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COMPETITIVE BALANCE IN EUROPEAN FOOTBALL: COMPARISON BY ADAPTING MEASURES: NATIONAL MEASURE OF SEASONAL IMBALANCE AND TOP 3

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JEL CLASSIFICATION: C81, F02, L83.

Introduction

Since Rottenberg[1] described the labour market of 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[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."* We start with a short description of the evolution of research in the field of Sport Economics.

In the early stages, theoretical research questions concerning

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[1] See S. ROTTENBERG, *The baseball players' labor market, J. of Pol. Ec.*, vol. 64, n.3, 1956, 242-258.

[2] R. SANDY, P. SLOANE, M. ROSENTRAUB, *The Economics of Sport, an International Perspective*, Palgrave Macmillan, New York, 2004, 2.

American Leagues were tackled by the following major contributors. Neale[3] 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[4] became a specialist in the National Hockey League (hereafter NHL). He showed among many other things that the NHL can be characterized to have monopolistic as well as monopsonistic features. El-hodiri and Quirk[5] formalized the theory of Rottenberg and gave proof of the '*invariance principle*'.[6] The first sports economics book was edited by Noll[7] in 1974 and gathered the most influential articles at that time. This book gave an extra boost to the new research area. He called attention to attendance, price setting and policy alternatives in his book. Empirics were introduced by Scully[8] and Canes[9] in the same year 1974. Scully 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 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.

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[3] See W.C. Neale, *The peculiar economics of professional sports: a contribution to the theory of the firm in sporting competition and in market competition, Quart. J. of Ec.*, 78, n. 1, 1964, 1-14.

[4] Some of his earliest work: J.C.H. Jones, *The economics of the national hockey team, Can. J. of Ec.*, vol. 2, n. 1, 1969, 1-20; J.C.H. Jones, W. D. Walsh, *Salary determination in the NHL: effects of skills, franchise characteristics and discrimination, Ind. and Lab. Rel.*, vol. 41, n.4, 1988, 592-604; J.C.H. Jones, D.G. Ferguson, *Location and survival in the NHL, J. of Ind. Ec.*, vol. 36, n. 4, 1988, 443-457.; J.C.H. Jones, S. Nadeau, W. D. Walsh, *Ethnicity, productivity and salary: player compensation and discrimination in NHL, Appl. Ec.*, vol. 31, n. 5, 1999, 593-608.

[5] M. El-Hodiri, J. Quirk, *An economic model of a professional sports league, J. of Pol. Ec.*, vol. 79, n. 6, 1971, 1302-1319; M. El-Hodiri, J. Quirk, *The economic theory of a professional sports league, in Government and the sports business,* R. G. Noll, Washington D.C., The Brookings Institution, 1974, 33-80.

[6] Gate revenue sharing has no impact on the distribution of talents. Kesenne and others showed that this no longer holds in other settings. For more details see S. Kesenne, *League Management in professional team sports with win maximizing clubs, European Journal for Sport Management*, vol. 2, n. 2, 1996, 14-22 and much of his later work.

[7] R.G. Noll, (Ed) (1974), *Government and the sports business,* Washington D.C., The Brookings Institution, 445.

[8] G.W. Scully, *Pay and performance in MLB, Am. Ec. Rev.*, vol. 64, n. 6, 1974, 915-930.

[9] M.E. Canes, *The social benefits of rrestrictions on team quality, chapter 3 in Government and the sports business,* Washington D.C., The Brookings Institution, 1974, 81-114.

He offers on his website[10] an extensive 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[11] in collaboration with Quirk and became a recognized authority in the sector of sports economics research. Zimbalist[12] 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[13] as pioneer in 1969. He looked at English football and introduced the importance of league objectives: win maximizing versus profit maximizing. Hart, Hutton and Sharot[14] constructed and estimated a basic demand model for British Association football but the empirical testing was limited to four teams over two seasons. Bird[15] ameliorated the model by using time series for the whole league. Andreff focused attention on the economics of sport in 1986 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.[16]

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 (hereafter NASSM) was formed to promote, stimulate and encourage studies, research, scholarly writing and professional development in the field of sport management. Their

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[10] See www.rodneyfort.com/SportsData/BizFrame.htm (*July, 2006*).

[11] For example see: J. Quirk, R. D. Fort, *Pay Dirt: the business of professional team sports*, New Jersey, Princeton University Press, 1997.

[12] A. Zimbalist, *Baseball and Billions. A Probing Look Inside the Big Business of Our National Pastime*, Basic Books, New York, 1992.

[13] P. J. Sloane, *The labour market in professional football, British Journal of industrial relations*, vol. 7, n. 2, 1969, 181-199.

[14] R. A. Hart, J. Hutton, T. Sharot, *A statistical analysis of Association Football Attendances, Appl. Stat.*, vol. 24, n. 1, 1975, 17-27.

[15] P. J. W. N. Bird, *The demand for league football, Appl. Ec.*, vol. 14, n. 6, 1982, 637-649.

[16] R. Fort, J. Quirk, *Cross-subsidization, incentives, and outcomes in Professional team sports leagues, J. of Ec. Lit.*, vol. 33, n. 3, 1995, 1265-1299 and S. Szymanski, *Economic design of sporting contests, J. of Ec. Lit.,* vol. 41, n. 4, 2003, 1137-1187.

research journal is the Journal of Sport Management. The European Association for Sport Management (hereafter 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 (hereafter 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 (hereafter IASE) which was founded in 1999 to increase collaboration and to organize an annual conference to discuss research.

In this paper we focus on a important subject situated in the discussed research area: competitive balance in European football leagues. Within most European countries the national highest league football competition is prominent in tv sports coverage as well as in recreational spending. Football can be considered as the most popular European sport. The highest league is in almost all European countries covered on tv. The English Premier League as well as the German Bundesliga but also others are even worldwide broadcasted. The World Cup as well as the European Cup are important mega-events. The Champions League, and to a smaller extent the Uefa Cup, are yearly European competitions that gather the top of the European teams with huge compensations for participating teams and their home leagues. To give an example: the Champions league distributed Euro 33.9 Million among Europe's domestic leagues in the season 2004-2005 and had a gross budgeted income in 2005 of Euro 560 million.

The need of a certain balance on the field is a major concern in football leagues, as it is in all team sports. Teams should not excel excessively in playing strength. Fans are assumed to appreciate a game much more when one team wins by 4 goals against 3 than when a team scores 7 goals and the other none. For a few games the latter imbalance is without repercussions but when the winning team outperforms all of the opposing teams and this in every game, we can expect that even the fans of the winning team loose interest. This basic idea is often discussed by leagues and team owners in the media, as well as in Sports Economics.

In general, firms try to dominate and outperform competitors as much as possible. In sports however we can talk about peculiar economic characteristics since this kind of competitive behaviour is absent.

Topkis[17] was one the first academic researchers to address this. 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[18] captured 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, a championship, is an indivisible joint-product and so teams need each other. The more attractive a championship is, the more fans buy a ticket, the more broadcasters are willing to invest, the more sponsors are attracted,… And it is generally accepted that a competition with more competitive balance is a more attractive one, ceteris paribus. 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 in European football, the courts did not agree with the restrictions. Even though some restrictions are abandoned, others appear or are adjusted. In this paper we will not specifically address the influence of interventions on competitive balance. We provide a first empirical discussion of the evolutions of competitive balance of the highest league football instead, which can give some provisional insights concerning interventions. The importance for the sports sector[19] and the use of it as a justification for restrictions makes a comparison of European countries very informative.

How competitive are the leagues in Europe? Is there need for concern? How do the European national competitions compare to each other? Can they be considered as one group and hence are international policy decisions possible? Who is obviously most or least competitive? These are the research questions that we address in this paper.

We begin with a definition of the concept based on a short literature overview. Next we discuss the most frequently used measures. For an international comparison we show that an adaptation of existing measures is advisable. A new measure is constructed for seasonal imbalance. We formed a comprehensive international database combining final tables of eleven

[17] J. H. Topkis, *Monopoly in Professional Sports, Yale Law J.*, vol. 58, 1949, 708.

[18] W.C. Neale, *The peculiar economics of professional sports: a contribution to the theory of the firm in sporting competition and in market competition*, cit., 2.

[19] Many managers and sports related people feared the Bosman-case in 1995 because most expected high inequalities in player talents acquisitions. In the Sunday Mirror of 3 September 2000, Andy Gray (?) for example expressed his concerns about the possible creation of elite clubs because of the high wages in sports. Jan Peeters, former president of the Belgian Football Association (KNBV), 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. These two, but many others with them, feared that the playing equalities were threatened.

European countries. These countries are chosen based on the top 20 FIFA world ranking of April 2006. We replaced the Czech Republic by Belgium. So we include '*the big 5*'[20] together with 6 smaller countries: Belgium, Denmark, England, France, Germany, Greece, Italy, Netherlands, Portugal, Spain and Sweden. We focus on the highest leagues for 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 include two central countries, two northern and two southern countries. Once we calculated appropriate measures we discuss the trends. We use cluster analysis to verify whether the European countries can be considered as one group. Conclusions are drawn in the last subsection.

1. Concept of competitive balance

Most authors who do research in the field of economics of team sports include the idea of competitive balance and its importance but use different terms for it. The following short literature overview gives some of those alternative naming. We also show that the concept can include several dimensions. So before empirical research can start, a description of the dimension of interest is necessary.

Topkis[21] did not name the idea of competitive balance but he includes the idea 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?*» According to the founder of Sports Economics research, Rottenberg:[22] «*The nature of the industry (of baseball) is such that competitors must be of approximate equal 'size' if any are to be successful*.» Neale[23] talks about the «*League standing effect*» to underline the importance of differences in standings of the teams over several years. Jones[24] mentions the «*importance of competitive equality*». El-hodiri and Quirk[25] discuss «*equalization of competitive playing strengths*» as an important objective for a sports league. Janssens and Kesenne[26] stress the importance of «*sporting*

[20] These five countries combine an important football culture with large populations.
[21] J. H. Topkis, *Monopoly in Professional Sports*, cit., 708.
[22] S. Rottenberg, *The baseball players' labor market*, cit., 242.
[23] W.C. Neale, *The peculiar economics of professional sports: a contribution to the theory of the firm in sporting competition and in market competition*, cit., 1-3.
[24] J.C.H. Jones, *The economics of the national hockey team*, cit., 3.
[25] M. El-Hodiri, J. Quirk, *An economic model of a professional sports league*, cit., 1303.
[26] P. Janssens, S. Kesenne, *Belgian Soccer Attendances*, *Tijdschrift voor Economie en Management*, vol. 32, n. 3, 1986, 305.

equality». Quirk and Fort and others[27] include «*uncertainty of outcome*» in their research. «*Symmetry among teams*» is used by Palomino and Rigotti.[28]

Sloane[29] stresses the multidimensionality of competitive balance by distinguishing short-run uncertainty[30] from long-run uncertainty of outcome.[31] He adds that long run domination of one or two clubs may be more important. 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 the championship that influences utility. Last there is the absence of long-run domination.[32] Vrooman[33] points out that there are actually three possible interpretations of competitive balance, all connected to each other but now the last is somewhat less clear for us. 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[34] provides the clearest division. He 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.

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[27] J. Quirk, R. D. Fort, *Competitive Balance in Sports Leagues*, in J. Quirk, R.D. Fort, (ed.), *Pay Dirt, The business of professional team sports*, New Jersey, Princeton University Press, 1997, 240-293. See also for example S. Kesenne, *The salary cap proposal of the G-14 in European football, Eur. Sp. Man. Quart.*, vol. 3, n. 2, 2003, 120-128; M. Baimbridge, S. Cameron, P. Dawson, *Satellite Television and the Demand for Football, A whole new ball game?, Scot. J. of Pol. Ec.*, vol. 43, n. 3, 1996, 317-333; G. Knowles, K. Sherony, M. Haupert, *The Demand for MLB, A test of the UOO hypothesis, Am. Ec.*, vol. 36, n. 2, 1992, 72-80.

[28] F. Palomino, L. Rigotti, *The Sport League's Dilemma, Competitive balance versus incentives to win*, Industrial Organization 0012003, Economics Working Paper Archive at WUSTL, 2001.

