The Long-Term Performance of Professional Sports Clubs:

An Organizational Ecology Perspective

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1 Introduction

The English striker Gary Lineker once famously summarized the game of soccer with a simple formula:

"Football is a simple game; 22 men chase a ball for 90 minutes and at the end,
the Germans always win."

Unfortunately (for Germany), it is not that easy. Starting in the mid-twentieth century with "The Baseball Players' Labor Market" by Simon Rottenberg (1956) and "The Peculiar Economics of Professional Sports: A Contribution to the Theory of the Firm in Sporting Competition and in Market Competition" by Walter Neale (1964), sports economics developed as a research field for scientists. The research on soccer started a couple of years later with "The Labour Market in Professional Football" and "The Economics of Professional Football: the Football Club as a Utility Maximizer" by Peter Sloane (1969; 1971). With this dissertation, I contribute to the sports economics literature by helping to better understand the determinants of athletic, and indirectly economic, success, as measured by promotion and relegation.

Apart from its obvious appeal from the standpoint of a passionate viewer and player, there are reasons that soccer inspires scientific fervor as well. Distinct characteristics of the soccer industry make it specifically apt for scientific research: data is very comprehensive when it comes to athletic success and some key statistics, such as league position at the end of a season, are readily available dating back over a hundred years, which enables a multitude of statistical methods. Moreover, success of individual teams in soccer is measurable, discrete and ordinal, which again assures a special fitness for valid statistical results. In addition, performance data on individual players as well as their salaries are readily available (at least for recent years). For these reasons research in the field of soccer generates not only statistically significant results for the industry, but also yields benefits for the advance of organizational theory and for statistical methodology beyond the boundaries of sports. In no other industry is it possible to analyze, e.g., the impact of labor market liberalization (see, e.g., Simmons 1997; Antonioni and Cubbin 2000; Frick 2009a; Binder and Findlay 2012), the performance of employees (see, e.g., Scully 1974; Dawson et al. 2000b; Eschweiler and Vieth 2004) or the impact of management on athletic success (see, e.g., Kahn 1993; Dawson et al. 2000a; Frick 2008) in such detail. In this dissertation, I use organizational ecology, a widely used theoretical and empirical approach to study the emergence, growth, change and disappearance of (the population of) organizations. One of its key characteristics is that it analyzes an industry from its very beginning.

In soccer, the data for all companies (clubs) is available, even if they only played for one season in the nineteenth century. In most other industries it is difficult to find data on all companies. Many industries date back to the nineteenth or even eighteenth century (e.g., railways). Many small companies that went bankrupt early on cannot be found and therefore cannot be included in the analyses. A complete analysis of all companies is almost impossible in most industries.

From an economic standpoint, European soccer, as an industry, has developed over the last one and a half centuries from an amateur sport into a multi-billion-Euro industry. Revenues in European soccer were approximately €16 billion in 2010/11. Real Madrid alone earned almost €500 million (Deloitte 2012). Christiano Ronaldo transferred from Manchester United to Real Madrid in 2009 for over €90 million. He earns around $38 million (Badenhausen 2011) from salary and endorsement contracts. However, soccer as an industry is—compared to other sectors—still very small. In Germany, Bayern Munich was the club with the highest revenues of all 'Bundesliga' clubs: €312 million in 2009 (Bayern München AG 2010). As a comparison, the biggest German companies in other sectors earn a multiple of that (Volkswagen AG (2010): €105,187 million, Bayer AG (2010): €31,168 million).

In my research I combine a statistical method, survival analysis, which is still relatively new to the field of organizational theory, with matters relating to the determinants of promotion and relegation as measures of athletic success. My results answer the following questions:

— Beyond pure financial power, what factors determine a club's probability of relegation in professional soccer?
— Do the determinants of promotion and relegation differ between various countries in Europe?
— Looking at leagues with relegation and promotion, do the same factors have an impact on promotion and relegation?

Being promoted or relegated has huge implications for the affected sports clubs. External stakeholders such as media stations, sponsors as well as fans are less likely to pay the same price as in higher tier leagues. Therefore, relegated teams face a decrease in revenues. In addition, the best players normally leave relegated clubs to continue playing in the higher tier league. Due to the reduced revenues and the lower quality of the roster, raising money from banks or private investors to, e.g., build new stadiums, perform stadium maintenance, invest in new players, and so forth becomes much more difficult and the cost of capital will be higher. The revenue gap between large and small clubs as well as higher and lower leagues increasingly widens. The top 20 clubs account for over 25% of total revenues of the European football market, leaving the smaller clubs behind (Deloitte 2012). Nevertheless, there are measures in place to help relegated clubs. In England, for example, relegated clubs receive a larger proportion of the TV revenues compared to the other second tier clubs. In Germany, TV revenues are distributed not only by the current position in the league but also the final rankings in the last seasons, leaving relegated clubs with higher revenues than other second tier clubs. Nevertheless, being relegated from a first division is usually associated with a dramatic decline in revenues for the affected teams. Consequently, athletic success measured by promotion and relegation is within reasonable boundaries tantamount to financial and economic success. Thus, from a managerial standpoint, understanding the determinants of promotion and relegation is highly relevant.

Despite this fact, promotion and relegation have not been the focus of much research so far (Matheson 2006; Szymanski 2006b). The reasons may be a) that there is no promotion and relegation in the United States major leagues where much of the sports economics research is done and b) that most research focuses on championship titles and the top rather than the end of the league table. There are two strands of literature cover promotion and relegation as a research topic. First, promotion and relegation is part of the broader research topic covering the differences between open and closed leagues – promotion and relegation being one of the main differences between the two systems. In closed leagues, the same clubs compete each season. Changes in the composition of the league are only possible by allowing new members to the league by vote of all existing members. In open leagues, the weakest teams are relegated at the end of each season to a lower tier, while the best teams from that lower tier are promoted. This model of competition is widely used in European sports leagues as well as in most soccer leagues all over the world.[1] The European Commission even characterized the promotion and relegation system as "one of the key features of the European model of sports" (1998). In this manner, promotion and relegation produce a key measure of athletic success for academic research. The second string of literature covers studies on the factors that have an effect on the promotion and relegation probabilities of individual clubs.

To the best of my knowledge, Noll (2002), Ross and Szymanski (2002), Szymanski and Zimbalist (2005), Szymanski and Valletti (2005) and Szymanski (2006) have analyzed the differences between the promotion-relegation-system and the closed-league-system. While Ross and Szymanski (2002) use a theoretical approach, Noll (2002) as well as Szymanski and Valletti (2005) use data from the English Football Leagues to support their model empirically. Szymanski (2006) discusses the

[1] Major League Soccer (MLS) in the U.S. is the best known example of a soccer league without promotion and relegation.

differences as well as the cost and benefits of a league system with promotion and relegation. Ross and Szymanski (2002, p. 625) argue that "the institution of promotion and relegation tends to raise consumer welfare by increasing effective competition among the teams in a league." Noll (2002) states that players' wages as well as attendance are generally higher in open leagues. Szymanski and Valletti (2005) show that teams at the bottom of the league are more eager to win in an open league. In closed leagues, teams that cannot qualify for the playoffs anymore have no incentive to win. In some closed leagues with a draft system, where the worst team of the season gets to pick their new players first, teams may even have an incentive to lose (Taylor and Trogdon 2002). In open leagues, even teams at the bottom of the league have an incentive to win each game until the end of the season, as they could be facing relegation otherwise. In addition, the willingness to share revenues (e.g., from media or fans) between the teams is less in open leagues.

The following paragraph outlines previous research specifically on determinants of promotion and relegation. To the best of my knowledge, only Frick and Prinz (2004), Dherbecourt and Drut (2009) and Oberhofer et al. (2010) have contributed to this topic. Frick and Prinz (2004) analyze twelve major European soccer leagues over a period of twenty-five years (1976-2000). Using a fixed-effects regression model and a limited amount of variables,[2] they find the 'Bosman-ruling' to have different effects on promoted teams in stronger rather than in weaker leagues.[3] Survival probabilities of newcomers in strong leagues such as England, Italy or Spain have decreased since the 'Bosman-ruling' has become effective. Established teams in these strong leagues[4] started signing many foreign-born top players that weaker teams cannot afford. In countries with weaker leagues such as Yugoslavia, Russia or Belgium, the dominant teams have lost their star players to foreign clubs. Therefore, survival chances of promoted teams have increased. Dherbecourt and Drut (2009) estimated the impact of socio-economic variables such as GDP, population or unemployment, as well as club internal factors such as average age of the team, coach seniority, percentage of foreign players or championship history on promotion and relegation. Their sample included the five biggest soccer leagues in Europe from 2004 to 2009. They found that regional factors play a significant role: Teams from regions with a larger service industry and more highly educated inhabitants have a lower probability of being relegated. From the nineteenth until the mid-twentieth century, soccer was a way for people to socialize in industrial towns (see Kuper and Szymanski 2009). Therefore, teams from industrial regions (e.g., Birmingham) used to be top clubs. With globalization and the decrease of production industry in developed countries, clubs from other regions now have increased chances

[2] The variables are: the number of points scored, a promotion dummy, the duration of the current spell in the league, a dummy for the seasons after the introduction of the three-point-rule, a dummy for the seasons after the Bosman ruling, a linear time trend and a variable as measurement of the competitive balance.

[3] Strength of a league is defined by its Union of European Football Associations (UEFA) coefficient.

[4] In European soccer leagues, players are signed and paid by the teams and not by the league (as is the case in MLS).

to perform well in the championship. Dherbecourt and Drut (2009) do not state the correlation between the industrial sector and population or the GDP. It could be that the GDP and population rather than the industrial sector are the drivers of promotion and relegation probabilities. In addition, experience in the top division, qualification for a European cup competition and stadium attendance reduce the probability of relegation. Moreover, the promotion probability is negatively impacted by GDP growth and positively by unemployment, as well as by the fact that another club from the same city is playing in the top division. Dherbecourt and Drut also include the shareholder structure of the clubs in their analyses. The fact that a billionaire owns the majority of shares of a club—such as Roman Abramowitsch at Chelsea London or Silvio Berlusconi at AC Milan—also decreases (increases) its relegation (promotion) probability. Oberhofer et al. (2010) examine the determinants of relegation from an organizational ecology perspective. They use a dataset from the 'Bundesliga' starting in the 1981/1982 season and ending in the 2009/2010 season. They find that new teams with less experience in the first league are more likely to be relegated. Apart from that, they observe that the duration in the league is positively affected by a team's budget and the number of competitors in the local market. All other things being equal, the number of foreign players also increases the duration in the first division.

Overall, only a limited amount of research has been dedicated to analyzing promotion and relegation systems in general, and specifically to factors that are responsible for teams being promoted or relegated. The existing research, both theoretical and empirical, is limited by geographical, temporal and methodological restrictions. The authors focus either on one specific country (Oberhofer et al. use only the German Bundesliga), a very limited time period (Dherbecourt and Drut use only a period of five years) or a limited number of variables to discuss their findings. A broader analysis across different countries, a wide range of explanatory variables and a long-term period of study on the determinants that influence the promotion and relegation probabilities of teams, however, is missing so far.

My dissertation aims at filling this gap by analyzing the underlying factors using a comprehensive dataset for the empirical analyses in this work. In the following four chapters I discuss determinants of promotion and relegation in professional soccer leagues in Europe. In comparison to earlier research, I focus on longer time periods, a broader geographical coverage, and a broader range of variables. All of my estimations in the following chapters are based on at least forty-four seasons per league, with a maximum of 110 seasons for the English Football League in chapter 4. My method of research in the following chapters is survival analysis (also known as event history or duration analysis) to identify the factors that determine the length of time until the occurrence of an event; in this case, the event is promotion or relegation of a club. This statistical method is so far predominantly applied in the field of organizational ecology.

Additionally, I introduce an approach to increase competitive balance within a league by using schedule design. Giving weaker teams an easier schedule could decrease their chances of relegation from the first league.

The structure of this dissertation is as follows. Each of the chapters is written as an individual scientific paper that is either already published or in the publishing process. While individual papers, they all contribute to the research questions outlined above. The following paragraphs give a short summary of each paper's contribution. The titles of these papers/chapters are:

- Chapter 2: Infant Mortality of Professional Sports Clubs: An Organizational Ecology Perspective
- Chapter 3: Location and Success in German Soccer: The Impact of Location on the Performance of 'Bundesliga' Soccer Clubs
- Chapter 4: Up and Down: Competing Risks in Second Tier Soccer in the Top European Leagues
- Chapter 5: Increasing Competitive Balance Differently: How Schedule Design Can Help Promoted Teams

Chapter 2 introduces the concept of organizational ecology and the methodology of event history analysis. A broad dataset is used, covering seven different professional first tier sports leagues in four different European countries over a period of 44 to 71 seasons, depending on the respective league. Organizational ecology is a widely used theoretical concept to study the impact of characteristics of individual organizations, the total population, and the environment on the emergence, growth, change, and disappearance of (populations of) organizations. It was first applied in biology to predict the survival of animal populations and later introduced to organization theory by Hannan and Freeman's (1977) seminal paper "The Population Ecology of Organizations." Organizational ecology has four key properties. First, it analyzes the complete history of a population of organizations (e.g., an industry). Second, it includes all organizations, no matter how large or small they are. Third, it collects detailed information on the type of entry (e.g., foundation, spin-off) or exit (e.g., dissolution, merger) of organizations. Fourth, it estimates the effects of different variables on the pattern of entry and exit. This chapter is based on joint research with Bernd Frick which has already been published in the Journal of Economics and Statistics (232/3 (2012)). We use different semi-parametric (e.g., Cox) and parametric (e.g., Gompertz or Weibull) survival models to estimate our models. We discuss different theory fragments within organizational ecology theory for seven sports leagues. Specifically, we test the liability of newness and the liability of smallness hypotheses for the professional sports team industry. Both features describe the fact that a club that is new to a first division, or small in size, respectively, has difficulties 'surviving.' In addition, we control for conditions that were prevailing at the time of the first entry of a club in the first division. This theory fragment is known as the 'founding conditions' in organizational ecology. We use team specific information such as number of championship titles won or average attendance as well as external information (e.g., number of clubs in the league, number of relegations in a league). Due to the long time period of our study, we exclude financial data of the clubs since it is not available for the complete period.

