# A New Approach for the Measurement of Seasonal Competitive Balance

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Competitive balance is a very important issue for professional team sports since its existence leads to an increased demand for sport events and therefore to the economic growth and blossom of a sport league. Even though in the course of the last decades sports economists have devoted a considerable amount of work studying the notion of competitive balance, its measurement is still a matter of debate. In this paper we investigate the measurement of the 'seasonal' competitive balance, which focuses on the relative quality of teams within a particular season. Our approach is 'dynamic' since it takes into consideration not only the final league table but also the weekly rounds of each season. Therefore it puts forward round-based indices of seasonal competitive balance. We focus on the European professional football but the methodology can be easily implemented in any other sport using round-robin tournaments.

## I. Introduction

Football is one of the most popular professional team sports in the world and a very profitable business, as professional leagues (especially in Europe) show considerable growth in annual turnover figures. Despite its substantial growth, there are important issues that the industry has to address in order to ensure its long-term success. The most important issue is competitive balance (Michie & Oughton, 2004) which is one of key issues in professional team sports. Its importance derives from the fact that it creates an uncertainty of outcome, which intrigues sport fans' interest leading to an increased demand for attending and viewing sport events (El-Hodiri & Quirk, 1971; Rottenberg, 1956).

Due to its prominent importance for professional team sports, competitive balance has become the main topic of discussion and study amongst researchers in sport economics. Nevertheless, its measurement still remains an issue since the concept of competitive balance is hard to define. The problem arises from the fact that it is a multidimensional factor with properties and aspects that cannot be fully described via a single measure (Zimbalist, 2003).

In our view, part of the problem relates to the definition of the dimensions of competitive balance. We therefore start by discussing its dimensions before we attempt to shed light on the measurement of the seasonal dimension. In doing that, we employ two of the existing indices and, based on this implementation, we put forward a new approach for their measurement. In contrast to the conventionally static approach, which only makes use of the final league table, our approach

incorporates all weekly rounds of the league. In essence, the new approach is dynamic and introduces a new dimension of competitive balance, the round uncertainty. Each national football league (with very few exceptions) consists of a round-robin tournament format with each team playing twice (one home and one away) against the others. Since every championship consists of (usually weekly) rounds[1], our intuition is that this feature should be taken into consideration when measuring competitive balance.

In effect, we expect that the dynamic approach will illustrate the fluctuation of competitive balance in the course of the season and provide enhanced estimations for the value of the seasonal dimension through the creation of round-based indices. What is more, we investigate whether our proposed round-based indices may capture different effects of seasonal competitive balance and also examine their correlation with the conventional indices.

We begin our analysis by discussing the dimensions of competitive balance and then we introduce our proposed dimension of round uncertainty. In the following section we present two of the most frequently used seasonal indices and subsequently a detailed discussion of our round-based indices. Following that, we empirically investigate both the existing and the proposed indices using a comprehensive database from the German and the Greek highest leagues from 1963 until today. In the last section we conclude our analysis with a synopsis of the key points of this article and some final remarks.

## II. Dimensions of Competitive Balance

Competitive balance is unanimously agreed that it is a multi-faceted notion. One of the first researchers observed the multidimensionality of competitive balance was Sloane (1971), who reports two dimensions: (1) the uncertainty of the outcome of the league's title race and (2) the uncertainty of the length of a team's winning run. The most popular classification was introduced by Cairns (1987), who distinguishes three temporal forms of competitive balance: (1) uncertainty with respect to the outcome of individual games, (2) the outcome of the championship, and (3) the absence of long-run domination of the championship by the same club. In the course of the past few years this factorization was followed by many researchers and slightly different definitions emerged in the literature (Borland & MacDonald, 2003; Goossens, 2006; Kesenne, 2007; Michie & Oughton, 2004; Quirk & Fort, 1997; Szymanski, 2003), This is also the distinction we follow in our analysis and consider the following three dimensions of competitive balance:

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[1] The number of rounds is *2(N-1)*, where *N* is the number of teams.

(1) ‘Match uncertainty’,

(2) ‘Seasonal’ or ‘Medium’

(3) ‘Between seasons’ or ‘Long run’

At this point we must emphasise that any potential dimension has to be important primarily from the fans’ point of view. The dimension of ‘match uncertainty’ simply refers to the expectations from a particular game. The evidence of ‘match uncertainty’ on attendance is rather weak (Borland & MacDonald, 2003), mainly because the majority of fans prefer their home team to be the winner with the biggest possible goal difference. Many factors, which are difficult to control, affect the final outcome of a particular game and fans can be attracted to a particular game for various reasons aside from the uncertainty of its outcome. From this perspective, ‘match uncertainty’ does not constitute a basic dimension of competitive balance. Even though any other dimension includes ‘match uncertainty’ at its core (Michie & Oughton, 2004), its individual examination seems to be an issue only for academic concern (Szymanski & Zimbalist, 2005). The concept of competitive balance mainly consists of a longer dimension. Moreover, fans might need more information (i.e. more matches) to value the importance of competitive balance.

It is generally accepted that interest of the fans is more sensitive to the dimensions of ‘seasonal’ and ‘between-seasons’ competitive balance (Borland & MacDonald, 2003). The ‘seasonal’ dimension deals with the relative qualities or strength of teams in the course of a particular season. Fans are familiar with this dimension, since football is organised in seasonal competitions. Therefore, the uncertainty of outcome over which team is going to win the title in a single season is essential for fans. The ‘between-seasons’ dimension concerns the relative qualities of teams across a number of seasons. It is reasonable to assume that fans might care about the turnover or turbulence of teams over the seasons; in any case, it is not exciting to have the same team winning the title year after year or the same group of teams fighting for relegation. Consequently, it seems that the latter two dimensions are of the utmost importance for the study of competitive balance.

