Competitive Balance in European Football:

Comparison by adapting measures: NAtional Measure of Seasonal Imbalance and Top3

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ABSTRACT

Competitive balance is a widely used concept in team sports and often put forward and accepted as a justification of exemptions and interventions. We describe this concept and construct measures in order to compare European national highest league football. We believe that in a unified Europe an international comparison is requisite and precedes the empirical evaluation of theories and implications of policy decisions. We concentrate on two kinds of uncertainty: seasonal imbalance and dominance of teams over seasons and adapt three measures for them. We introduce the National Measure of Seasonal Imbalance (NAMSI): the standard deviation of the winning percentages divided by the standard deviation when there is complete certainty about all outcomes of the games. To include championship dominance we calculate the number of teams that entered the top 3 in a period of 3 years as well as constructing the Lorenz curves for the distribution of championship titles. We compare the highest leagues of 11 European football countries from the season 1963-1964 until 2004-2005 to determine whether there are diverging levels between countries and between measures. We add cluster analysis to show that European competitive balance differs among countries and that depending on the interpretation of the concept other groups exist. We show that the big5 are not necessarily one group and caution for evaluation of unified interventions is hence appropriate. Ranking of the countries learns that Portugal, the Netherlands and Greece are the least balanced countries independent of the chosen definition and hence measure.

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1. Introduction

Since Rottenberg described the baseball league in 1956, many authors have taken up the challenge to do research on the economics of professional team sports. It is a complex but appealing research area. Sandy, Sloane and Rosentraub (2004, p. 2) correctly described the two-folded reason of interest as follows: “The sports industry raises fascinating economic questions and … sports have been a high-profile component of all societies for more than 4,000 years.”

In the early stages, theoretical research questions concerning American Leagues were tackled by major contributors as Neale (1964) , Jones (1969), El-hodiri and Quirk (1971) and Noll (1974). Neale (1964) discussed the peculiar economics of team sports and mentioned that restraints on competition are justifiable to prevent strong financial teams to acquire all the best players. Jones (1969, 1988a, 1988b, 1999) became a specialist in the National Hockey League. He showed among many other things that the NHL can be characterized to have monopolistic as well as monopsonistic features. El-hodiri and Quirk (1971, 1974) formalized the theory of Rottenberg (1956) and gave proof of the ‘*invariance principle*’[2]. The first sports economics book was edited by Noll in 1974 and gathered the most influential articles. This book gave an extra boost to the new research area. Noll added to the literature by calling attention to attendance, price setting and policy alternatives in his book. Empirics were introduced by Scully (1974) and Canes (1974). Scully (1974) estimated a production function and a revenue function to compare marginal revenue product with the salary of Major League Baseball players. He found monopsonistic exploitation based upon data of the seasons 1968 and 1969. Canes (1974) showed that the player reservation system did not improve the distribution of players in the National League.

Since the eighties research of teams sports economics augmented exponentially and an overview of all contributors is no longer possible. In the following chapter many important authors are included. We restrict ourselves here to two authors. Rodney Fort was hired by Roger Noll in 1982 and began to collect data about the U.S. professional sports leagues. He offers on his website the most complete dataset about economics and business of the National Hockey League, the National Football League, the National Basketball Association and Major League Baseball. He published some books (1992, 1997, 1999) in

[2] Gate revenue sharing has no impact on the distribution of talents. Kesenne (1996) and others showed that this no longer holds in other settings. For more details we refer to their papers.

collaboration with Quirk and became a recognized authority in the sector of sports economics research. Zimbalist is another important author and editor of many books. '*Baseball and Billions: A Probing Look Inside the Big Business of Our National Pastime'* was listed by Business week as one of the top eight business books of 1992.

European research took a bit longer to jump the wagon with Sloane as pioneer in 1969. He looked at English football and introduced the importance of league objectives: winmaximizing versus profitmaximizing. Hart, Hutton and Sharot (1975) constructed and estimated a demand model for British Association football but the empirical testing was only limited to four teams over two seasons. Bird (1982) ameliorated the model by using time series for the whole league. Andreff (1986) focused attention on the economics of sport by his contribution in the collection "Que sais-je" and published the book Economie politique du Sport in 1989. At the end of the eighties and especially the nineties European research cleared its arrears concerning theoretical research and can now be equally valued to the US research. Some of the later influential authors are mentioned in the next chapter. The Journal of Economic Literature accepted 2 papers with sports economics as subject. One was written by Fort and Quirk in 1995 and the other by Szymanski in 2003.

The birth of several important sports journals and associations underline the importance of the growing sector. We mention the four most established ones but many others have appeared since the end of the nineties. In 1987 the North American Society for Sport Management (NASSM) was formed to "promote, stimulate and encourage studies, research, scholarly writing and professional development in the field of sport management". Their research journal is the Journal of Sport Management. The European Association for Sport Management (EASM) was founded in 1994 for the same reasons. They published the European Journal for Sport Management from 1994 to 2000. In 2001 they started a new journal called European Sport Management Quarterly. Australia and New Zeeland followed by establishing their own Sport Management Association of Australia and New Zealand (SMAANZ) and publish the Sport Management Review since 1998. The increased interest and ensuing research papers about the economics of sports induced the creation of the Journal of Sports Economics in 2000. The editorial board consists of both important European as well as American sports economists. Some of them constitute the International Association of Sports Economists (IASE) which was founded in 1999 to increase collaboration and to organize an annual conference to discuss research.

Data is not easily traceable for European team sports despite common impression. Financial data remains rare. Only the UK disposes of financial databases for their football leagues thanks to Deloitte. Data on attendances, stadium information, name changes, prices and many other are very scattered and infrequently at the disposal of researchers. Compared to the US major leagues Europe's empirical research can not keep up pace and is mostly limited to the UK or a few seasons[3].

When we look at European team sports, football can be considered as the most popular one. A comparison of several European countries, including both the big 5[4] as well as several smaller ones, over a larger time period is to our knowledge not present. If the UEFA wants to unify legislation or when the European Court investigates presumed justifications of interventions, an international comparison of competitive balance is an important contribution. We want to fill the gap with this paper.

Before we can empirically test theories and look at implications of policy decisions by using complex econometrics we need to define the concept and find or construct the correct measure for it. Collecting and adapting data is the next step. A basic data analysis can detect significant deviant levels and give a provisional ranking of the countries. No comprehensive international database exists which makes this possible. Our contribution starts here. We collected final tables on eleven European countries. These countries are chosen based on the Deloitte's estimated market shares as shown in Chart 1.

Chart1: European League Football – top 15 leagues estimated market shares 2000/2001

Based on the market shares we include 'the big 5' together with 6 smaller countries: Belgium, Denmark, England, France, Germany, Greece, Italy, Netherlands, Portugal, Spain and Sweden. We focus on the highest leagues from the seasons 1963-1964 to 2004-2005. Lower leagues are not included because of data restrictions and too distinct structures across Europe. The smaller countries are chosen to include two central countries, two northern and two southern countries[5]. Once we calculated appropriate measures we discuss the trends. We use clustering to verify whether the European countries can be divided into groups and whether the big 5 can be considered as a separate group against the other countries.

After a short review of the literature about the concept of competitive balance we discuss the most frequently used measures. For an international comparison we show that an adaptation of existing measures is advisable. In chapter 3 our data, the chosen measures and the results are presented. Conclusions are drawn in the last subsection.

[3] For an overview we refer to Szymanski (2003)
[4] England, France, Germany, Italy and Spain receive this name for their big market shares.
[5] Scotland is excluded for their deviant tournament structure. In the future we would like to include Austria, Norway and Switzerland as well.

2. Concept of Competitive balance

In general economics, firms try to dominate and outperform competitors. In sports however we can talk about peculiar economic characteristics since this kind of competitive behaviour is absent. Teams do want to win but not all the time. One of the first to address this was Topkis (1949, p.708). He mentioned that teams want to come close to a perfect team but that they realize that it can not be too perfect since "there would not be any money in that". Neale (1964, p. 2) captures this thought in one sentence: "pure monopoly is disaster". When only one team survives no games could be played and so the sports branch ceases to exist. The product in sports is a result of two firms and a certain level of competitive balance can be assumed to be necessary to hold people's interest. (Janssens and Kesenne, 1987)

The leagues and team owners have used the concept of competitive balance to justify restrictions on behaviour of players and teams, as revenue sharing, transfer fees, salary caps and many other. In several cases, as with the Bosman-ruling, the courts did not agree with the restrictions. Even though some restrictions are done away with, others appear or are adjusted. In this paper we will not address the influence of interventions on competitive balance; however our results could be used to empirically test the assumed justifications.

Many managers feared the Bosman-case in 1995 in the football business because they all expected high inequalities in player talents acquisitions. Even though at first glance no big changes in win equalities are noted, concerns still remain.

In the Sunday Mirror of 3 September 2000, Andy Gray[6] expressed his concerns about the possible creation of elite clubs because of the high wages in sports. Jan Peeters, now the president of the 'Belgische voetbalbond', mentioned in 2000 that he feared that with the construction of the new transfer system the big teams would be favoured and hence making it more difficult for the little teams to compete. So they all fear that the playing equalities are threatened. These concerns underline the fact that the concept is important to managers.

Most authors who do research in the field of economics of team sports mention competitive balance[7] and its importance. The following short literature overview shows that the concept can include several dimensions and before empirical research can start a description of the dimension of interest is necessary.

Topkis (1949, p.708) did not name the idea of competitive balance but he underlined the importance of some equality as follows. "Baseball magnates are not fools. If anyone got together a group of perfect players, who would pay to see them play the other teams in the league?" Rottenberg (1956) is considered

[6] He was a Scottish soccer player who became a well-known sports presenter after he stopped playing in 1990.
[7] They use the term competitive balance or another expression that is linked to it.

to be the founder of Sports Economics research. He mentions the importance of the "closeness of competition". According to Rottenberg (1956, p.242), "The nature of the industry (of baseball) is such that competitors must be of approximate equal 'size' if any are to be successful". Neale (1964, p.1-3) talks about the `League standing effect' to address the importance of differences in standings of the teams over several years. Jones (1969, p.3) mentions the importance of "competitive equality". El-hodiri and Quirk (1971, p.1303) mention "equalization of competitive playing strengths" as an important objective for a sports league. Janssens and Kesenne (1987, p.305) stress the importance of "sporting equality". Quirk and Fort (1992, 1999); Kesenne (2003); Baimbridge, Cameron and Dawson (1996); Knowles, Sherony and Haupert (1992) include "uncertainty of outcome". "Symmetry among teams" is used by Palomino and Rigotti (2001).

Sloane (1971) adds that the long run domination of one or two clubs may be more important. The latter stresses the multidimensionality of competitive balance since he distinguishes between short-run (within one season, Rottenberg's dimension) and long-run (within one league, over more seasons) uncertainty of outcome. Four different interpretations of uncertainty of outcome are given by Cairns, Jennett and Sloane in 1986. First they mention match uncertainty. The second and third interpretations are less clear: they distinguish between seasonal uncertainty with an uncertain winner that influences utility and seasonal uncertainty with the probability that the own team wins championship that influences utility. Last there is the absence of long-run domination. Vrooman (1996) points out that there are actually three possible interpretations of competitive balance, all connected to each other with the last somewhat less clear. First there is the interpretation of closeness of league competition within seasons. Secondly the absence of dominance of a large market club can be indicated. Last competitive balance can also mean continuity of performance from season to season. The latter is emphasized in his paper of 1996. Szymanski (2003) emphasizes that there are three kinds of uncertainty. First there can be match uncertainty. Secondly there is season uncertainty which looks at the uncertainty within one season. The third kind is the dominance of a few teams over seasons called championship uncertainty.