The following, chapter 3, applies the methodology introduced in chapter 2 to a wider variety of variables. At the same time, I focus my analyses on a single league, the German soccer league, the 'Bundesliga,' since its inaugural season in 1963/64. In order to fill a gap in the search for determining factors of relegation, I specifically consider socio-economic, club external factors that characterize the location of a club such as population, GDP per capita, number of companies with more than 150 full-time employees as well as the number of other sports clubs in the region. These factors will probably have less influence on success in sports than factors such as the amount of money a club can invest in players. Therefore, they have not been widely discussed in previous research. In addition, club management can hardly influence external factors that are specific to the location of a club. They cannot increase the population or the number of companies in the area and they can only increase the GDP of a region marginally.[5] In addition, German soccer clubs have never been relocated to another city, as is more common in the U.S. (see, e.g., Lewis 2001). Nevertheless, the results can still be interesting for investors. They can invest in a minor league club in a region that promises the most success if the club is promoted to the first division.

Chapter 4 extends the findings from chapter 2 by adding another dimension to the methodology, focusing on second instead of first division clubs. They face the risk of relegation (as in first tier leagues) but also the chance of promotion. Again, I want to answer the question: what factors determine whether a club is promoted or relegated. Since clubs play for promotion and against relegation at the same time, I use a competing risks model as suggested by Lunn and McNeil (1995), a special case of the survival analysis methodology presented in chapters 2 and 3, to estimate my model. Competing risk models estimate the coefficients for promotion and relegation

[5] The club with the highest revenues in 2009 was Bayern Munich with €312 million (Bayern München AG 2010). The county in which Bayern Munich is located had a GDP of €70.2 billion (City of Munich Statistical Institute 2011).

simultaneously, using only one regression. Via competing risk analysis, estimated regression coefficients can be compared, in order to find different levels of impact of the variables on relegation and promotion. The dataset used contains information on six different second tier soccer leagues in Europe from as early as 1892, adding two more countries as well as several seasons in comparison to the data analyzed in chapter 2. Due to the long time frame, I am able to focus on variables that are related to the league's final tables such as number of championship titles in the first and second tier league, experience in the first and second division, size of the city the club is located in, the fact that other teams from the same city play in the first league at the same time, and so forth. Findings may generate information on the differences between clubs playing at the top of the league, compared to clubs at the bottom of the league, showing whether the same or different factors determine the probability of promotion and relegation. In addition, using the estimation results, I suggest a forecast model to generate information for club management. With the proposed early warning system, managers can adequately prepare their teams in seasons with high probability of promotion or high risk of relegation. A strategic implication could be to save money in a season with low chances (for promotion) or risks (for relegation) and invest that money in seasons with increased chances or risks.

In chapter 5 I discuss a simple possibility to increase competitive balance in sports leagues. Competitive balance, another major research topic in sports economics, is a measure to describe the fans' expectations about who will be the winner (Buzzacchi et al. 2003). If the competition is perfectly balanced, then all outcomes are equally possible. This would be a situation of complete outcome uncertainty. If the contest is perfectly unbalanced, on the other hand, the winner is known in advance. Leagues and team owners have used the concept of competitive balance to impose and justify restrictions such as revenue sharing, transfer fees, salary caps or the draft system. In Europe, different measures are in place to increase competitive balance. Most leagues sell their broadcasting rights collectively and distribute the revenues between the member clubs (see, e.g., Parlasca 2006). In addition, the "UEFA[6] Financial Fair Play Regulations" were introduced to prevent professional soccer clubs from spending more money than they earn (UEFA 2010). The implementation of these rules was recently postponed from 2012 to 2015. The promotion and relegation system can also be seen as a measure to increase competitive balance. The weakest teams of the season are replaced by the best teams from the minor league. Provided that these new teams are stronger than the relegated teams, competitive balance should increase in the next season. Empirical evidence on the comparison of competitive balance between open European soccer leagues and closed U.S. sports leagues is ambivalent. Comparing the English soccer league and Major League Baseball, Szymanski and Valletti (2005) show that both leagues can have a higher competitive balance dependent on the

[6] The Union of European Football Associations (UEFA) is the administrative body for association football in Europe.

used measure. Analyzing a game by game dataset of the league since 1965/66, I uncover the impact of the schedule of a team on its win percentage. Using the estimation results, I derive easy and difficult schedules, i.e., schedules that help clubs increase or decrease their win percentage. The analysis lays the foundation to give league governing bodies two major options. First, they can use easy and difficult schedules to raise competitive balance in a league by giving the weakest teams the easiest schedule. Second, schedules can be used to generate money by, e.g., auctioning schedules, beginning with the easiest one, to the clubs. This money could, e.g., be distributed to weaker clubs. That way, these clubs could invest in better players and competitive balance would also increase. Overall, the survival chances of promoted teams could be increased using schedule design.

Finally, chapter 6 concludes the dissertation by summarizing the results and giving a short outlook on future research opportunities.

2 Infant Mortality of Professional Sports Clubs: An Organizational Ecology Perspective

2.1 Introduction

Apart from the most prominent and successful clubs, such as Bayern Munich, Real Madrid, Manchester United and Inter Milan, that have dominated their respective country's first division in professional football for decades already, many clubs in the European top leagues have managed to survive for only one season. Examples are Blau-Weiss 90 Berlin in Germany, CD Condal in Spain, Northampton Town in England, and A.C. Pistoiese in Italy. Moreover, each of these leagues has its 'yoyo teams' such as 1. FC Nuremberg, Real Murcia, AFC Sunderland, or Atalanta Bergamo that have been relegated from and promoted to the respective country's first division several times.

Half life—the age at which half of the clubs have failed—is, e.g., three years in German soccer (Wallbrecht 2010). This is not a bright perspective for teams that have just been promoted to the first division. However, this is neither a soccer nor a team sports specific problem. Half life in other industries is quite similar: more than 50% of all American newspapers have failed after five years (see Freeman et al. 1983) and for American automobile producers, half life is only one year (see Hannan et al. 1998). Thus, successful organizations surviving for decades are equally rare in sports as they are in other industries.

In this paper we discuss a number of important factors influencing club survival in seven different professional team sports leagues in Europe using organizational ecology as our starting point. This approach was first applied in biology to predict the survival of animal populations and later introduced to organization theory by Hannan and Freeman (1977). It looks at populations of organizations and tries to explain the impact of characteristics of individual organizations, the total population, and the environment on the observable patterns of survival. The approach has been used before in a number of different industries such as newspapers, wineries, breweries, restaurants, railway companies, credit and labor unions (see, e.g., Singh and Lumsden 1990; Hannan 2005), but never before in sports. In line with that literature, we use event history analysis (also known as 'survival analysis') to estimate our models.

The paper is organized as follows: In section 2 we briefly review the available literature on 'births' and 'deaths' (i.e., promotions and relegations in professional team sports leagues), while section 3 outlines the basic propositions of organizational ecology. In section 4 we present the data and some descriptive evidence, in section 5, our model and the econometric results. Section 6 discusses our findings and section 7 concludes.

2.2 Literature Review

While the European Commission (1998) describes the promotion and relegation system as "one of the key features of the European model of sport" it is virtually unknown in North America, where the professional leagues are 'closed shops.' Until recently, the sports economics literature has, therefore, only occasionally addressed the issue of promotion and relegation. To the best of our knowledge, only Noll (2002); Ross and Szymanski (2002); Szymanski and Zimbalist (2005) and Szymanski (2006b) have analyzed the differences between the (European) promotion-relegation-system and the (North American) closed-shop-system. While the former system is usually associated with a more balanced competition, more excitement for the fans and lower barriers of entry, advantages of the latter are a better protection of specific investments and a higher level of financial stability.[7]

Many more papers have analyzed the relationship between team wage bills and team performance (for a summary of the most recent studies see, e.g., Frick (2011b) and Szymanski (2003)). While these studies agree that higher player salaries are usually associated with a better performance on the court/field, the relationship seems to be much closer in the European team sports leagues with their de-regulated labor market. However, due to their limited financial resources, finishing at the top of the league or even winning the national championship and qualifying for an international cup competition is not a viable option for most small market clubs in any of the European team sports leagues, such as soccer, hockey, basketball or handball. Since a particularly poor performance is usually punished by relegation and since being relegated to the respective second division is on average associated with a dramatic decline in revenues, avoiding relegation is a target in itself.

Apart from two exceptions (Wallbrecht (2010) and Frick and Prinz (2004)) few papers in the sports economics literature have used survival analysis.[8] Wallbrecht (2010) looked at the impact of club external factors, such as per capita income and the presence of competing clubs, on the sporting success of teams in the German 'Bundesliga,' while Frick and Prinz (2004) analyzed the impact of

7 There are two other papers with a somewhat similar approach to the one we develop below: first, Oberhofer et al. (2010) investigated survival in professional football, but restricted their econometric analysis to the German "Bundesliga" and covered a relatively short period of time (1981/82-2009/10). Second, Dherbecourt and Drut (2009) used a larger dataset including the first and second divisions in England, Germany, Italy and Spain but covered an even shorter period of time (i.e., they restricted their analysis to the seasons 2005/06-2008/09) and used simple logit regressions to predict the individual teams' probability of promotion (from 2nd to 1st division) or relegation (from 1st to 2nd division).

8 Most of these papers studied the factors influencing career duration of either players (see, e.g., Frick et al. 2007; Frick et al. 2009), head coaches (Barros et al. 2009; Barros et al. 2010) or referees (Frick 2011a).

revenue sharing systems on the survival probabilities of recently promoted teams in twelve different European soccer leagues.

Since 'survival' in the sense of avoiding relegation is—apart from the number of wins and ties during the season—for many teams an obvious measure of success in 'open leagues,' we use data from seven different sports leagues in four different countries to estimate various parametric and semi-parametric regression models to identify the determinants of the clubs' length of stay in their respective first division.

2.3 Organizational Ecology

Organizational ecology is a widely used theoretical and empirical approach to study the emergence ('birth'), growth, change, and disappearance ('death') of (populations of) organizations. In their now seminal paper "The Population Ecology of Organizations," sociologists Hannan and Freeman (1977) first outlined the characteristics of this approach that has since then become one of the cornerstones of organization theory. Due to its quantitative focus and its emphasis on (market driven) selection processes, it has, over the years, also received increasing recognition and acceptance by many economists. Nevertheless, a full integration of organizational ecology and industrial organization is yet to come (for a promising approach, see van Witteloostuijn and Boone 2006). Organizational ecology has four key characteristics (see, e.g., Carroll and Hannan 2000):

— It looks at populations of organizations and analyzes their complete history. A population is often an industry, but can also be just a part of that industry or some other group of organizations, sharing common characteristics.
— It collects 'life history data' of all organizations, no matter how large or small these organizations are.
— It records detailed information on the type of entry and exit. An entry can be the founding of a new organization, but also the arrival from another industry, a merger, or a spin-off from an already existing organization. An exit can be the closure of an organization, a merger with another organization or the move to another industry.
— It estimates the effects of characteristics of individual organizations, populations of organizations, and the environment on the patterns of entry and exit.

Organizational ecology contains a number of 'theory fragments,' of which 'age dependence' is of particular importance in the context of our paper (see, e.g., Singh and Lumsden 1990).[9] The term 'liability of newness' refers to the fact that—all other things being equal—younger firms have a higher failure rate (see, e.g., Stinchcombe 1965). This is primarily due to the fact that new organizations have to learn their role and, in addition, to compete with existing organizations that already have well-established relations with clients, suppliers, politicians, and the public administration (see, e.g., Carroll and Delacroix 1982; Freeman et al. 1983). Consequently, Hannan and Freeman (1984) argue that older and, therefore, 'established' organizations have higher levels of reliability and accountability and that these two factors work in favor of incumbent organizations in selection processes. Moreover, organizational ecologists have identified two other forms of age dependence: the term 'liability of adolescence' implies that mortality rates rise during the early years and decline later (see, e.g., Brüderl and Schüssler 1990; Fichman and Levinthal 1991). A plausible explanation is that new organizations are started with enthusiasm and a stock of capital that both ensure survival for a while. On the other hand, there also exists a 'liability of senescence' which refers to the internal inefficiencies arising from the aging of an organization (i.e., the 'power of inertia'):[10] Older organizations, on average, experience more problems when confronted with changes in the environment and are, therefore, much more likely to disappear from their respective market than are younger organizations (see, e.g., Barron et al. 1994; Ranger-Moore 1997). Since the available theoretical explanations are conflicting, Le Mens et al. (2011) have recently developed a model in which the hazard of failure depends on the stock of organizational capital, and the rate of its accumulation depends on fitness. Organizational fitness, in turn, is particularly high in (rather) young and in (rather) old organizations. However, although past success (indicating a high degree of organizational fitness) is likely to lead to a better performance in the future (see, e.g., Levinthal 1991), the selection process is not completely free of error (see, e.g., Levinthal and Posen 2007). It is, for example, possible that the long-term-strategy of developing young players is punished by failure (i.e., relegation to the second division) while the short-term strategy of signing experienced (and, therefore, expensive) players is rewarded by avoiding failure (relegation). In the industry that we are interested in—the professional team sports industry in Europe—newcomers are likely to be at a disadvantage compared to established clubs, since the latter have accumulated knowledge, have built routines and have established structures that foster survival in a highly competitive environment, where failure to adapt is punished very quickly (within a single season).

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9 The other concepts are 'inertia' (the ability of surviving organizations to adapt to changes in the environment), 'niche width' (the distinction between 'generalists' and 'specialists'), 'resource partitioning' (predictions about the founding and mortality rates of generalists and specialists as a function of market structure, (see, e.g., Carroll 1985) and 'density dependence' (the founding and mortality rates of organizations as a function of the number of organizations in a particular market, (see, e.g., Freeman and Hannan 1983; or Hannan 1986)).

10 The term 'liability of obsolescence' refers to an increasing mismatch of an organization's structure and capabilities with its environment.

Of equal importance is the concept of 'liability of smallness' (see, e.g., Freeman et al. 1983) emphasizing a close positive relationship between the size of an organization and its survival probability, suggesting that larger organizations (or those serving larger markets) have lower mortality rates. According to Aldrich and Auster (1986) selection processes favor organizations with structural inertia and inertia increases with the size of an organization for a number of reasons. First, small organizations have more difficulties raising new capital. Second, tax laws create an incentive for small firms to be sold to larger ones. Third, government regulation has a less favorable impact on small organizations. Finally, small firms have fewer possibilities to offer an internal labor market with a high degree of job security and experience, and therefore, have more difficulties attracting talented employees from the external market.