In our view it is doubtful that those two dimensions alone can capture all aspects of competitive balance. The ‘seasonal’ dimension gives us an idea of the level of competitive balance at the end of the season, while the ‘between-seasons’ dimension shows us the progress of competitive balance in the course of the years. After the exclusion of the shortest dimension, namely, that of ‘match uncertainty’, a rather large time-gap exists between the match and the seasonal levels. This time-gap might generate a misleading idea for the level of seasonal competitive balance. As a common practice, the measurement of seasonal competitive balance is based on the final league table, which alone cannot fully depict the picture of the seasonal competitive balance. Our claim is that a considerable amount of ‘seasonal’ information is lost, if we solely rely on final league table results

or standings. In order to fill this time-gap, it seems wise to return back to the fans perception in order to discern what could trigger their interest during the season.

## III. Dimension of Round Uncertainty

Aside from single matches, an important component for the design of the national championship tournaments during the season is the weekly round. Rounds usually take place during the weekend and every club competes in home or away matches in rotation. The tournament's round by round schedule is known to all competitors before the start of each season. A group of individual matches compose each round and, in turn, rounds compose the season. The round dimension is an essential element for soccer fans. For every round the best goal, the best player, or playing action are voted and the official ranking of the league as well as various statistics for the fans are announced, while throughout the week numerous discussions both for past and upcoming rounds take place in the media. The debate amongst fans for the results and standings of the previous round nourish the excitement for the upcoming round.

Following the previous discussion, 'round uncertainty' is the most suitable candidate to fill in for the aforementioned time-gap. Neale (1964) indirectly mentions the concept of round uncertainty in his discussion of "league standings" and emphasises "the progress towards a championship or daily changes in the standings". Intuitively, 'round uncertainty' may demonstrate in detail how competitive balance develops throughout the season. It may also sufficiently describe cases where the champion or other league positions are determined weeks before the end of the tournament. Round uncertainty matters to the fans. As Neale (1964) explains: "the closer the standings, and within any range of standings the more frequently the standings change, the larger the gate receipts". Therefore, round uncertainty could capture fans' responsiveness to competitive balance. In our view, the round dimension might reveal more effectively the behaviour of competitive balance throughout the season. Moreover, it offers a new approach to the measurement of seasonal competitive balance. Based on this dynamic approach we can have indices for every round[2] as well as a single round-based index of seasonal competitive balance. Essentially, this new dimension can help us to re-design the existing indices of seasonal competitive balance in a dynamic way i.e. their calculation can be based not only on the final league table but also on each round during the season.

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2 Di Domizio (2008) presents a single round decomposition using a taxonomic approach to measure seasonal competitive balance.

## IV. Indices of seasonal competitive balance

In this section we proceed on the estimation of the seasonal competitive balance. In order to implement our approach we employ two of the most widely used indices but before presenting them, it is important to mention their essential components. Firstly, we calculate winning percentages[3] of the teams competing in the league under consideration. Secondly, the two extreme cases of perfectly balanced and totally unbalanced leagues must be taken into account[4]. Thirdly, in order to make the indices comparable across leagues of different size, they must be normalised in such a way that their values range from zero (perfect balance) to unity (complete imbalance).

We begin with a rather new index, the so called National Measure of Seasonal Imbalance (*NAMSI*), which was put forward by Goosens (2006). Substantially, the *NAMSI* index is an adaptation of the ratio of standard deviation (*RSD*)[5] applied to European soccer. In effect, Goosens compares the observed standard deviation of teams' winning percentages (*STD*) not with the ideal situation (*ISD*), as suggested by Noll (1988) and Scully (1989), but rather with the most undesirable (*WSD*), that is, the case of a completely unbalanced league. The *NAMSI* index is expressed as:

$$NAMSI = \frac{STD}{WSD} \tag{1}$$

where *STD* stands for observed standard deviation and *WSD* stands for the standard deviation in a completely unbalanced league.

What follows is the Herfindahl-Hirschman Index (*HHI*), which was introduced in sports by Depken II (1999). It is used to measure the degree of concentration across units and is defined by the quadratic summation of the market shares of all companies in a particular industry. When applied to the professional sport setting, market share becomes the winning share in the league and it captures the inequalities amongst the clubs that take part in the championship. It is specified as:

$$HHI = \sum_{i=1}^{N} (MS_i)^2 \tag{2}$$

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3 For the calculation of winning percentages in football, a draw is estimated as half of a win. For instance, a team with five wins, two draws and three losses has a sixty percent winning record. Our calculations are based on older point scheme (two points for a win, one for a draw and zero for a loss) which is not only the prevalent scheme for the period under investigation but also provides quite robust results (Goossens, 2006).

4 In the case of a perfectly balanced league all teams equally share points and wins and each has a win record of 50 percent at the end of the season, while in the case of a completely unbalanced league the strongest team wins all games, the next strongest team wins all games against the weaker teams, and so on.

5 This is the most widely cited index and was first developed by Noll (1988) and Scully (1989).

where $MS_i$ stands for the winning share of club $i$ and $N$ is the number of clubs in the league. Owen et al. (2007) correctly normalised the index by proposing the normalized $HHI^*$, which takes into account both the lower and the upper bounds of $HHI$ and is given by:

$$HHI^* = \frac{HHI - HHI_{ideal}}{HHI_{ub} - HHI_{ideal}} \quad (3)$$

where $HHI_{ideal}$ and $HHI_{ub}$ are the $HHI$ indices in the cases of a perfectly balanced and a completely unbalanced league respectively.

## V. Round-Based Indices

Using the above indices we can measure seasonal competitive balance both in the conventional "static" and in our proposed "dynamic" approach. While the "static" approach is quite simple the "dynamic" approach is more complicated since it should be incorporated both cases of a perfectly balanced[6] and a completely unbalanced league. The former can be calculated in a straightforward manner by allocating each team 50 percent of points or wins for every round. As far as the latter is concerned, it is not possible to be calculated in a similar straightforward manner for every round because its value depends on the order of competing teams. For instance, the second best team can only lose if it plays against the best team; yet, it is not known in which round this game will take place.