Because the concept can have several dimensions and a widely used definition does not exist yet, it is advisable to explain what is meant when the concept is used. We will show that a distinction is necessary since evolutions differ.

We agree with Szymanski that there are three kinds of competitive balance. The predictability of the outcome of a single match or match uncertainty is less appropriate when international policy decisions are considered and will hence not be included in our paper. We focus on season uncertainty and championship uncertainty. We interpret seasonal balance as the closeness of winning percentages in one season and championship uncertainty as the absence of dominant teams over seasons.

To impose policy decisions, it would be ideal to determine how the optimal level of competitive balance can be reached and act accordingly, assuming of course that competitive balance is a major concern[8]. A certain level of competitive balance seems reasonable to hold the interest of spectators and sponsors for all teams but the determination of the optimal level is very complex. Research should be done on the objectives of the agents in the market. The optimization of these objectives will determine the optimal level but interpersonal wealth measuring is necessary and this is very complex. Because of the unsolved issues we will not include optimal competitive balance in our research. We do not believe that this is a loss. No convincing evidence is present that the commonly used ideal level[9] is optimal. There is however no doubt about the necessity to prevent complete imbalance. When it is always known in advance, without exception, who wins, the foundation of sports is destroyed and it will cease to exist. An appropriate expression like 'you never know in sports, anything can happen' captures the necessity of absence of complete imbalance. Consequently we believe that it makes more sense to consider the worst case instead of the ideal case to look at the levels of European football countries. When policy decisions need to be made a measure that includes this complete imbalance seems justified. Moreover, including this complete imbalance solves the problem of differing number of teams between and within countries as we will show in chapter 3.

2. Measures of competitive balance

Since there are several interpretations of competitive balance, there are also several proposed measures. We give a short overview of some existing measures for seasonal balance and championship uncertainty. We do not present an exhaustive list. For more details on the measures we refer to the articles.

Surprise Index

Groot and Groot (2003) introduce the surprise index.

The surprise index is the ratio between P, the realized surprise points and M, the maximum number of surprise points that is possible when the teams are perfectly balanced[10]. Two surprise points are given when a team looses from a lower ranked team and one point is awarded when the game ends in a tie. These points are weighted with the rank difference[11].

Algebraic:

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[8] Convincing evidence has yet to be found. We hope our data can help to solve this.
[9] The use of a win probability of fifty percent for each team is most common to describe sports in perfect balance. So all teams win half of their games or all games end in a tie.
[10] Every game ends in a draw or every team wins its home match.
[11] (j-i) gives the rank order difference with $i < j$ and i and j the rank number at the end of the season.

$$S = \frac{P}{M} = \frac{1}{M}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(R_{ij} + R_{ji})(j-i)$$

with R_{ij} = result of game between home team with rank i and away team with rank j[12],

$$M = 2\sum_{i=1}^{N-1}(N-i)i = (N-1)N(N+1)/3$$

This ratio varies between 0 and 1. There are no surprises when the champion always wins, the second ranked team always wins except against the champion, the third ranked team always wins except the former two etc, P will equal 0 and so S also equals 0. This is a perfectly unbalanced competition. P equals M and hence S equals 1 when all games end in a draw or every team wins its home match. The latter represents a perfectly balanced competition.

Groot and Groot (2003) found a ratio of 0,68 for French football, for Dutch football only an average of 0,54 is calculated so the Netherlands are less balanced than France.

This measure needs game-by-game information and hence is very data-intensive. The possibility to compare countries is an advantage[13]. They emphasize that caution is needed because some assumptions can be doubtful[14].

Groot and Groot (2002) show that it is highly correlated with the standard deviation and our results show the same ranking.

Winning percentage

In what follows we will discuss some measures that use the winning percentage as basis. For the winning percentage, the number of wins in one season are counted and divided by the total nr of games played by that team. Draws are possible in Europe[15]. Mostly this is counted for as half a win so the number of wins are multiplied by one and then added by the number of draws multiplied by a half. This way winning half of your games and losing the other half gives the same result as always ending the games in a tie.

In most European countries the point distribution changed in the nineties to three points for wins and one for draws. The objective was to give an incentive for teams to try to win more instead of being content with a draw.

[12] 2 when j wins, 1 when draw.
[13] The differences in number of teams do not give problems since it is taken up in the numerator as well as in the denominator.
[14] See paper for more details.
[15] Contrary to American sports were draws are not allowed and every game needs a winner.

Range

The range is one of the easiest measures for competitive balance. It is the difference between the highest and lowest win percentage. The bigger the range the more the best and worst team differ and hence the bigger the imbalance. The big disadvantage of this measure is its high sensitivity for outliers.

We looked at the information this measure gave us but we prefer to use the standard deviation of the distribution of the winning percentages because this takes all the teams into account.

Standard deviation of winning percentage

The standard deviation[16] of the winning percentages in one season is often used to measure the spread of the winning percentages. The larger the standard deviation, the less the competitive balance is in the season. By definition it gives more weight to the teams at both ends of the competition which is exactly what we need.

The standard deviation as a measure of spread has the disadvantage of the necessity of a scale when comparing over countries or years. It depends on the average. Only when the average is the same, comparison over countries or over seasons is possible. When we use the 2-1-0 points, the average is always 0.5 and hence comparison is possible. With the 3-1-0 points, the averages differ; hence the standard deviation cannot be compared anymore. The use of the coefficient of variation[17] solves that problem.

The standard deviation is sensitive to outliers as well but we assume that the European promotion and relegation scheme can limit this. The outliers at the highest end of the game will be accounted for in the dynamic measure.

Standard deviation ratio

The standard-deviation-ratio is the ratio of the actual standard deviation to an idealized standard deviation. The ideal ratio is 1. The higher the ratio, the more the actual spread diverges from the ideal one and hence the worse the competitive balance.

Quirk & Fort (1992) used 0.5/√N as the idealized standard deviation with N the number of games played in a season. Their ideal league is one where every team has a probability of 0.5 to win. The number of

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[16] SD= $\sqrt{\frac{\sum_{i=1}^{n}(winperc_i - averagewin)^2}{n}}$; n = number of teams

[17] The coefficient of variation=sd/average

wins (x) in N games follows a binomial distribution; hence the winning percentage (x/N) follows also a binomial distribution with an average of 0.5 in the ideal situation and a standard deviation of $0.5/\sqrt{N}$. Vrooman (1995), Humphreys (2002) and others mention this ratio as well. Buzzachi, Szymanski and Valletti (2003) used this American ideal SD for Europe.

In Europe however this ideal standard deviation is more complicated to calculate because you have now three possible outcomes: a win, a loss and a draw. The use of a trinomial distribution should be used to determine the new ideal SD[18]. We did not calculate an adapted ideal standard deviation for Europe since we do not opt for using this measure. As we discussed in the previous chapter, we prefer a comparison to perfect imbalance instead of to perfect balance.

Gini coefficient

The Gini coefficient is originally developed to measure income inequalities. Schmidt (2001) and Schmidt & Berri (2001) use it to measure the inequality of winning percentages. It was earlier already applied to measure another kind of competitive balance, namely the championship variation. This will be discussed later.

The cumulative percentage of teams is placed on the horizontal axis. On the vertical the cumulative percentage of winning can be found. The 45-degree line presents equal winning percentages. The Gini-coefficient is calculated by the area between the 45-degree line and the line determined by the data divided by the total area below that equal winning line. But with this formulation, the most unequal outcome is when one team wins all the games. This is however not possible since one team can only win its own games and not the games played between two other teams.

Utt and Fort (2002) hence argue that this measure cannot be used for within season competitive balance since it understates the level. The numerator should be smaller. They propose an adjusted Gini-coefficient but underline that there remain problems with it[19]. Consequently we do not consider it for our comparison of countries.

Competitive balance ratio

The standard deviation only accounts for seasonal uncertainty and not for championship uncertainty because the dominance of teams is not taken into account. We show this in the next chapter. Humphreys and Eckard concentrated on a more dynamic measure to include both kinds of uncertainty. Eckard (1998) decomposed the variance of winning percentages into a cumulative and time varying component.

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[18] I want to thank Keith Mclaren for his help and Ross Booth for introducing me to him.
[19] For an overview we refer to their paper.

Humphreys (2002) used Eckard's idea to model an easier measure but with the same basics. He named it the competitive balance ratio (CBR). Since both measures are equally valued we prefer to discuss the CBR. (Humphreys, 2003; Eckard, 2003)

The variance of winning over seasons per team is now included, this received the name 'within-team-standard deviation'. The standard deviation used before is called the 'within-season-standard deviation'.

Within-team-standard deviation:

$$SD_{wt,i} = \frac{\sqrt{\sum_{s=1}^{S} (w_{i,s} - \overline{w_i})^2}}{S}$$

Within-season-standard deviation:

$$SD_{ws,s} = \frac{\sqrt{\sum_{i=1}^{n} (w_{i,s} - \overline{w_s})^2}}{n}$$

With i= team, s= season, n= total nr of teams, S= total nr of seasons, $w_{i,s}$= win percentage of team i in season s, $\overline{w_i}$ = average win percentage of team i over total nr of seasons, $\overline{w_s}$ = average win percentage of season s for all n teams together[20]

Competitive Balance Ratio (CBR):

$$CBR = \frac{\frac{\sum_{i=1}^{n} SD_{wt,i}}{n}}{\frac{\sum_{s=1}^{S} SD_{ws,s}}{S}}$$

The CBR lies between 0 and 1. If every team ends on the same place in the final ranking every season, all within-team standard deviations equal zero and hence the CBR equals 0. So champion certainty gives a CBR of 0. The same CBR is reached when the denominator is very large. When the within-season standard deviation is very large in most seasons, the teams' performances are very distinct with very poor teams and very strong teams.

Championship uncertainty gives a CBR of 1: the within-team standard deviation equals the within-season standard deviation. Every team wins every nth season.

This measure is not straightforward to calculate in European football because of promotion and relegation. This means that not every team stays in the highest league during the total sample period. There is also the problem of the total number of teams playing in the first league. In every country there is a mixture as shown in Table1 in the next chapter. Hence to calculate the CBR several assumptions

[20] = 0.5 in US and in Europe when 2-1-0 points

have to be made, which are highly arbitrarily and will differ according to the researcher. We were not able to find or develop a good CBR measure for Europe.

Strength difference by Ordered Probit model

Koning (2000) did research on the competitive balance in Dutch soccer. To analyse the outcome of football games he proposed the following model:

$D_{ij}^{*} = a_i - a_j + h_{ij} + \eta_{ij}$

With D_{ij}^{*} = a random variable that determines the outcome of a game

a_i (a_j) = the strength parameter of team i (j) and $a_i - a_j$ = difference in strength,

h_{ij} = home ground advantage of team i over team j, normally distributed with mean h

η_{ij} = the random term with expected value of 0.[21]

Since the actual strength difference is not observed, he transformed the model into an ordered probit model with c'_1 and c'_2 as limit parameters[22]. He assumes that h_{ij} and η_{ij} are independent normally distributed and imposes the standard normalization[23].

$$D_{ij} = \begin{cases} 1 \ if \ D_{ij}^{*} > c'_2 & : win \\ 0 \ if \ c_1 < D_{ij}^{*} \leq c'_2 & : draw \\ -1 \ if \ D_{ij}^{*} \leq c'_1 & : loss \end{cases}$$

The likelihood function is made up of the probabilities of the results D_{ij} . The assumption is made that the strength parameter a_i is independent of the opposite team and constant for each season. To maximize the likelihood function to estimate the limit parameters c_1, c_2, and the a's, an identification restriction is added. The sum of all a's needs to be zero[24]. The standard errors of the found a_i 's are used as a measure for competitive balance. A large standard error indicates an imbalance.