Moreover, environmental conditions at the time a particular organization is founded are likely to affect that organization's survival probability, too (see, e.g., Stinchcombe 1965). Some of the founding conditions—in particular, population density, niche width and macroeconomic situation—affect an organization and its performance throughout its complete life cycle (see, e.g., Carroll and Delacroix 1982; as well as Carroll and Huo 1986). We will not address the important issue of organizational legitimacy (see, e.g., Singh et al. 1986) because we assume that there is hardly any variation in the industry that we are looking at (i.e., the different teams are likely to enjoy the same level of legitimacy). This, in turn, implies that the reasons for failure are differences in capabilities and the quality of internal coordination processes. We will return to this issue in the final section of our paper.

We use the concept of 'organizational ecology' to explain the patterns of 'birth' (i.e., arrival in the respective first division) and 'death' (i.e., relegation from that division) to explain changes in the composition of professional team sports leagues. We admit that relegation is different from real exit, but nevertheless think that the logic of organizational ecology is applicable here. Relegation is nothing but a (usually involuntary) move to another (usually less lucrative) market, where the available resources may be used in a way that either allows returning to the more attractive market or exploiting the potential of the initially less lucrative market. Many second division clubs seem not to be interested in getting promoted, as this would require the mobilization of resources that are—whether falsely or correctly—considered far too expensive.

Moreover, organizational ecology has, in the past, not only been used to explain failures (in the sense of the 'deaths' of organizations), but also mergers, i.e., the 'absorption' of particularly successful newcomers by already established firms (see, e.g., Bröcheler et al. 2004). It has also already been used to research the performance of start-up as well as established companies (see, e.g., Brüderl et al. 2007, Hinz 1994, Woywode 1998). It has also been used to analyze the duration of albums on ranking charts (Bhattacharjee et al. 2007), the survival of movies in cinemas (Mezias and Boyle 2005), the duration of Broadway shows (Simonoff and Ma 2003) and the duration of books on bestseller lists (Clement et al. 2007).

Using populations of professional sports teams has five major advantages over most other industries. First, the necessary data is available from the very first year of all leagues under consideration. Second, the 'birth' as well as 'death' of a club can easily be identified as the year of promotion and the year of relegation (a club is either playing or not playing in the first division; an intermediary state is not possible). Third, there are no mergers or acquisitions where it is difficult to identify the organization that survives and the one that disappears.[11] Fourth, we can identify all the clubs playing in the first division in a particular sport and a particular year. Fifth, since nearly all clubs have been relegated at least once during our period of investigation, we do not encounter the problem of most organizational ecology studies, which is that the especially large organizations do not 'die,' but seem to live forever.

2.4 Survival in Professional Team Sports Leagues: Descriptive Evidence

In the empirical sections of our paper we use detailed information from four different sports and four different countries, yielding seven unique 'league histories.' This allows us to compare, first, the survival probabilities of new (i.e., recently promoted) and established teams and, second, the impact of changes in the environment on the different types of clubs. Our dataset includes the four economically most relevant football leagues in Europe (i.e., in England, Germany, Italy and Spain, see Deloitte 2011) and the four economically most relevant professional team sports leagues in Germany (i.e., football, ice hockey, handball and basketball, see Deloitte 2010). Our observation period starts with either the inaugural season of a particular league (ice hockey, handball, basketball and soccer in Germany) or with the first season following a historical break (i.e., the end of the Spanish Civil War or the end of World War II) in the remaining three soccer leagues.[12]

Thus, depending on the particular league, we use information covering a period of 44 (handball and basketball in Germany) to 71 (soccer in Spain) seasons. Since the German ice hockey league has been

[11] Perhaps surprisingly, we observe not a single merger of two (previously) competing clubs while both were playing in their country's respective first division. Mergers do occur, however, among second division clubs.

[12] When practicing their sport at a competitive level, male athletes are usually at an age where they will be drafted for military service.

a closed shop for a number of years, most figures (such as the number of clubs and relegations) are particularly low for this league.

In the period under investigation we observe between 62 (German ice hockey) and 198 (soccer in Italy) relegations. The number of 'forced relegations' (i.e., cases in which the license has been withdrawn by the league) is highest in German ice hockey with 14 despite the fact that there are only 62 relegations in total. In the four soccer leagues, only Germany (n=1)[13] and Italy (n=9)[14] have so far experienced forced relegations. The number of clubs that have ever played in the respective first division is quite different and ranges from 38 (German ice hockey) to 88 (German handball). Spanish soccer, with only 56 different clubs in 71 seasons, has the highest number of multiple relegations (the relegations per club ratio is 3.5). On average, the seven leagues have between 1.2 and 3.2 relegations per season. Excluding German ice hockey, which has been a closed league for many years, the results in average number of relegations are quite similar, ranging between 2.4 and 3.2 per year.

Most leagues include a number of 'yoyo teams' that have experienced multiple relegations, followed by another promotion: the maximum number of relegations by one club is eleven for Real Murcia in Spanish soccer. It is followed by Betis Sevilla, CD Malaga, and Celta Vigo from Spain as well and by Atalanta Bergamo from Italy, with ten relegations each. Moreover, there also exist a number of clubs in each league that have never been relegated, with some of them having been members of that particular league since its inaugural season or its re-start. Examples are VfL Gummersbach in German handball, MTV 1846 Gießen in German basketball, Hamburger SV in German soccer, FC Arsenal in English soccer and Inter Milan in Italian soccer. In Spanish soccer, three clubs have managed to survive all 71 seasons under consideration (FC Barcelona, Real Madrid, and Athletic Bilbao).

Descriptive evidence on the survival rates of clubs in the different leagues is displayed in Figure 2-1 below. It is based on the nonparametric Kaplan-Meier survival method that allows for the calculation of the probability of survival past a certain point in time (Kaplan and Meier 1958). It appears from Figure 2-1 that the survival rates are indeed quite similar (Appendix 2-1 reveals that according to the Wilcoxon-Test, equality of pairs of survivor functions cannot be rejected for most cases).

[13] Hertha BSC Berlin following the 1964/65 season due to illegal signing bonuses.
[14] Most notably, AC Milan and Lazio Rome in 1980 due to match fixing ("Totonero scandal") and Juventus Torino also for match fixing in 2006.

	Germany Ice Hockey	Germany Handball	Germany Basketball	Germany Soccer	Spain Soccer	England Soccer	Italy Soccer
Launch of league	1958	1966	1966	1963	1939	1946	1946
Number of seasons	52	44	44	47	71	64	64
Number of clubs	38	88	77	50	56	59	57
Number of relegations	62	139	106	122	197	166	198
Number of forced relegations	14	9	11	1	0	0	9
Relegations per season	1.2	3.2	2.4	2.6	2.8	2.6	3.1
Relegations per club	1.6	1.6	1.4	2.4	3.5	2.8	3.5
Max relegations per club	7	5	4	7	11	8	10
Number of clubs without relegation	5	9	7	5	5	2	1
thereof: in league since first season	0	1	1	1	3	1	1

Table 2-1 Descriptive statistics I: league characteristics

Looking at Figure 2-1, it appears that after only one year, between 17% (English soccer) and 43% (German handball) of all recently promoted clubs have been relegated again (i.e., these clubs managed to survive for just one season). After five years, between 56% (English soccer) and 77% (Spanish soccer) have disappeared and after 20 years, only between 1% (Italian soccer) and 8% (German ice hockey) of the clubs have survived. Moreover, 50% of all clubs are relegated within the first two (German handball and ice hockey as well as Spanish soccer) to four years (English soccer).

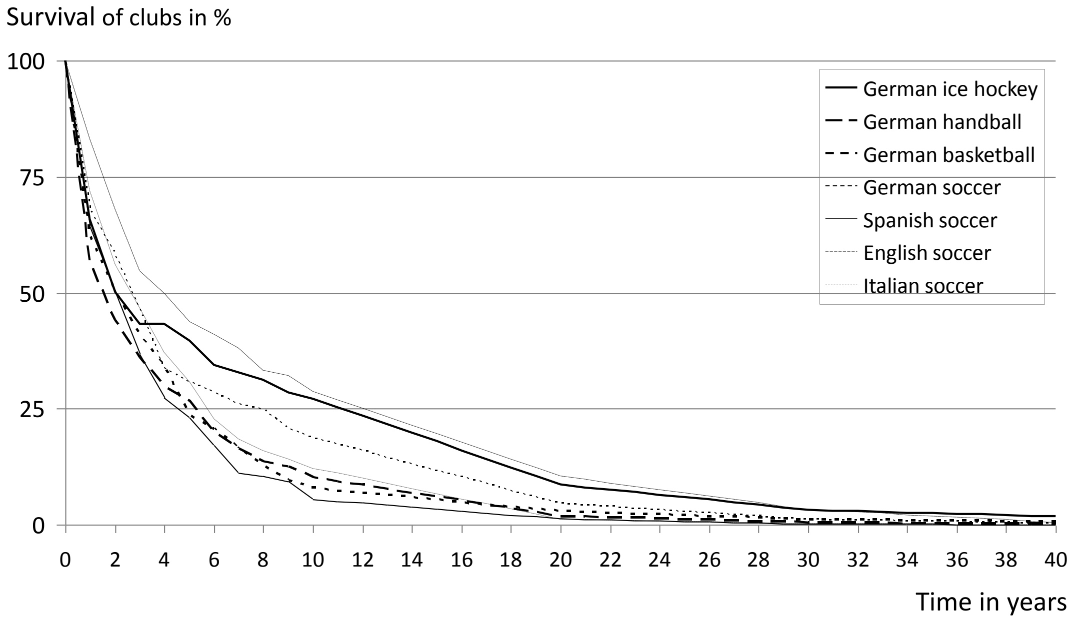

Figure 2-1 Survivor curves for different leagues

2.5 Model, Estimation Method, and Findings

We focus in our estimations on a subset of the 'theory fragments' discussed in organizational ecology: liability of newness, liability of smallness, and founding conditions.[15]

— Our measure of 'liability of newness' is straightforward. Since we know the exact date of birth of a particular club—in our case, the year of promotion to the first division—and the exact date of death—the year of relegation to the respective second division—we can easily calculate the number of seasons that a club played in its first division. Thus, we measure a club's experience as the number of seasons played in the first league. This variable takes a

[15] We do not consider density dependence (the number of clubs is more or less constant over time, i.e., there is little if any change in the number of competing organizations). We also exclude the distinction between generalists and specialists (all clubs are identical in the sense that they produce a homogeneous service—sports entertainment).

value of zero for the first season and increases by one for every additional year a club played in the first league.

— Contrary to the available literature, where revenues, profits and/or number of employees are used as proxies for 'liability of smallness,' we have to use a less obvious measure, because neither revenues nor profits are available for most of the clubs in our sample. However, since ticket sales accounted for almost 100% of the club's revenues until the mid- to late 1980s, we use average attendance as our preferred measure of club size. Unfortunately, even that information is available only for the English and German soccer leagues. In addition, we therefore use the number of national championship titles as a second, admittedly rather indirect measure of club size or—perhaps better—'club resources.' Since 'rich' clubs can afford to sign better players and since these better players increase the chance of winning championships, we consider this measure of club size acceptable.

— To account for differences in 'founding conditions,' we use a number of different variables: The year a club was promoted to the first division for the first time; the number of previous relegations of a particular club; a dummy variable to distinguish the Pre-Bosman from the Post-Bosman era (induced by the respective verdict of the European Court of Justice in December 1995 and enacted at the beginning of the 1996/97 season);[16] and a linear time trend to account for the increasing 'commercialization' of professional team sports as well as the skyrocketing TV revenues in some of them. Controlling for particularly 'turbulent times' is standard in the organizational ecology literature. Since the 'Bosman-ruling' of the European Court of Justice in December 1995 was a landmark event in the history of the professional team sports industry, we introduce in our estimations a dummy variable that separates the period before that verdict from the period thereafter. Moreover, since TV revenues have replaced the revenues from ticket sales as the clubs' most important revenue, we control for these developments in our estimations indirectly by including a linear time trend. This is necessary, because TV revenues are not available for German handball, basketball, and ice hockey.[17]

[16] Prior to the 1995/96 season, all European leagues operated their transfer market on two basic principles: first, a transfer fee had to be paid even if a player's contract had expired and the player wanted to change clubs. Second, football leagues operated strict protectionist controls on the number of foreign-born players who could appear in a team in a particular match. Following that decision, average contract length increased significantly, and transfer fees became a function of a player´s remaining contract duration. Moreover, the influx of players from abroad increased significantly in all of the 'Big 5' leagues in Europe (England, France, Germany, Italy and Spain), making it easier for recently promoted teams to sign "quality players" from all over the world. For a review of the evidence see, e.g., Frick (2007).

[17] However, less than 10% of the clubs' revenues in ice hockey, handball and basketball come from TV revenues (see Deloitte 2010).

Apart from the variables measuring 'liability of newness and smallness' as well as changes in 'founding conditions,' we include a number of control variables in our estimations:

— Since the number of teams in a league as well as the number of promotions and relegations is not constant over time in the different leagues, we control for these changes that are—on average—of minor quantitative importance (i.e., an increase in league size from 16 to 18 clubs or a reduction in the number of promoted and relegated teams from three to two per year).
— In a number of exceptional cases (bribery scandals, match fixing, insolvency) clubs were relegated although they had been successful enough on the pitch to avoid relegation. We control for these events by including a dummy variable, taking the value of one if a club was denied the license for the next season.
— One of the major differences between professional sports clubs and other organizations—be they for-profit or not-for-profit—is that the former can be 're-born', i.e., they can be promoted to the first division again either after just one season or a few years later. Thus, many clubs oscillate between the first and second division in their respective sports, causing a particular problem that has to be addressed adequately. Clubs that cannot be observed temporarily are removed from the risk pool for the duration of their absence. In order to account for these temporary exits, two different approaches are available: re-entries (clubs returning to the first division) can either be treated as new clubs or as incumbents. However, since repeated relegations are not independent from the number of previous relegations, we use an event history model with repeated events where a club can be relegated several times. This is clearly the most appropriate option. Thus, we use the number of previous relegations as an additional control variable instead of stratifying our regression model by number of relegations.
— To account for unobservable differences between the leagues in our sample, we also include a series of dummy variables to control for these seven leagues: German handball, German basketball, German ice hockey, German soccer, English soccer, Italian soccer and Spanish soccer.

Table 2-2 displays the descriptive statistics of the independent variables used in our estimations.
Table 2-3 provides the correlation matrix for the variables used in the empirical analyses.