[29] P. J. Sloane, *The Economics of Professional Football, The football club as a utility maximizer, Scot. J. of Pol. Ec.*, vol. 18, n. 2, 1971, 121-146.

[30] This is what Rottenberg discusses in his paper on the labour market of baseball. The focus lies on the balance within one season, so whether a team obviously outperform the others.

[31] Long run domination looks at whether there are some teams that remain in the top over several seasons. For example, the New York Yankees dominated baseball in the 1950's when they won eight American league pennants in 8 years.

[32] For more details we refer to their article: J. Cairns, N. Jennett, P. J. Sloane, *The Economics of Professional Team Sports, A survey of theory and evidence, J. of Ec. Stud.*, vol. 13, n. 1, 1986, 1-80.

[33] J. Vrooman, *The Baseball Players' Labour Market Reconsidered, South. Ec. J.*, vol. 63, n. 2, 1996, 339-360.

[34] S. Szymanski, *Economic design of sporting contests*, cit..

Because the concept can have several dimensions and a widely used definition does not exist, 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 follow Szymanski and consider the following three kinds of competitive balance.

(i) Match uncertainty.
(ii) Seasonal Uncertainty
(iii) Championship Uncertainty

We focus on season uncertainty and championship uncertainty in this paper. 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, we should determine how the optimal level of competitive balance can be reached and act accordingly.[35] 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 on the objectives of the agents in the market is necessary. The optimization of these objectives determines the optimal level but interpersonal wealth measuring is needed and this is very complex. Because of the unsolved issues about optimal competitive balance an ideal level is frequently used instead.

Two alternatives are often used in the literature of sports economics to describe a league in perfect balance. Quirk and Fort introduced the use of a win probability of fifty percent for each team. This means that the ideal level is present when the real number of wins is close to the one a computer would generate if it randomly picks a number out of a binomial distribution.[36] The alternative is the use of a win percentage of 50% for all teams in the league, which is equal to stating that all teams win half of their matches an loose the other half or that all games end in a tie. The two alternatives are not equal because the standard deviation differs: for the first it equals equals $0.5/\sqrt{N}$, while for the second it is zero. Neither is proven to be optimal and both are obviously disputable. We are convinced that it is more appropriate to use another basis of comparison.

There is no doubt about the necessity to prevent complete imbalance.

[35] Assuming of course that competitive balance is a major concern. Convincing evidence has yet to be found. But as long as team managers, sports directors and others use the concept for restrictions, it is at least very relevant for the team sports industry.
[36] We discuss their measure more thoroughly in the next chapter.

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. The fact that a league diverges from an ideal league does not mean that intervention is necessary. However when a league is very close to complete imbalance, reaction seems reasonable. So 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 many proposed measures. We give a short overview of some existing measures for both seasonal and championship uncertainty and divide the chapter following this distinction into two subsections. We do not present an exhaustive list. For more details on the measures we refer to the articles.

2.1. Seasonal imbalance

We begin with a discussion of the seasonal uncertainty measures based on the win percentages. Next we discuss other measures chronologically.

Win or point percentage

In what follows we will discuss some measures that use the win percentage as basis. For the win percentage, the number of wins in one season are counted and divided by the total nr of games played by that team. In American sports most games are played until a winner prevails. In Europe draws are possible and they are commonly included 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 gives the same result as always ending the games in a tie. The calculation of win percentages is equivalent to the use of points when 2 points are awarded to the winner and 1 for each team in a tie. This total of points is divided by the maximum: the number of games multiplied by 2. The general American counterpart consists of 1 point for winning and dividing by the number of games. They all give an

average league winning percentage of 0,5. In most European countries the point distribution changed in the nineties to three points for wins and one for draws. When the latter is applied, the use of points renders a seasonal average different from 0,5 so it is no longer equivalent to the use of wins.

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. It only takes two teams into account which is the biggest disadvantage of this measure. 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[37] of the winning percentages in one season measures how far the win percentages are spread around the average. The larger the standard deviation, the less the competitive balance is because the win percentages are hence very different between teams. 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 so the standard deviation cannot be compared anymore and the use of the coefficient of variation[38] is necessary.

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.

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

[38] The coefficient of variation=sd/average.

Quirk and Fort introduced $0.5/\sqrt{N}$ 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 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 $0.5/\sqrt{N}$. This ratio is the measure most frequently used in sports economics.[39]

As discussed in our introduction, we do not opt for the use of this '*ideal*' measure. Our objection against the notion ideal is supported by our finding that the calculation of this ratio renders significant numbers below 1. In 1969 for example Germany has a ratio equal to 0,695. This means that the championship is more equal than when a computer would have picked the results if all teams had a chance to win of 0,5. So in terms of the interpretation given by Quirk and Fort, we find a competition that is more equal than when the league is perfectly balanced.

Gini coefficient

The Gini coefficient is originally developed to measure income inequalities by Gini Corrado. Schmidt and Schmidt & Berri[40] use it to measure the inequality of the distribution of win percentages. It was earlier already applied to measure another kind of competitive balance, namely the championship variation. This is discussed later in the paper.

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 actual 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[41] hence argue that this measure cannot be used for

[39] J. Quirk, R. D. Fort, *Competitive Balance in Sports Leagues*, cit.. See other papers as well that use this ratio: J. Vrooman, *A General Theory of Professional Sports Leagues, South. Ec. J.*, vol. 61, n. 4, 1995, 971-990; B. R. Humphreys, *Alternative Measures of Competitive Balance in Sports Leagues, J. of Sp. Ec.*, vol. 3, n. 2, 2002, 133-148; L. Buzzacchi, S. Szymanski, T. M. Valletti, *Equality of Opportunity and Equality of Outcome, Open leagues, closed leagues and competitive balance, J. of Ind. Comp. and Tr.*, vol. 3, 2003, 167–186.

[40] M. B. Schmidt, *Competition in Major League Baseball, The impact of expansion, Appl. Ec. Let.*, vol. 8, 2001, 21-26; M. B. Schmidt, D. J. Berri, *Competitive Balance and Attendance, The case of Major League Baseball, J. of Sp. Ec.*, vol. 2, n. 2, 2001, 145-167.

[41] J. Utt, R. Fort, *Pitfalls to Measuring Competitive Balance with Gini- Coefficients, J. of Sp. Ec.*, vol. 3, n. 4, 2002, 367-373.

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.[42] 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 over seasons is not taken into account. We show this in the next chapter. Humphreys and Eckard[43] concentrated on a more dynamic measure to include both kinds of uncertainty. Eckard decomposed the variance of winning percentages into a cumulative and time varying component. Humphreys 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.

The standard deviation of winning over seasons per team is now included and it is named '*within-team-standard deviation*'. The standard deviation used before is called the '*within-season-standard deviation*'.[44]

Within-team-standard deviation Within-season-standard deviation:

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

The Competitive Balance Ratio (CBR) is the ratio of these two standard deviations:

$$CBR=\frac{\frac{\sum_{i=1}^{n}SD_{wt,i}}{n}}{\frac{\sum_{s=1}^{S}SD_{ws,s}}{S}} \qquad (2)$$

[42] For an overview we refer to their paper.

[43] W. Eckard, *ANOVA-Based Competitive Balance Measure, Defense, J. of Sp. Ec.*, vol. 4, n. 1, 2003, 74-80; B. R. Humphreys, *ibidem*, 2002 and B. R. Humphreys, *The ANOVA-Based Competitive Balance Measure: A reply, J. of Sp. Ec.*, vol. 4, n. 1, 2003, 81-82.

[44] 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

The CBR lies between 0 and 1. When 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 championship 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 so a large imbalance. 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 we show in Table 1 in the next chapter. Besides the need for adaptation to apply it for the European leagues, combining these two kinds of balance makes it impossible to distinguish between them. For policy decisions it is important to pinpoint the balance that needs to be tackled since interventions can be expected to have different impacts on the two kinds of uncertainties.

Relative Entropy

Horowitz[45] chose to use the Relative-Entropy measure of information theory to measure seasonal competitive balance in Major League Baseball.[46]

$$R = \frac{H}{H_M} = \frac{-\sum_{i=1}^{n} p_i \log_2 p_i}{-\log_2 \frac{1}{n}} \qquad (3)$$

To estimate whether a systematic and asymptotic approach to 1 is found over S seasons he calculated the following regression

percentage of season s for all n teams together= 0,5.

[45] I. Horowitz, *The Increasing Competitive Balance in MLB, Rev. of Ind. Org*., vol. 12, n. 3, 1997, 373-387. No original references are found in Horowitz's paper but see the work of Raul Caruso for this. He uses the entropy measure to measure conflict and conflict management: R. Caruso, *Conflict and Conflict Management with Interdependent Instruments and Asymmetric Stakes*, paper prepared for the Jan Tinbergen Peace Science Conference, 2006.

[46] With i = team; n = total nr of teams; p_i = the proportion of the league victories of team i. H_M = maximal entropy is found when every team has the same share of victories: $p_i = 1/n$, for an 8 team league: p_i=8 and H_M =3. The latter maximum only applies when all teams play an equal number of games.

$Y_s=Ln(1/R_s-1)= \alpha_s + \beta_s s + \mu$. If the estimator of â over all seasons is significantly negative, an increase in balance is present. Horowitz warns for an autocorrelation problem signaled by the Durbin Watson test. He uses dummies for important structural changes in the Baseball leagues and added them to the regression to remove the problem. He then estimated whether this balance measure R increased to 1 over time in a decreasing rate.[47] 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. A problem with the use of R is that it is always close to 1 when there are many teams because one team cannot win more than their number of games. In European football this is not the case.

Herfindahl-Hirschman Index (HHI)

Depken II[48] looks at the Herfindahl-Hirschman index. Market shares are squared and then summated over all firms in the market. This measure was constructed in 1982 to assess mergers. The US government's antitrust enforcement guidelines use the height of the HHI for that assessment.

$$HHI= \sum_{i=1}^{n} MS_i^2 \quad [49] \qquad (4)$$

It lies between 0 and 10000, zero when there is perfect competition and 10000 when there is perfect monopoly. Depken II warns against the use of the winning percentages since the maximum of 100 is not attainable. No team can win games played between two other teams. The actual minimum is when teams have an equal share 1/n and so the minimum is 1/n. This only approximates zero if n is very large which is not the case for many European football leagues. He proposes the alternative of using production categories that influence the number of wins. A team is assumed to attract those players that can maximize the market shares in those production categories so that a (near) monopoly can be attained. For the Major League baseball he found that homeruns and strikeouts are the most important ones and uses the market shares of both to calculate the HHI. Because of the accurate production statistics of baseball, he had no problems to calculate the market shares of each team.

[47] If R=1: perfect balance.

[48] C. A. Depken II, *Free Agency and the Competitiveness of MLB, Rev. of Ind. Org.*, vol. 14, n. 3, 1999, 205-17.

[49] With i = team; n = total nr of teams; MS_i= market share of team i, going from zero to 100.

For other team sports, before the HHI can be calculated, a thorough study needs to be performed to discover the production categories that have the greatest influence on the number of wins. This forms a whole new research subject and is not included.

Strength difference measured by an Ordered Probit model

Koning[50] supposes that a latent random variable Y_{ij}^* exists that determines the outcome of a game. This variable is influenced by two factors. The first factor is the difference in strength between team i and j, formalised by $a_i - a_j$. This strength is independent of the opponent and constant over a season. To include random factors ε_{ij} is added. So in general you have $Y_{ij}^* = a_i - a_j + \varepsilon_{ij}$.

Since the actual strength difference is not observed, he transformed the model into an ordered probit model. The home team i can win, lose or tie the game. The following defendable ordering for the team is assumed. A team is assumed to prefer winning over tying the game and the latter is preferred to losing, so the ordered probit model is as follows:

$$Yij = \begin{cases} 0 \text{ if } Yij^* \leq \mu_1 : \text{loss} \\ 1 \text{ if } \mu_1 < Yij^* \leq \mu_2 : \text{draw} \\ 2 \text{ if } Yij^* > \mu_2 : \text{win} \end{cases} \qquad (5)$$

Maximizing the appropriate likelihood function gives the standard errors of the a_i's and these are used as a measure for competitive balance. A large standard error indicates an imbalance. The use of this measure is not straightforward and an advanced knowledge of econometrics is necessary to apply it.