### a. Using Random Simulation to Estimate Unbalanced Values

Depending on the official draw of the championship, any particular game could happen at any round of the championship. In a completely unbalanced league only for the first, the mid-season[7], and the last round the winning percentages of the clubs are known beforehand and can easily be calculated regardless of the possible draw. The corresponding values for all the remaining rounds depend on the fixture and the competing sequence of the championship.

To overcome this, we simulate approximately five thousand, randomly selected draws and based on Berger tables[8] generate the corresponding championship fixtures. Since the championship fixtures are randomly generated, the end result is a random distribution of each particular game across the

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6 In the *NAMSI* index, the standard deviation in the case of a perfectly balanced league ($STD_{min}$) is not included since it equals zero.

7 The mid-season round is the last round of the first part of the championship. For instance, in a league with 20 teams, the mid-season round is the 19th round.

8 Various patterns of the Berger table have been tested with almost identical results.

rounds. In those simulations the relative strength of each team is predetermined and thus the desired completely unbalanced league is attained for every simulated championship. The unbalanced values of the above presented indices are calculated for each round of all simulated championships. They are denoted as $WSD_{(r)}$ and $HHI_{ub(r)}$ respectively where ($r$) stands for the relevant round.

### b. Graphical Representation of Unbalanced Values of the Indices

The distribution of $WSD_{(r)}$ and $HHI_{ub(r)}$ under the simulated unbalanced leagues of 18 teams[9] appears in Figures 1 and 2. It can be verified, as noted above, that the values of $WSD_{(r)}$ and $HHI_{ub(r)}$ in the first, 17th, and 34th round respectively do not vary[10]. The limits (upper and lower) represent the relevant limits of the frequency distribution and contain 95 percent of the five thousand simulated unbalanced values for each round. It must be pointed out that the distance between the two limits is rather large at the beginning of the championship and sharply diminishes after the first few rounds. As the championship approaches towards the end of the first part and until the end of the season the distance between the two limits becomes progressively negligible. Our chosen value is the median of the frequency distribution, although it almost coincides with the average. This chosen value is denoted as $WSD_{(r)M}$ and $HHI_{ub(r)M}$ respectively.

Figures 1 and 2 also illustrate the observed round values in Greece and in Germany for the year 1993. They are basically the unadjusted indices $STD_{(r)}$, which denotes the observed standard deviation of win percentages in round ($r$), and the $HHI_{(r)}$, which denotes the observed *HHI* in round ($r$). The closer the $STD_{(r)}$ and $HHI_{(r)}$ are to the simulated unbalanced $WSD_{(r)}$ and $HHI_{ub(r)}$ respectively, the more unbalanced the round is. In both countries we observe higher values of $STD_{(r)}$ and $HHI_{(r)}$ at the beginning of the season.

### c. Adjusting Round Indices

Based on the simulation's results, competitive balance indices can be estimated for each round; we thus get a round index, which is basically the round uncertainty. We calculate the round values of *NAMSI* index denoted as $NAMSI_{(r)}$ by:

$$NAMSI_{(r)} = \frac{STD_{(r)}}{WSD_{(r)M}} \qquad (4)$$

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[9] It is required that the simulation is repeated whenever there is a different number of teams N that comprise the league.

[10] In the first round the value of $WSD_{(r)}$ is always 0,5 since there are only wins while the value of the $WSD_{(r)}$ in the 17th and 34th rounds is the (0,305), because in those rounds any team has played against all the others once and twice respectively. The relevant values for the $HHI_{ub(r)}$ are 0,111 in the first round and 0,076 for the 17th and 34th rounds respectively.

**Figure 1: *WSD* $_{(r)}$ Round distribution under the simulated Unbalanced League and actual STD$_{(r)}$ Round values in Germany & Greece in 1993**

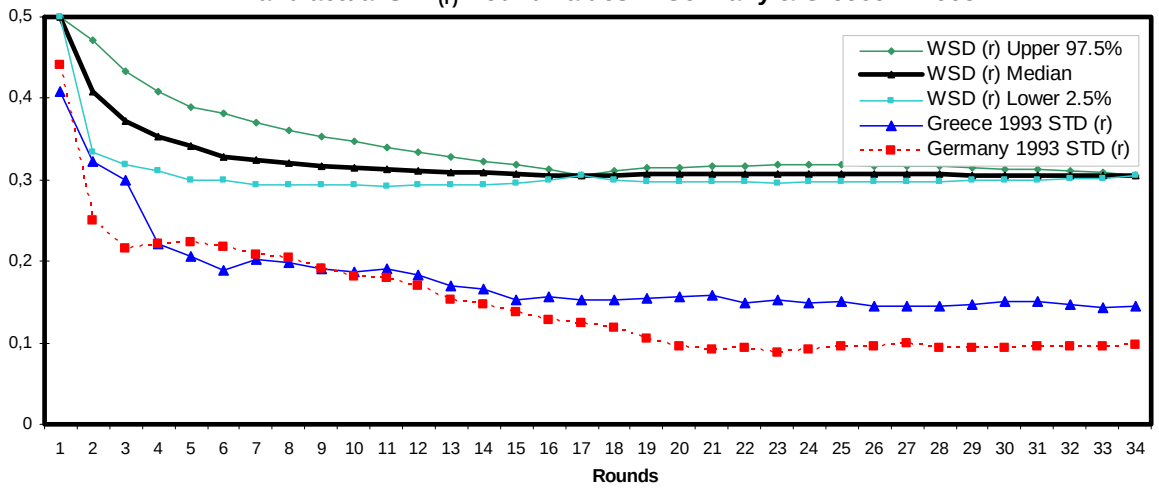
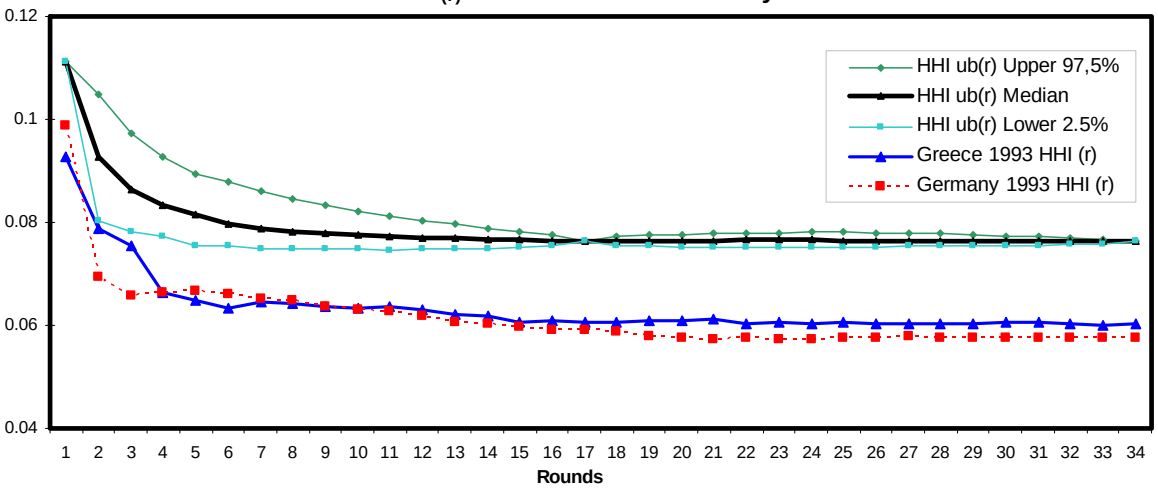