We analyze the 'survival time' of each club in each of the seven leagues, using duration analysis (also called survival or event history analysis), a technique that seeks to identify (the effects of) factors that determine the length of time until the occurrence of an event. Since this method was initially used by medical statisticians, the event studied has often been (the time until) the death of a patient or, more recently, the dismissal of an employee (Allison 1984; Cox and Oakes 1984; Yamaguchi 1991). Given the specific character of our data—sports clubs can by relegated from the first division due to poor performance league, but can be promoted again—we use event history analysis with repeated events. That means that a club can experience several relegations that are treated as distinct events with the first events influencing the probability of the latter ones. A number of different models for repeated events have been proposed in the literature. On the one hand, there are 'semi-parametric' models (Prentice et al. 1981; Andersen and Gill 1982; Wei et al. 1989) that use a Cox regression (Cox 1972). On the other hand, there are various 'parametric' models, most notably the exponential, the Gompertz, and the Weibull model. Generally, the hazard of being relegated can be written as

$$h_i(t; X_i) = h_0(t)\ exp(\beta X_i)$$

where $h_0(t)$ is the baseline hazard, X_i is a vector of i covariates that can be time dependent and β is a vector of parameters.

The difference between the semi-parametric and the parametric models is the estimation of $h_0(t)$. In the semi-parametric Cox model, $h_0(t)$ is not estimated. The model makes no assumption about the shape of the hazard over time. The main assumption is that however the baseline hazard is shaped, it is the same for every individual or organization. In parametric models $h_0(t)$ has always a particular underlying functional form. If we assume

$$h_0(t) = exp(\beta_0)$$

for a constant β_0, we have the exponential model. Here, the baseline hazard is assumed to be constant over time. One additional parameter (β_0) has to be estimated by the model. A constant β_0 means that the failure rate is independent of time. In the Gompertz (1825) model

$$h_0(t) = exp(\beta_0)\ exp(\gamma t)$$

			Observations	Mean	Std. Dev	Min	Max
Liability of smallness	Number of championship titles		6547	1.42	3.17	0	29
	Years of experience		6547	16.49	15.13	0	70
	Average attendance		3443	26905.20	13608.76	1627	79600
Founding conditions	Number of relegations		6547	2.44	1.22	0	11
	TV revenues		6547	6.23	47.43	0	716
	Bosman dummy		6547	0.04	0.19	0	1
	Year of first promotion		6547	1959.66	16.69	1939	2009
Control	Number of clubs		6547	17.71	3.28	8	28
	Number of relegations		6547	2.68	1.19	0	11
	Forced relegation		6547	0.01	0.08	0	1
	Previous relegations		6547	1.21	1.69	0	10
	Dummy for each league	German basketball	6547	0.09	0.29	0	1
		German ice hockey	6547	0.09	0.29	0	1
		German handball	6547	0.11	0.31	0	1
		German soccer	6547	0.13	0.34	0	1
		English soccer	6547	0.21	0.41	0	1
		Spanish soccer	6547	0.19	0.39	0	1
		Italian soccer	6547	0.17	0.38	0	1

Table 2-2 Descriptive statistics II: club characteristics

		Number of championship titles	Years of experience	Average attendance	Number of relegations	TV revenues	Bosman dummy	Year of first promotion	Number of clubs	Number of relegations	Forced relegation	Previous relegations	Dummy for each league: German basketball	German ice hockey	German handball	German soccer	English soccer	Spanish soccer	Italian soccer
Number of championship titles		1																	
Years of experience		0.57	1																
Average attendance		0.48	0.48	1															
Number of relegations		-0.04	-0.17	-0.23	1														
TV revenues		-0.06	-0.11	-0.14	0.10	1													
Bosman dummy		-0.08	-0.17	-0.22	-0.05	0.50	1												
Year of first promotion		-0.22	-0.45	-0.51	0.30	0.30	0.49	1											
Number of clubs		0.01	0.20	0.12	-0.05	0.06	-0.02	-0.24	1										
Number of relegations		0.03	0.12	0.20	0.29	0.05	-0.09	-0.07	0.39	1									
Forced relegation		0.00	-0.02	-0.03	-0.01	-0.01	0.02	0.07	-0.05	-0.02	1								
Previous relegations		-0.17	0.29	-0.03	-0.10	-0.06	-0.13	-0.26	0.15	0.12	-0.02	1							
Dummy for each league	German basketball	-0.03	-0.16	-0.28	0.30	-0.04	0.09	0.32	-0.29	-0.02	0.04	-0.13	1						
	German ice hockey	-0.01	-0.09	-0.25	-0.20	-0.04	0.05	0.20	-0.52	-0.40	0.06	-0.07	-0.10	1					
	German handball	-0.03	-0.16	-	0.42	-0.05	0.10	0.36	-0.07	0.19	0.02	-0.13	-0.11	-0.11	1				
	German soccer	-0.03	-0.02	-0.05	-0.10	0.03	-0.01	0.18	0.03	-0.02	-0.03	-0.07	-0.12	-0.12	-0.14	1			
	English soccer	-0.03	0.08	0.13	-0.17	-0.02	-0.08	-0.25	0.59	-0.04	-0.04	0.02	-0.17	-0.17	-0.18	-0.20	1		
	Spanish soccer	0.09	0.18	0.02	-0.09	0.02	-0.04	-0.39	0.01	0.07	-0.04	0.23	-0.16	-0.16	-0.17	-0.19	-0.25	1	
	Italian soccer	0.03	0.08	0.09	-0.06	0.07	-0.06	-0.19	0.02	0.16	0.01	0.06	-0.15	-0.15	-0.16	-0.18	-0.24	-0.22	1

Table 2-3 Correlation matrix

we have two ancillary parameters (β_0, γ) to estimate. The Gompertz model is suitable for data with monotone hazard rates that either increase or decrease exponentially over time. The parameter γ defines the shape of the hazard as follows: $\gamma=0$ for a constant hazard, $\gamma<0$ for a decreasing and $\gamma>0$ for an increasing hazard. The baseline hazard in the Weibull model can be written as

$$h_0(t) = pt^{p-1}\, exp(\beta_0)$$

Depending on the parameter p, the hazard function can be monotonically increasing or decreasing. Both the Gompertz (for $\gamma=0$) and the Weibull (for $p=1$) model have a special case each in which they are identical to the exponential model.

Many papers in the tradition of organizational ecology use the Gompertz model because survival is assumed to be monotonically decreasing over time (Carroll and Delacroix 1982; Delacroix et al. 1989; Carroll et al. 1993). Some authors extend the Gompertz model with Makeham's law (Makeham 1859) which adds a constant parameter α to the hazard. With this extension, the hazard does not decrease towards 0 but towards α. While this extension makes sense for many industries—where many companies survive in the long run—we see that in our data only eight (out of 425 different clubs) have survived the whole period under investigation. Thus, we do not need the Makeham extension in our analysis (see Appendix 2-2 for a detailed comparison of the fit of the different parametric models).

In survival analyses the parameters are estimated by maximizing the partial likelihood that, in turn, can be specified as

$$L(\beta) = \prod_{i=1}^{n} \prod_{k=1}^{K_i} \left(\frac{e^{\beta X_{ik}}}{\sum_{i=1}^{n} \sum_{k=1}^{K_i} Y_{ik} e^{(\beta X_{ik})}} \right)^{\delta_{ik}}$$

where δ is a censoring indicator which is equal to one if an event is observed and zero if the observation is censored (i.e., no failure has occurred yet). Y is a risk indicator. If the individual is at risk for the current event, then Y is one and zero otherwise.

Two problems—one of which is characteristic of survival analyses and one that occurs only in data such as ours—require a brief discussion: first, we have a number of cases that are right-censored (i.e., we do not know how long into the future the clubs that we observe today will manage to survive in their respective first division).[18] Second, there is a considerable age difference between the leagues in our sample (i.e., the inaugural season ranges from 1939 to 1966).

We deal with these problems in two different ways: first, to check the robustness of our results we estimate our models with a different end date as suggested by Ruef (2004) and censor our data set one year earlier (in 2009 instead of 2010; the result are displayed in Appendix 2-3). It appears that the parameters are virtually identical, suggesting that our results are very robust. Second, we also present in Appendix 2-3 estimations that are based on an equal number of seasons for each league (either the first 44 seasons, irrespective of the year of the inaugural season, or the last 44 seasons until 2010, irrespective of the year of the inaugural season). Again, the results turned out to be very robust, increasing, once more, our confidence in the findings presented below.

Table 2-4 displays the results of our preferred Gompertz model for the seven leagues. The first column includes the full model with a dummy variable for each team sports league. The remaining columns include the model for each of the leagues separately.

Table 2-5 also includes the Akaike Information Criterion (AIC) (Akaike 1974) that allows us to distinguish the fit of the different models (see Appendix 2-2 for a more detailed discussion of the AIC) where a lower AIC indicates a better fit.

In the estimations displayed in Table 2-5 we include information that was available for only some of the leagues in our data set. The first model (a) for each league is identical with the one in Table 2-4. The second model (b) includes a measure characterizing the 'founding conditions' in terms of TV revenues. For the English and the German soccer leagues, we estimate two additional models including average attendance as a measure of club size and club resources. While model (c) for German and English soccer includes average attendance as well as the number of previous championships as measures of market size and resources, model (d) excludes the latter variable again.

2.6 Discussion

It appears from Table 2-4 that the coefficient of a club's length of stay (measured as 'years of experience') is negatively signed and statistically significant in virtually all of our models. In the case

[18] Moreover, our data set includes a number of left-censored cases (i.e., clubs that played in their country’s highest division before the league that we investigate started in its first season). Due to a lack of data, we are unable to control for that duration.

of the 'full model' (column 1), this means that each additional year of membership in the first division reduces the hazard of being relegated by 4.4%.[19] Apart from one exception, this effect is nearly identical in all models (in German ice hockey the coefficient is still negative, but statistically insignificant).

This result is in line with prior research on the 'liability of newness:' organizations that have just entered a particular market (segment) have yet to learn their role and are, therefore, particularly threatened by the forces of competition. With regard to professional team sports leagues, this implies that clubs that have just been promoted have to adapt to the higher standards in their new environment, i.e., management as well as players have to make themselves familiar with the more talented and better qualified squads they have to face on the pitch every weekend. Since the higher quality of the opponents is to be anticipated, promoted teams usually try to increase their probability of survival by signing better and more experienced players who, in turn, have to be integrated into a team that proved to be successful in the recent past. In addition, due to the increasing fan and media attention, players on the rosters of first division clubs may experience a higher level of pressure, leading to 'choking behavior' when it really counts. Finally, teams that have just been promoted very often lack the financial resources to keep up with the more established clubs, increasing the probability of immediate relegation after their first season in the higher division.

The coefficient of the number of previous championship titles as well as the coefficient of average attendance (our two complementary measures of 'liability of smallness') is also negative and statistically significant. Every league title is associated with a 21% reduction in the relegation hazard. This result is again very similar across the different leagues (only in German ice hockey and German basketball did it prove to be insignificant). Unfortunately, average attendance is only available for the clubs playing in the English and German soccer league. It appears, from Table 2-5 (models 5c and 5d for German and 6c and 6d for English soccer), that an additional audience of 1000 spectators reduces the relegation hazard by around 7% in both leagues.

As before, our results are in line with the literature on organizational ecology: smaller organizations experience more difficulties in a competitive environment due to, for example, their difficulty in raising capital for investments (in our case, for signing new and better players). This, in turn, is familiar to every sports economist, as money does indeed 'buy success' (see, e.g., Forrest and Simmons 2004; Frick 2005). This may induce a 'virtuous cycle:' successful clubs are able to attract

[19] Calculated as follows: exp(-0.045) -1 = -4.4%. We present the increase/decrease in the hazard in percent if not indicated otherwise.

	Total	German basketball	German ice hockey	German handball	German soccer	English soccer	Spanish soccer	Italian soccer
	Model 1	Model 2	Model 3	Model 4	Model 5a	Model 6a	Model 7a	Model 8a
Number of championship titles	-0.241 ***	-0.125	-0.074	-0.421 **	-0.243 **	-0.339 ***	-0.567 ***	-0.117 *
	(0.041)	(0.123)	(0.114)	(0.177)	(0.123)	(0.109)	(0.169)	(0.065)
Years of experience	-0.045 ***	-0.101 ***	-0.018	-0.111 ***	-0.064 ***	-0.024 **	-0.037 ***	-0.044 ***
	(0.005)	(0.027)	(0.039)	(0.027)	(0.021)	(0.012)	(0.011)	(0.010)
Number of relegations (1. season)	0.023	-0.039	-0.047	0.028	-0.408 *	0.601	-0.067	0.239
	(0.028)	(0.077)	(0.240)	(0.040)	(0.246)	(0.456)	(0.127)	(0.212)
Bosman dummy (1. season)	-0.321 *	0.610	-0.846	-0.395	-1.188 **	0.032	-0.620	-0.465
	(0.191)	(0.477)	(1.106)	(0.483)	(0.577)	(0.639)	(0.477)	(0.633)
Year (1. season)	0.014 ***	-0.013	0.025	0.015	0.047 ***	0.011	0.023 **	0.003
	(0.003)	(0.015)	(0.019)	(0.012)	(0.016)	(0.015)	(0.012)	(0.009)
Number of clubs	-0.121 ***	-0.139 ***	-0.270 ***	-0.125 **	-0.035	0.084	-0.138	-0.103 *
	(0.017)	(0.039)	(0.100)	(0.052)	(0.222)	(0.145)	(0.094)	(0.055)
Number of relegations	0.306 ***	0.313 ***	0.725 ***	0.261 ***	0.452 *	0.196	0.361 ***	0.327 **
	(0.030)	(0.072)	(0.192)	(0.077)	(0.239)	(0.246)	(0.102)	(0.138)
Forced relegation	1.933 ***	1.602 ***	2.680 ***	1.883 ***	2.621 **	(omitted)	(omitted)	1.843 ***
	(0.162)	(0.362)	(0.365)	(0.361)	(1.073)			(0.357)
Previous relegations	0.050 *	-0.198	0.146	-0.122	0.057	0.045	0.003	0.078
	(0.029)	(0.154)	(0.141)	(0.145)	(0.106)	(0.079)	(0.054)	(0.059)
German basketball	-0.685 ***							
	(0.157)							
German ice hockey	-0.824 ***							
	(0.178)							

Table 2-4 Parametric Gompertz model for all seven leagues

	Model 1	Model 2	Model 3	Model 4	Model 5a	Model 6a	Model 7a	Model 8a
German handball	-0.462 ***							
	(0.144)							
English soccer	0.419 ***							
	(0.139)							
Spanish soccer	0.109							
	(0.129)							
Italian soccer	0.043							
	(0.122)							
Constant	-28.224 ***	25.019	-48.678	-30.550	-93.432 ***	-27.062	-45.074 **	-6.705
	(5.733)	(30.105)	(37.661)	(23.181)	(31.466)	(29.222)	(21.770)	(18.230)
Gamma	0.023 ***	0.040 **	0.002	0.077 ***	0.042 *	0.026 *	0.025 **	0.017 **
	(0.004)	(0.020)	(0.035)	(0.020)	(0.022)	(0.013)	(0.012)	(0.008)
LL	-288	-98	-47	-103	-37	-19	22	31
CHI2	579	60	71	88	68	64	119	117
P>chi2	0	0	0	0	0	0	0	0
No of subjects	425	77	38	88	50	59	56	57
No of failures	990	106	62	139	122	166	197	198
Time at risk	6547	616	612	731	844	1371	1238	1135

Table 2-4 continued

better players not only due to their financial resources but also because players want to win titles and to appear in international cup competitions. Thus, the 'liability of newness' and the 'liability of smallness' have to be distinguished, as there are a number of rather 'young' clubs that have large investors behind them (in German soccer the most prominent examples are VfL Wolfsburg (supported by automobile producer, Volkswagen), Bayer Leverkusen (supported by chemicals producer, Bayer), and TSG 1899 Hoffenheim (supported by Dietmar Hopp, one of the co-founders of SAP), none of which have been relegated since their arrival in the first division.