Surprise Index

Groot and Groot[51] introduce the surprise index. The surprise index is the

[50] The model is very technical. We offer only a general discussion, for more technical details, see his paper: R. H. KONING, *Balance in Competition in Dutch Soccer, The Stat.*, vol. 49, n. 3, 2000, 419-431. Marques used his model to apply to the Portuguese league: A. MARQUES, *Competitive Balance in the Portuguese Premier League of Professional Soccer,* Industrial Organization 0211025, Economics Working Paper Archive at WUSTL, 2002.

[51] See J. GROOT, L. GROOT, *The Competitive Balance of French Football, 1945-2002, Ec. Appl.*, vol. 56, n. 4, 2003, 91-113 and L. GROOT, *De-Commercializzare il Calcio Europeo e Salvaguardarne l'Equilibrio Competitivo, Una proposta welfarista, Riv. di Dir. ed Ec. dello Sp.*, vol. 1, n. 2, 2005, 63-91.

ratio between P, the realized surprise points, and M, the maximum number of surprise points that is possible when the teams are perfectly balanced.[52] 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.[53]

$$S = \frac{P}{M} = \frac{1}{M}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(R_{ij} + R_{ji})(j-i) \qquad (6)$$

$$M = 2\sum_{i=1}^{N-1}(N-i)i = (N-1)N(N+1)/3 \qquad (7)$$

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.

They found a ratio of 0,68 for French football, for Dutch football only an average of 0,54 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.[54] Groot and Groot show that it is highly correlated with the standard deviation and our results show the same ranking. They do emphasize that caution is needed because some assumptions can be doubtful.[55]

2.2. Championship uncertainty

To measure dominance of teams only a few measures[56] have been used before. The measures of Eckard and Humphreys include this kind of balance as well but we preferred to discuss it under the section of win percentages.

[52] Every game ends in a draw or every team wins its home match.

[53] (j-i) gives the rank order difference with i < j and i and j the rank number at the end of the season. R_{ij} = result of game between home team with rank i and away team with rank j.

[54] The differences in number of teams do not give problems since it is taken up in the numerator as well as in the denominator.

[55] See their paper of 2003 for more details.

[56] The measure of Jennett is not included since it calculates out-of-contention per game and does not include dominance of teams over seasons. For more details see: N. Jennett, *Attendances*,

Number of championships won

Rottenberg[57] 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 championships won per team. He found that in the American Baseball league the Yankees dominated for eighteen years over the period from the 1920s to 1951. In the National League the St. Louis Cardinals won nine times in that same period. He concluded that there was a very unequal distribution in American baseball leagues.

The ideal situation for Rottenberg is when every team in the league wins an equal number of times. This measure is very simple but it says only something about the champion. In Belgium for example the struggle between Club Brugge and Anderlecht is often fierce and at the beginning of the season it is difficult to predict who will win. However we are certain that the battle for the championship title will include both. So including more teams can give important extra information.

In Europe the playlist of teams differs every year because of the promotion and relegation scheme. Some teams enter, others leave the highest league. Using the ideal situation where each team should win every nth season is hence no option. But this measure does show in a fast an easy way whether some teams win significantly more than others.

Top k ranking

To look at the dynamic imbalance, top k ranking can be used as a complement for the previous measure. The number of different teams that ended in the top k is now counted. When more teams end in the top k over a certain period of time than in a previous period of the same length, the competition has become less dominated. In Italy for example in the period 1980-1989 8 different teams ended in the top 3, while in the period 1990-1999 it were 10 different teams.[58]

To allow comparison between European countries we assume that the probability that a team enters the top k of the highest league will be comparable when all leagues (second, third and so on) are taken into account in a country. So that different number of teams in the highest league does not present a problem.[59]

Uncertainty of Outcome and Policy in Scottish League Football, Scot. J. of Pol. Ec., vol. 31, n. 2, 1984, 176-198.

[57] S. Rottenberg, *The baseball players' labor market,* cit..

[58] In the next chapter more details are given.

[59] We hope to clarify this assumption by the following example. A country A has 16 teams in the

We use 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.[60]

Gini coefficient and Lorenz-curve

The Lorenz curve or Gini-coefficient can be used to measure the variation in championships. Quirk and Fort[61] 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 constructed the necessary database and include it in our analysis.

3. Data, used measures and results

Data were gathered on the end rankings of the highest domestic football leagues of 11 European countries:[62] Belgium (B): Jupiler league, Denmark (D): SAS Ligaen, England (E): Barclaycard Premiership, France (F): Ligue 1, Germany (GE): Bundesliga, Greece (GR): Alpha Ethniki, Italy (I): Serie A, Netherlands (N): Holland Casino Eredivisie, Portugal (P): Campeonato Nacional, Spain (S): Primera División and Sweden (SW): Allsvenskan. 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.

highest league during 3 years. Five teams entered the top 3 in that period. Country B has 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 is correct when 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. We assume that this applies.

[60] We were not able to find or construct a better alternative that we could use for our comparison. The ratio between the actual number of teams entering the top k and an ideal number is presented by BUZZACCHI, SZYMANSKI and VALLETTI, cit., but we were not able to reconstruct this measure.

[61] J. QUIRK, R. D. FORT, *Competitive Balance in Sports Leagues*, cit..

[62] We use the name of season 2004-2005 for the highest league competition. www.uefa.com/FootballCentral/Directory/index.html (*July, 2006*).

We start with an overview of our chosen measures based on the previous chapter. Next we discuss our results structured into three subsections based on the chosen measures.

3.1. Our Measures

For the balance within seasons we start from the win percentages.[63] Theoretical research discusses the distribution of player talents and the latter can be represented by the number of wins. All else equal, the more talents a team possesses the more games will be won. So a measure that is based on win percentages seems justified. We interpret seasonal balance as the spread of these win percentages within the season so that the use of the standard deviation is the obvious choice. For the balance between seasons we need to measure dominance of teams over seasons. We include both the top 3 as well as the Lorenz curve to have a measure that focuses on the champion alone.

The National Measure of Seasonal Imbalance

To compare winnings over seasons and over countries an adaptation of the existing measures is appropriate because the number of teams differs. An example clarifies this. Assume that there is perfect certainty about the outcomes of the championship, which is of course the worst case scenario:[64] team 1 wins all of its games, team 2 always wins except against the first team, team 3 always wins except games against the first and second, … The standard deviation of win percentages of such a competition with 18 teams is: 0,305148. Suppose this 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

[63] We first want to draw attention for the point schemes used by the leagues because this is relevant for European football leagues. In general, games in the American major league sports cannot end in a draw and a win is rewarded by 1 point, a loss by zero. In the nineties most European countries changed their reward for winning from two to three points while a draw receives one point and loosing zero. In the sports literature it is custom to take up a draw as half a winning. This follows the old European scheme but a draw could also be included as one third of a winning. 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 (divide sd by the average) needs to be calculated. We therefore decided to include a tie as half a winning.

[64] See the discussion in our introduction about the basics of team sports: we need some unpredictability to keep the interest of fans and sponsors.

balance improved. But this is not correct since we still know in advance who will win and what the end ranking will be. 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 10 teams with England having 22 teams, the 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 Table 1.

Table 1: 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

season	*B*	*D*	*E*	*F*	*GE*	*GR*	*I*	*N*	*P*	*S*	*SW*
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

For an international comparison, using the standard deviation alone biases the results as we have shown in our example. Using the standard deviation ratio is one possibility. However, as we have discussed above, we do not believe that this is suitable. So we develop a new measure.

We propose the National Measure of Seasonal Imbalance (NAMSI) that includes both the minimum and maximum standard deviation. The minimum standard deviation is when all teams have equal winning percentages of 0,5. This is a league in perfect balance: all have an equal number of points at the end of the season. The maximum standard deviation is reached when perfect imbalance occurs and the first team wins all its matches, the second all except against the first and so on.[65]

NAMSI = actual range sd /maximal range sd

$$\frac{sd_s - sd_{\min}}{sd_{\max} - sd_{\min}} = \frac{\sqrt{\frac{\sum_{i=1}^{n}(w_i - 0,5)^2}{n}}}{\sqrt{\frac{\sum_{i=1}^{n}(w_{i\max} - 0,5)^2}{n}}} = \sqrt{\frac{\sum_{i=1}^{n}(w_i - 0,5)^2}{\sum_{i=1}^{n}(w_{i\max} - 0,5)^2}} \quad (8)$$

[66]

[65] The calculation of this maximal sd is only applicable for team sports that play each other an equal number of games.

[66] Averagewin is by definition 0,5. Including the minimal standard deviation results in the same measure as excluding since it is by definition zero. The symbols represent the following: i = team; n = total nr of teams; w_i = win percentage of team i; w_{imax} = win percentage of a team when there is complete predictability: When n=3: team 1 wins all of its games so has a win percentage of 1 (4 out of 4), team 2 wins only against team 3 so win percentage of 0,5 (2 out of 4) and team 3 has a win percentage of 0. For all possible n this is calculated. An overview is available upon request.

When all teams win half of their games or all games end in a tie there is perfect balance. The standard deviation of the season equals zero since the win percentages of all teams are 0,5. Hence the NAMSI will equal zero. If the worst case scenario is present the seasonal standard deviation equals the maximal standard deviation and the NAMSI equals 1. 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. We discussed the example of the Belgian teams RSC Anderlecht and Club Brugge in the previous chapter. To measure the latter, the standard deviation measure[67] is inefficient as the example in Table 2 shows.

Table 2: 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

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 team 1 dominates the competition. They

[67] This obviously applies to the NAMSI as well.

win every game every season. In the second league team A dominates the competition 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.[68]

Number of teams entering the top 3 in 5 consecutive years

For the dynamic measure we look at the number of teams that end up in the top K ranking. The choice of K and the number of years is arbitrary. We choose the top 3 because in most European countries it are two or three teams that are commonly considered to be dominant. Taking up more teams underrates the dominance since the top 4 and 5 often change.

We divide our dataset in periods of 5 years to be able to discuss evolutions. We expect spectators to have this timeframe in mind when they consider dominance of teams. More research is necessary to validate this assumption. We present the number of teams with a rolling or moving average.[69] The number of teams ranges between 3 and 15. The minimum is reached when the competition is dominated by 3 teams and so the same three teams end up in the three highest places.[70] When 3 different teams enter the top 3 every season we find the maximum of 15.[71]

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. The example of Anderlecht and Club Brugge clarifies this. Anderlecht is expected to enter the top 3 every year but winning the championship is not 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

[68] This is also 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.

[69] When we use consecutive periods, depending on the start season we get different significant trends. When we use a moving average, our results are quite robust independent of the chosen timeframe.

[70] In Portugal for example in the seasons 1992-1993 untill 1996-1998 only FC Porto, Sporting CP and SL Benfica reached the top3.

[71] No country reached this maximum. Eleven teams is the highest in our database. In the seasons 90-91untill 94-95 the following 11 English teams reached a place in the top3: Arsenal, Aston Villa, Blackburn Rovers, Crystal Palace, Leeds United, Liverpool, Manchester United, Newcastle United, Norwich City, Nottingham Forest and Sheffield Wednesday.

considered and should consequently be looked at as well.

We include the Lorenz curves for the championship title distribution and the subsequent Gini-coefficients over the entire period. This measure is originally developed for income inequality but can be used in this context as Quirk & Fort[72] 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 too. Name changes, mergers and disbandment make it even more challenging. Szymanski and Kuypers[73] used a simplified version in their book to circumvent these problems but our contribution lies in a more realistic calculation.

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. 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.[74] We believe this is informative since competitions with a team that won 10 titles over 40 years can be considered to be different from one that won 10 over 20 years.

We use the Brown formula[75] to calculate the Gini-coefficient:

$$G = 1 - \sum_{i=0}^{k-1} (Y_{i+1} + Y_i)(X_{i+1} - X_i) \qquad (9)$$

[72] J. Quirk, R. D. Fort, *Competitive Balance in Sports Leagues*, cit..

[73] S. Szymanski, T. Kuypers, *Winners and losers, the business strategy of football*, Harmondsworth UK, Viking Press, 1999, 408.

[74] J. Quirk, R. D. Fort, *Competitive Balance in Sports Leagues*, cit..