**Figure 2: *HHI* $_{ub(r)}$ Round distribution under the simulated Unbalanced League and actual HHI$_{(r)}$ Round values in Germany & Greece in 1993**




The round values of the *HHI** index are denoted as $HHI^{*}_{(r)}$ and are formulated as:

$$HHI^{*}_{(r)} = \frac{HHI_{(r)} - HHI_{ideal}}{HHI_{ub(r)M} - HHI_{ideal}} = \frac{HHI_{(r)} - 1/N}{HHI_{ub(r)M} - 1/N} = \frac{N\left(HHI_{(r)}\right)-1}{N\left(HHI_{ub(r)M}\right)-1} \qquad (5)$$

The value of the $HHI_{ideal}$ is constant across rounds since it depends only on the number of teams competing in the league and is equal to $1/N$.

The values of $NAMSI_{(r)}$ and $HHI^{*}_{(r)}$ indices for the year 1987 in Germany are illustrated in Figures 3 and 4 respectively. The vertical bars represent the values of the round indices if instead of the median we incorporate the upper and lower limits from the simulated unbalanced league. This range

becomes substantially small after the first quarter of the championship and practically minimal afterwards.

**Figure 3: NAMSI$_{(r)}$ In Germany 1987**

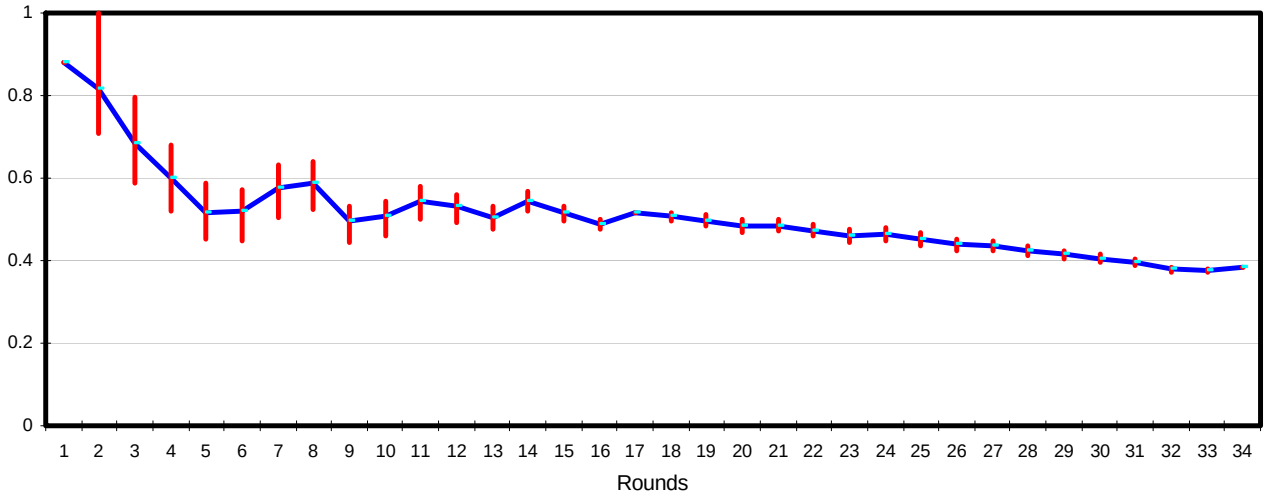
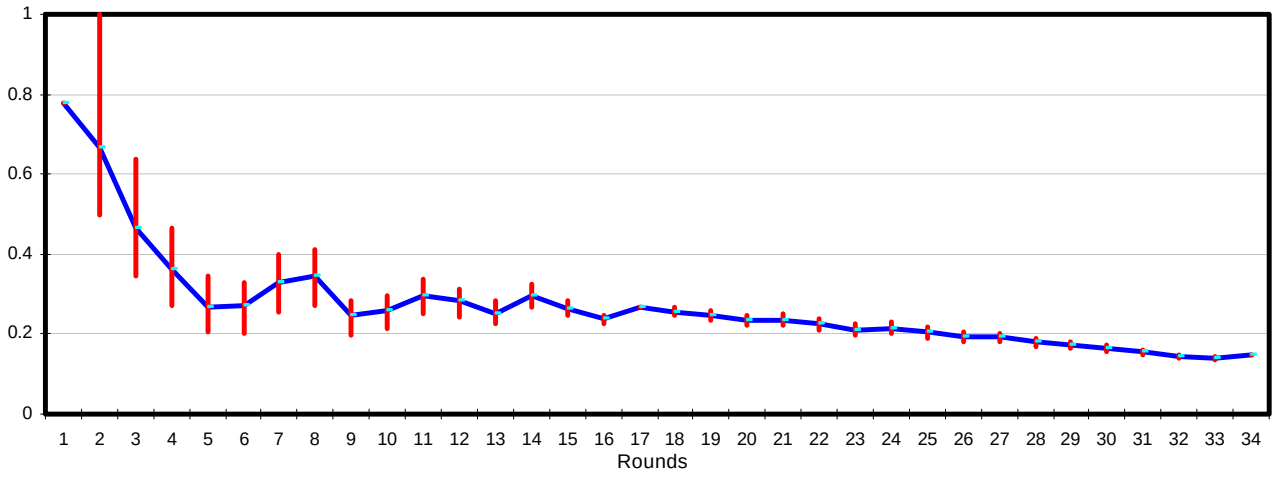



