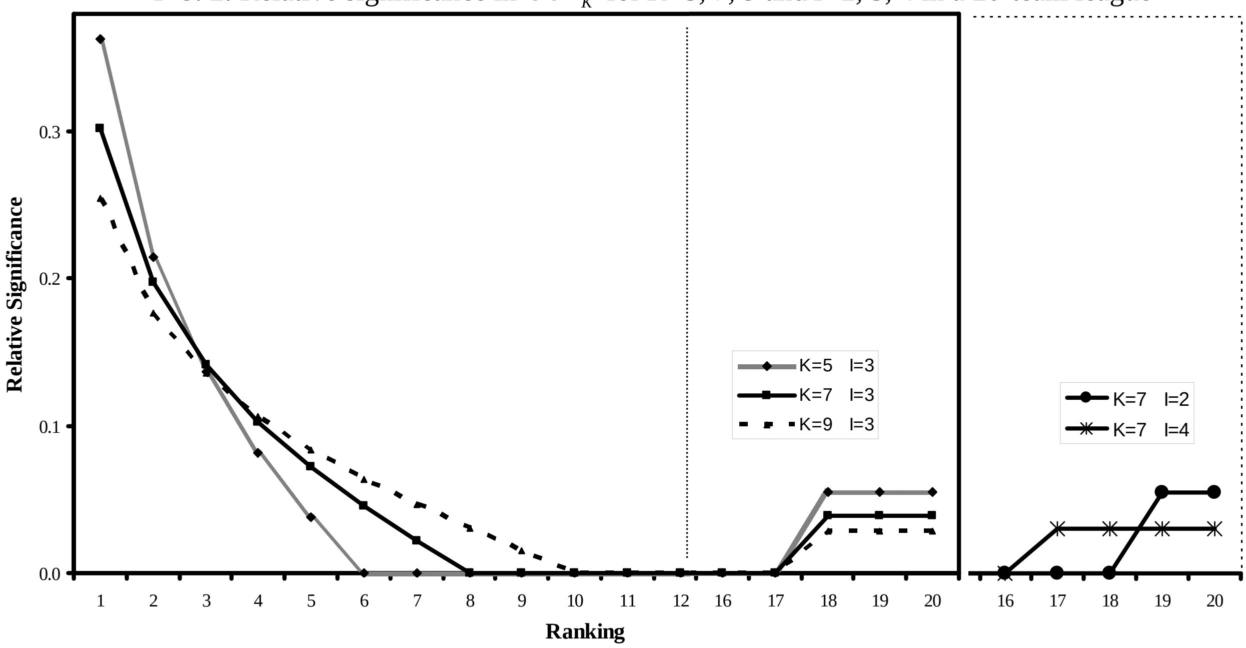
As expected, the interpretation of SCR_K^I is not straightforward since it captures three different qualities: a) the degree of domination by the top K teams, b) the degree of competition among the K teams, and c) the degree of weakness of the last I teams. Similarly to ACR_K, the SCR_K^I also embodies two important features:

a) SCR_K^I is a composite index comprised by K+1 simpler indices. However, it can be decomposed into its various components without losing any information. Consequently, the ingredient sources of the overall competitive balance may be determined by the degree of competition in any component index.
b) The weighting pattern offered by SCR_K^I meets the criteria set in Section 2. More specifically, SCR_K^I rates the top K teams -at a decay pattern of weights- higher than the bottom I teams. Any of the I teams is rated higher than the teams in the middle of the ladder (N-K-I) since those are not included in the index. We should point out that this weighting pattern is not necessarily an optimal one, but it provides a simple and plausible benchmark for the study of competitive balance in European football.

In particular, the weight w_i attached to the top K teams is identical to corresponding one in (3). On the other hand, the weights of all relegated teams are the same (w_I) and equal to $1/[2I(N\text{-}I)]$. This is due to the assumption that on the one hand the choice between any these positions is indifferent and on the other the competition among the relegated teams is not intriguing for either the fans or for the teams themselves. As expected, w_I is a decreasing function of both N and I (for $I<N/2$). Yet, an undesirable property of w_I is that it is higher than w_K concerning the realistic values of $I<K<N/2$. However, this can be easily corrected by increasing the value of K and/or I. Increasing K is justifiable since in that manner way we can also measure the competitiveness of the teams which struggle for the last position leading to European tournaments; similar justification may also be attached to a possible increase of I. Note that w_I may also be higher than w_{K-1} but only for $I<K/3$, which is not common in top European football leagues.