In models 5c and 6c we include average attendance as an additional explanatory variable in our estimations. In both models, the coefficient of our original measure of market size (the number of championship titles) loses in significance, but nevertheless, remains important, suggesting that the two variables are (highly) correlated. Since average attendance is perhaps a better measure of size, its coefficient does not change very much if we exclude the number of championship titles (as in models 5d and 6d). This is also supported by the change in the AIC[20] decreasing e.g., from 98 to 77 for the German soccer league (since a lower AIC denotes a better fit of the model, our preferred specifications are 5d and 6d).

The impact of the overall market conditions a club experienced when it arrived in the first division (representing the 'founding conditions' in the terminology of organizational ecology) is clearly different from what we expected: the number of clubs that were relegated in a club's first season in the first division (a measure of 'environmental threats') is not statistically significant. Moreover, the coefficient of that variable even has different signs in the different models, suggesting that the impact of the number of relegations is, by and large, random. The only exception here is the German first division in soccer—but here, the result is counterintuitive in the sense that a larger number of relegations at the end of a club's first season in the first division is associated with a lower hazard of being relegated (our initial hypothesis was that the hazard should increase. A possible explanation is that the variation in the number of relegated clubs is quite low, ranging only from zero to four).

[20] The Akaike Information Criterion is calculated as follows: $AIC = -2 \ln L + 2 (k + c)$; see Appendix 5-2 for a more detailed explanation.

	German soccer							
	Model 5a		Model 5b		Model 5c		Model 5d	
Number of championship titles	-0.243	**	-0.242	**	-0.221	*		
	(0.123)		(0.123)		(0.128)			
Average attendance					-0.070	***	-0.072	***
					(0.015)		(0.015)	
Years of experience	-0.064	***	-0.064	***	-0.054	***	-0.063	***
	(0.021)		(0.021)		(0.020)		(0.020)	
Number of relegations (1. season)	-0.408	*	-0.411	*	-0.538	**	-0.555	**
	(0.246)		(0.247)		(0.256)		(0.257)	
TV revenues (1. season)			-0.001		0.003		0.002	
			(0.003)		(0.004)		(0.004)	
Bosman dummy (1. season)	-1.188	**	-1.075		-1.492		-1.476	
	(0.577)		(0.861)		(0.979)		(0.974)	
Year (1. season)	0.047	***	0.048	***	0.040	**	0.043	**
	(0.016)		(0.018)		(0.018)		(0.018)	
Number of clubs	-0.035		-0.038		-0.261		-0.277	
	(0.222)		(0.222)		(0.238)		(0.239)	
Number of relegations	0.452	*	0.453	*	0.558	**	0.564	**
	(0.239)		(0.239)		(0.237)		(0.237)	
Forced relegation	2.621	**	2.621	**	3.752	***	3.817	***
	(1.073)		(1.073)		(1.115)		(1.115)	
Previous relegations	0.057		0.057		0.024		0.071	
	(0.106)		(0.106)		(0.097)		(0.095)	
Constant	-93.432	***	-95.910	***	-74.506	**	-80.745	**
	(31.466)		(34.540)		(35.296)		(35.121)	
Gamma	0.042	*	0.042	*	0.061	***	0.060	***
	(0.022)		(0.022)		(0.020)		(0.021)	
LL	-37		-37		-25		-27	
CHI2	68		68		93		89	
P>chi2	0		0		0		0	
No of subjects	50		50		50		50	
No of failures	122		122		122		122	
Time at risk	844		844		844		844	
AIC	96.4		98.3		75.6		77.3	

Table 2-5 Additional Gompertz models for four soccer leagues

	English soccer							
	Model 6a		Model 6b		Model 6c		Model 6d	
Number of championship titles	-0.339	***	-0.339	***	-0.192	*		
	(0.109)		(0.109)		(0.110)			
Average attendance					-0.072	***	-0.078	***
					(0.013)		(0.012)	
Years of experience	-0.024	**	-0.024	**	-0.007		-0.015	
	(0.012)		(0.012)		(0.013)		(0.012)	
Number of relegations (1. season)	0.601		0.590		0.829	*	0.730	
	(0.456)		(0.455)		(0.466)		(0.462)	
TV revenues (1. season)			-0.002		0.000		0.000	
			(0.003)		(0.003)		(0.003)	
Bosman dummy (1. season)	0.032		0.848		0.941		0.895	
	(0.639)		(1.546)		(1.567)		(1.566)	
Year (1. season)	0.011		0.012		-0.021		-0.020	
	(0.015)		(0.015)		(0.016)		(0.016)	
Number of clubs	0.084		0.088		-0.098	**	-0.114	
	(0.145)		(0.146)		(0.139)		(0.138)	
Number of relegations	0.196		0.186		-0.011		-0.036	
	(0.246)		(0.246)		(0.238)		(0.235)	
Forced relegation	(omitted)		(omitted)		(omitted)		(omitted)	
Previous relegations	0.045		0.044		0.143	*	0.204	***
	(0.079)		(0.079)		(0.080)		(0.073)	
Constant	-27.062		-29.276		41.745		40.007	
	(29.222)		(29.466)		(31.745)		(31.503)	
Gamma	0.026	*	0.027	**	0.002		-0.001	
	(0.013)		(0.013)		(0.014)		(0.014)	
LL	-19		-19		-2		-4	
CHI2	64		64		99		95	
P>chi2	0		0		0		0	
No of subjects	59		59		59		59	
No of failures	166		166		166		166	
Time at risk	1371		1371		1371		1371	
AIC	58.5		60.2		27.4		29.2	

Table 2-5 continued

	Spanish soccer				Italian soccer			
	Model 7a		Model 7b		Model 8a		Model 8b	
Number of championship titles	-0.567	***	-0.567	***	-0.117	*	-0.118	*
	(0.169)		(0.169)		(0.065)		(0.065)	
Average attendance								
Years of experience	-0.037	***	-0.037	***	-0.044	***	-0.043	***
	(0.011)		(0.011)		(0.010)		(0.010)	
Number of relegations (1. season)	-0.067		-0.085		0.239		0.291	
	(0.127)		(0.131)		(0.212)		(0.212)	
TV revenues (1. season)			-0.002				-0.006	
			(0.003)				(0.005)	
Bosman dummy (1. season)	-0.620		-0.006		-0.465		2.712	
	(0.477)		(1.133)		(0.633)		(3.077)	
Year (1. season)	0.023	**	0.024	**	0.003		0.007	
	(0.012)		(0.012)		(0.009)		(0.010)	
Number of clubs	-0.138		-0.138		-0.103	*	-0.092	*
	(0.094)		(0.094)		(0.055)		(0.055)	
Number of relegations	0.361	***	0.358	***	0.327	**	0.331	**
	(0.102)		(0.103)		(0.138)		(0.138)	
Forced relegation	(omitted)		(omitted)		1.843	***	1.836	***
					(0.357)		(0.357)	
Previous relegations	0.003		0.002		0.078		0.077	
	(0.054)		(0.054)		(0.059)		(0.058)	
Constant	-45.074	**	-47.149	**	-6.705		-15.356	
	(21.770)		(22.014)		(18.230)		(19.349)	
Gamma	0.025	**	0.025	**	0.017	**	0.017	**
	(0.012)		(0.012)		(0.008)		(0.008)	
LL	22		22		31		31	
CHI2	119		120		117		118	
P>chi2	0		0		0		0	
No of subjects	56		56		57		57	
No of failures	197		197		198		198	
Time at risk	1238		1238		1135		1135	
AIC	-24.6		-23.0		-39.7		-38.9	

Table 2-5 continued

The coefficient of the 'Bosman dummy' (another proxy for 'environmental turmoil') appears to be marginally significant (at the 10% level) in the full model and in the model for German soccer only. For clubs that played their first season after the 'Bosman-ruling,' the hazard is about 27% lower than a club that played its first season before that verdict. This is consistent with findings reported in detailed analyses of the labor market effects of its liberalization (see, e.g., Frick 2009b): small market teams may benefit most from the opportunity to sign high quality players from abroad. A good example is Energie Cottbus, a small-market club from the eastern part of Germany that was promoted to the first division in German soccer for the first time in 2000 with just five Germans on its roster of 24 players. As Battré and Meyer (2010) show, the salaries of players from Eastern Europe are—all other things being equal—lower than the salaries of their colleagues from either Western Europe or South America (see also Szymanski 2000 for a detailed analysis of the consequences of pay discrimination in professional football).

The linear time trend that we have included in our estimations is also statistically significant, suggesting that arriving one year later in the first division increases the hazard of being relegated by 1.4%. However, this effect appears to be statistically significant only in the models for German and Spanish soccer, while in some other leagues (such as German basketball) the sign of the coefficient is reversed, or as in the case of English and Italian soccer, remains positive, but far away from statistical significance. Since modern training and coaching techniques as well as management expertise can be easily purchased by each of the clubs, the information disadvantage for new clubs may be smaller than it used to be decades ago. Therefore, the hazards of relegation are likely to be the same for all teams—irrespective of the time of their arrival in their sports first division.

Finally, the amount of money available from the sale of broadcasting rights in the first season that a club spends in its respective first division is available only for the four soccer leagues (models 5b-8b in Table 2-5). As expected, higher TV revenues do not affect the hazard. All coefficients are very small and statistically insignificant. Moreover, including the TV revenues in the estimations leaves the coefficients of the other variables completely unaffected.

The coefficients of the control variables that we have included in our estimations are mainly as expected. The number of clubs playing in the respective first division decreases each club's hazard: one more club in the league is associated with a hazard that is 11% smaller. The coefficients for the individual leagues are similar in magnitude and are mostly statistically significant. The number of clubs that are relegated at the end of a season is also associated with a larger hazard of 36% (this result is virtually identical across the different leagues with the exception of English soccer).[21]

The coefficient of the number of previous relegations is marginally significant (at the 10% level) suggesting that each previous relegation increases the hazard of being relegated again by about 5%. While the sign and the magnitude of the coefficient is as expected, we are somewhat surprised by its marginal significance. Since there are a number of 'yoyo teams' playing in each of the leagues, we expected a much stronger impact of the number of previous relegations on the current hazard.[22] On the one hand, it is conceivable that some of these yoyo teams are not at all interested in surviving in the first division for a longer period of time but try to harvest the higher media and ticket revenues, already anticipating being relegated after their first season. These teams 'contaminate' the competition and their existence will bias our results.[23] On the other hand, there are also some teams that either need to stay in their current league or even need to be promoted in order to survive financially. A recent example is Dynamo Dresden that needed a bank guarantee before the start of the 2011/12 season to get their license from the German Football Association. The association asked for a guarantee of €2.045 million in case Dresden stayed in the third division and €830,000 in case they were promoted to the second division (Kicker 2011). Unfortunately, the necessary data is not available to control for these different motivations and restrictions.

In the full model, most of the league dummies turned out to be statistically significant (with the exception of the Spanish and Italian soccer leagues). The basis for comparison is the German soccer league. The hazard is lower in the German basketball, handball, and ice hockey leagues while it is higher in the other European soccer leagues. In Italian and Spanish soccer, the number of yoyo teams is particularly high and competitive balance is lower than in either German or English soccer. It is, therefore, quite likely that in the latter two countries in every single year a group of five to six teams are fighting relegation while about eight clubs are far away from the championship as well as the relegation zone. In German and in English soccer, on the other hand, the majority of the clubs is either involved in the fight against relegation or the fight for qualification for international cup

21 The same is true for the control variable for forced relegations. Since a forced relegation always includes being relegated, the coefficient is extremely high and not interpretable. For the English and Spanish soccer league, the variable is omitted since there were no forced relegations (see Table 2-1).

22 Moreover, estimation of a stratified Cox model that takes into account that there may be a difference in the baseline hazard for the first, second, third, and so forth relegation, yields almost identical results. These results are, of course, available from the authors upon request.

23 It is, of course, very unlikely that managers will ever admit engaging in this kind of 'free-rider behavior.'

competitions. Moreover, especially in German ice hockey and basketball, the relegation hazard is lower since there is always a large number of teams competing for the championship.[24]

2.7 Summary and Conclusions

In this article we have analyzed the survival times of individual clubs in seven different professional team sports leagues since their inaugural season (varying between 1939 and 1966) up until today. Based on a detailed comparison of the different models that are available, we have chosen a Gompertz survival model to estimate our results. Using an organizational ecology approach, we find that two of the fundamental propositions in the organizational ecology literature find much support in professional team sports leagues: 'liability of newness' and 'liability of smallness.' New and/or small clubs have a disadvantage compared to old and large clubs in the sense that the former have a significantly lower probability of surviving in the long run (we find no signs of either a liability of adolescence or of senescence in sports).

Table 2-6 displays a summary of our results: all other things being equal, we find a statistically significant and economically relevant impact of a new club's size and experience on the survival probability. Clubs that have been playing in the first division for a longer period of time have more experience and more resources, enabling them to survive in a highly competitive environment for an extended period of time while less experienced and poorer clubs have a considerable disadvantage.