**Figure 4: HHI*$_{(r)}$ in Germany 1987**




### d. Round Based Indices of Seasonal Competitive Balance

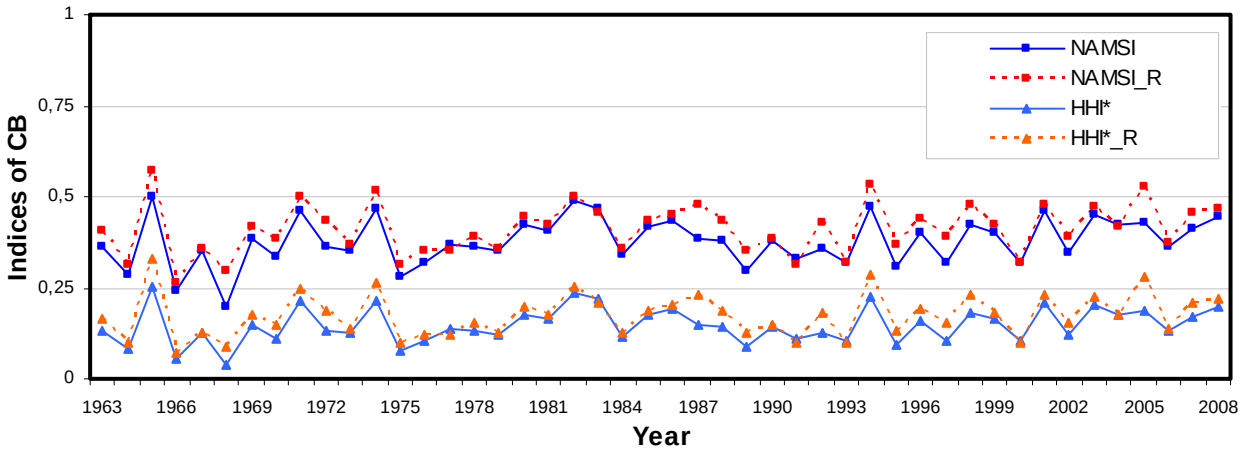
In this subsection we utilize the round indices to compute a single round-based index which is the index of seasonal competitive balance measured "dynamically". In effect, this "dynamic" approach provides a more helpful tool for the study of competitive balance than the "static" one for two main reasons: a) it contains more "seasonal" information since all rounds are included in the measurement and b) it takes into account the dynamic features of competitive balance and consequently effectively captures its fluctuation in the course of the season. For the estimation of the round-based indices denoted as $NAMSI^R$ and $HHI^{*R}$ respectively, we chose the median of the relevant round indices. It may be argued that there is an unacceptable degree of noise early in the season, when the teams' winning percentages are mostly driven by the opponents they have faced so far (Forrest, Beaumont, Goddard, & Simmons, 2005). This is also verified by the simulation

results, in which even though a high degree of noise appears in the first rounds, it diminishes in subsequent rounds. In the present study we omitted approximately the first quarter of the championship, that is, the first eight rounds out of a total of 34 for a championship with 18 teams[11].

## VI. Competitive Balance in Germany and Greece: Empirical Investigation

In this section we present an implementation and empirical investigation of all seasonal indices introduced in this study. Our primary concern is to examine the performance and the behaviour of both approaches. Our empirical analysis is based on a dataset from year 1963 till 2008 from the top leagues in Germany and Greece. The former is a representative of the top five leagues in terms of revenues while the latter represents the small countries group (Koning, 2000; Michie & Oughton, 2004). The development of competitive balance for each country, measured both with the conventional indices of *NAMSI* and *HHI** and with our proposed round-based indices ($NAMSI^R$ and $HHI^{*R}$), is depicted in Figures 5 and 6. It appears from those Figures that the level of the *NAMSI* and $NAMSI^R$ indices is markedly higher than that of the *HHI** and $HHI^{*R}$ indices for both countries. This may be explained by the nature of the indices, which assign different weight to winning records of each team.