The behaviour of the weights (w_i and w_I) is graphically illustrated in Fig. 2 for a 20-team league with K=5, 7 & 9 European places and for I=2, 3 & 4 relegation places. Note that for K=7, the relative significance for the top K teams remains almost the same regardless of I. Fig. 2 also confirms that the highest relative significance is given to the first place (which is the champion) while the weight for the remaining places decreases, and the weight attached to the relegated teams is between the corresponding weights for the Kth and (K-1)th places with the exception of K=7 and I=2 where $I<K/3$.

FIG. 2: Relative significance in SCR_K^I for K=5, 7, 9 and I=2, 3, 4 in a 20-team league



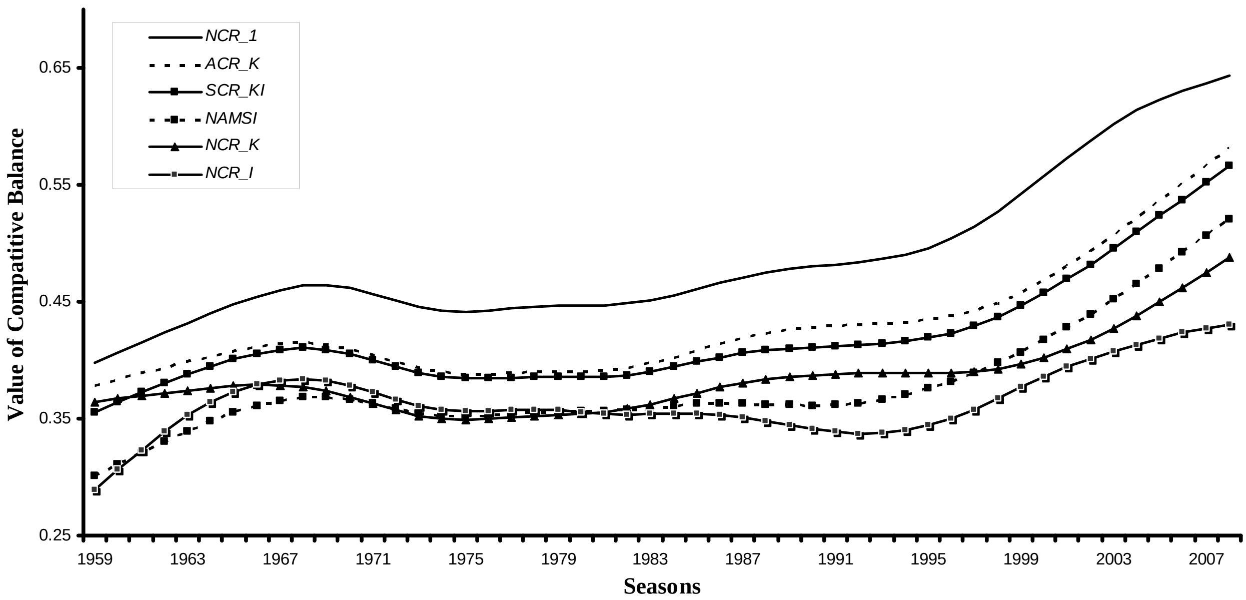
4. **Implementation to English Data**

In order to demonstrate the main features of the new indices, we present a thorough implementation to Premier League data for a period of 50 seasons (from 1959 till 2008). The usefulness of the proposed indices is further illustrated by a detailed comparison to the conventional *NAMSI* and NCR_K indices. Table 3 summarises the evolution of those indices using five–season averages. Moreover, their behaviour is graphically displayed in Fig. 3 by curves smoothed using the Hodrick-Prescott (HP) filter. All indices have been calculated with the appropriate *N*, *K*, and *I* for every season. For instance, in season 2008-09, SCR_7^3 is calculated on the basis of the fact that four teams qualified to the Champions League, three to the Europa League, and three were relegated to the Football League Championship[4].