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[21] To allow for unmeasured characteristics.

[22] The probabilities of the possible outcomes can be calculated with $c_1 = c_1' - h$ and $c_2 = c_2' - h$. Please look at the paper (Koning, 2000) for algebraic expressions and more detailed explications.

[23] $\varepsilon_{ij} = h_{ij} + \eta_{ij} \sim \mathrm{N}(h,1)$

[24] With the consequence that when a > 0 this indicates that the team has a strength larger than average.

The results of the research of Koning for the Netherlands are similar to our results with the standard deviation of the winning percentages. Marques (2002) used the same method for Portugal and here as well we have similar results.

Number of championships won

Rottenberg (1956) was the first to suggest that the equality of the distribution of player ability, which is the theoretical counterpart of competitive balance, can be easily measured by just counting the number of won championships per team. He used his proposition empirically for the two then existing baseball leagues from the 1920s to 1951. In the American Baseball league for example the Yankees dominated for eighteen years. In the National League the St. Louis Cardinals won nine times. He concluded that there was a very unequal distribution.

The ideal situation for Rottenberg would have been that every team in the league wins an equal number of times. This measure is very simple but it says only something about the champion. It may be possible that even though many times the same team wins, it is every year a struggle with other teams. So including more teams can give important extra info. In Europe there is the promotion and relegation scheme so that it are not the same teams that play every season in the first league. In addition the number of teams fluctuates. This makes a comparison with the ideal situation presented by Rottenberg very difficult.

Nevertheless this measure can be used since the presence of several teams that win significantly more than others points in the direction of competitive imbalance.

Top k ranking

To look at the dynamic imbalance, top k ranking can be used as a good European substitute for the last measure. The number of different teams that entered the top k is counted. The more teams end in the top k over a certain period of time, the less the competition is dominated by a few teams.

Buzzacchi, Szymanski and Valletti (2003) presented the number of teams entering the top k ranks over T years relative to the ideal number. They found that the number of actual entrants turns out to be much lower than the potential number.

One could expect that comparison between European countries is not possible since most countries have a different number of teams in the first league. Assume the following: country A has had 16 teams in the highest league during 3 years with 5 teams entering the top 3 in those 3 years. Country B has had 22 teams in the first league during the same 3 years and also had 5 teams that entered the top 3. Both have the same degree of competitive balance (both 5 teams) even though they have a different nr of teams in the first league. This applies because the probability to enter the top 3 resembles the probability to enter the top league. When there are fewer teams in the first league, there is a higher probability to enter the top k but also less probability to enter this top league. So the probability that a team in football enters the top k will be comparable when all leagues (second, third and so on) are taken into account in a country.

We used this measure for dynamic competitive balance since it is relatively easy to compute and is good to take the promotion and relegation scheme into account. For measuring dominance of teams in European football we believe this measure is one of the best.

Gini coefficient and Lorenz-curve

The Lorenz curve or Gini-coefficient can be used to measure the variation in championships. Quirk and Fort (1992, 1997) plot the cumulative percentage of league championships on the vertical axis and on the horizontal the cumulative percentage of team years in the league. The most successful teams (those who have the highest titles/year ratio) are started with in the left corner. To calculate the Gini-coefficient the area between the Lorenz-curve and the 45°-line is calculated and divided by the area above that line. The 45°-line represents the case in which each team has the same frequency of league championships per year in the league. The larger the bulge, the more games are won by only a few teams.

We were able to construct the necessary database and will include it in our analysis.

Hirfindahl-Hirschman Index (HHI)

Depken II (1999) uses the Herfindahl-Hirschman index. Market shares are squared and then summated over all firms in the market. This measure is taken over from industrial economics.

$$\text{HHI}= \sum_{i=1}^{N} MS_i^{\,2}$$

With i = team; N = total nr of teams; MS_i= market share of team i, going from zero to 100

It will be between 0 and 10000, zero when there is perfect competition and 10000 when there is perfect monopoly. Depken II (1999) uses data on homeruns and strikeouts to look at the Major League Baseball. Because of the accurate production statistics of baseball, he had no problems to calculate the market shares of each team. In other sports however this is not straightforward.

Entropy

Horowitz (1997) chose to use the relative-entropy measure of information theory to measure seasonal competitive balance in Major League Baseball.

$$R = \frac{H}{H_M}$$

With $H = -\sum_{i=1}^{n} p_i \log_2 p_i$

i = team; n = total nr of teams; p_i = the proportion of the league victories of team i.

H_M = maximal entropy: every team has the same share of victories: $p_i = 1/n$ [25].

He then estimated whether this balance measure R increased to 1 over time in a decreasing rate [26]. He found that this was the case and hence concluded that the competitive balance improved for both the American league as for the National league.

3. Data, used measures and results

Data were gathered on the seasonal outcomes of the highest football leagues of 11 European countries[27]: Belgium: Jupilerleague, Netherlands: Holland Casino Eredivisie, England: Barclaycard Premiership, Italy: Serie A, France: Ligue 1, Germany: Bundesliga, Spain: Primera División and Portugal: Campeonato Nacional, Sweden: Allsvenskan, Denmark: SAS Ligaen. We look at the seasons beginning with the foundation of the Bundesliga in the season 1963-1964 and end with the season 2004-2005. So we have a dataset of 42 seasons per country.

For an international comparison over countries and over seasons we concentrate on two kinds of uncertainty: seasonal imbalance and dominance of teams over seasons. Since they can not be adequately calculated by one measure, we adapt existing measures for them. We start with an overview of our measures. Next we calculate them and discuss the national trends. We also want to find out whether the European countries can be divided into groups. This is important for evaluations of unified interventions. We use cluster analysis for this. A ranking of countries over the total period is also given.

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[25] For an 8 team league, p_i=8 and H_M =3

[26] If R=1: perfect balance.

[27] We use the name of season 2004-2005 for the highest league competition. (http://www.uefa.com/FootballCentral/Directory/index.html)

3.1 Our Measures

Before we discuss our measures we want to draw attention to the point schemes used by the leagues. In the nineties most countries changed their reward for winning from two to three points while a draw remained one point and loosing zero. In general, games in the American major league sports cannot end in a draw. In European football however ties need to be accounted for. In the sports literature it is custom to take up a draw as half a winning and we decided to do the same. This follows the old scheme but a draw could also be included as one third of a winning[28]. We compared the two possible point-schemes for all countries but the trends are quite robust. With the use of the 3-1-0 distinction we no longer get an average winning percentage of 0.5 and then the coefficient of variation[29] needs to be calculated. We therefore decided to include a tie as half a winning.

For the static competitive balance and hence the balance within seasons we use the winning percentages. Theoretical research discusses the distribution of player talents and can be represented by the number of wins. All else equal, the more talents a team possesses the more games will be won. So to test theoretical frameworks a measure that is based on winning percentages is justified.

The National Measure of Seasonal Imbalance

To compare winnings over seasons and over countries an adaptation of the measure is appropriate because the number of teams differs. An example clarifies this. Assume that the worst case scenario exists in one country: every game is won by one team, a second team always wins except against the first team, the third team always wins except games against the first and second, … The standard deviation of winning percentages of such a competition with 18 teams is: 0,305148. Suppose the league decides to increase the number of teams in the next season to 20 teams. When the worst scenario remains the standard deviation becomes 0,303488. So by adding two teams it has decreased its uncertainty measure, and hence gives the impression that the within seasonal balance improved. But this is not correct since we still know in advance who will win. This worst case scenario is a competition with perfect certainty. The difference appears to be very small but when we compare countries like Sweden and Denmark who had for example in the season 91-92 ten teams with England having twenty two teams, the certainty standard deviation is respectively 0,3021 and 0,3191, a difference of 6 percent. Every country changed the number of teams during our chosen period and between countries there are also differences. An overview can be found in Tabel1. Hence for an international comparison, using the standard deviation alone can bias the results. Using the standard deviation ratio is one possibility. However, as we have

[28] To calculate winning percentages a victory is multiplied by 1, a draw by 0,5 or 0,333.
[29] The coefficient of variation=sd/average

discussed above, we do not believe that this is suitable. Since international comparison over many seasons lacks in the literature, we need to develop a new measure.

Table1: number of teams in highest league for all countries for seasons 63-64 to 2004-2005

We propose the NAtional Measure of Seasonal Imbalance (NAMSI):

$$\text{NAMSI} = \frac{sd_{season}}{sd_{certty}} = \frac{\sqrt{\frac{\sum_{i=1}^{n}(winperc_i - 0,5)^2}{n}}}{\sqrt{\frac{\sum_{i=1}^{n}(certwinperc_i - 0,5)^2}{n}}}$$ [30]

With i = team; n = total nr of teams; winperc = win percentage of team i; certwinperc = win percentage of a team when there is complete certainty[31]

When all teams win half of their games or all games are ended in a tie complete balance occurs. The standard deviation of the season equals zero since the win percentage of all teams is 0,5. Hence the NAMSI will equal zero. If there is absolute certainty about who wins the game the seasonal standard deviation equals the certainty standard deviation and so NAMSI equals 1. This is the situation of complete imbalance. So the NAMSI ranges between 0 and 1. When comparing two seasons or two countries a higher NAMSI indicates a higher seasonal imbalance.

Besides seasonal imbalance we also need a dynamic imbalance measure. The standard deviation is a static measure since it only looks at one season independently of other seasons. In Europe there can be a close fight for the championship's title in one season but over seasons it are often the same teams that compete for the first places. To measure the latter, the standard deviation measure[32] is inefficient as the example in Table2 shows.

Table2: Win percentages of two hypothetical leagues

In both leagues the standard deviation of every season equals 0,354. So according to this measure, both leagues are equally balanced. In the first league however it is obvious that team1 dominates the competition. They win every game every season. In the second league teamA dominates the competition

[30] Averagewin is by definition 0,5.
[31] In the case of three teams: team 1 wins all games: winpercentage of 1 (4 out of 4), team2 wins only against team3 so winpercentage of 0,5 (2 out of 4) and team3 has a winpercentage of 0. For all possible n this is calculated. An overview is available upon request.
[32] This obviously applies to the NAMSI as well.

in season1 but in the next seasons it does not do so anymore. The final ranking in the second league is different every season while in the first there is no variability. Hence to include dominance of teams we need another measure[33].

Number of teams entering the top 3 in 3 consecutive years

For the dynamic measure we opted for the top K ranking. It has not the problems with promotion and relegation like other measures have and in addition it takes more than one team into account. The choice of K and the number of years can be considered to be arbitrary. We choose to look at the top 3 because in most European countries it are two or three teams that in general are considered to be dominant. Taking up more teams underrates the dominance since the top 4 and 5 often change. So using the top 3 is more accurate to look at the dominance of teams in Europe.