**Figure 5: Competitive Balance in Germany 1963-2008**

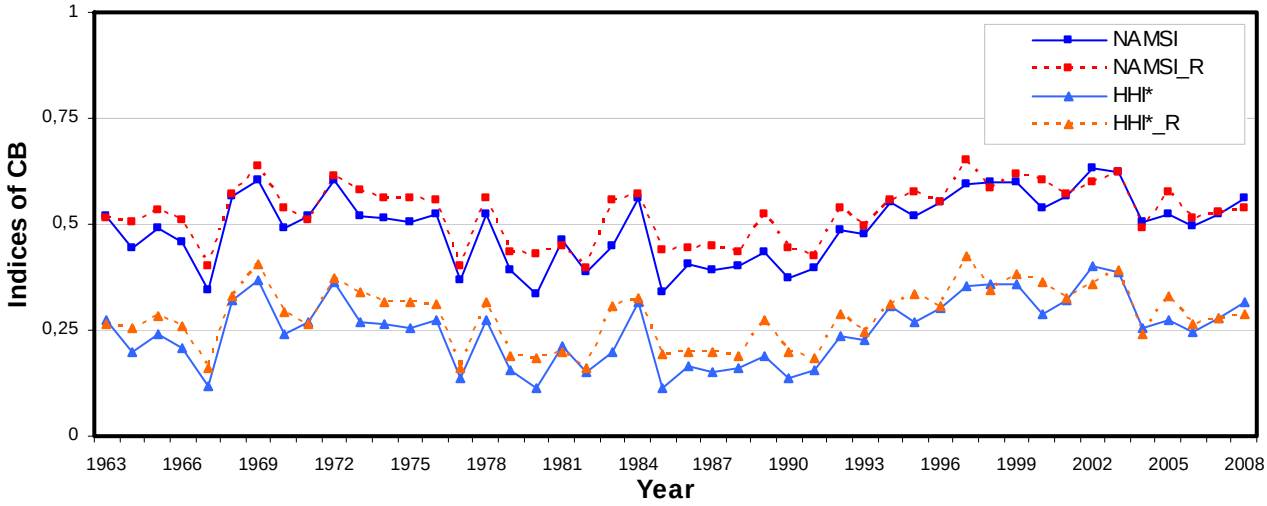



It is also worth pointing out that on average Greece presents 28% higher values than Germany, which means that Greek championship is more unbalanced than the German one.

However, our main interest is to examine the extent to which the levels of the round-based and the conventional indices differ. We start with the examination of the percentage difference between the two approaches.

11 For championships with 30 and 38 rounds we omitted the first 7 and 9 rounds respectively.

**Figure 6: Competitive Balance in Greece 1963-2008**




As is illustrated in Figures 7 & 8, there is considerable difference between the two types of measurement in both countries. There is strong evidence that the $HHI^{*R}$ demonstrates much higher percentage difference than the $NAMSI^{R}$ when compared with the related conventional index; however, this can also be attributed to the nature of the indices. The average percentage difference is 9.1% for the $NAMSI^{R}$ and rises to 19.7% for the $HHI^{*R}$. Those differences are all statistically significant in both countries at 1% level. The corresponding descriptive statistics are presented in Table 1.

It should also be noted that for both countries there are cases where the values of the round-based indices are close or even smaller than those of the conventional ones. However, in the majority of cases, the round-based indices show considerably higher values than the conventional ones. Most notably, the highest difference for Germany is observed on 1968 where the round-based indices of $NAMSI^{R}$ and $HHI^{*R}$ are 50.9% and 127,8% higher than the corresponding conventional ones. The corresponding highest differences for Greece appear for year 1985 and are equal to 29.5% and 67.7% respectively.

On average, the values of the round-based indices are higher by 8% for the $NAMSI^{R}$ and 18% for the $HHI^{*R}$. According to the round-based indices competitions are less balanced than what the conventional indices imply. This may be explained by the fact that a stronger team employs most of its resources at the beginning of the season to gain competitive advantage and, after securing its position, it tends to slow down towards the end of season. Intuitively, the winning percentage advantage of the stronger team will be lower the more times it plays against the others. Let us consider a situation in which Olympiacos or any other strong team has an advantage of five wins against the second best at the end of the first part of the championship. It is quite probable that this

advantage will be lower than ten wins at the end of the championship, which means that the percentage advantage will be lower at the end of the season.