[75] M. BROWN, *Using Gini-Style Indices to Evaluate the Spatial Patterns of Health Practitioners, Theoretical considerations and an application based on Alberta data, Soc. Science and Med.*, vol. 38, n. 9, 1994, 1243-1256. 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.

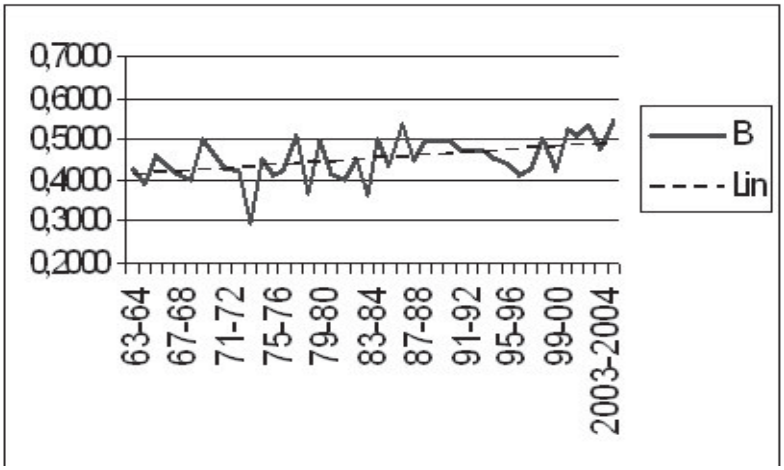
3.2. Results

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

The National Measure of Seasonal Imbalance

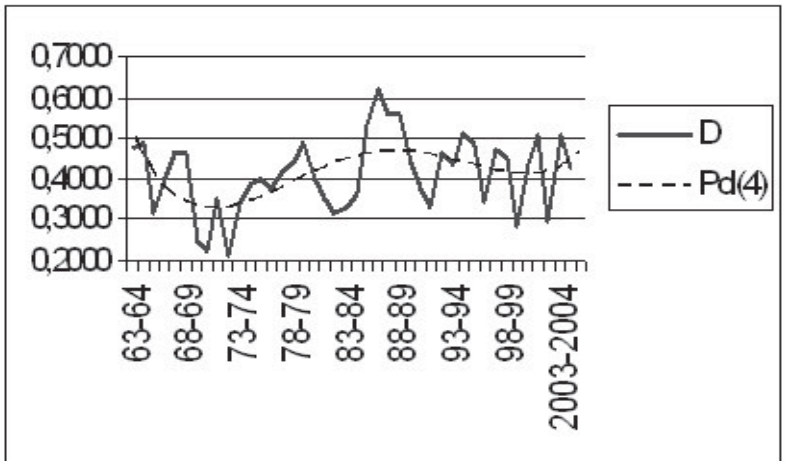
The calculated NAMSI can be found in Figure 1.[76] Separate graphs are presented for individual evolution combined with a significant trend line.[77]

Figure 1: NAMSI with trend for all countries individually for seasons 63-64 to 04-05



[76] 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 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.

[77] We tested via OLS estimation which of the following regressions had significant p-values at level 5%: namsi=$\alpha + \beta t + \mu.$; namsi=$\alpha + \beta t + \gamma t^2 + \mu.$; namsi=$\alpha + \beta t + \gamma t^2 + \delta t^3 + ì$; namsi=$\alpha + \beta t + \gamma t^2 + \delta t^3 + pt^4 + \mu.$ with t =1 to 42.


0,7000
0,6000
0,5000
0,4000
0,3000
0,2000
63-64
68-69
73-74
78-79
83-84
88-89
93-94
98-99
2003-2004
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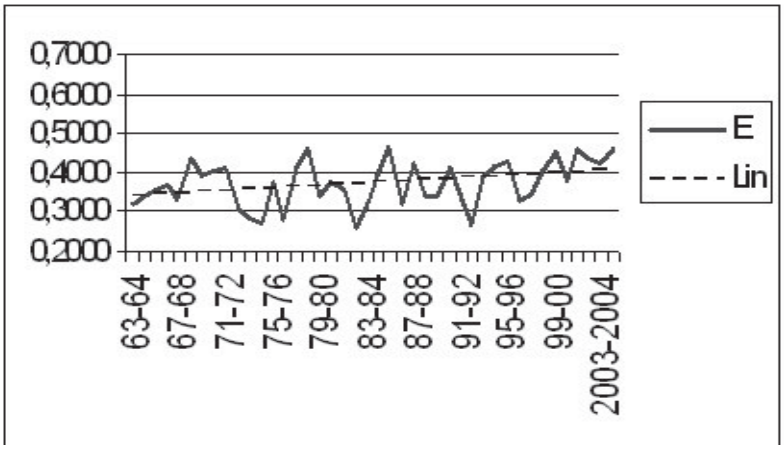
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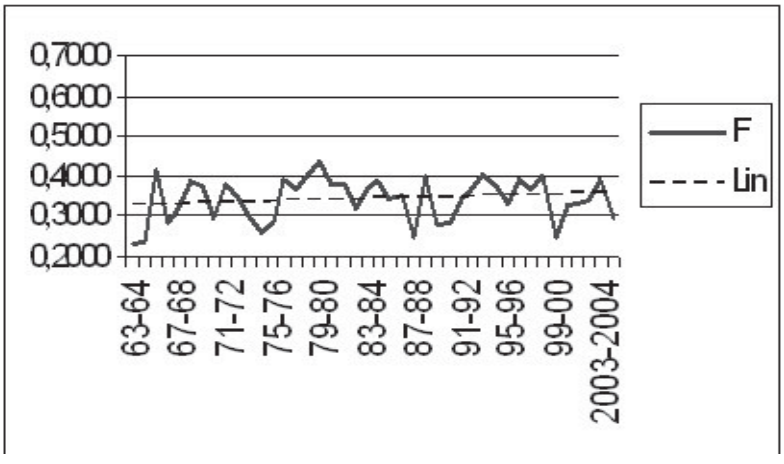
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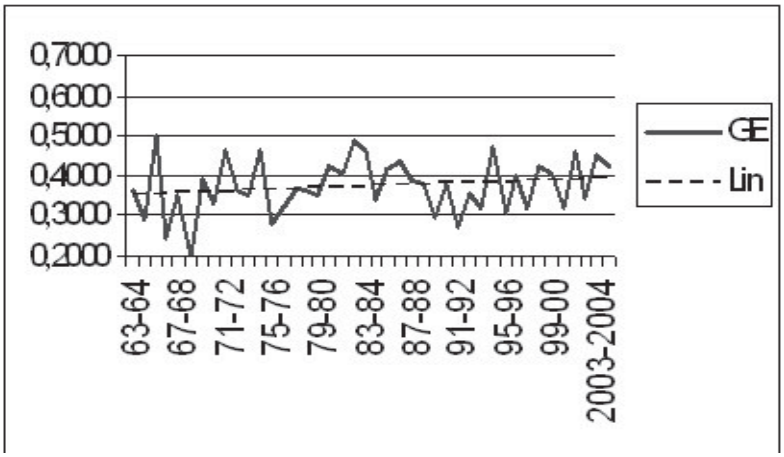
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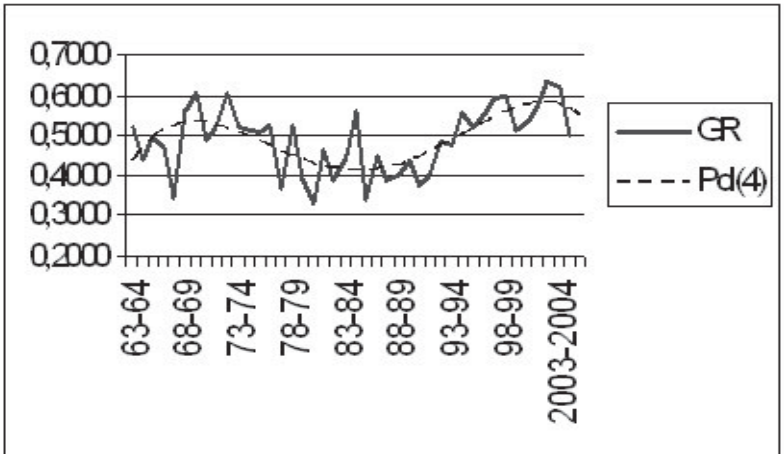
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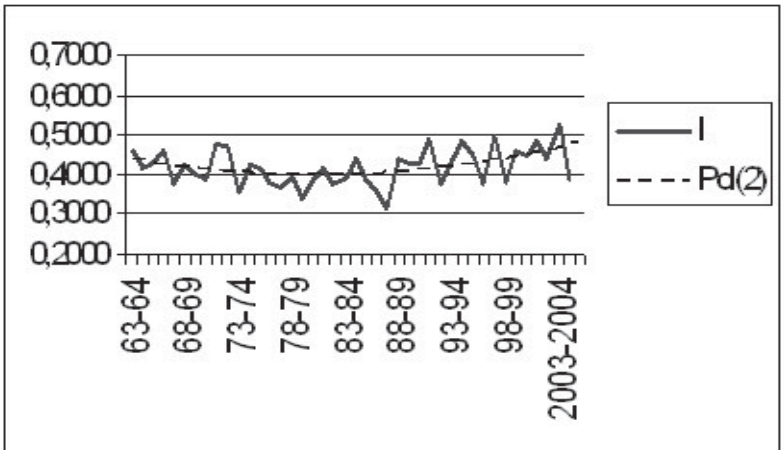
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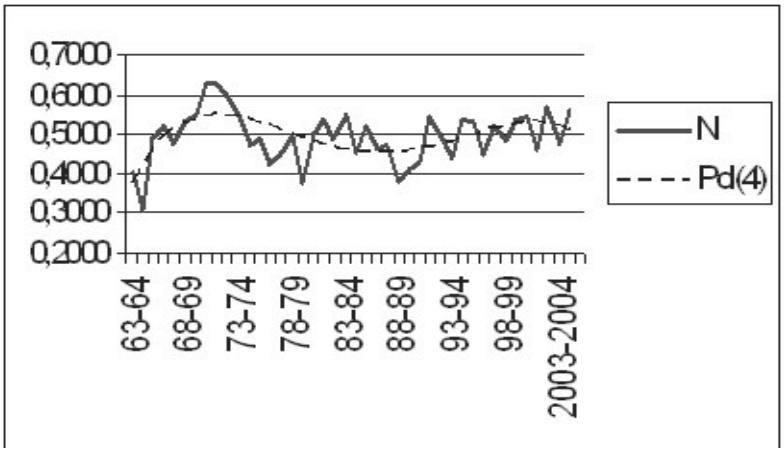
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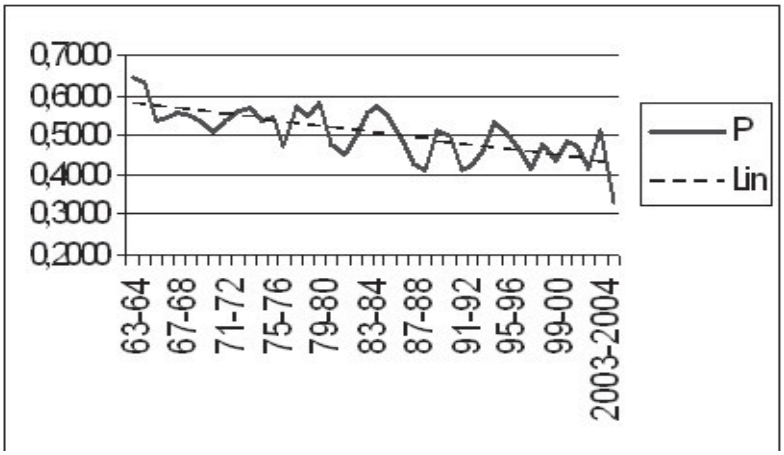
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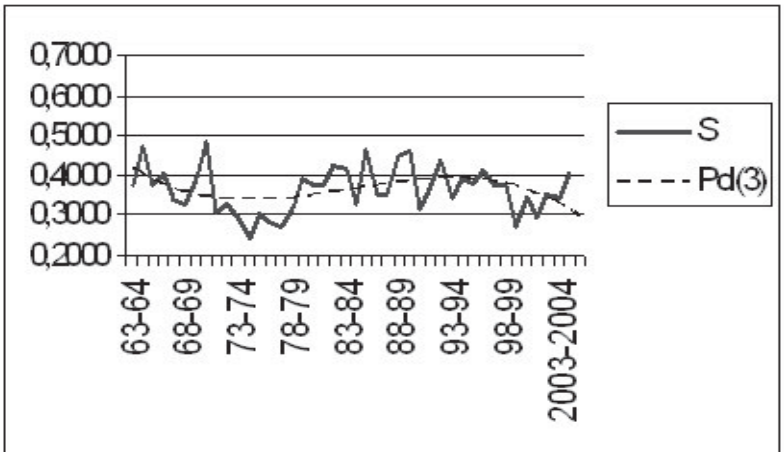
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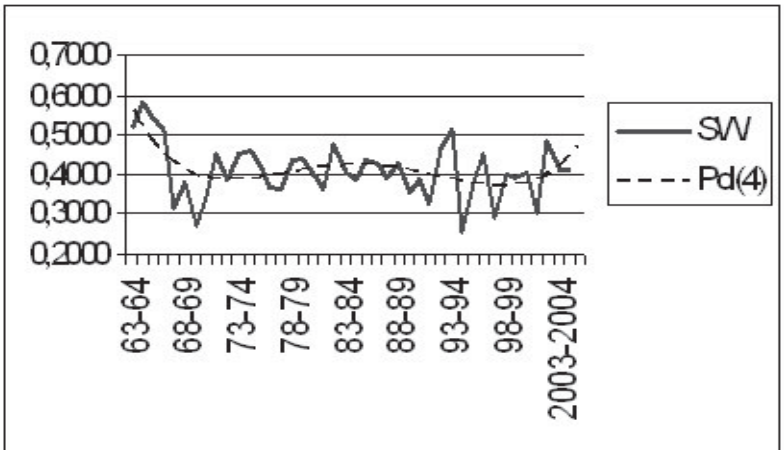