We calculate the number of teams over 3 years because we can expect spectators to have this timeframe in mind when they consider dominance of teams. Restricting ourselves to the total period excludes the possibility to look at evolutions. More research is necessary to validate this assumption.

The number of teams ranges between 3 and 9. The minimum is reached when the competition is dominated by 3 teams. In Portugal for example in the seasons 2002-2003 until 2004-2005 only FC Porto, Sporting CP and SL Benfica reached the top3. When 3 different teams entered the top3 every season we get the maximum of 9. No country reached this maximum. Eight teams is the maximum number in our database. In the seasons 90-91 until 92-93 the following eight English teams reached the top3: Arsenal, Liverpool, Crystal Palace, Leeds United, Manchester United, Sheffield Wednesday, Aston Villa and Norwich City. Manchester United was the only team that ended in the top3 two times in those 3 seasons.

Lorenz curves and Gini coefficients

Besides this dominance of top 3 teams we also want a measure to focus on the champion. We expect that the top 3 teams can be dominated by the same teams but that it is possible that the champion frequently changes. An example can clarify this. In Belgium Anderlecht is expected to enter the top 3 every year but winning the championship is less certain. Of the 42 seasons they ended 35 times in the top 3 and won 18 times. We believe that this is also an important factor when dominance of teams is considered and should consequently be taken up as well.

We include the Lorenz curves for the championship title distribution and the subsequent Gini-coefficients. This measure is originally developed for income inequality but can be used in this context as

[33] This is why the CBR was constructed: the first league has a CBR of zero since the $SD_{wt,i}$ equals zero for all five teams. In the second league every team has a $SD_{wt,i}$ of 0,354, the average is hence also 0,354 and a CBR of 1 is reached.

well as Quirk & Fort (1992, 1997) demonstrated. For European football leagues the calculation is not straightforward. The promotion and relegation schemes shift many teams over the total period between the two highest leagues of a country. Adaptations to the number of teams within countries as well as different numbers between countries obstruct calculations as well. Name changes, mergers and disbandment make it even more challenging. Kuypers and Szymanski (1999) used a simplified version in their book to circumvent these problems but for an international comparison that can be used for policy decisions and theoretical testing, a more realistic calculation is preferable.

All teams that appeared in the highest leagues over the total period were researched. If they were present for more than ten years, they were taken up in our calculations. This assumption is plausible since an overview of all champions in our countries showed that 12 years was the lowest number of years a champion was in contest. Very few spectators will account for the possibility that a team that ascends infrequently to the highest league could win the championship in those years. We can expect that spectators do not consider this as a competitive imbalance. Hence dismissing these teams is acceptable.

The number of titles a team won is weighted by the number of years the team was present in the highest league[34]. We believe this is necessary since competitions with a team that won 10 titles in 40 years will not be considered as imbalanced as one that won 10 in 20 years.

We use the Brown formula (Brown, 1994) to calculate the Gini-coefficient:

$$G = 1 - \sum_{i=0}^{k-1} (Y_{i+1} + Y_i)(X_{i+1} - X_i)$$

With Yi = cumulated proportion of the champions titles won weighted with the number of years in the first league; Xi = cumulated proportion of the number of teams; k = number of teams

3.2 Results

We discuss the results from our calculations separately for each measure.

The NAtional Measure of Seasonal Imbalance

The calculated NAMSI can be found in Figure1. Separate graphs are presented for individual evolution combined with the most suitable trend line. Sweden changed the structure of the highest league football at the start of the season 81-82 till the season 90-91. After the regular seasonal play the final rankings were used to play the Slutspil. This Slutspil consisted of the first eight teams which had to play a

[34] Following the example of Quirk and Fort (1992).

Quarter-finale, a Semi-final and a Final to determine the national champion. For the calculation of the NAMSI we use the final tables of the regular Allsvenskan and hence do not include these games. For the top 3 however the outcomes of these finals are used. In the seasons 90-91 and 91-92 the Slutspil was replaced by the Meidsterskapserien where the top 8 teams had to play each other and points were awarded. The points earned in the first part (the regular seasonal play) were divided by 2 and added to the points earned in the second part of the Championship. We do not include these Meidsterskapserien in our calculations. From the season 92-93 on, the structure again resembled the other European countries.

Figure1: NAMSI for all countries individually for seasons 63-64 to 2004-2005

Germany and France can be considered status quo over the entire period, only a very small increase is present for Germany but it is not statistically significant[35]. Portugal is the only country that has a significant negative trend which states a decreasing imbalance. Belgium and England display a moderate rise in imbalance. So within one season the deviation of winning percentages between teams has increased a little over the total period.

Denmark, Greece, the Netherlands, Spain and Sweden all have a trend best approximated by a polynomial. The trend of Spain is best presented by a polynomial of the third degree; the others show a statistically significant trend of the fourth degree. Greece and the Netherlands are comparable. Both experienced an increase with a peak at the end of the sixties, early seventies. A decrease sets in as far as the mid eighties. Contrary to Greece, the Netherlands do not reach the low level from the beginning of the period. Next the imbalance increases again which subsides in the last seasons to what appears the beginning of a new decrease. The other three countries show an opposite evolution also comparable to one and another but less distinct in Spain and Sweden contrary to Denmark. A decrease sets in till the early seventies; deviation of winning percentages augments after this with highs in the late eighties. All three countries almost reach their levels of the early sixties. Whether Sweden and Denmark will continue their new increase started at the beginning of the new century needs to be awaited.

Italy shows a small narrowing of the spread of winning percentages in the eighties but it increases again to reach a slightly higher deviation at the latest seasons.

We are interested in using this data to verify whether the ‘big 5’ present a distinct group from the rest of Europe when seasonal imbalance is concerned. Clustering analysis is an exploratory data analysis tool which divides cases[36] into groups without providing an explanation. It looks for structures in the data with two objects belonging to one group if their degree of association is maximal and minimal if they present different groups. When distinct groups can be found for the total period, future econometrical

[35] We based all our evaluations of the trends on p-values of an OLS estimation of the trend with significance level 5 %.

[36] Countries in our case.

testing can be refined by using these classes. It also gives a warning that when groupings exist, unified policy decisions need to be evaluated considering these classes.

The distances between countries are calculated by the Euclidean distance. We then use Ward's method (Ward, 1963) to group the countries. This method ensures that we have the highest possible homogeneity within groups. The cluster to be merged is the one which will increase the sum of squared distances the least. This method seems the most appropriate one for our data[37]. Since we have only eleven countries and hence the number of cases is limited we can use hierarchical clustering. The dendrogram helps us to visually distinguish clusters. The inter-cluster distance is measured horizontally. Those distances should be small enough to have close countries. The dendrogram can be found in Chart2.

Chart2: Dendrogram NAMSI All countries Ward's method

Three groups can be classified[38].

Group1: Belgium, Italy, Sweden and Denmark.

Group2: France, Spain, England and Germany

Group3: Greece, the Netherlands and Portugal.

What Figure1 and the discussion of the trends already predicted is validated by the clustering: the 11 chosen European football countries are too distinct to form one close group. When the big5 is concerned, Italy can not be grouped with the other big market shares countries. The other four however do make up one separate cluster.

To determine a ranking of the countries based on the NAMSI we calculate the averages over the total period. Figure2 shows that the averages approximate the groupings from the clustering. Belgium however could be regarded as a separate country. France has the lowest average NAMSI closely followed by the other countries of the same group. Group 3 are the least balanced countries with Portugal as the tailender. Complete imbalance is presented by 1, all countries are between 0,34 and 0,51 and hence on average they can not be evaluated as extremely imbalanced.

Figure2: Ranking of Average NAMSI for all countries for seasons 63-64 to 2004-2005 from most balanced to most unbalanced

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[37] The proximity measure of Furthest Neighbours gives the same classification. Other measures are not very effective since the distances are too long and interpretation needs caution. In general however they distinguish between the same three groups but with Denmark more distinct than with our measure. http://www.psychstat.missouristate.edu/multibook/mlt04m.html

[38] The number of groups chosen is determined by interpretability.

Number of teams entering the top 3 in 3 consecutive years

The results for the number of teams that entered the top 3 over 3 years are presented in Figure3. For Sweden the Finals are used to determine the top 3 teams[39]. We believe this is most appropriate since the title of National Champion is awarded by these games and hence for the Swedish spectators these games determine the top 3.

Figure3: Top 3 with trend for all countries individually for seasons 63-64 to 2004-2005

The evolution in Belgium, Denmark, England, France, Germany, Italy, Portugal and Spain is best approximated with a linear trend. Belgium and France both stay status quo. Denmark, England, Germany, Italy and Portugal all show a slow decrease in number of teams but only England presents a significant[40] increase of dynamic imbalance, the others stay status quo. Spain and Sweden show a linear positive trend but neither is significant.

Greece and the Netherlands exhibit a significant parabolic trend. Greece had a high in the early eighties. The Netherlands had the reverse evolution with a low in the late eighties.

We use Ward's method (Ward, 1963) again to cluster the eleven countries. The dendrogram is presented in Chart3.

Chart3: Dendrogram TOP 3 All countries Ward's method

Four groups can now be separated[41].

Group1: Belgium, Italy, the Netherlands and Spain
Group2: Greece and Portugal
Group3: England, Sweden and Denmark
Group4: France and Germany

Based on this imbalance measure the Big5 can not be classified separately from the others. Compared to the seasonal balance they are less related since they can now be placed in three different groups.

[39] The third team is chosen on the basis of goal differences in the semi final. For the seasons 90-91 and 91-92 we use the top 3 of the Meidsterskapserien.
[40] With significance-level 5%
[41] Depending on what will be researched, choosing two groups is possible as well. We wanted a similar distance cut off as with the Namsi (around 5) and hence we find four groups.

A general ranking based on the averages is given in Figure4 and shows that we loose valuable information. Not four but three groups can then be distinguished with the Netherlands, Greece and Portugal showing the highest dominance of teams, followed by Italy, Spain and Belgium. The other countries form the third group. More than with seasonal imbalance this stresses that it is preferable to include as much information as possible. Nevertheless the ranking does show that the big5 are not one group. When imbalance is discussed in the media concerning Italy and Spain versus the other three Big5 countries, our data shows that dynamic balance is the concept where this relates to.

Figure4: Ranking of Average Number of teams entering Top 3 over 3 years for all countries for seasons 63-64 to 2004-2005 from most balanced to most unbalanced

Lorenz curves and Gini coefficients

To draft the Lorenz curves many adaptations are necessary which make it very complex. One example is given[42]. When two teams merged and both were present in the highest league in at least one season we regard the team that was present in the season preceding the merger as the new formed team. The other team is regarded as a separate team that dissolved. The Dutch teams Elinkwijk and DOS formed FC Amsterdam in the season of 70-71. Both were in the highest league in seasons 65-66 and 66-67. Elinkwijk did not re-enter the highest league. Dos was present in 69-70 and was the reason FC Amsterdam could play in the highest league in 70-71, hence the years DOS was in the highest league are included in the total number of years of FC Amsterdam, as if DOS always was FC Amsterdam. Elinkwijk remains a separate team. The explanation of the changes is more complicated than the actual adaptations so we will not go into it any further.

The Lorenz curves are presented in Figure5. Because of the different number of teams we have not yet found a way to present them all in the same graph. Germany, Greece and Italy had 23 teams in the highest league for more than 10 years and are combined. Belgium and Sweden had 20 teams each. The other countries are presented separately: Denmark with 24 teams, England 34, France 29, the Netherlands 26, Portugal 25, and Spain 27.