**Figure 7: Percentage difference between *NAMSI*$^R$ and *NAMSI***

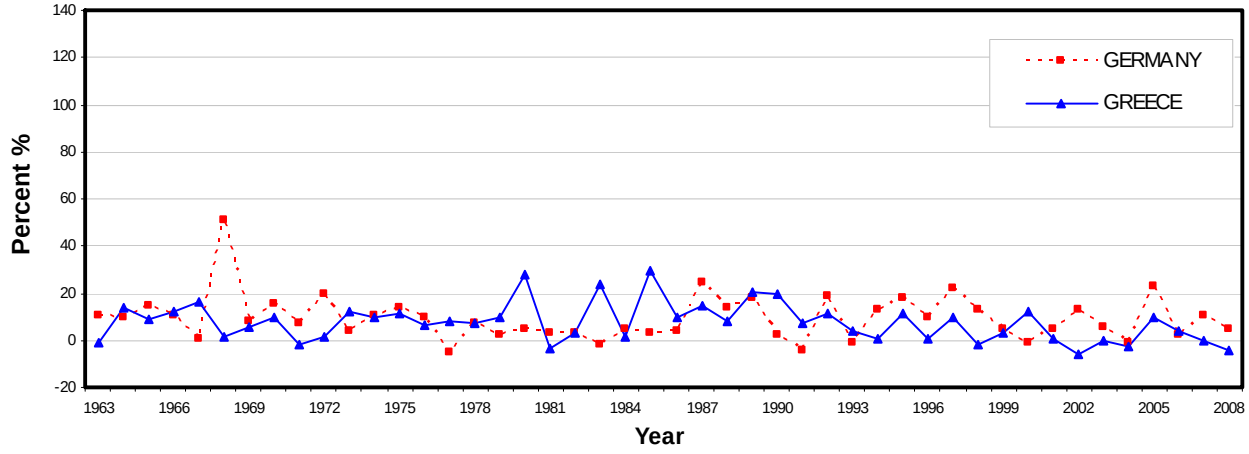



**Figure 8: Percentage difference between *HHI**$^R$ and *HHI****

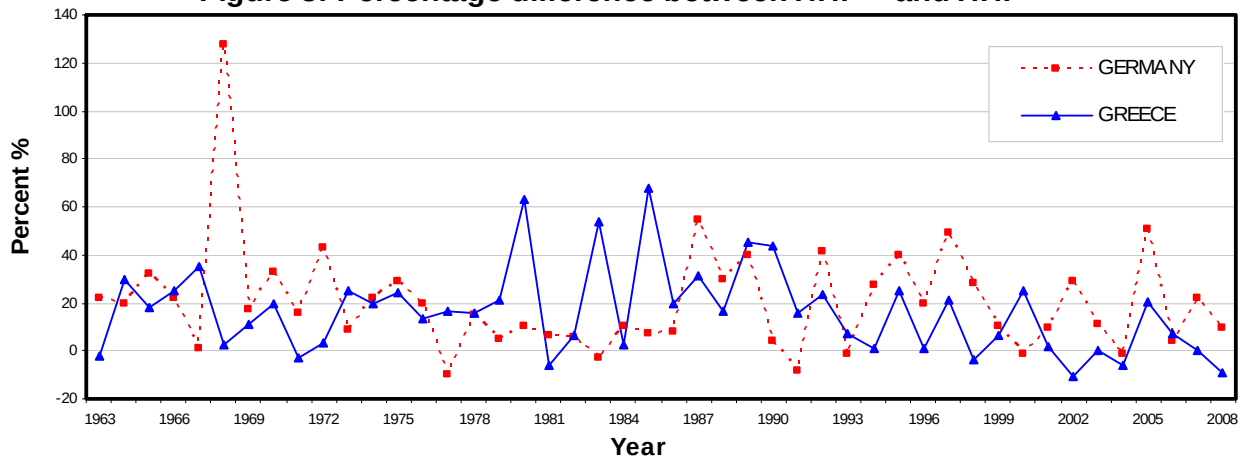



**Table 1: Descriptives Statistics for *NAMSI* and *HHI* indices***

| | GERMANY | | | | | | GREECE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *NAMSI* | *NAMSI*$^R$ | *Diff %* | *HHI** | *HHI*R* | *Diff %* | *NAMSI* | *NAMSI*$^R$ | *Diff %* | *HHI** | *HHI*R* | *Diff %* |
| *Mean* | 0.38 | 0.41 | ***9.85*** | 0.15 | 0.17 | ***21.46*** | 0.49 | 0.53 | ***8.39*** | 0.25 | 0.28 | ***17.97*** |
| *Median* | 0.37 | 0.42 | ***7.95*** | 0.14 | 0.18 | ***16.55*** | 0.51 | 0.54 | ***7.77*** | 0.26 | 0.29 | ***16.14*** |
| *SD* | 0.07 | 0.07 | ***8.90*** | 0.05 | 0.06 | ***21.41*** | 0.08 | 0.07 | ***7.14*** | 0.08 | 0.07 | ***16.10*** |
| *Min* | 0.20 | 0.26 | ***0.62*** | 0.04 | 0.07 | ***1.23*** | 0.33 | 0.40 | ***0.07*** | 0.11 | 0.16 | ***0.14*** |
| *Max* | 0.50 | 0.57 | ***50.94*** | 0.25 | 0.33 | ***127.85*** | 0.63 | 0.65 | ***29.52*** | 0.40 | 0.43 | ***67.74*** |

**All comparisons are statistically significant at 1% level using paired, two sided t-Test for the differences. The corresponding observed values of the t-statistic are -7.7, -7.4, -6.5, and -6.4 respectivelly.*

It is instructive to compare the mid-season round with the last round of the championship since their unbalanced values are identical. Only 10% of the cases considered for the two countries are more balanced in the mid-season round than in the final round of the championship. According to *NAMSI*$^R$, the mid-season round is less balanced than the final round by 17% in Germany and 13% in Greece respectively which are statistically significant at the 1% level[12]. The results of the *HHI**$^R$

[12] The values of the paired t-statistic are -8.67 for Germany and -6.69 for Greece respectively.

index are more impressive, since the corresponding percentages rise to 39% and 23% respectively. Those differences are also statistically significant at the 1% level[13].

Some interesting facts can also be derived from the trend of the indices, which has been tested via OLS for the period 1963-2008. Trent analysis in Germany follows a linear model as:

Trend model in Germany: $Index = \beta + \gamma T$

while this for Greece follows a quadratic model:

Trend model in Greece: $Index = \beta + \gamma T + \delta T^2$

where $T$ is the year, $\beta$ is the intercept and $\gamma, \delta$ are the coefficients.

As Table 2 shows, there is no observable trend in Germany for the entire period, except for a moderate linear trend in the *NAMSI*, even though it is significant at the 0.1 level. This means that competitive balance is rather stable during the above period, which is comparable with the studies of Goosens (2006) and Michie & Oughton (2004). In our study Greece exhibits a significant trend of second grade in both conventional indices, while following Goosens the trend is of fourth degree. However, according to the round-based indices, the trend follows the same pattern but it is significant only at 10% significant level. It can easily be drawn from the trend analysis that NAMSI shows a more consistent trend than the HHI* in both countries and, what is more, the conventional indices show a more consistent trend than the respective round-based indices. The different behaviour that the round-based indices present in the course of the period examined is presumably the result of the different qualities they possess.

**Table 2: Trend of indices for the period 1963-2008**

| | GERMANY | GREECE | |
|---|---|---|---|
| Index | $T$ | $T$ | $T^2$ |
| *NAMSI* | 0.00129* | -0.77541*** | 0.00020*** |
| *NAMSI*$^R$ | 0.00119 | -0.47345* | 0.00012* |
| *HHI*$^*$ | 0.00083 | -0.72641*** | 0.00018*** |
| *HHI*$^{*R}$ | 0.00086 | -0.46166* | 0.00012* |

*significant at α= 10%
**significant at α= 5%
***significant at α= 1%

Finally, the correlation between the two types of measurement is presented in Table 3. As it is expected, all correlations are close to one (>0.90). Note that the two indices NAMSI and HHI have correlations extremely high (~0.995) indicating that they tell us the same story. However, the correlation between the two types of measurement (dynamic and conventional) is also high (~0.91) but lower than the correlation of NAMSI and HHI. This indicates that the dynamic approach captures at least slightly different components of competitive balance in the course of a particular season.