Germany and France show no significant trend over the entire period. So in these countries over the entire period the playing differences of the teams in the highest leagues did not change. It is often said in the media that the highly equal distribution of French broadcast rights has equalled the national domestic competition making them weaker to play on European level. Our results do not suggest that the spread of win percentages changed over the entire period.

Portugal is the only country that has a significant negative linear trend which states a increasing balance. Belgium and England display a very moderate linear rise in imbalance. So within one season the deviation of winning percentages between teams has increased a little over the total period. For Belgium we found a significant coefficient of 0.0019, while in England it is 0.0016. So even though they are significant at the 5% level, the change is extremely small.

Denmark, Greece, Italy, 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, Italy of the second and the others show a statistically significant trend of the fourth degree.[78] Greece and the Netherlands are comparable. Both experienced an increase with a

[78] Mostly in empirical research, the trend is limited for interpretation to a linear trend line but because we present a first empirical investigation and interpretation is not our main interest we look at significant polynomials as well. We would like to cooperate with sports fans/ researchers in all of these countries to verify whether important facts occurred that could explain these evolutions. Unfortunately we are not informed enough of the histories of all these leagues at this moment.

peak at the end of the sixties-early seventies.[79] 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. The imbalance then 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 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 use this data to verify whether distinct groups exist. Clustering analysis is an exploratory data analysis tool which divides cases[80] 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. It 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 Squared Euclidean distance.[81] Independent of the chosen linkage method[82] we find the same two groups. Since we have only eleven countries and so the number of cases is limited the use of hierarchical clustering is justified. 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 is presented in Chart 1.

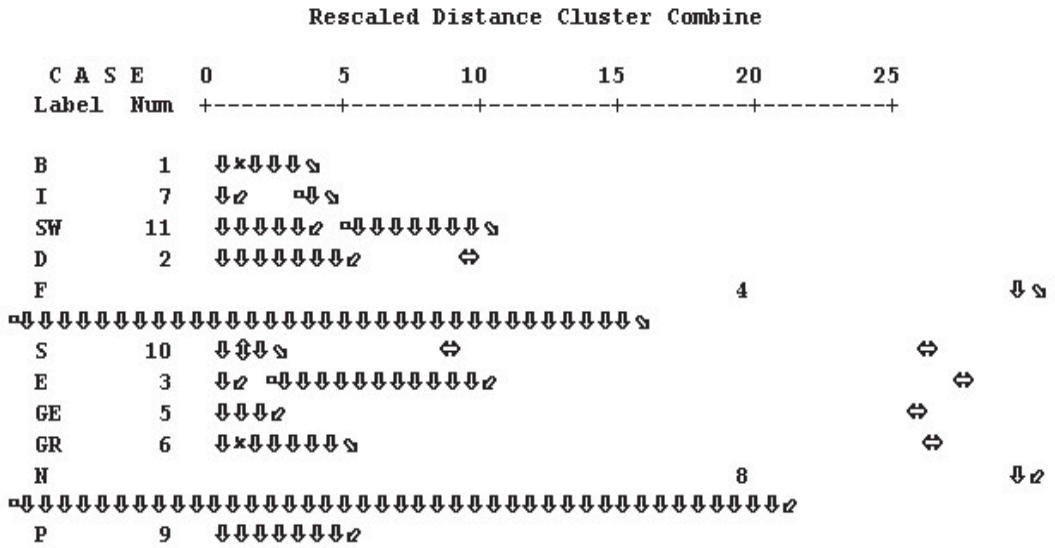
[79] The peak in the seasonal imbalance could be contributed to the fact that Ajax was superior; they won the Champions Cup three times in the early seventies.

[80] Countries in our case.

[81] This calculates the shortest distance between two points by the following formula: $\sum_{s=1}^{S} (x_s - y_s)^2$ with x and y the calculations of the measure for each country. Other measures show the same results.

[82] There are several possible linkage methods to determine which clusters need to be formed. Ward's method is discussed in JR. J. H. WARD, *Hierarchical Groupings to Optimize an Objective Function, J. of the Am. Stat. Ass.*, vol. 58, n. 301, 1963, 236-244. It ensures that we have the highest possible homogeneity within groups because it minimizes the sum of squares of any two hypothetical clusters. So the cluster that increases the sum of squared distances the least is added. This method seems the most appropriate one for our data but the other methods show the same two resulting groups.

Chart 1: Dendrogram NAMSI All countries Wards method



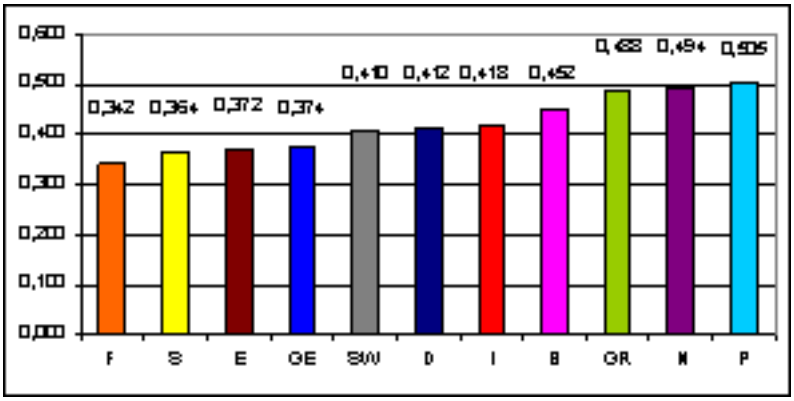
Two groups can be classified.[83]

Group 1: Belgium, Denmark, France, England, Italy, Germany, Spain and Sweden
Group 2: Greece, the Netherlands and Portugal.

What Figure 1 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. To determine a ranking of the countries based on the NAMSI we calculate the averages over the total period. Figure 2 shows that the averages approximate the groupings from the clustering. Belgium is somewhat in the middle of the two groups. France has the lowest average NAMSI closely followed by the other countries of the same group. Group 2 is the least balanced with Portugal as the tail-ender. Complete imbalance is presented by 1 and all countries lie between 0,34 and 0,51 so on average they can not be evaluated as imbalanced.

[83] The number of groups chosen is determined by interpretability. Since all linkage methods show the same two groups the result is robust. Within the first group the distinction between two groups is different for different linkage methods so we do not include this result.

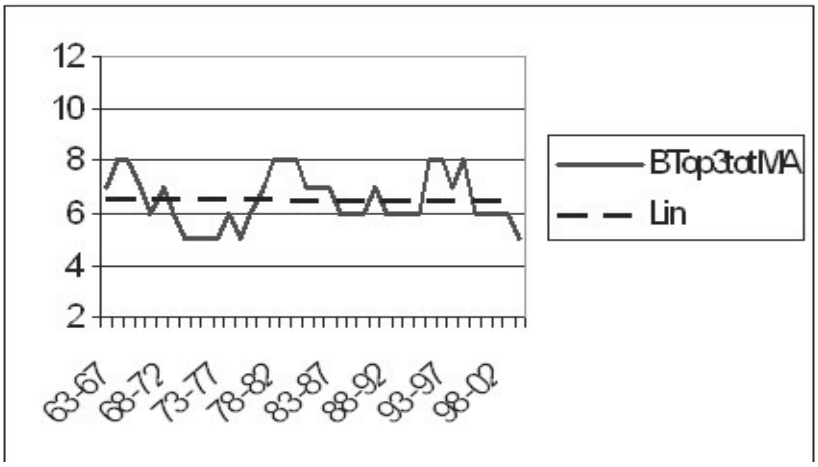
Figure 2: Ranking of Average NAMSI for all countries for seasons 63-64 to 2004-2005 from most balanced to most unbalanced

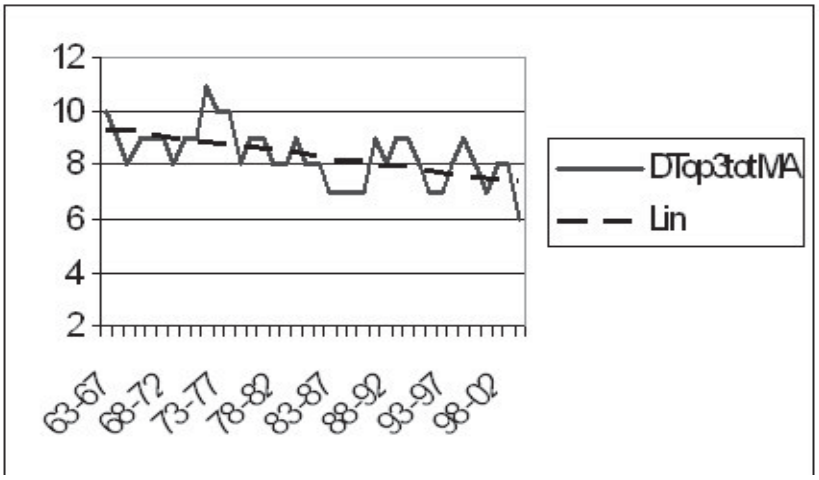


Number of teams entering the top 3 in 5 years

The results for the number of teams that entered the top 3 over 5 years are presented in Figure 3. We use the presentation of a moving average.