We find the coefficients of both variables of club size and club resources (number of championship titles and average attendance) to support the liability of smallness-hypothesis in sports. Average attendance, however, is a better proxy of club size and club revenues with its impact being almost identical in the German and the English soccer league. Unfortunately, attendance figures are not available for the other leagues. Future research should, therefore, try to collect that information and use it to test the liability of smallness-hypothesis using data for other periods and other team sports leagues.

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[24] The Gompertz model gives us two more parameters that are of interest here, gamma and β_0. Both are necessary to determine the underlying baseline hazard that is independent of the covariates of the model. As mentioned above, the baseline hazard is $h_0(t) = \exp(\beta_0) \exp(\gamma t)$. For our most general model 1 with a gamma of 0.023 and a β_0 of -28.224, this implies that the baseline hazard is monotonically increasing with time. On the other hand, a very small $\exp(\beta_0)$ implies that the starting point for the increase is very low at 0.00000000000055. Even with the increase over time, the baseline hazard is still very low after 50 years at 0.00000000000175. Thus, most of the overall hazard seems to be driven by the covariates of our model.

Type of variable	Variable	Hazard increase	Significance level
Liability of newness	Years of experience	-4%	1%
Liability of size	Number of championship titles	-21%	1%
	Average attendance	-7%	1%
Founding conditions	Year (1. season)	1%	1%
	Bosman dummy (1. season)	-27%	10%
Control	Number of relegations	36%	1%
	Number of clubs	-11%	1%
	Previous relegations	5%	10%
	German basketball dummy	-50%	1%
	German ice hockey dummy	-56%	1%
	German handball dummy	-37%	1%
	English soccer dummy	52%	1%

Table 2-6 Summary of (statistically significant) findings

One of the most interesting findings is that the 'Bosman-ruling' had—contrary to the expectations by many sports officials—a positive and significant impact on the survival probabilities of recently promoted clubs. Thus, the liberalization of the player market now allows small market teams to sign better players from foreign leagues and countries, enabling them to field a competitive roster. Since the wages of players from Eastern Europe have not yet reached the levels of their colleagues from either Western Europe or South America, 'cheap labor' is still available, allowing even small market teams to avoid relegation in a highly 'dangerous' environment.

Admittedly, the potential of organizational ecology to explain the observable patters of the emergence and dissolution of firms—be it for-profit or non-profit—has not yet been fully explored. Based on our empirical analysis on the one hand, and our reading of the available literature on the other hand, we suggest the following three areas for future research:

— First, the human capital of players and head coaches as well as the arrival and departure of players and head coaches is likely to affect the survival probabilities of teams. Therefore, the composition as well as changes in the composition of the teams should be taken into account when estimating more elaborate models as in e.g., Pennings et al. (1998) as well as Pennings and Wezel (2010), both using a large sample of Dutch accounting firms to analyze the impact of individuals' skills and expertise on the performance of their respective companies.

— Second, other 'fragments' of organizational ecology such as geographical overlap and crowding should be considered as (potential) determinants of firm survival too. It is, for example, possible that a certain 'crowding' of clubs—such as e.g., in the Ruhr area—increases the individual club’s survival probability because local 'derbies' are particularly attractive to fans which, in turn, increase the club’s revenues. On the other hand, crowding can also be detrimental to the different clubs' performances, as it may induce a 'rat race' in attracting sponsors.

— Third, differences in the institutional arrangements across leagues and changes in these arrangements over time are likely to affect the survival probabilities of new and established teams perhaps in similar, perhaps in different ways: 'inertia', i.e., a particular club's approved routines and structures, may either be helpful to adapt to a changing environment, or may also turn out to be a particular 'burden' in times of change (see, e. g., the case study by Zhou and Witteloostuijn 2010).

2.8 Appendix 2-1: Testing the Equality of Survivor Functions

There are different tests that can be used to compare survivor functions. Two commonly used tests are the Log-rank and the Wilcoxon test. As displayed in Figure 2-1, the survivor functions converge towards the end of the observation period while they are quite different in the first years. Since the Log-rank (or Savage) test stresses increasing differences at the end of the process while the Wilcoxon test emphasizes differences at the beginning (Blossfeld et al. 2007), we use the Wilcoxon test here.

Table 2-7 displays the pairwise correlation coefficients (including their significance levels) of the different survivor curves. It appears that according to the results of the Wilcoxon test, we have to reject the assumption that the survivor functions for most pairs of leagues are correlated.

Wilcoxon	German ice hockey	German handball	German basketball	German soccer	Spanish soccer	English soccer	Italian soccer
German ice hockey	-						
German handball	0.009	-					
German basketball	0.092	0.537	-				
German soccer	0.210	0.076	0.363	-			
Spanish soccer	0.001	0.744	0.368	0.040	-		
English soccer	0.875	0.000	0.003	0.075	0.000	-	
Italian soccer	0.002	0.410	0.984	0.127	0.598	0.000	-

Table 2-7 Correlation of survivor curves

2.9 Appendix 2-2: Comparison of the Fit of the Different Parametric Models

The choice of the appropriate parametric model is usually based on the Akaike information criterion (see Cleves et al. 2002). Following the estimation of the different parametric models the AIC is compared. It is defined as

$$AIC = -2lnL + 2(k + c)$$

where L is the log likelihood, k the number of model covariates, and c the number of model-specific distributional parameters. According to Akaike (1974), the log likelihood values should be adjusted by the number of the parameters that have been included in each model. The model with the best fit is the one with the lowest AIC. In our case, the Gompertz model is to be preferred (see Table 2-8).

2.10 Appendix 2-3: Sensitivity Analysis

The first column of Table 2-9 is identical with model (1) displayed in Table 2-4 above. We have performed a number of additional estimations to document the robustness of our findings. First, we have right-censored our data after the 2008/09 season (column 2). It appears that nearly all the coefficients retain their sign and level of significance. Only the coefficient of the 'Bosman dummy' becomes insignificant. This is probably due to the difference in the duration of the two regimes (1939 to 1995 = 56 years, 1996 to 2010 = 14 years).

In addition, we have also taken into account the differences in the inaugural season of the seven leagues. We did that in two ways: First, we only looked at the first 44 years of the leagues in our sample and, second, we looked at the period 1966-2010 because the German handball and basketball, as the youngest leagues, started 44 years ago in 1966. Again, the majority of the coefficients retain their sign and their statistical significance, indicating that the results we have presented above are indeed robust and independent of changes in the length of the observation period.

		Gompertz		Weibull		Exponential	
Number of championship titles		-0.240	***	-0.243	***	-0.233	***
		(0.041)		(0.041)		(0.041)	
Years of experience		-0.045	***	-0.036	***	-0.026	***
		(0.005)		(0.005)		(0.004)	
Number of relegations (1. season)		0.027		0.037		0.028	
		(0.028)		(0.028)		(0.028)	
TV revenues (1. season)		-0.001		-0.001		-0.001	
		(0.001)		(0.001)		(0.001)	
Bosman dummy (1. season)		-0.224		-0.116		-0.188	
		(0.226)		(0.227)		(0.226)	
Year (1. season)		0.015	***	0.013	***	0.012	***
		(0.003)		(0.003)		(0.003)	
Previous relegations		0.051	*	0.108	***	0.149	***
		(0.029)		(0.024)		(0.022)	
Dummy for each league	German basketball	-0.712	***	-0.673	***	-0.668	***
		(0.162)		(0.162)		(0.162)	
	German ice hockey	-0.839	***	-0.778	***	-0.791	***
		(0.179)		(0.179)		(0.179)	
	German handball	-0.491	***	-0.482	***	-0.482	***
		(0.149)		(0.149)		(0.149)	
	English soccer	0.433	***	0.456	***	0.455	***
		(0.141)		(0.142)		(0.141)	
	Spanish soccer	0.116		0.127		0.114	
		(0.129)		(0.129)		(0.130)	
	Italian soccer	0.050		0.070		0.078	
		(0.122)		(0.121)		(0.121)	
Number of clubs		-0.123	***	-0.114	***	-0.113	***
		(0.018)		(0.018)		(0.017)	
Number of relegations		0.309	***	0.312	***	0.302	***
		(0.030)		(0.030)		(0.030)	
Forced relegation		1.931	***	1.922	***	1.954	***
		(0.163)		(0.163)		(0.162)	
Constant		-29.212	***	-25.765	***	-24.777	***
		(5.878)		(5.777)		(5.756)	
Gamma		0.023	***				
		(0.004)					
Ln_p				0.139	***		
				(0.033)			
P				1.149			
				(0.038)			
1/p				0.871			
				(0.029)			
Log likelihood		-288		-292		-300	
Chi2		580		579		588	
AIC		611		620		634	

Table 2-8 Alternative specifications

	Censored 2010		Censored 2009		Censored after 44 years		All leagues from 1966 onward	
Number of championship titles	-0.241	***	-0.241	***	-0.287	***	-0.211	***
	(0.041)		(0.041)		(0.052)		(0.040)	
Years of experience	-0.045	***	-0.044	***	-0.063	***	-0.047	***
	(0.005)		(0.005)		(0.009)		(0.006)	
Number of relegations (1. season)	0.023		0.024		0.034		0.021	
	(0.028)		(0.028)		(0.029)		(0.030)	
Bosman dummy (1. season)	-0.321	*	-0.295		-0.132		-0.029	
	(0.191)		(0.196)		(0.244)		(0.200)	
Year (1. season)	0.014	***	0.014	***	0.013	***	0.000	
	(0.003)		(0.003)		(0.004)		(0.004)	
Number of clubs	-0.121	***	-0.120	***	-0.125	***	-0.117	***
	(0.017)		(0.018)		(0.020)		(0.021)	
Number of relegations	0.306	***	0.306	***	0.311	***	0.300	***
	(0.030)		(0.031)		(0.034)		(0.035)	
Forced relegation	1.933	***	1.931	***	1.852	***	1.964	***
	(0.162)		(0.163)		(0.168)		(0.169)	
Previous relegations	0.050	*	0.054	*	0.041		0.041	
	(0.029)		(0.030)		(0.045)		(0.031)	
German basketball	-0.685	***	-0.678	***	-0.714	***	-0.673	***
	(0.157)		(0.160)		(0.167)		(0.168)	
German ice hockey	-0.824	***	-0.809	***	-0.766	***	-0.782	***
	(0.178)		(0.179)		(0.193)		(0.190)	
German handball	-0.462	***	-0.463	***	-0.477	***	-0.429	***
	(0.144)		(0.145)		(0.151)		(0.149)	
English soccer	0.419	***	0.421	***	0.442	***	0.531	***
	(0.139)		(0.141)		(0.171)		(0.148)	
Spanish soccer	0.109		0.106		0.051		0.333	**
	(0.129)		(0.130)		(0.166)		(0.147)	
Italian soccer	0.043		0.043		0.066		0.136	
	(0.122)		(0.123)		(0.144)		(0.134)	
Constant	-28.224	***	-27.912	***	-25.918	***	-1.212	
	(5.733)		(5.774)		(7.762)		(7.559)	
Gamma	0.023	***	0.022	***	0.038	***	0.024	***
	(0.004)		(0.004)		(0.007)		(0.006)	
LL	-288		-294		-445		-412	
CHI2	579		565		441		486	
P>chi2	0		0		0		0	
No of subjects	425		423		396		404	
No of failures	990		976		764		818	
Time at risk	6547		6418		5061		5212	

Table 2-9 Sensitivity analyses

3 Location and Success in German Soccer: The Impact of Location on the Performance of 'Bundesliga' Soccer Clubs

3.1 Introduction

The following paper discusses location and its effects on success in German 'Bundesliga' soccer. In particular, I will try to answer the following question: which club-external locational factors of 'Bundesliga' soccer teams have an effect on their sportive success? To be able to do that, I have to clarify two questions:

- What are club-external locational factors?
- What is success?

Locational factors are attributes of a particular place. Since the paper examines the German 'Bundesliga,' this place is always a city or region within the borders of Germany.[25] 'Club-external' means that I only include factors that the club cannot (or only marginally) influence. Club-external locational factors could therefore be population, GDP, number of other soccer clubs, climate, and so forth. All factors that a club can influence—e.g., players or coaches and their salaries, (ability of) club management, stadium size, legal form of the club—are not part of this paper.

Success can mean different things in soccer: winning the championship, qualifying for international cup competitions, reaching a specific rank, scoring the most goals or even receiving the lowest number of yellow and red cards. For the purposes of this paper, I will consider 'not being relegated' as success.

The empirical study will therefore analyze the 'survival time' of each club in the 'Bundesliga.' I use event history analysis,[26] a technique that focuses on the effects of factors that determine the length of time until the occurrence of an event. In the beginning of event history analysis, these events have often been the death of a patient or the dismissal of an employee (Allison 1984; Cox and Oakes 1984; Yamaguchi 1991). The technique has also been used in sports e.g., by Ohkusa (1999; 2001) to analyze quit decisions of baseball players in Japan and by Barros, Frick, and Passos (2009) to analyze coach career durations in German 'Bundesliga' soccer.

[25] Seasons 1963/64 until 1990/91 Federal Republic of Germany without German Democratic Republic, from 1991/92 onwards Germany.

[26] Also known as survival analysis or duration analysis.

This article is organized as follows. First I will give an overview of the relevant literature (chapter 3.2). Then I explain the promotion and relegation system in Germany in chapter 3.3. After that I will discuss club-external factors that are relevant for the analysis (chapter 3.4). In chapter 3.5 I will discuss the statistical model for the analysis and present the empirical results. Chapter 3.6 presents the regression results, chapter 3.7 discusses these findings and chapter 3.8 summarizes.

3.2 Literature Review

In his first research on sports economics, Rottenberg (1956) concludes that a rich club is located in an area where attendance is high and a poor club is located where the attendance is low. El-Houdiri and Quirk (1971) recognize the link between city dimensions and club dimensions based on the density of the population from which fans are drawn. The greater the revenue generating ability of a team's location, the greater will be its long-term stock of skills. In addition, Szymanski (2003) states that most clubs are in or near big cities but the implications of population density for revenue generation remain to be explored.

Since there are no studies on the impact of socioeconomic factors on team performance in soccer, I focus on three neighboring topics in the literature overview.