[13] The values of the paired t-statistic are -8.43 for Germany and -6.66 for Greece respectively.

Table 3: Correlation Matrix

| | NAMSI | HHI* | NAMSI$^R$ | HHI*$^R$ |
|---|---|---|---|---|
| NAMSI | 1.0000 | 0.9945 | 0.9118 | 0.9026 |
| HHI* | | 1.0000 | 0.9133 | 0.9104 |
| NAMSI$^R$ | | | 1.0000 | 0.9964 |
| HHI*$^R$ | | | | 1.0000 |

## VII. Conclusion

The concept of competitive balance is an important topic in professional football because it drives fans' demand, and its measurement is therefore crucial. However, since there are different dimensions of competitive balance, it is important to clarify its multidimensionality aspect before attempting its quantification. It seems that in the past few years three dimensions have prevailed in the relevant literature: These are the 'match uncertainty' dimension and the 'seasonal' and 'between-seasons' dimensions. The latter two, longer in time dimensions, they are more sensitive to fans' interest. The present study gives focus on the measurement of the seasonal dimension, which is conventionally based on the final league table. In contrast to this "static" measurement, we propose to construct indices which account for round uncertainty in order to offer a dynamic approach to measure competitive balance. Two of the most commonly used indices, *NAMSI* and *HHI**, are employed for the application of our proposed "dynamic" approach using a dataset from the German and Greek championships. The behaviour of the derived round-based indices is illustrated for the last 46 years in both countries and is contrasted against that of conventional indices. According to the level and the trend of the indices the two types of measurement exhibited considerable differences. Furthermore, the correlation matrix confirms that the round-based indices pick up at least a slightly different set of competitive balance factors. As expected, there is evidence in favour of a different behaviour of our proposed round-based indices, which is interpreted by their ability to effectively capture the fluctuation of competitive balance throughout the season. This attribute provides a new powerful tool for the analysis of competitive balance in the course of the season. In light of the present study it is implied that the "dynamic" approach, since it contains more information, may proved to be more helpful than the "static" one. However, it is important to emphasise that we do not suggest that the dynamic approach should take the place of the conventional one, before both types of measurement thoroughly examined in various empirical studies. (Fort & Maxcy, 2003; Zimbalist, 2002, 2003).

## References

Borland, J., & MacDonald, R. (2003). Demand for Sport. *Oxford Review of Economic Policy*, *19*(4), 478-502.

Cairns, J. (1987). Evaluating changes in league structure: the reorganization of the Scottish Football League. *Applied Economics, 19*(2), 259-275.

Depken II, C. A. (1999). Free-Agency and the Competitiveness of Major League Baseball. *Review of Industrial Organization, 14*, 205-217.

Di Domizio, M. (2008). The competitive balance in the Italian football league: A taxonomic approach. [Electronic Version]. *Department of Communication, Working Paper No 48, University of Teramo.*

El-Hodiri, M., & Quirk, J. (1971). An Economic Model of a Professional Sports League. *The Journal of Political Economy, 79*(6), 1302-1319.

Forrest, D., Beaumont, J., Goddard, J., & Simmons, R. (2005). Home advantage and the debate about competitive balance in professional sports leagues. *Journal of Sports Sciences, 23*(4), 439-445.

Fort, R., & Maxcy, J. (2003). Competitive Balance in Sports League: An Introduction. *Journal of Sports Economics, 4*(2), 154-160.

Goossens, K. (2006). Competitive Balance in European Football: Comparison by Adapting Measures: National Measure of Seasonal Imbalance and TOP 3. *Rivista di Diritto ed Economia Dello Sport, II*(2).

Kesenne, S. (2007). *The Economic Theory of Professional Team Sports*. Cheltnham, UK: Edward Elgar.

Koning, R. H. (2000). Balance in competition in Dutch Soccer. *The Statistician, 49*(3), 419-431.

Michie, J., & Oughton, C. (2004). *Competitive Balance in Football: Trends and Effects.* London: The Sports Nexus.

Neale, W. C. (1964). The peculiar economics of professional sports. *Qurterly Journal of Economics, 78*(1), 1-14.

Noll, R. (1988). Professional Basketball. *Stanford University Studies in Industrial Economics Paper no. 144*.

Owen, P. D., Ryan, M., & Weatherston, C. R. (2007). Measuring Competitive Balance in Professional Team Sports Using the Herfindahl-Hirschman Index. . *Review of Industrial Organization, 31*(3), 289-249.

Quirk, J., & Fort, R. (1997). *Pay Dirt: The Business of Professional Team Sports.* Princeton, New Jersey: Princeton University Press.

Rottenberg, S. (1956). The Baseball Players' Labor Market. *The Journal of Political Economy, 64*(3), 242-258.

Scully, G. (1989). *The Business of Major League Baseball*. Chicago: University of Chicago Press.

Sloane, P. J. (1971). The Economics of Professional Football: The Football Club as a Utility Maximiser. *Scottish Journal of Political Economy, 18*(2), 121-146.

Szymanski, S. (2003). The Economic Design of Sporting Contests. *Journal of Economic Literature, XLI*, 1137-1187.

Szymanski, S., & Zimbalist, A. (2005). *National pastime: How Americans Play Baseball and the Rest of the World Plays Soccer*. Washington, DC: Brookings.

Zimbalist, A. (2002). Competitive Balance in Sports Leagues. *Journal of Sports Economics, 3*(2), 111-121.

Zimbalist, A. (2003). Competitive Balance Conundrums: Response to Fort and Maxcy's Comment. *Journal of Sports Economics, 4*(2), 161-163.