Figure 3: Top 3 with trend for all countries individually for seasons 63-64 to 04-05

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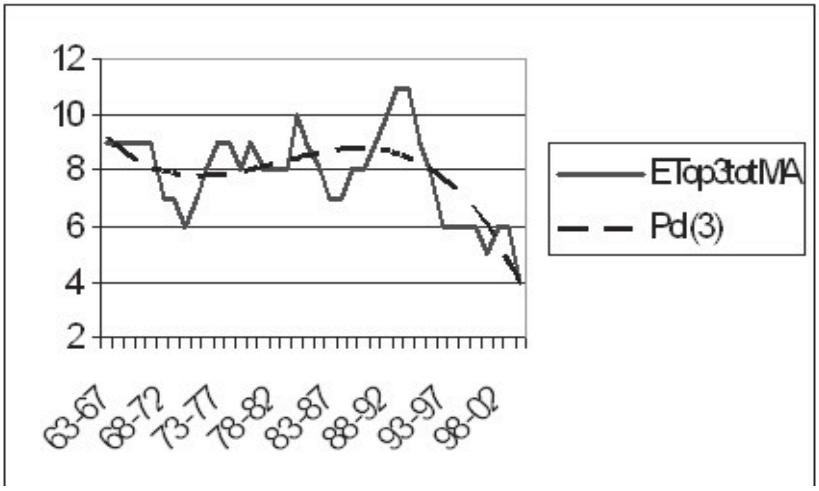
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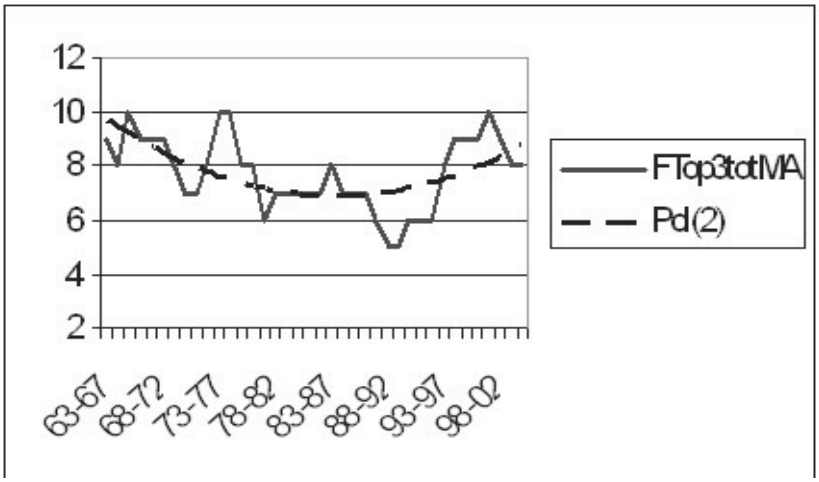
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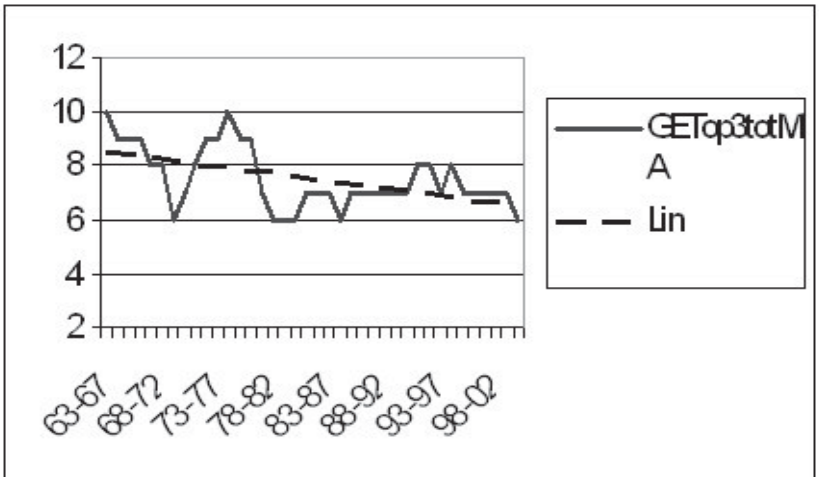
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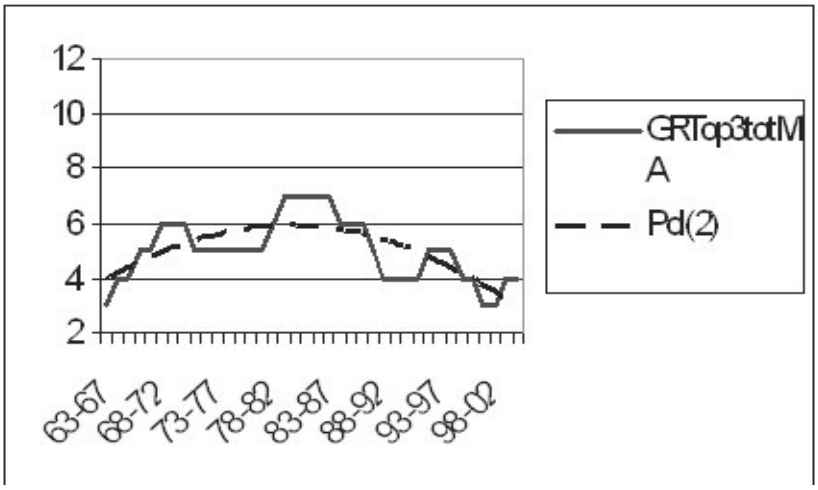
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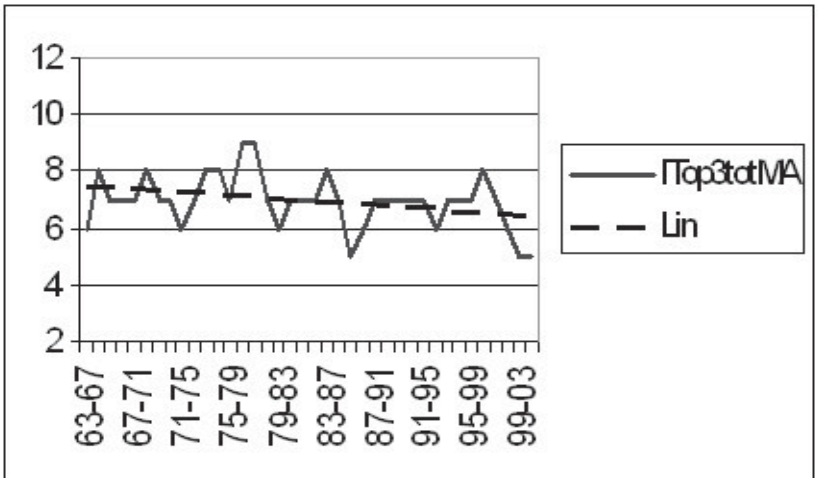
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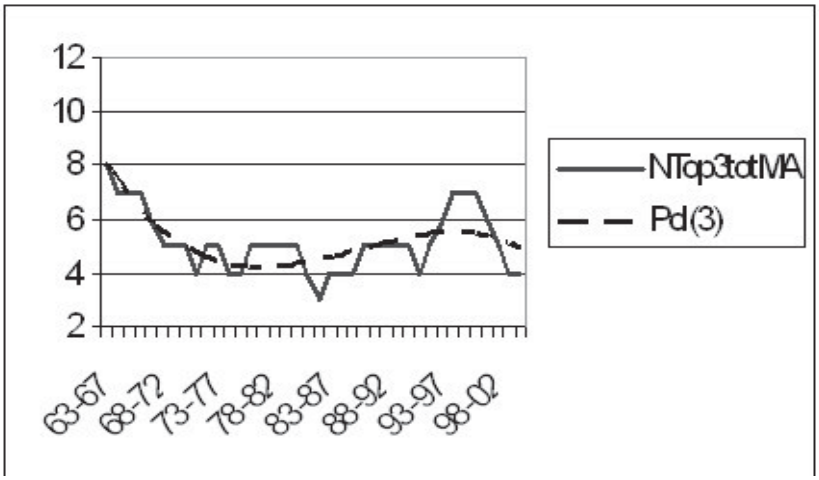
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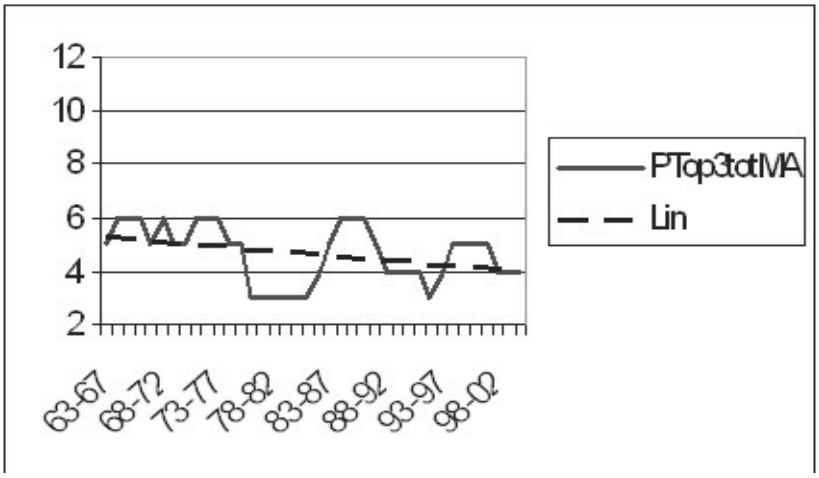
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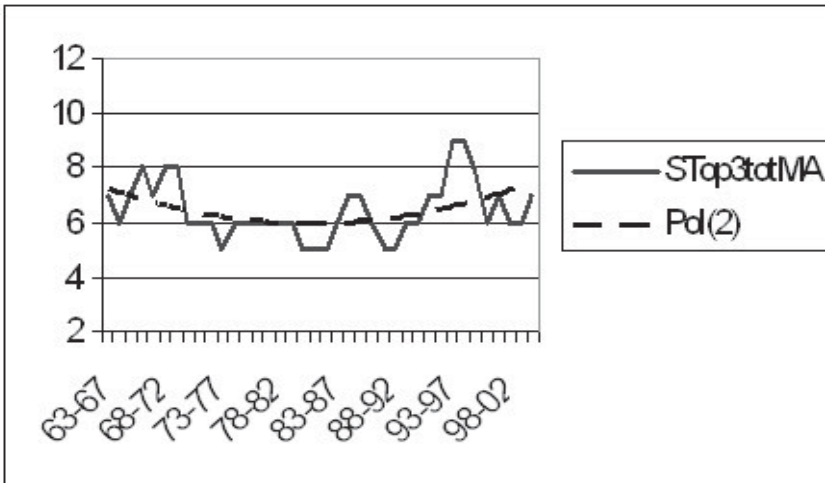
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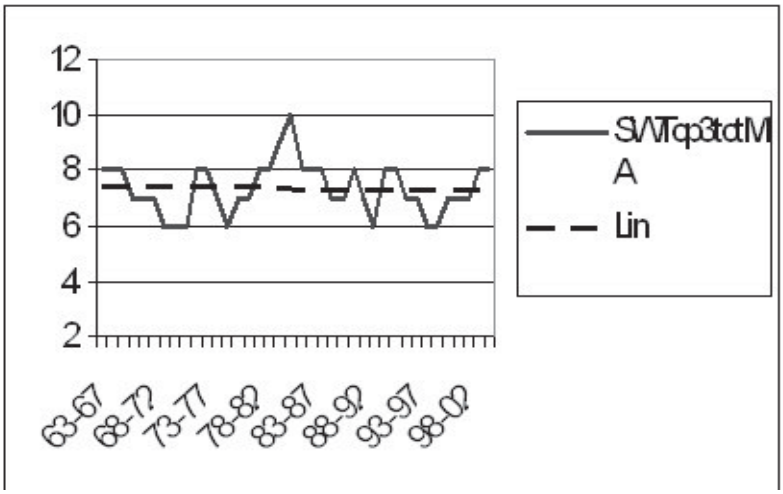


The evolution in Belgium, Denmark, Germany, Italy and Portugal is best approximated with a linear trend. Belgium and Sweden have no statistical significant trends so over the total period the number of teams that dominate the top 3 has not changed. Sweden does show a peak in the beginning of the eighties. This is possibly an indication that the Slutspil increased the number of teams in the top 3 and hence increased championship uncertainty. Denmark, Germany, Italy and Portugal all show a decrease in number of teams which indicates a worsening in dominance. The size of the decrease is very limited for all, we find a time coefficient of -0.028 for Italy, -0.036 for Portugal and -0.053 for both Denmark and Germany.