— Impact of club-internal factors on team performance
— Impact of sports on economy (economic impact studies)
— Impact of socioeconomic factors on sport performance

3.2.1 Impact of Club-Internal Factors on Team Performance

Much research has been conducted on club-internal determinants of team performance. In the U.S., Quirk and Fort (1999) first showed that there is a correlation between team salary and performance in the NBA and NHL but not in MLB and NFL. After that, several authors found that this link between salary and performance is true for all major leagues in the U.S. (Forrest and Simmons 2002; Frick et al. 2002; Hall et al. 2002; Szymanski 2003; Wiseman and Chatterjee 2003).

In Europe, many studies show the above mentioned relationship between salary and team performance for soccer leagues (Lehmann and Weigand 1997; Szymanski and Smith 1997; Frick et al. 1999; Szymanski and Kuypers 1999; Szymanski 2000; Forrest and Simmons 2002; Hall et al. 2002; Forrest and Simmons 2004; Frick 2004). In addition, several other variables were tested. Frick (2004) shows that besides player salaries, head coach salary has a positive impact on team success in the German 'Bundesliga.' Lehmann and Weigand (1997) find that the average age of players also has an effect on the team's success. Overall, the impact of salary on performance in Europe is higher than in the U.S. The interpretation is that the player market in the U.S. is highly regulated compared to the player market in Europe.

The overall result is that 'money scores goals.' The more money you invest in players, coaches, and so forth, the more success you have.

3.2.2 Impact of Sport on Economy

Costs of hosting a mega sport event such as the Olympic Games or the FIFA World Cup are massive. Expenditure for new infrastructure in Japan for the 2002 World Cup exceeded $5.6 billion (Sloane 2002). Most candidate cities or countries argue that those events also promise an economic windfall. Scientific research has failed to support this thesis.

Baade and Matheson (2000) analyzed the 1999 Super Bowl and found that the NFL had overestimated the economic impact by factor 10. Porter (1999) expects that if measured properly, the Super Bowl's economic impact would be zero. The same holds true for other mega events. For the recent FIFA World Cups, several authors have found negative impact of the event on the local economy. Baade and Matheson (2004) showed a negative result of 60% for the 1994 World Cup. While Kurscheidt (2006) expects it to be slightly better for the 1998 World Cup in France. Finer (2002) expects the economic impact of the 2002 World Cup to be a great illusion. Since the Olympic Games are much more complex (due to e.g., more events, more athletes) than the other two mega events mentioned, researchers have a hard time evaluating the impact of Olympic Games. Problems especially arise for the long-term effect of Olympic Games. St. Moritz, which hosted the Winter Olympics in 1928 and 1948, may still profit from the image it acquired back then. Munich and Montreal have to rebuild their Olympic parks now (35 years after the respective games), which means new expenses for the host cities for renovation or destruction of the facilities. In total, whether or not hosting the Olympics is a lottery jackpot or 'fool’s gold' (Baade and Matheson 2002), seems to depend on the new infrastructure a city needs. Since the impact of mega sport events is difficult to isolate, Baumann et al. (2009) analyze the impact of sports events in Hawaii using airport arrival data. They show that there is a net increase in airport arrivals for three of the big sport events—the Marathon, the Ironman Triathlon, and the Pro Bowl—but it is not nearly as much as the sponsors claim it is.

On a smaller scale, the same holds true for investments in professional sports facilities and franchises. Economic impact studies have been used for a long time to determine the impact of sport facilities and franchises on the local economy. One of the first to study the relationship between sports facilities and municipal economy was Okner (1974). He found that clubs primarily benefit from the civic largesse directed at sports. These results could not be supported by research by other authors. Almost no study revealed any significant gains for metropolitan areas. In general, sports has no noteworthy impact on metropolitan economies (Quirk 1987; Baade and Dye 1988; Baade and Dye 1990; Baim 1990; Baim 1992; Quirk and Fort 1992; Euchner 1993; Greco 1993; Baade 1994; Rosentraub et al. 1994; Baade 1996). If results were statistically significant, they tended to be generally negative (Coates and Humphreys 1999). Housing prices are higher in cities with sports franchises, which could be explained by the willingness of buyers to pay a premium in cities with sports franchises (Carlino and Coulson 2004a). On the other hand, one could argue that sports franchises are located in bigger cities that also have more cultural and other offerings. Only one study, when determining quality-of-life benefits and including them in the model, found that building new stadiums for NFL franchises may be a good deal for cities and their residents (Carlino and Coulson 2004b).

The overall result is that mega sport events, sports facilities and franchises do not have a statistically significant positive effect on the local economy.

3.2.3 Impact of Socioeconomic Factors on Team Performance

Studies on the impact of socioeconomic factors have mainly focused on the Olympic Games. Several authors showed, during the 1970s, that a country's population and GDP per capita have a significant positive effect on their ability to win Olympic medals (Ball 1972; Grimes et al. 1974; Levine 1974). Due to the boycott of the 1980 Olympic Games in Moscow by the USA and the 1984 Games in Los Angeles by Russia, no research was done in the 1980s. Recently, more authors have covered the topic with the same outcome that population and GDP per capita have a statistically significant positive impact on the number of medals won by a country (Johnson and Ali 2000; Andreff 2001; Bernard and Busse 2004).

Besides those on the Olympic Games, there are only a few other papers that cover the impact of socioeconomic factors on team performance. Jones and Ferguson (1988) analyzed the location and survival of franchises in the NHL 1977-1978. They argued that population (as indicated in the papers on Olympic Games) has a positive impact on team performance. On the other hand, they showed that per capita income has a negative effect. They argued that hockey must therefore be an inferior good. However, Siegfried and Peterson (2000) found that audiences for professional sports tend to be of higher-than-average income. Barros (2006) analyzed socioeconomic determinants of sport expenditure for 308 municipalities in Portugal and found that area size, tax base, and population have a positive impact and GDP has a negative impact on sports expenditures.

The overall result is that population has a positive impact on sports performance. The effect of GDP is unclear. It has a positive effect on a macro level (athletes from specific countries winning medals at Olympic Games) and negative effect on regional level (clubs winning championships).

3.3 Promotion and Relegation in German 'Bundesliga' Soccer

In all but three of the 47 seasons that are covered in this paper, 18 teams were playing in the 'Bundesliga.' 1963/64 and 1964/65 only 16 teams were playing and after German reunification there were 20 teams in 1991/92. In the first seasons, until the '2. Bundesliga' was introduced in 1974, two teams were relegated to the 'Regionalligen' every season. The only exception was the season 1964/65, when only Hertha BSC Berlin was relegated and the league expanded to 18 clubs. After 1974/75 (with the exception of 1991/92 when 4 teams were relegated), three teams were relegated. Between 1981/82 and 1990/91 the third to last team played a relegation match against the third team from the '2. Bundesliga.' Seven out of ten times the team from the 'Bundesliga' won and stayed in the league.

In total, 50 teams have played in the 'Bundesliga' since it was founded in 1963. One hundred and twenty-two relegations have been recorded so far. While some clubs have only played in the 'Bundesliga' for one year (six clubs), some clubs have played there over 40 years. Hamburger SV has even played all 47 seasons since 1963/64. Only one time (Hertha BSC Berlin 1964/65) a club got relegated by league ruling while being qualified for the next season by its rank. See Figure 3-1 for details.

Some clubs have not been relegated at all while other clubs have been relegated up to seven times. Record holders are 1. FC Nuremberg and Arminia Bielefeld. Next to Hamburger SV, there are four other clubs[27] that have never been relegated. Figure 3-2 shows the distribution of clubs by number of relegations.

[27] Bayern München since 1965, Bayer Leverkusen since 1979, VfL Wolfsburg since 1997, TSG 1899 Hoffenheim since 2008.

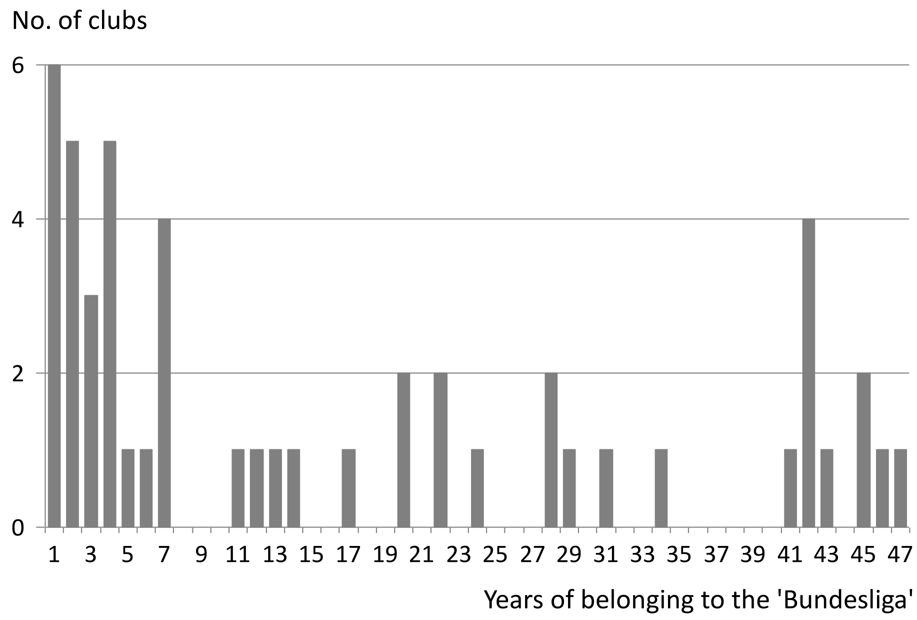

Figure 3-1 Number of clubs by number of seasons played in the 'Bundesliga'

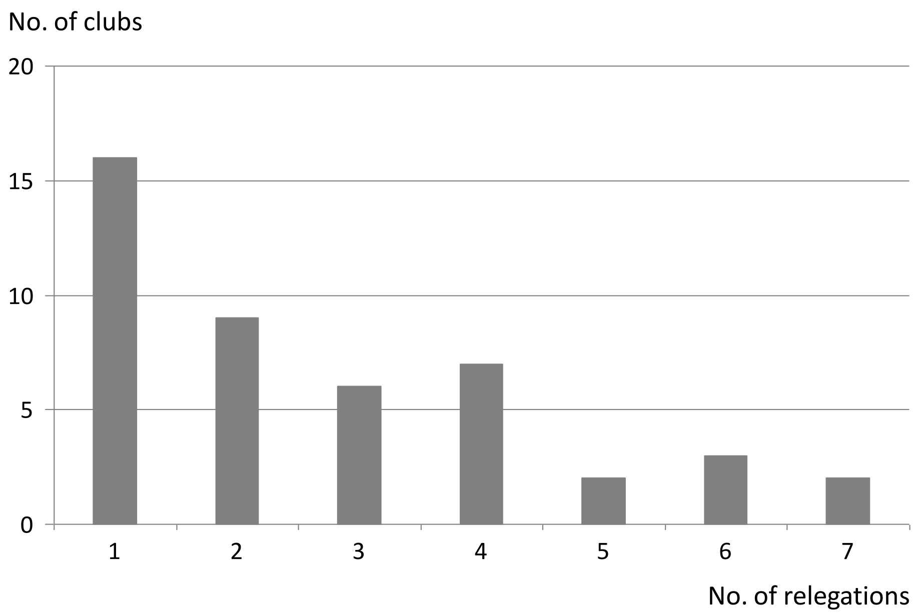

Figure 3-2 Number of clubs by number of relegations

In event history analysis with multiple episode data, the nonparametric Kaplan-Meier survival method can be used to estimate the probability of survival past a certain point in time (Kaplan & Meier, 1958). Figure 3-3 shows that the chances of survival for a club in the 'Bundesliga' for more than three years are less than 50%. And there is a 30% chance of being relegated in the first season.

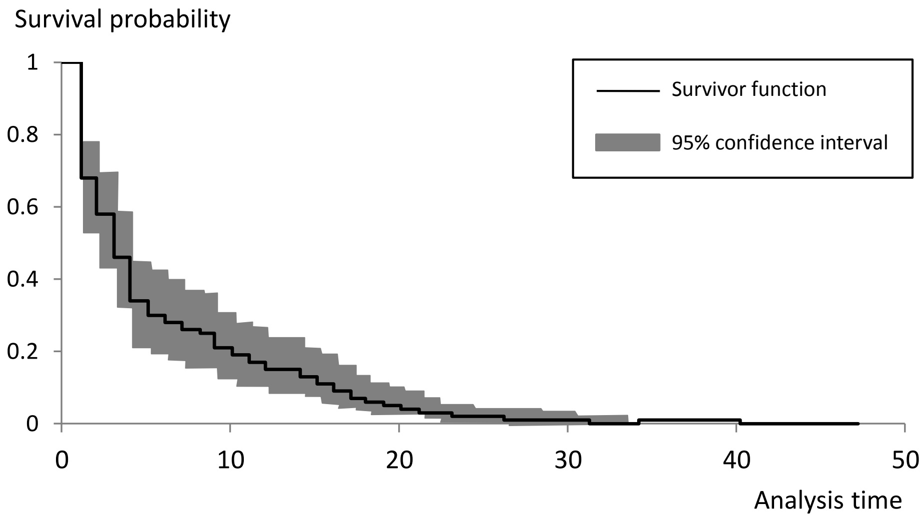

Figure 3-3 Kaplan-Meier estimate for survival in the 'Bundesliga' since 1963/64

3.4 Club External Factors

To identify the club-external socioeconomic factors for my analysis, I use a model suggested by Andreff (2006).

Until the end of the 1980s, income of a soccer club in Europe was mainly driven by spectators and their entry fees.[28] Other sources of income included sponsoring, which began to pick up in the 1970s and 1980s, and subsidies from municipal governments. However, those subsidies were a relevant portion of income only in France. In other countries, and especially in Germany, there were few direct subsidies (mostly in the case of bankruptcy of clubs). Most subsidies are in the form of supplying police forces at games and supporting clubs financially in building new stadiums or putting in guarantees at banks (Breuer 2010).

[28] See, e.g., Frick (2006) for Germany, Bolotny (2006) for France.

Starting in the early 1990s, other sources of revenue emerged. Most European leagues signed their first notable TV contracts when private TV stations entered the broadcasting bids.[29] Other clubs became limited companies to raise money during the IPO. In addition, some clubs started to issue bonds.[30] Also merchandising increased to become a significant revenue stream.

Andreff's first financial model, which contains mainly local revenue streams, is called SSSL-model (Spectators, Subsidies, Sponsors, and Local). Since subsidies are less important in Germany, I adjust the model to the situation in Germany, making it the SSL-model. The second and more contemporary MCMMG-model (Media, Corporations, Merchandising, Markets, and Global) contains more revenues from a global (or at least national) level.