Figure5: Lorenz curves for championship winners of all countries over total period

Belgium is more concentrated than Sweden. Greece is the least balanced compared to Italy and Germany, Italy is the second in ranking. We calculate the Gini-coefficients to be able to rank all the countries. Figure6 shows that Denmark is the most balanced one, followed by Sweden. Greece, the Netherlands and Portugal are the most dominated countries. Belgium is in the middle. Of the big 5 Germany is the least

[42] An overview of the adaptations can be delivered upon request

concentrated, followed closely by Italy. France is third. England and Spain have more dominant champions.

Figure6: Gini coefficients of all countries over total period for seasons 63-64 to 2004-2005 ranged from most balanced to most unbalanced

Even within one kind of competitive imbalance a good definition of the subject of research is essential. Concerning the big5 a different picture appears when using the Gini coefficient versus the use of the number of teams entering the top 3. Spain and especially England turn out to be more concentrated than with the use of the latter measure. The calculation of Gini coefficients over a shorter period can be an amelioration of our use and then you can compare them to evaluate important changes.

4. Conclusions and future research

We calculated adapted measures for international comparison of competitive balance, giving attention to three possible interpretations of the concept: dispersion of winning percentages as a percentage of complete certainty; dominance of top 3 teams over 3 years and dominance of champions over the total period. We show that it is essential to clearly define which kind is referred to since the three measures show different evolutions and interventions can be expected to influence them distinctly. We also expect spectators to react differently to changes of these imbalances. We would like to test to which imbalance spectators are the most sensitive and how for example TV revenue sharing schemes affect the levels.

The countries differ not only between each other but depending on the chosen kind of competitive balance, different evolutions are also noted within the European countries. In table3 we present an overview of the trend lines. Research on causes of changes can render meaningful insights. Portugal for example experienced a decrease in its seasonal imbalance. Increasing the number of teams in the highest league could have caused a shift in the actual playing strengths of the teams. In all countries questions are raised on the most appropriate number of teams in the highest league. Hopefully we can a give a decisive answer in the future.

Table3: Overview of the trends in seasonal and dynamic imbalance measured by the NAMSI and number of teams entering the top 3 in 3 years for the seasons 63-64 to 2004-2005

Remarkably the changes over the total period are limited for the Big 5. Germany and France even show on both the seasonal imbalance as the championship uncertainty a status quo over the total period. The influence of the Champion’s league on the number of teams entering the top 3 turns out to be very limited and often stated concerns can hence be considered to be overrated.

When the 'big5' demand national or international bodies for unified interventions an evaluation with caution is now shown to be essential. Greece, Portugal and the Netherlands have some catching up to do if a more similar level to the other European countries is an objective. They are the least balanced for all three measures.

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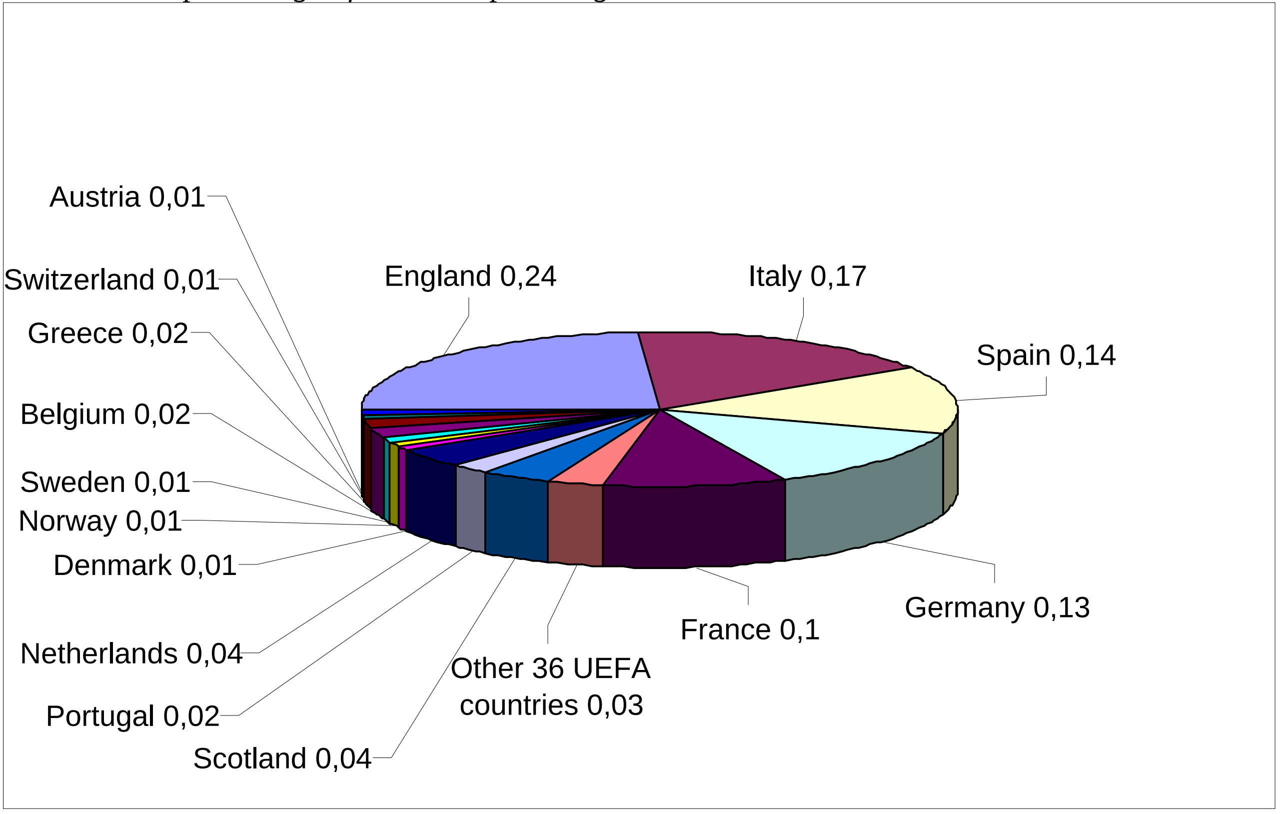
Appendices

Chart 1: European league football- top 15 leagues estimated market shares 2000/2001



Source: Deloitte & Touche (2002), Annual Review of Football Finance 2001/2002, p. 16

Table1: number of teams in highest league for all countries for seasons 63-64 to 2004-2005

season	*B*	*D*	*E*	*F*	*GE*	*GR*	*I*	*N*	*P*	*S*	*SW*
63-64	16	12	22	18	16	16	18	16	14	16	12
64-65	16	12	22	18	16	16	18	16	14	16	12
65-66	16	12	22	20	18	16	18	16	14	16	12
66-67	16	12	22	20	18	16	18	18	14	16	12
67-68	16	12	22	20	18	18	16	18	14	16	12
68-69	16	12	22	18	18	18	16	18	14	16	12
69-70	16	12	22	18	18	18	16	18	14	16	12
70-71	16	12	22	20	18	18	16	18	14	16	12
71-72	16	12	22	20	18	18	16	18	16	18	12
72-73	16	12	22	20	18	18	16	18	16	18	14
73-74	16	12	22	20	18	18	16	18	16	18	14
74-75	20	16	22	20	18	18	16	18	16	18	14
75-76	19	16	22	20	18	16	16	18	16	18	14
76-77	18	16	22	20	18	18	16	18	16	18	14
77-78	18	16	22	20	18	18	16	18	16	18	14
78-79	18	16	22	20	18	18	16	18	16	18	14
79-80	18	16	22	20	18	18	16	18	16	18	14
80-81	18	16	22	20	18	18	16	18	16	18	14
81-82	18	16	22	20	18	18	16	18	16	18	12
82-83	18	16	22	20	18	18	16	18	16	18	12
83-84	18	16	22	20	18	16	16	18	16	18	12
84-85	18	16	22	20	18	16	16	18	16	18	12
85-86	18	14	22	20	18	16	16	18	16	18	12
86-87	18	14	22	20	18	16	16	18	16	18	12
87-88	18	14	21	20	18	16	16	18	20	20	12
88-89	18	14	20	20	18	16	18	18	20	20	12
89-90	18	14	20	20	18	18	18	18	18	20	12
90-91	18	10	20	20	18	18	18	18	20	20	10
91-92	18	10	22	20	18	18	18	18	18	20	10
92-93	18	10	22	20	18	18	18	18	18	20	14
93-94	18	10	22	20	18	18	18	18	18	20	14
94-95	18	10	22	20	18	18	18	18	18	20	14
95-96	18	12	20	20	18	18	18	18	18	22	14
96-97	18	12	20	20	18	18	18	18	18	22	14
97-98	18	12	20	18	18	18	18	18	18	20	14
98-99	18	12	20	18	18	18	18	18	18	20	14
99-00	18	12	20	18	18	18	18	18	18	20	14
00-01	18	12	20	18	18	16	18	18	18	20	14
2001-2002	18	12	20	18	18	14	18	18	18	20	14
2002-2003	17	12	20	20	18	16	18	18	18	20	14
2003-2004	18	12	20	20	18	16	18	18	18	20	14
2004-2005	18	12	20	20	18	16	20	18	18	20	14

Source: own calculations based on www.rsssf.com

Table2: Win percentages of two hypothetical leagues

League1:

	Season1	Season2	Season3	Season4	Season5
Team1	1	1	1	1	1
Team2	0,75	0,75	0,75	0,75	0,75
Team3	0,5	0,5	0,5	0,5	0,5
Team4	0,25	0,25	0,25	0,25	0,25
Team5	0	0	0	0	0

League2:

	Season1	Season2	Season3	Season4	Season5
TeamA	1	0,75	0,5	0,25	0
TeamB	0,75	0,5	0,25	0	1
TeamC	0,5	0,25	0	1	0,75
TeamD	0,25	0	1	0,75	0,5
TeamE	0	1	0,75	0,5	0,25

Source: own calculations

Figure1: NAMSI with trend for all countries individually for seasons 63-64 to 2004-2005