TABLE 3. Indices of competitive balance in Premier League, England

Index	*59-63*	*64-68*	*69-73*	*74-78*	*79-83*	*84-88*	*89-93*	*94-98*	*99-03*	*04-08*
SCR_K^I	0.36	0.42	0.41	0.39	0.36	0.42	0.41	0.42	0.47	0.55
NAMSI	0.31	0.37	0.36	0.36	0.33	0.39	0.35	0.38	0.43	0.50
NCR_1	0.40	0.46	0.48	0.44	0.41	0.48	0.50	0.47	0.59	0.64
ACR_K	0.38	0.43	0.41	0.39	0.36	0.44	0.43	0.43	0.48	0.56
NCR_K	0.36	0.39	0.36	0.36	0.33	0.40	0.38	0.38	0.41	0.47
NCR^I	0.32	0.38	0.37	0.37	0.32	0.38	0.33	0.34	0.42	0.42

FIG. 3: HP filter for all indices in Premier League (1959-2008), England



Although competitive balance remains generally constant until the middle of the 1990’s, its decline following that period is remarkable. These results are similar to the ones reported by Michie and Oughton (2004), with a change occurring slightly earlier in season 1987. However, competitive balance further declines during the last 5 seasons when all indices display their highest values. We should emphasise that competitive balance worsens about 10% if we employ the composite SCR_K^I index instead of the conventional *NAMSI* index. This may be explained by the different weighting patterns followed by SCR_K^I and *NAMSI*. Similarly, NCR_K overestimates competitive balance since it fails to capture the degree of competition among the top *K* teams. According to Michie and Oughton (2004), the decline of competitive balance is due to the growing gap between the top and the remaining teams which is caused by the increased revenue sources for successful results.

The sources of competitive balance can be further explored by investigating the behaviour of the component indices. In particular, from the comparison between NCR_1 and NCR^I, we can conclude that the degree of the champion’s prevalence is worryingly high in contrast to the satisfactorily rate of competition to

[4] In most countries, one (or more) place for European contests is qualified by other knock-out tournaments (such as the F.A. Cup in England). Therefore, (*K*-1) top league positions (or less) are actually awarded a ticket for the European contests. Here, by using *K* (instead of the actual European places attributed by the league) is equivalent to considering an extended index which, as was discussed in Section 3.4, corrects the problems with weights.

avoid relegation. The percentage difference between the two indices increases continuously and rises up to 50%, which is a strong indication that the team winning the championship is much stronger than the remaining teams. On the other hand, the promotion-relegation rule greatly contributes to a more competitive championship and, thus, at least in England, proves to be a useful mechanism. These observations provide some reasonable justifications for the considerable decline of competitive balance during the last 5 seasons. The growing difference in favour of ACR_K over NCR_K may imply lower competition among the top K teams rather than increasing domination by the same teams. The latter may be confirmed by the relatively small difference between NCR_K and NCR^I, which entail that the degrees between domination by the top K and the weakness of the bottom I teams are comparable. Explanations derived from the analysis of component indices may facilitate policy makers in their effort to protect the viability of European football leagues, which is threatened by the deterioration of competitive balance.

5. **Conclusion**

The complex structure of the multi-prize sports leagues commonly found in European football generates challenges for quantifying competitive balance. It is distinguished by a three-level tournament structure which requires a new conceptual approach for the development of specially designed indices. In particular, levels and/or ranking positions are weighted according to their importance. The application to the English Premier League for the past 50 seasons estimates overall rates of competitive balance lower than those found using conventional indices. Moreover, the further examination of the proposed indices indicates them as a powerful tool for an in-depth analysis of competitive balance, since it reveals interesting facts for league officials. For instance, our discussion of the promotion-relegation rule is related with the recent news of US-owners of English clubs coveting to move towards a North American closed-league system. The full usefulness of our proposed indices requires an empirical examination of the uncertainty-of-outcome hypothesis (Fort & Maxcy, 2003, Zimbalist, 2002), an exciting opportunity for future research.

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