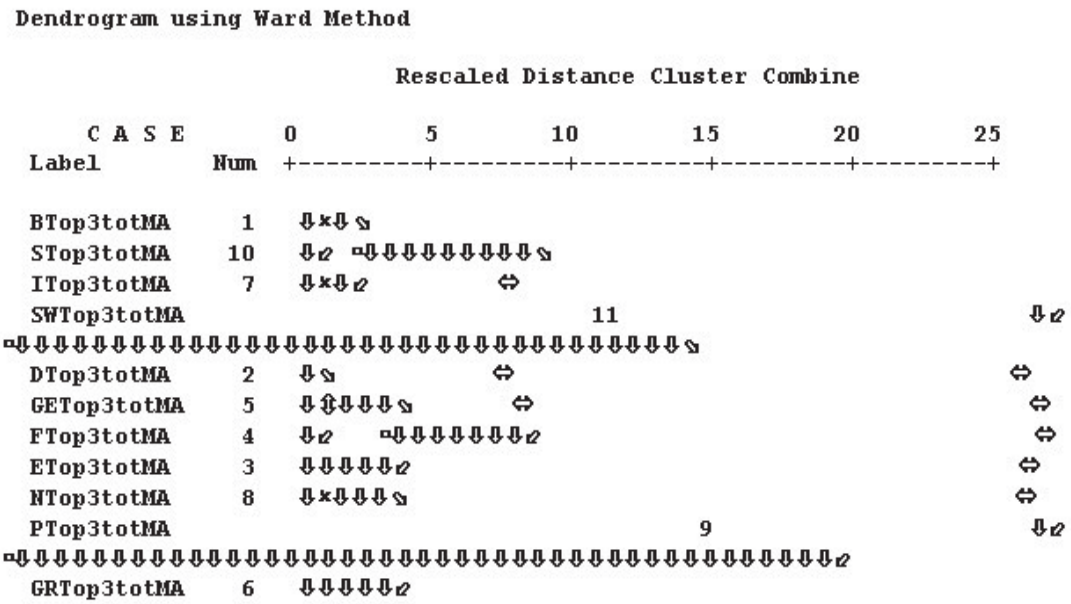
England shows a rather erratic evolution best approximated by a polynomial of the third degree. A low is present in the mid seventies and since the beginning of the nineties the number of teams has decreased quite substantially. Perhaps England has been very influenced by the changing structures of the Champion league such that the top teams remained on top. The Netherlands also follow a polynomial trend of the third degree. They show a substantial decrease till the mid of the eighties. Possibly Ajax is here the cause as well. Later they have extra teams entering the top 3 but do not reach the high of the early sixties. Since the late nineties a new decrease is present. The latest relative successes of the Dutch teams in the Champions league may cause this new decline in balance.

France, Greece and Spain have a quadratic trend. The number of teams decreased in the French competition until the early nineties, since

then an increase has set in. A possible explanation is the relatively equally divided broadcast rights since the late eighties which makes a better distribution of playing talent possible among the teams. The low of Spain in the mid eighties is only moderate. The mini peak in the mid nineties is somewhat puzzling. Greece shows an opposite quadratic trend with a high in the early eighties. We again do not have enough historical knowledge to give an intuitive explanation.

The clustering of the eleven countries shows the same robust result as before. The dendrogram is presented in Chart 2.

Chart 2: Dendrogram TOP 3 All countries Wards method



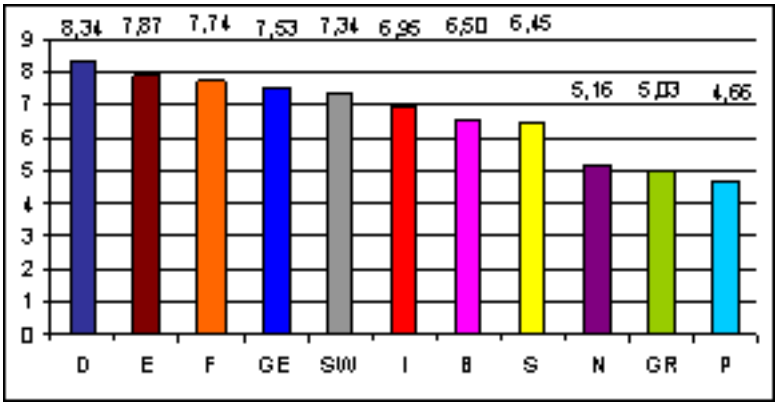
Two groups can again be separated.[84]

Group 1: Belgium, Italy, the Netherlands England, Sweden, Denmark, Spain, France, Germany
Group 2: Greece, Portugal and the Netherlands

[84] All possible cluster methods show here the same two groups as well.

A general ranking based on the averages is given in Figure 4. It is obvious that the Netherlands, Greece and Portugal show the highest dominance of teams. They are close to the perfect dominance result of three teams. They are followed by Italy, Spain and Belgium. When imbalance in Italian and Spanish football is discussed, our data shows that they do differ from the other three big 5 countries when the dynamic imbalance of a few teams is considered. Denmark is the most balanced one with on average around 8 teams ending in the top 3 over 5 years. With a maximum of 15 an minimum of 3 it is obvious that dominance of teams can be possible justified subject of concern.

Figure 4: Ranking of Average Number of teams entering Top 3 over 5 years for all countries for seasons 63-64 to 04-05 from most balanced to most unbalanced



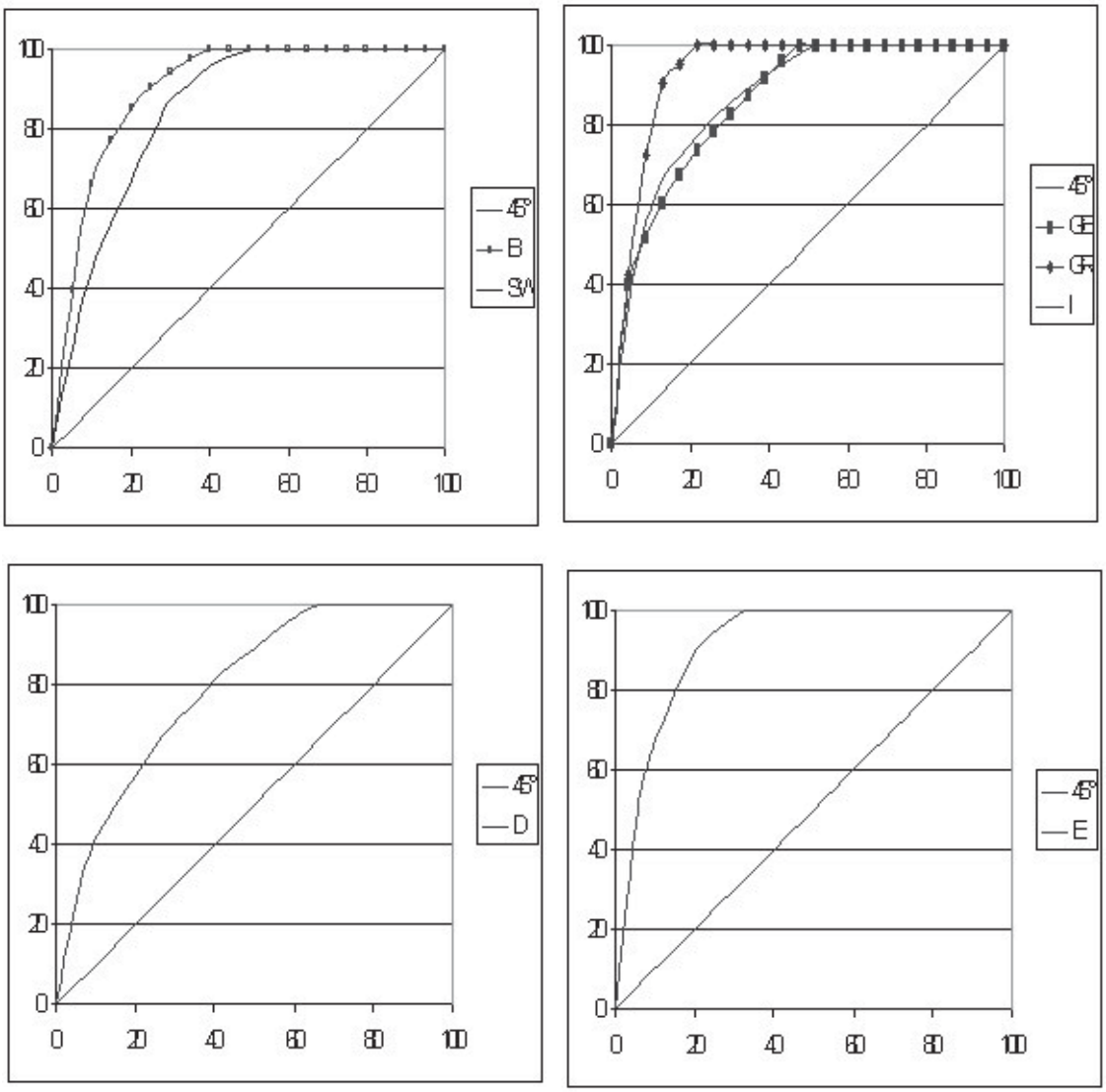
Lorenz curves and Gini coefficients

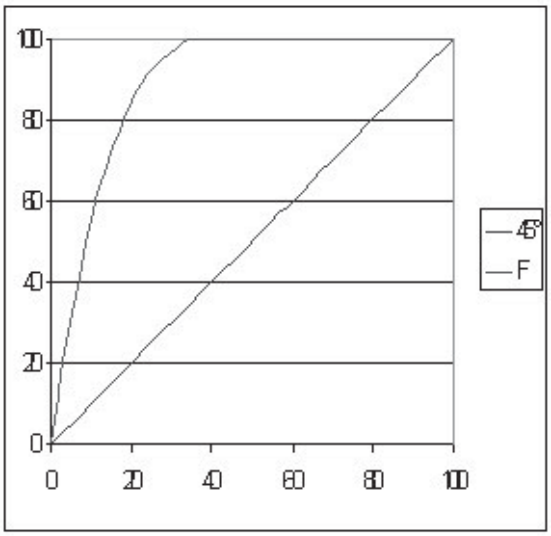
To draft the Lorenz curves many adaptations are necessary which make it very complex.[85] The Lorenz curves are presented in Figure 5. Because of the

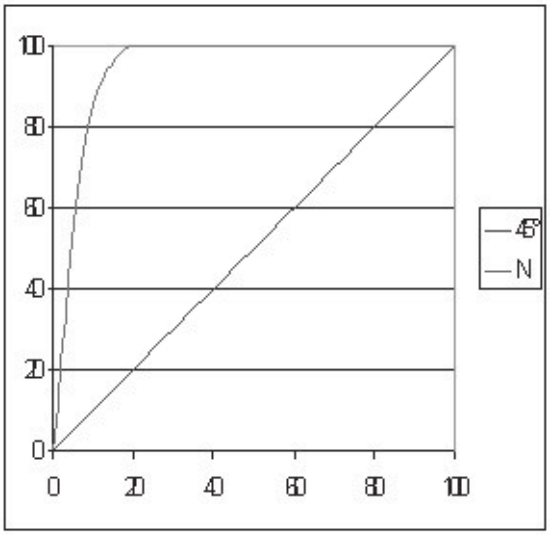
[85] An overview of the adaptations can be delivered upon request. One example is when two teams merged and both were present in the highest league in at least one season we regard the team that was present in the season preceding the merger as the new formed team. The other team is regarded as a separate 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.