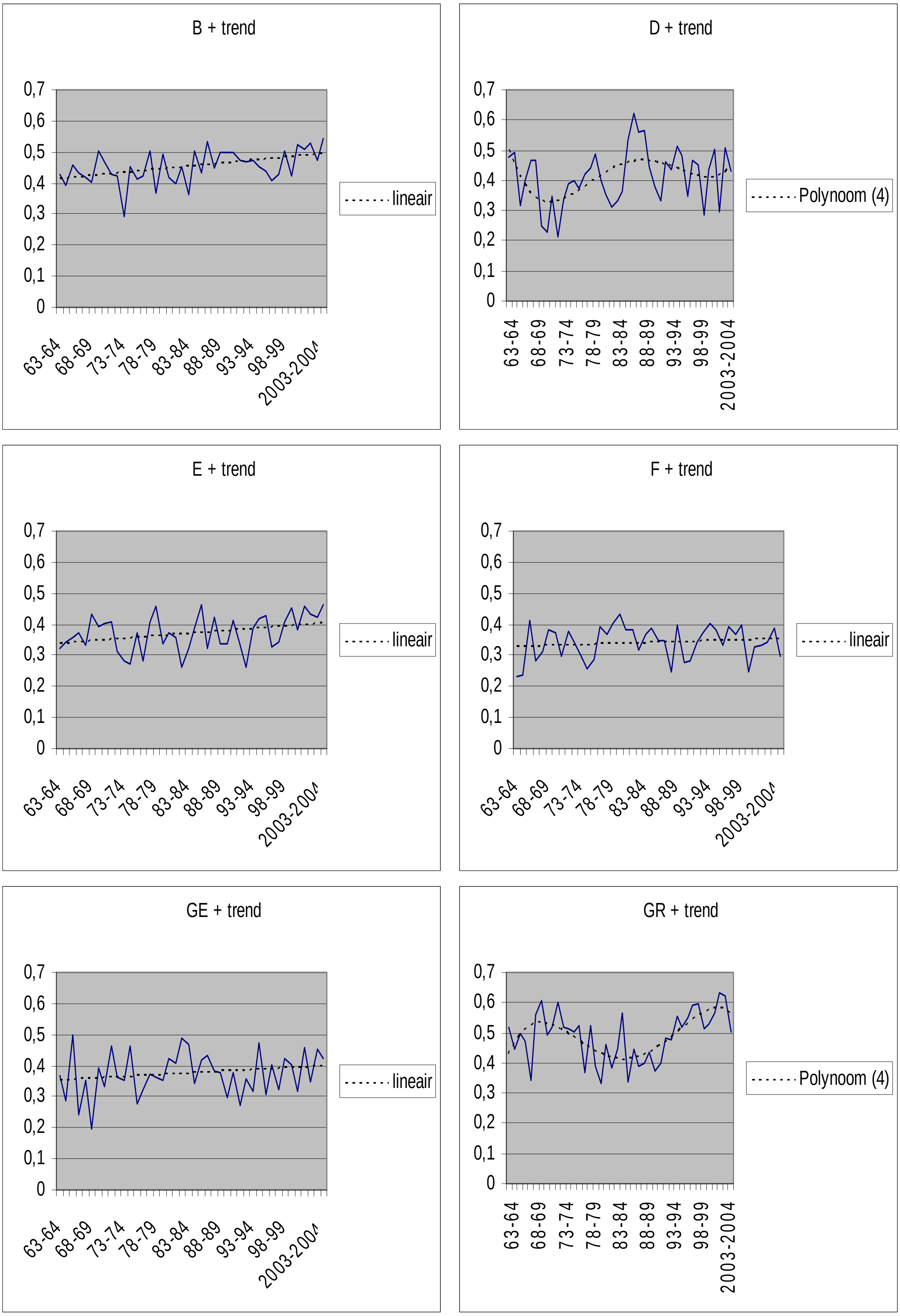
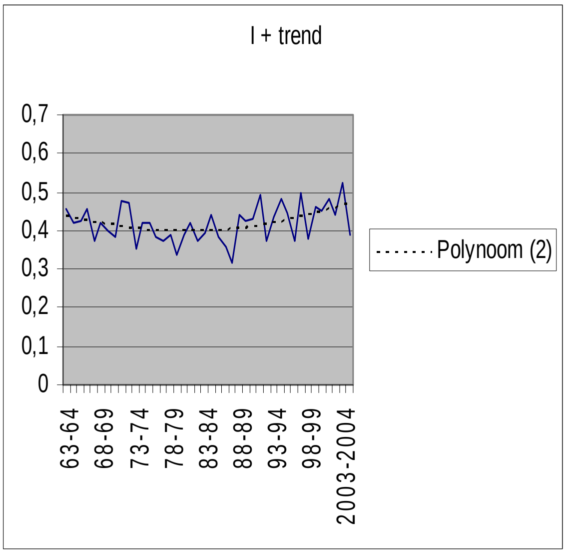
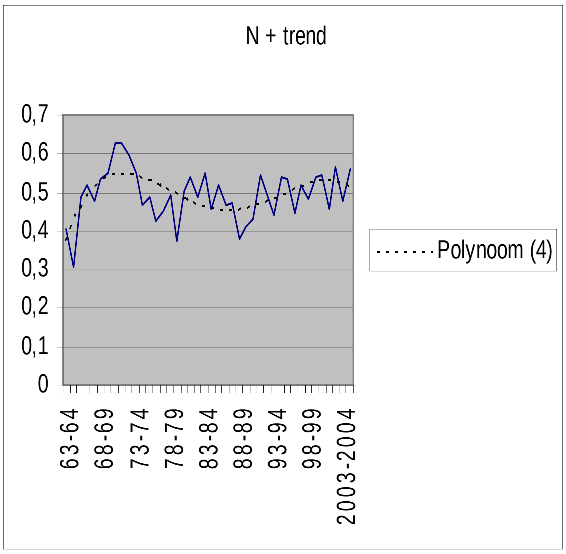
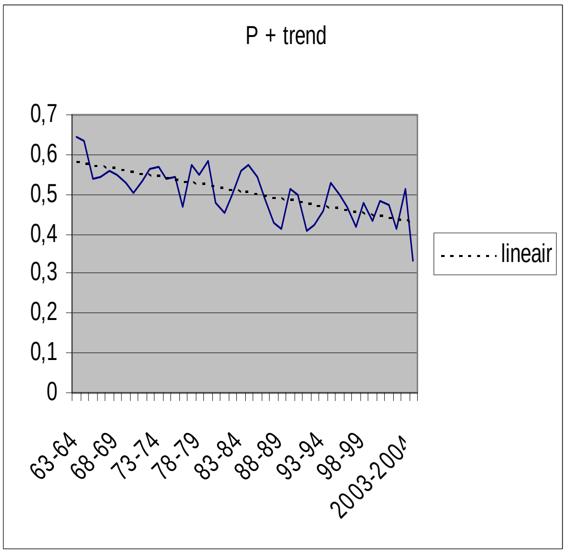
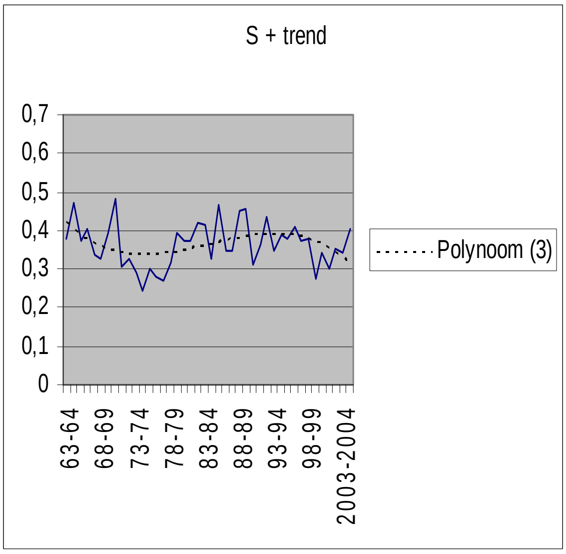


Figure1 Continued: NAMSI with trend for all countries individually for seasons 63-64 to 2004-2005









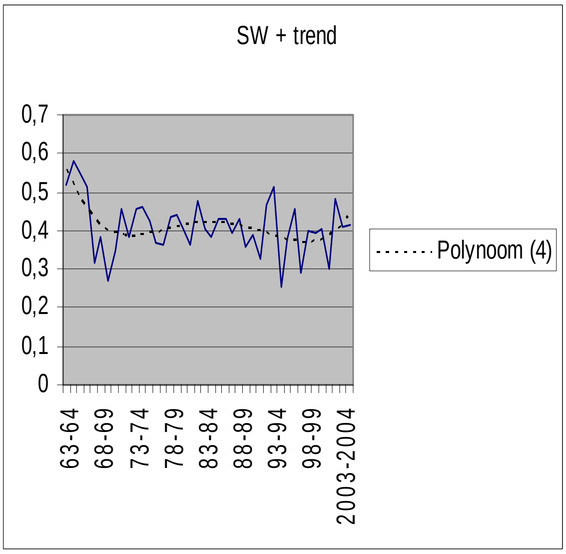


Chart2: Dendrogram NAMSI All countries Ward's method

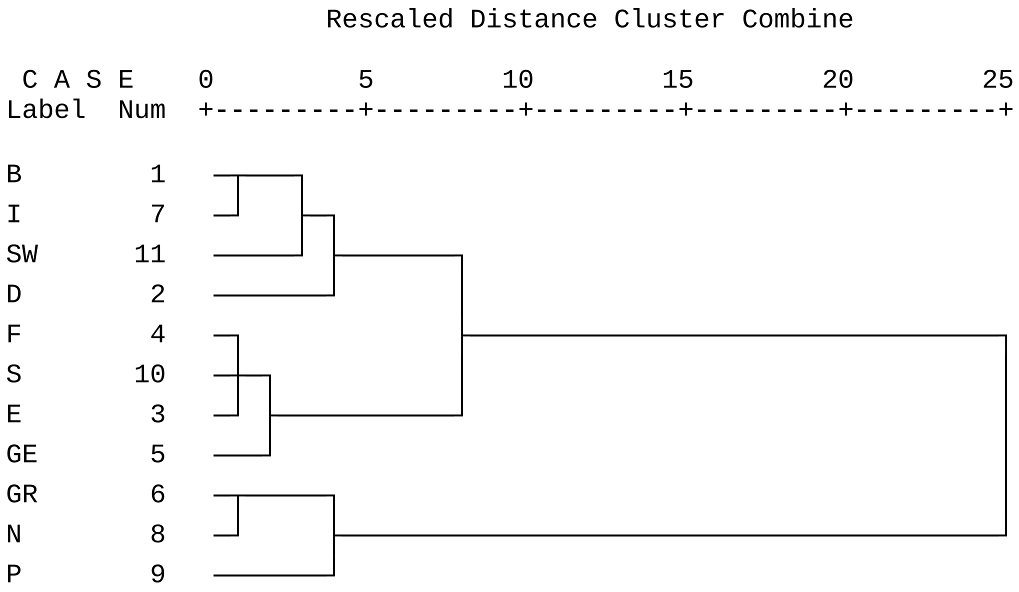


Figure2: Ranking of Average NAMSI for all countries for seasons 63-64 to 2004-2005 from most balanced to most unbalanced

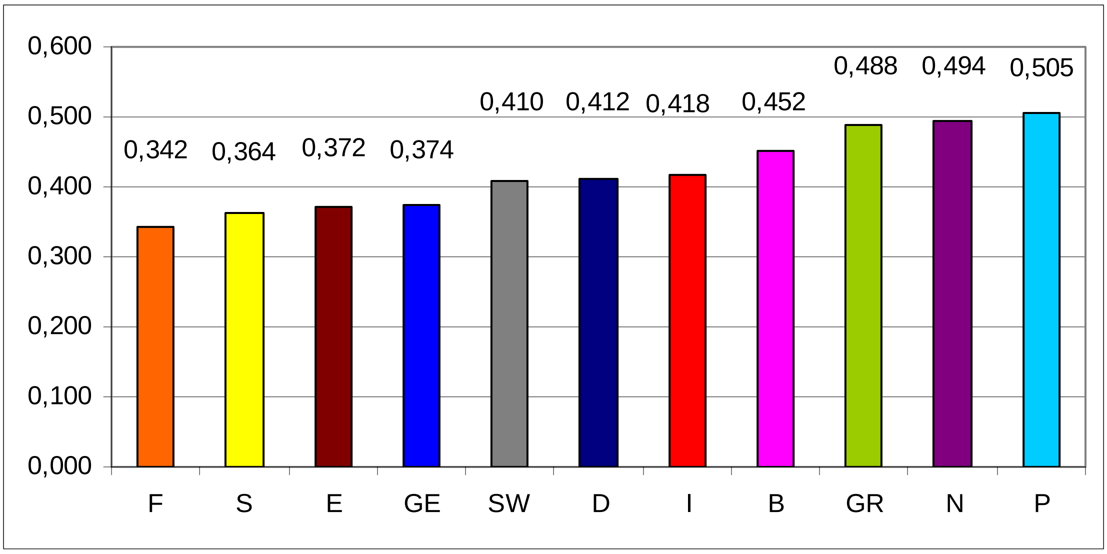


Figure3: Top 3 with trend for all countries individually for seasons 63-64 to 2004-2005

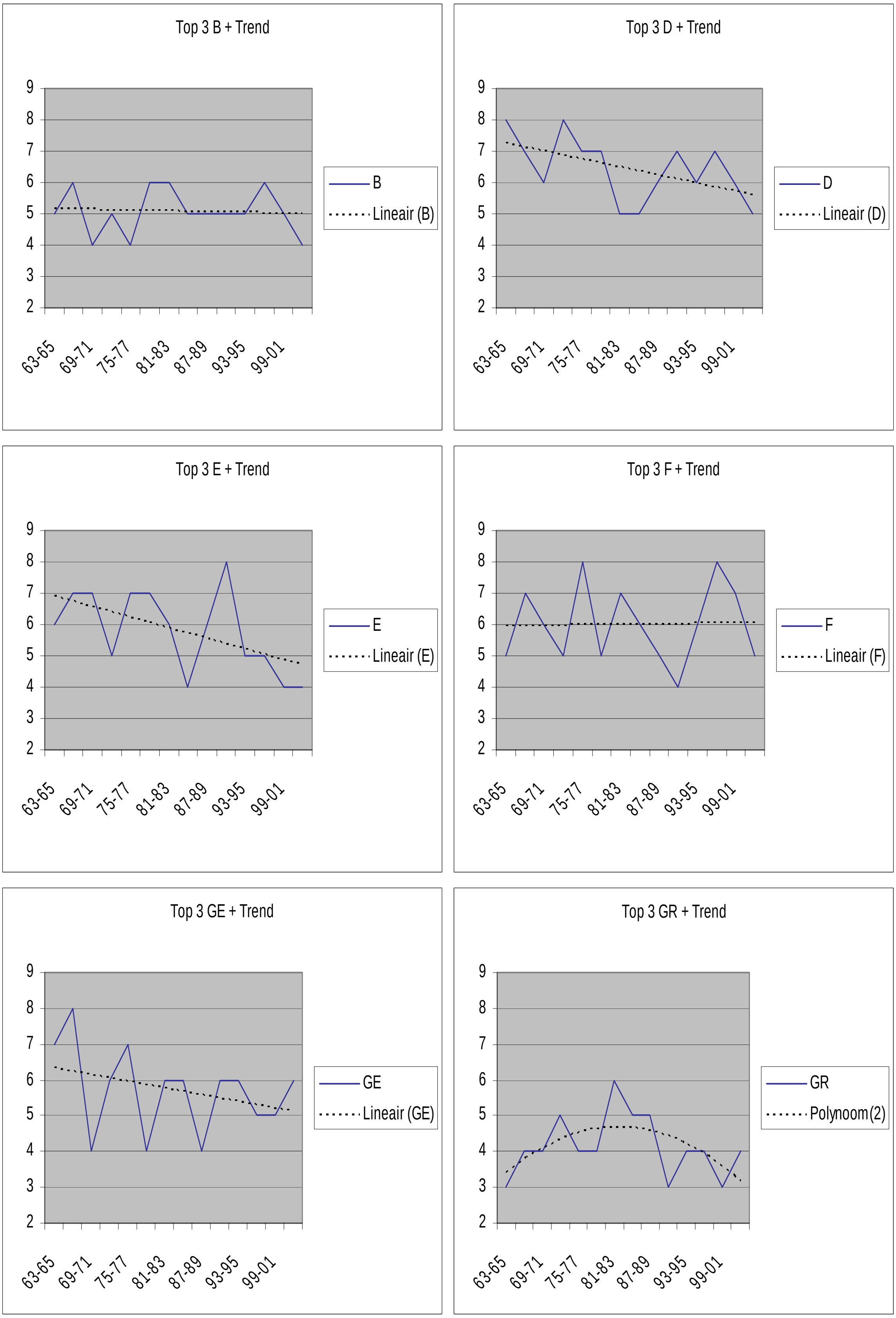


Figure3 Continued: Top 3 with trend for all countries individually for seasons 63-64 to 2004-2005

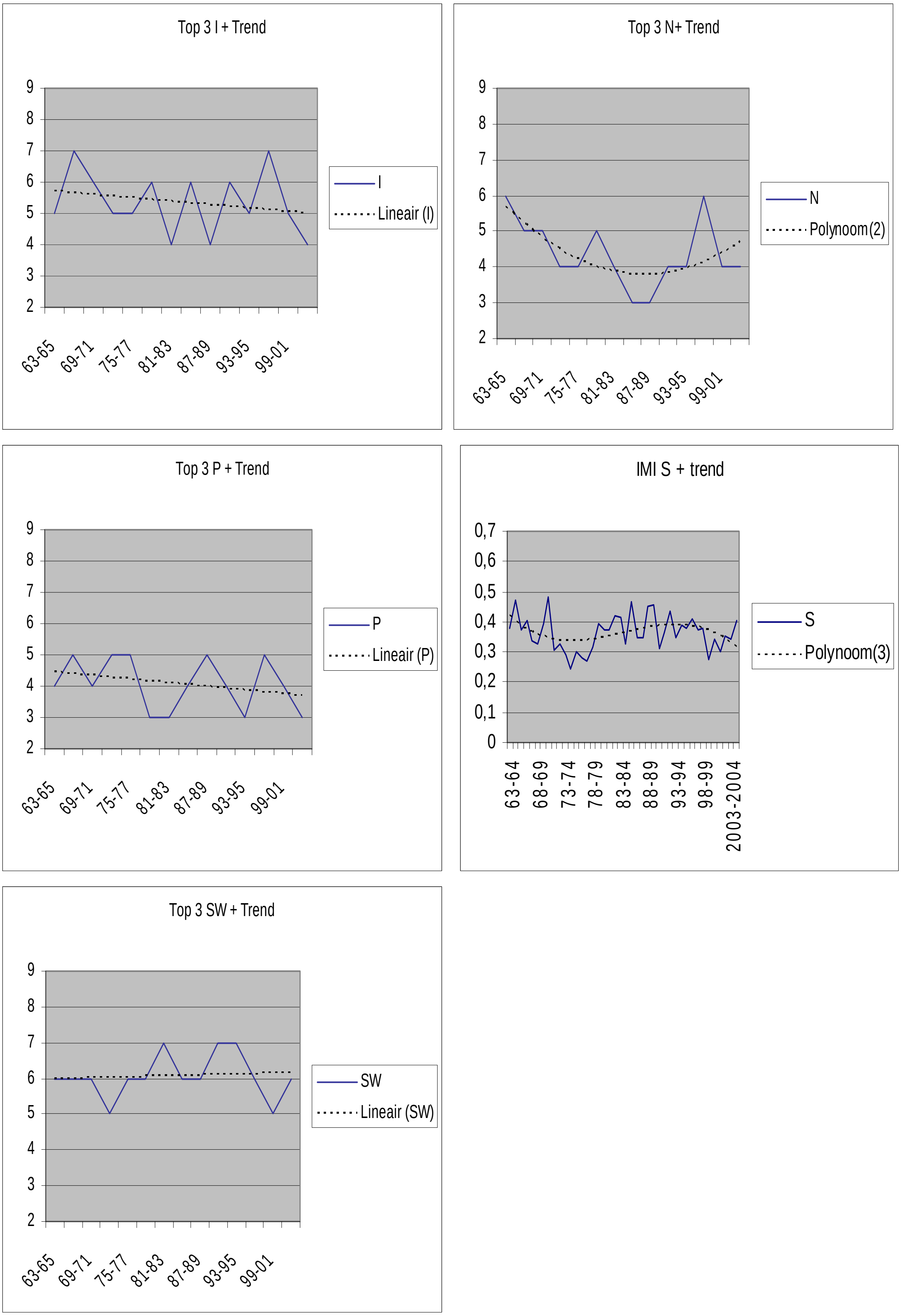


Chart3: Dendrogram TOP 3 All countries Ward's method

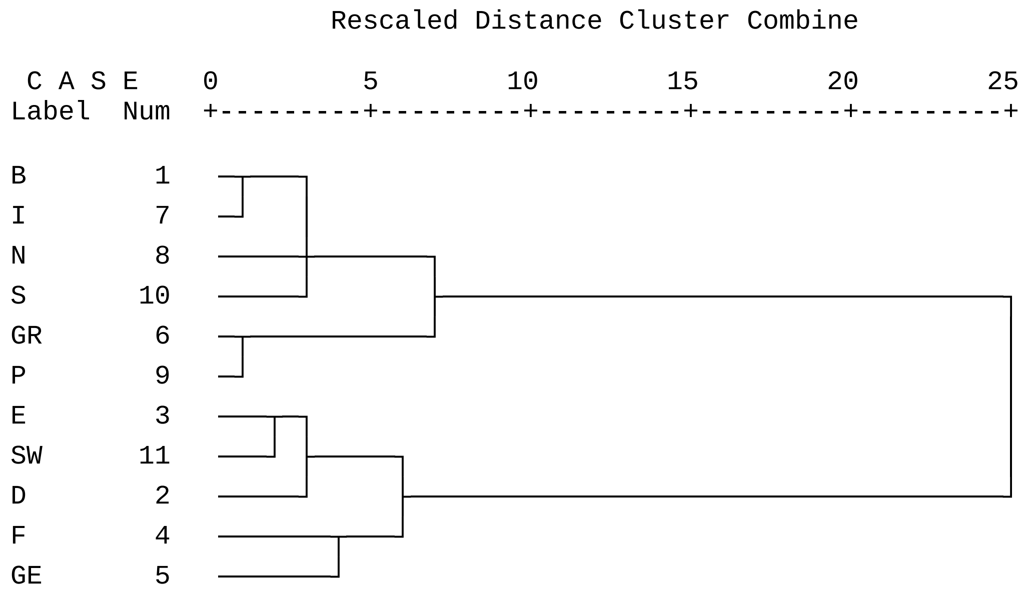


Figure4: Ranking of Average Number of teams entering Top 3 over 3 years for all countries for seasons 63-64 to 2004-2005 from most balanced to most unbalanced