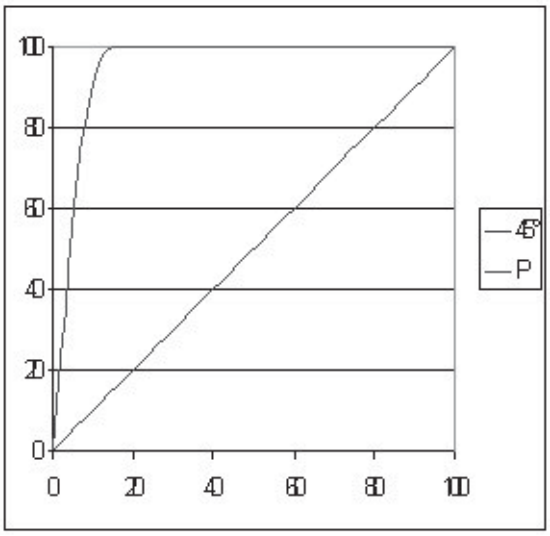
different number of teams we have not yet found a way to present them all in the same graph. Germany, Greece and Italy had 23 teams in the highest league for more than 10 years and are combined. Belgium and Sweden had 20 teams each. The other countries are presented separately: Denmark with 24 teams,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

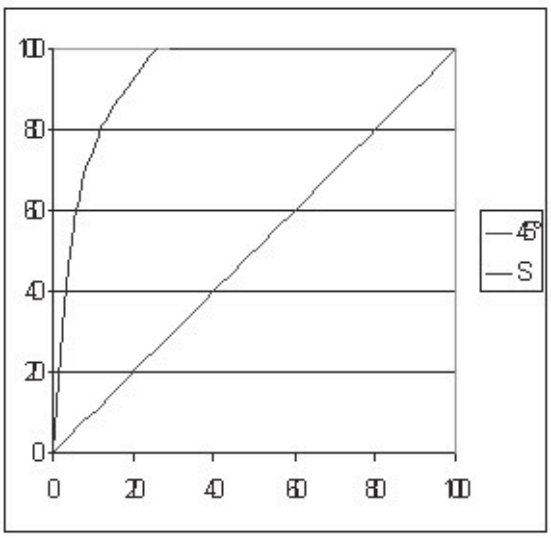
Figure 5: Lorenz curves for championship winners of all countries for seasons 63-64 to 2004-2005











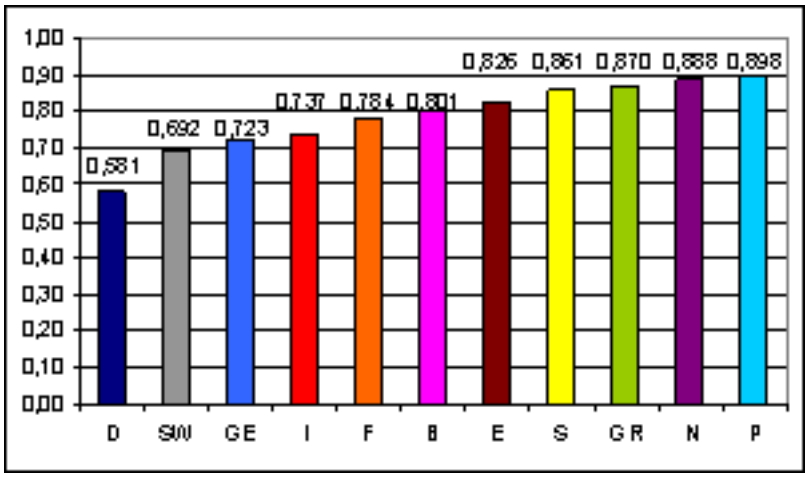
Belgium is more concentrated than Sweden. Only 8 teams were champion over the entire period in Belgium, while in Sweden there were 10 teams. Anderlecht won 18 times, Club Brugge 12, Standard 5 and the others only once or twice. In Sweden Malmö won 13 times, IFK Göteborg 9 times, three teams won 4 or 5 times and the rest once or twice. Greece is the least

balanced compared to Italy and Germany, Italy is the second in ranking. Greece only had 5 different champions with Olympiakos winning 18 titles, Panathinaikos 13 titles and Athinae won 8. Italy had 12 champions with 16 titles for Juventus, 9 for Milan and 5 for Internazionale. The others won once or twice. Twelve German champions are found with Bayern München as top champion of 18 titles. The others won all less than 6 times.

Denmark has the most different champions: 16. Brondby won 10 titles while all others 4 or less. There are 11 English championship winners with 13 titles for Liverpool, 10 for Manchester and 6 for Arsenal. All others won 3 or less championships. The French have 10 champions with no distinct dominating teams: 9 for St-Etienne, 8 for Nantes, 7 for Marseille, 5 for Monaco and the others have 5 or fewer titles. The Netherlands are clearly dominated with only 5 different teams that won the championship: Ajax won 19 times, PSV 14, Feyenoord 7 and the others only once. Portugal is even more concentrated with only four different champions. SL Benfica has 19 titles, FC Porto has 15, Sporting CP 7 and Boavista FC won only once. Finally there are 7 Spanish winners with Real Madrid as absolute dominant team: they won 20 titles, the most of all teams in our research. Fc Barcelona won 9 times and the others 5 or less.

We calculate the Gini-coefficients to be able to rank all the countries. Because the number of teams differs, this representation is biased but it shows the same ranking that could be expected from the discussion of the

Figure 6: Gini coefficients of all countries over total period for seasons 63-64 to 04-05 ranging from most balanced to most unbalanced



championship titles. Figure 6 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 concentrated, followed closely by Italy. France is third. England and Spain have more dominant champions than the other big 5 countries.

Even within the same group of competitive imbalance, championship dominance, a good definition of the subject is essential. Considering the big 5 a different picture appears when looking at the champions alone versus the use of the number of teams entering the top 3. England shows a lower balance when champions are considered. So it is often the same team that wins but the numbers two and three change more frequently. In Italy it is rather the opposite: the same teams enter the top 3 but it is less certain who will win. The calculation over a shorter period can be an amelioration of our research to evaluate important changes over time considering the champions. The two groups found by the other two measures are present here. Portugal, Greece and the Netherlands are still most imbalanced but now less distinctive.

4. Conclusions and future research

Different interpretations of the concept exist and therefore it is important to define what is understood by the concept. We give attention to three possible interpretations of the concept: dispersion of winning percentages, dominance of top 3 teams and dominance of champions. We compare the European domestic football leagues for all three interpretations. Because the number of teams differs between countries and over time, an international comparison of competitive balance needs an adaptation of measures. For a comparison within seasons we compare the actual standard deviation range to the maximal one. This makes sure that we have a measure ranging between 0 and 1 and, more importantly, it compares the actual spread of win percentages to the one that occurs when there is perfect imbalance. The latter is the worst case scenario by definition of team sports. So we prevent the use of an ideal spread.[86] Between seasons we use the number of teams that enter the top 3 over 5 years together with a discussion of the champions over the total time period.

The countries differ not only between each other but depending on the chosen kind of competitive balance, different evolutions are also noted

[86] The concept of 'ideal' remains up for discussion and is probably not a good substitute for an 'optimal' distribution so that, as discussed before, the results can not be interpreted as well as they should.

within the European countries. In table 3 we present an overview of the trends. Be aware that the second column discusses dominance and so when the number of teams in the top 3 increases, the dominance decreases.

Table 3: Overview of the trends in seasonal and dynamic imbalance measured by the NAMSI and number of teams entering the top 3 in 5 years for the seasons 1963-1964 to 2004-2005

	Trend NAMSI 63-04	Trend Dominance 63-04 nr teams in top3
Belgium	small rise (linear)	status quo
Denmark	down till seventies, up till eighties, down till begin new century (poly trend 4d)	Small increase (lin)
England	small rise (lin)	End eigthies a small peak, since mid nineties increase (3d)
France	status quo	Increase till begin nineties and then decrease (2d)
Germany	status quo	Small increase (lin)
Greece	up till seventies, **down till eighties**, up till begin new century (4d)	**low in early eighties** (2d)
Italy	decrease till eighties, then increase (2d)	Small decrease (lin)
Netherlands	up till seventies, *down till eighties, up till begin new century* (4d)	*Increase till begin eighties, decrease untill end nineties and then increase again* (3d)
Portugal	*Decline (lin)*	*Increase (lin)*
Spain	down till seventies, up till eighties and then back up (3d)	More dominance in mid eighties (2d)
Sweden	down till seventies, up till eighties, down till begin new century (4d)	status quo

The table shows that it is essential to clearly define which kind of balance is referred to because the measures show different evolutions and interventions can be expected to influence them distinctly. Portugal shows even opposing evolutions for the two measures, indicated by italic. Within seasons Portugal has known a better spread but between seasons the dominance of the top 3 has increased so that we can conclude that the three top teams: Benfica, Porto and Sporting are difficult opponents to beat but

that between the other teams a more equal distribution of talent is present. The Netherlands also show an opposing evolution after the success on European level in the seventies: within seasons the spread decreased but the top teams became more dominant. From the early eighties more teams reached the top 3 but the lower ranked teams had more difficulties to face the better teams. Greece is the only country that has an equal evolution for both measures for a part of the dataset, indicated in the table in bold. It had the closest competition within seasons in the seventies and eighties with also a higher number of teams entering the top 3. If we look at the number of points:[87] the best and worst team only had a difference of 28 points at the end of the season, while before and after these decades it was on average 43 points.[88] At the same time roughly 6 teams instead of 4 on average entered the top 3. The Champions league increased the revenues for their participants in the nineties which cause higher budget gaps between teams in the national competition. This might be the major reason of the decrease in balance in Greece. Knowledge of the histories of the different European leagues can give meaningful insights into possible reasons of changes but for now we lack the knowledge.

In some cases the competitive balance did not change significantly over the last four decades. This is the case for the French and German competitive balance within seasons . In Belgium and England only a small significant increase was found. When dominance in top 3 is considered Sweden did not experience a significant change. If we compare the begin situation in the early sixties to the latest seasons we often find only small differences, even if in between some peaks and lows are found. The one that does attract attention is England where a large decrease in number of teams in the top 3 is found. They started with on average 8 teams and end up in the last season with only 4 teams. Again we expect that the influence of the Champions League might be a major reason for this because the major decline started at the same time the Champions League was introduced.[89]

We expect spectators to react differently to changes in these imbalances. We would like to test to which imbalance spectators are the most sensitive and how for example TV revenue sharing schemes or the Champions league affect the levels.

Greece, Portugal and the Netherlands have some catching up to do

[87] Using points or win percentages is equivalent, see the discussion above.

[88] Roughly the best teams had 49 points on average and worst 19 against 57 as best and 14 as worst team. This is based on calculations with 2 points for a win and 1 for a draw.

[89] The European Cup changed its name in 1990-1991 to Champions League and became highly commercial with huge revenues to divide.

if a more similar level to the other European countries is an objective. They constitute a different group from the other countries and are the least balanced for all three measures. When the '*big5*' demand national or international bodies for unified interventions for all European football leagues an evaluation with caution is now shown to be essential. European football leagues do not evolve equally and have not the same levels. Our results point into the direction that every country should be looked at separately rather than together when competitive balance is considered and that national policies including the country-specific characteristiques should receive priority to international policies.

A next conclusion involves the sizes of imbalance. We find that within a season there is no need to worry. The teams have win percentages rather close to the average of 0,5. The Namsi-averages range between 0,342 and 0,505. So all countries are closer to perfect seasonal balance than to perfect imbalance.[90] For the dominance of top 3 teams however, the averages range from 4,66 to 8,34. Perfect dominance would mean 3 teams in the top 3 while perfect balance is attained with 15 teams. The results are now closer to perfect dominance, indicating that the discussions in the media might be justified. However we do not see any drastic evolutions in them, except maybe for England, and the imbalance should not be exaggerated since comparable dominance is present for at least four decades.

Last we want to focus on what the discussion of the championship titles shows: all countries have dominant champions. A creation of a European league,[91] which has received some media attention, might be a possible solution to decrease the dominance. Research of these dominant teams can give some indication whether a league between those teams would not be too imbalanced. Our results do not make this comparison possible. The end rankings of the Champions League can be helpful but because teams also play nationally we can expect that the results of a real European league will differ. But to decrease the dominance of champions, all dominant teams should enter the European League. If we look at teams that have won 5 titles or more, as summarized in table 4, our countries should have 3 participants each except France with 4 teams, Germany with 2 and Denmark with only 1. We can expect that a large country such as Germany might oppose to such a composition. The idea however renders an interesting subject for future research.

[90] Perfect balance: Namsi=0, Perfect imbalance: Namsi=1.

[91] This is a league in which all the dominant European teams would play each other and no longer play national. The use of promotion and relegation could be possible.

Table 4: Teams that have won 5 titles or more over the period 1964-2003.

Country	Team	Titles
Belgium	Brugge	12
	RSCA	18
	Standard	5
Denmark	Brøndby IF	10
England	Arsenal	6
	Liverpool	13
	Manchester United	10
France	Marseille	7
	Monaco	5
	Nantes	8
	St Etienne	9
Germany	Bayern München	18
	Borussia Mönchengladbach	5
Greece	AEK Athinai	8
	Olympiakos Piraeus	18
	Panathinaikos	13
Italy	Internazionale	5
	Juventus	16
	Milan	9
The Netherlands	Ajax	19
	feyenoord	7
	PSV	14
Portugal	FC Porto	15
	SL Benfica	19
	Sporting CP	7
Spain	Atlético de Madrid	5
	FC Barcelona	9
	Real Madrid	20
Sweden	Djurgårdens	5
	IFKGöteborg	9
	Malmö	13