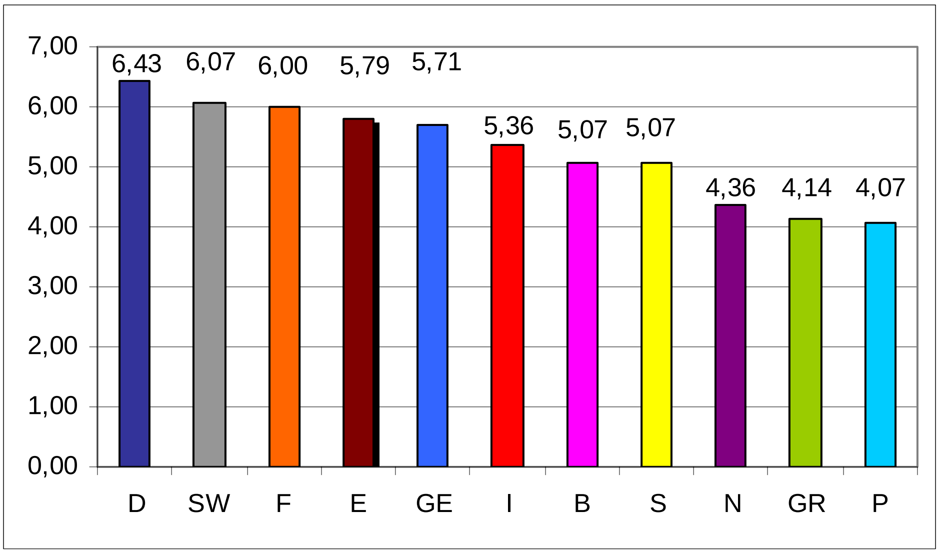


Figure5: Lorenz curves for championship winners of all countries for seasons 63-64 to 2004-2005

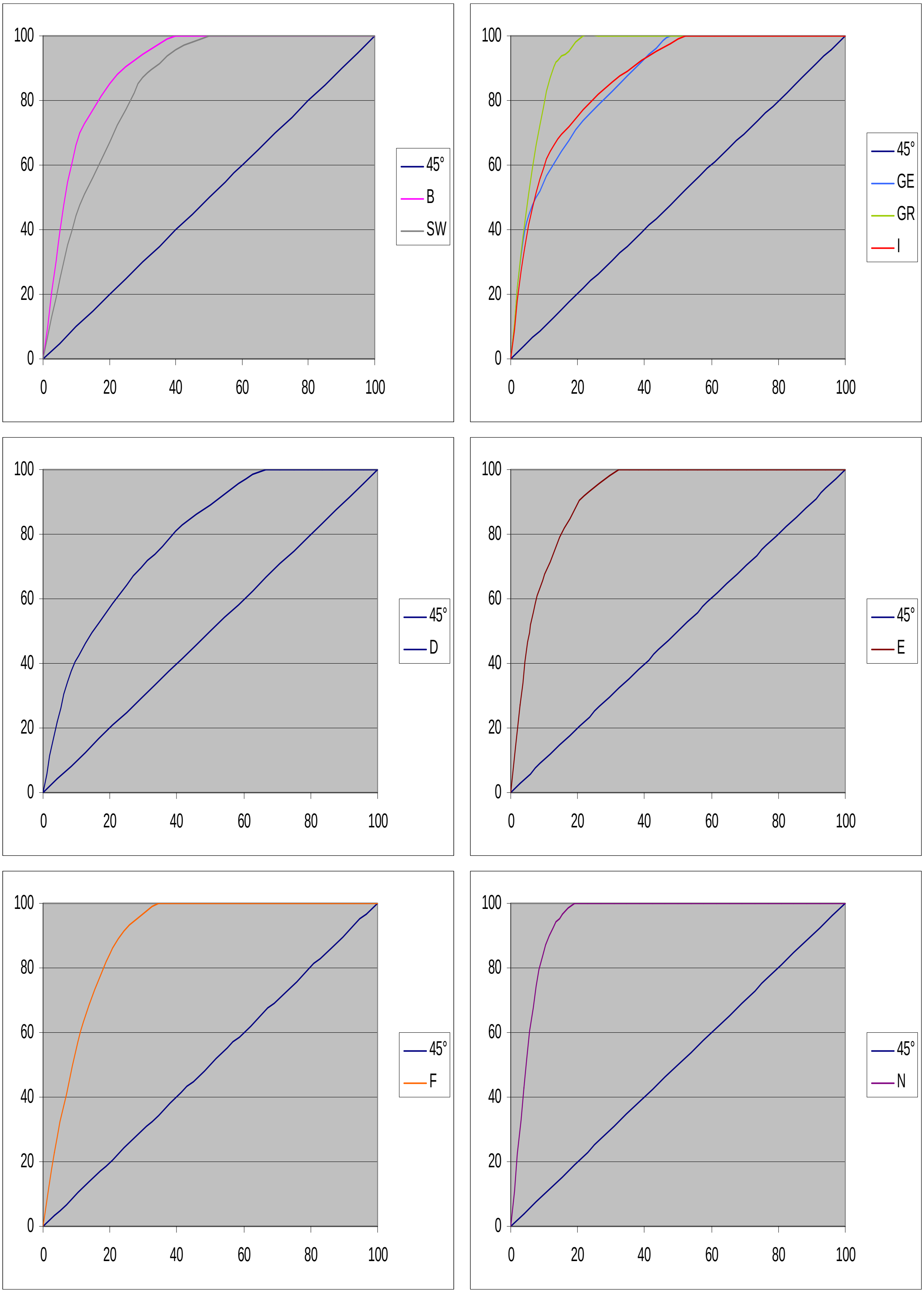
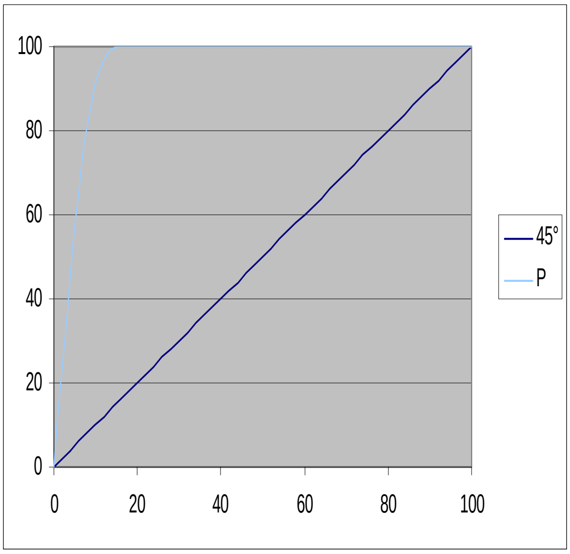
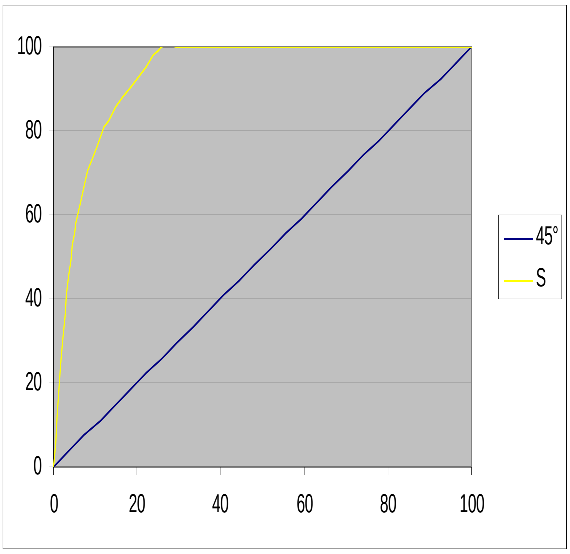


Figure5 Continued: Lorenz curves for championship winners of all countries for seasons 63-64 to 2004-2005





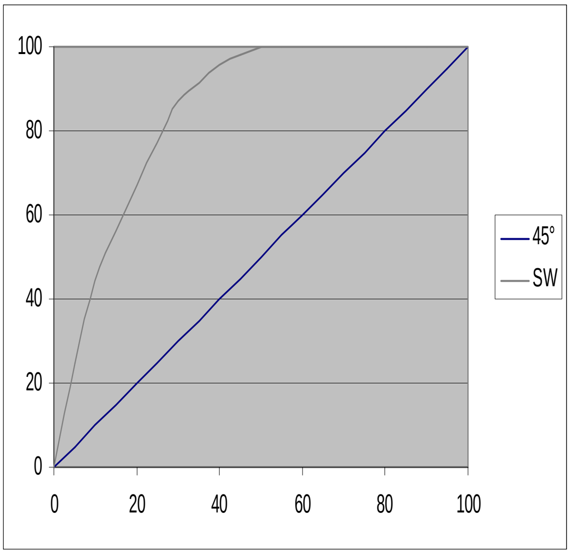


Figure6: Gini coefficients of all countries over total period for seasons 63-64 to 2004-2005 ranging from most balanced to most unbalanced

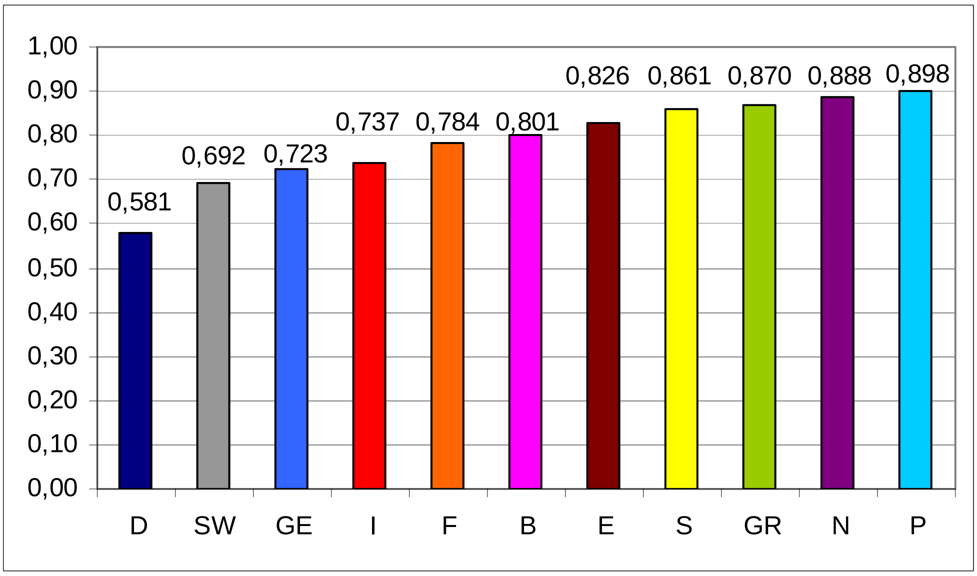


Table3: Overview of the trends in seasonal and dynamic imbalance measured by the NAMSI and number of teams entering the top 3 in 3 years for the seasons 63-64 to 2004-2005

	Trend NAMSI 63-04	Trend Dominance 63-04
Belgium	small rise	status quo
Denmark	up till seventies, down till eighties, up till begin new century	status quo
England	small rise	slow increase
France	status quo	status quo
Germany	status quo	status quo
Greece	down till seventies, up till eighties, down till begin new century	low in early eigthies
Italy	decrease till eigthies, then increase	status quo
Netherlands	down till seventies, up till eighties, down till begin new century	high in late eigthies
Portugal	decline	status quo
Spain	up till seventies, down till eighties and then back up	status quo
Sweden	up till seventies, down till eighties, up till begin new century	status quo

Table 2 shows the measures of competitive balance in English Premiership football.107 1.Minimum realized wins of one participant team.099 2004/05 16 .087 1. RSD . 803 .263 .155 .Â 30 . In Figure 1 we can see a graphical presentation of the comparative size of three leagues RSD index in the reporting period.219 .625 .383 .317 . N.088 1.835 2006/07 13 .325 2011/12 19 .583 .088 .283 .Ratio of Standard Deviation indeks.667 .Table 3 Competitive balance in the MLS lague S N max min SD ISD RSD (%) (%) 2012/13 19 .600 .163 2009/10 16 .Â Competitive balance in European football: Comparison by adapting measures. J. Groot. How exciting are the major European football leagues?