In addition to the Andreff financial models, I also analyze the ability of a region to provide talent. In the past, clubs had junior teams where young talent, mostly from the region, played. Nowadays, every club must have a high performance center for young talent (DFL 2007). These talents are recruited from all regions of Germany and even worldwide.

To analyze local determinants of team success, I mainly focus on factors that can be influenced by the location. These factors are: spectators, sponsors, merchandising and talent. Each factor in my analysis is at least allocated to one of the revenue streams stated by Andreff or the talent dimension. Table 3-1 shows detailed data for the independent covariates.

3.5 Research Design

In my analysis of German 'Bundesliga' soccer I want to explain the survival of clubs in the league. In the survival or event history analysis, I use relegation as the event I want to explain. The relegation can either be the first relegation of a club or a subsequent relegation. As shown above, the majority of clubs has been relegated at least two times. In event history analysis, one speaks of repeated events. Such repeated events can be independent of each other. In the case of relegations, it is unlikely that repeated events are independent.

Therefore, using event history analysis for single event data would give us possibly wrong estimates (Kalbfleisch and Prentice 2002). This has two main reasons. First, having dependent or correlated

[29] England 1992 - £167 million for four years (Szymanski 2006a), Italy 1993 - €93 million per season (Lago 2006), Spain 1990 - €30 million per season (García and Rodrígues 2006), Germany 1988 - €40 million per season (Frick 2006).

[30] The first team to be listed on the stock market was Tottenham Hotspur in 1983. After that, many followed (Gerrard 2006). In Germany, only Borussia Dortmund is listed.

events is similar to having autocorrelation in conventional regression models. Second, the model restricts the influence of the covariates to be the same across all events (Box-Steffensmeier and Zorn 2002).

Another option could be to analyze only the data up to the first event. Two problems arise: I would not analyze the second and the following relegations and could only assume that the results are the same. In addition, I would waste a lot of data. In my analysis, I could only use 45 instead of 122 relegations.

The most appropriate option is using semi-parametric proportional hazard-type models. Several authors have proposed models for repeated events. I present four widely used variance-correction models for repeated events that estimate risk-set and event-time differently.

The 'independent increments' model by Anderson and Gill (1982) is the simplest of the four models. It assumes that an event is not affected by any earlier event of the same subject. In practice, it is impossible to differentiate between the widely used Cox partial likelihood method (Cox 1972) and the method by Anderson and Gill (1982), since the Cox model is a special case of the Anderson and Gill (1982) model (Fleming and Harrington 1991).

The 'marginal risk-set' model by Wei, Lin, and Weissfeld (1989) is similar to traditional competing risk models. Each individual is at risk for the first, second, etc. event from the beginning. This means that in my case, the fourth relegation could occur before the first relegation does.

In the 'conditional risk-set' models developed by Prentice, Williams, and Peterson (1981) a subject is not at risk of an event k until it has experienced all prior k-1 events. The time measured in the conditional risk-set model can either be elapsed time or inter-event time. Elapsed time means that time is measured from the entry of the subject in the study. In the inter-event time option, time is measured from the previous event.

Since the Andersen/Gill model assumes independence between events of the same subject and since in the Wei/Lin/Weissfeld model a subject is at risk of all events at the same time, I find the conditional risk set model the most appropriate for my analysis. I will use the elapsed time option and cluster the data by club and stratify it by its number of relegation (i.e., first relegation, second relegation, etc.).

Variable	Unit	Description	Relevant for revenue stream	Min	Max	Mean	SD
countypop	M	Population in county where the club is located	Spectators, Merchandising, Talent	0.08	3.43	0.65	0.60
countygdppc	1000	Per capita GDP (or gross value added) in the county where the club is located	Spectators, Merchandising	7.56	83.34	34.53	14.68
1clubs	1	Number of 'Bundesliga' clubs within a 50km radius[13]	Spectators	0.00	8.00	1.47	1.92
123clubs	%	Percentage of 1., 2., and 3. league clubs within a 50km radius	Talent	0.00	15.84	6.24	4.29
othersport	1	Number of other first league clubs (Basketball, Handball, Ice hockey) within a 50km radius	Talent, Spectators, Sponsors	0.00	12.00	3.22	2.99
tvrevenue	€m	TV revenue of the 'Bundesliga' in total	Media	0.00	500.00	103.68	155.95
newstadium	binary	1 if new stadium was built within the last 10 years[14], 0 otherwise	Spectators, (Subsidies)	0.00	1.00	0.22	0.42
spectators	1000	Average number of spectators in the respective season	Spectators	6.10	79.60	25.68	12.34
stadiumfull	binary	1 if stadium was sold out more than 75% of the home games	Spectators	0.00	1.00	0.04	0.19
companies	1	Number of ´large companies (>150 full time employees) in the county where the club is located	Sponsors	20.00	513.00	142.97	111.39
berlin	binary	1 if club is from Berlin, 0 otherwise	control	0.00	1.00	0.04	0.19
relegations	1	Number of teams that are relegated in the respective season	control	1.00	4.00	2.60	0.57
timedummy	1	Number of years since start of the league in 1963	control	1.00	47.00	24.12	13.50
experience	1	Number of years played in the 'Bundesliga' before the respective season by the respective club	control	0.00	46.00	15.58	12.21
statepopperclub	m	Population in state where the club is located divided by amount of clubs located in the same state	Spectators, Merchandising, Talent	0.52	18.08	5.34	3.70
stategdppc-perclub	1000	Per capita GDP in state where the club is located divided by number of clubs located in the same state	Spectators, Merchandising	2.44	50.65	17.16	11.50

Table 3-1 Summary of independent covariates

The hazard of being relegated is

$$h_{ik}(t; X_{ik}) = h_{0k}(t)e^{\beta X_{ik}}$$

where k denotes the event number, $h_{0k}(t)$ is the baseline hazard and varies by event number k, X_{ik} is a vector of i covariates which can be time dependent and β is a vector of parameters.

In the survival analysis the parameters are estimated using the partial likelihood, which can be specified as

$$L(\beta) = \prod_{i=1}^{n}\prod_{k=1}^{K_i}\left(\frac{e^{\beta X_{ik}}}{\sum_{i=1}^{n}\sum_{k=1}^{K_i} Y_{ik}e^{(\beta X_{ik})}}\right)^{\delta_{ik}}$$

where δ is a censoring indicator which is equal to one if failure is observed and zero if the observation is censored. Y is a risk indicator. If the individual is at risk for the current event, Y equals one. For all other observations Y is zero.

Next to the 'conditional risk-set' model, I use the regular non-stratified Cox model as comparison. The only difference is that the baseline hazard is not stratified. Therefore, the hazard is

$$h_{ik}(t; X_{ik}) = h_0(t)\, exp(\beta X_{ik})$$

where $h_0(t)$ is no longer dependent on k.

In addition, I estimate two stratified parametric models: the exponential and the Gompertz model (see Appendix 3-1 for detailed comparison of the fit for the parametric models). In both parametric models, the baseline hazard $h_{0k}(t)$ is stratified by event k.

The hazard of the exponential model is

$$h_{ik}(t; X_{ik}) = exp(\beta_{0k})\, exp(\beta X_{ik})$$

where β_{0k} is the constant coefficient that varies by event k.

The hazard rate of the stratified Gompertz model is

$$h_{ik}(t; X_{ik}) = exp(\gamma_k t)\ exp(\beta_{0k})\ exp(\beta X_{ik})$$

where β_{0k} is again the constant coefficient that varies by event k and γ_k is the Gompertz coefficient that also varies by event k. If γ_k is equal to 0, one can see that the exponential model is a special case of the Gompertz model. The next chapter shows that γ_k is close to 0 in my analysis. Therefore, the Gompertz and the exponential model fit the data best.

As discussed above, there are clubs with up to seven relegations. Since the amount of data for more relegations becomes very small (see Fig. 2), I stratify by first, second, third, fourth and more than four relegations, meaning that I merge the fifth, sixth, and seventh relegation into one group.

3.6 Empirical Results and Analysis

The data used in the study was obtained from different sources. Population and GDP data is provided by the Federal Statistical Office of Germany and the regional statistical offices of the federal states, respectively. Population and GDP data at county[31] level was not available for the whole period. Therefore, I estimated the data using 2007 county data and growth rates for 1963–2009 on a state level, assuming that growth rates within a state did not differ largely. Since there is no better data available I have to take this assumption. In addition, I also used the state population and state GDP per capita to estimate the results. Since there are cases with more than one club per state, I divided the state population and GDP per capita by the number of 'Bundesliga' clubs. See regression results in Appendix 3-2.

Information on the final league tables of the 'Bundesliga' is from Kicker soccer magazine. For minor leagues ('2. Bundesliga', 'Regionalliga', 'Oberliga', 'Verbands-', and 'Landesliga'), the data was taken from www.fussballdaten.de and www.f-archiv.de (unofficial German soccer archive). Attendance information is listed in Kicker soccer magazine as well. Information on other sports (handball, basketball, ice hockey) was received from the respective national associations.[32]

Information on the construction of the new stadiums was researched from the stadium and club websites and newspaper articles.

[31] County is used as translation for the administrative unit 'Landkreis.'
[32] Handball: 'Deutscher Handball Bund,' Basketball: 'Deutscher Basketball Bund,' Ice hockey: 'Deutscher Eishockey Bund.'

Data on companies comes from the "Establishment History Panel" of the Institute for Employment Research (IAB). The data does not give information on how many companies have their headquarters within a specific region but rather how many establishments are situated in a specific county. Since the IAB uses a complete count of all establishments in Germany, this is the best data available to estimate a 'company landscape' for Germany. Unfortunately, IAB data just covers the years 1975 until 2006. Therefore, all analyses, including the 'company' variable, include only 84 of 122 relegations. In addition, data for two counties is not available in the IAB dataset, which means that the datasets for Dynamo Dresden and Alemannia Aachen had to be disregarded.

To analyze geographical distances in Germany, I used the World Geodetic System (WGS 84) coordination data available on Google Maps. I used the stadium as the location of the respective club.

Table 3-2 summarizes the regression coefficients, the standard errors, and the significance levels of all four models including all variables.

As you can see, the regular Cox model shows quite similar results to the other models even though the other models fit the data better statistically. Therefore, I used the Cox model to estimate more models with different sets of variables in Table 3-3.

3.7 Findings and Discussion

The results of the four models presented in Table 3-2 are quite similar. GDP per capita, number of spectators, the dummy variable for sold out games, and experience of the club in the league are statistically significant and have a negative influence on the hazard. Media revenues and the number of relegations per season are significant and have a positive influence on the hazard.

The population around the club has no significant results (see Table 3-2). However, if we look at model 1c in Table 3-3 we can see that the 'berlin' variable is important. Leaving 'berlin' out changes the coefficient from negative to positive. This is unexpected at first, but at a second glance, we find that Berlin, the county with by far the most inhabitants,[33] has had four clubs in the 'Bundesliga' and has seen nine relegations.

[33] Berlin has 3.4 million inhabitants while the second biggest county is Hamburg, with 1.7 million, followed by Munich, with 1.3 million, and Hannover, with 1.1 million—the smallest is Zweibrücken with 34000 inhabitants.

Covariate	Model 1 Cox	Model 2 Conditional risk set	Model 3 Parametric exponential	Model 4 Parametric Gompertz
countypop	-0.176	0.107	0.100	-0.088
	(0.284)	(0.323)	(0.283)	(0.283)
countygdppc	-0.01	-0.017 **	-0.011	-0.013 *
	(0.008)	(0.007)	(0.008)	(0.007)
1clubs	-0.073	-0.116	-0.074	-0.081
	(0.108)	(0.097)	(0.077)	(0.083)
123clubs	0.018	0.029	0.033	0.026
	(0.044)	(0.043)	(0.046)	(0.046)
othersport	0.010	0.013	-0.024	-0.007
	(0.059)	(0.072)	(0.061)	(0.067)
tvrevenue	0.002	0.003 *	0.002 **	0.002 *
	(0.002)	(0.001)	(0.001)	(0.001)
newstadium	-0.313	-0.184	-0.180	-0.228
	(0.312)	(0.314)	(0.294)	(0.300)
spectators	-0.080 ***	-0.082 ***	-0.069 ***	-0.080 ***
	(0.019)	(0.021)	(0.014)	(0.015)
stadiumfull	-2.016 *	-2.461 ***	-1.474	-2.054 ***
	(1.073)	(0.614)	(1.003)	(0.578)
berlin	0.914	0.280	0.466	0.768
	(0.698)	(0.743)	(0.668)	(0.656)
relegations	0.452 *	0.387 *	0.493 ***	0.500 ***
	(0.246)	(0.214)	(0.173)	(0.160)
timedummy	-0.004	0.001	-0.002	-0.005
	(0.020)	(0.017)	(0.017)	(0.018)
experience	-0.066 ***	-0.079 ***	-0.022	-0.080 ***
	(0.020)	(0.026)	(0.014)	(0.023)
constant			-1.691 ***	-1.212 **
			(0.602)	(0.604)
T2			0.520 *	0.132
			(0.273)	(0.433)
T3			1.044 ***	-1.305 **
			(0.267)	(0.548)
T4			1.106 ***	0.679
			(0.276)	(0.958)
T5			0.719 **	-2.475
			(0.334)	(2.128)
Gamma				0.046 *
				(0.024)
Gamma T2				0.024
				(0.023)
Gamma T3				0.113 ***
				(0.026)
Gamma T4				0.002
				(0.040)
Gamma T5				0.077
				(0.059)
Log likelihood	-330.37	-202.63	-25.19	-14.64
Wald Chi2	83.71	65.7	140.7	115.57

Table 3-2 Event history analyses results for Cox and parametric models

Covariate	Model 1	Model 1b	Model 1c	Model 1d	Model 1e	Model 1f	Model 1g
countypop	-0.176	-0.172	0.114	-0.211	-0.375	-0.291	-3.258 ***
	(0.284)	(0.283)	(0.166)	(0.278)	(0.363)	(0.361)	(1.209)
countygdppc	-0.010	-0.011	-0.013 *	-0.010	-0.004	-0.004	-0.037 **
	(0.008)	(0.008)	(0.008)	(0.008)	(0.010)	(0.010)	(0.017)
1clubs	-0.073	-0.074	-0.117				
	(0.108)	(0.108)	(0.103)				
123clubs	0.018	0.019	0.036				
	(0.044)	(0.043)	(0.041)				
othersport	0.010	0.010	0.015				
	(0.059)	(0.059)	(0.059)				
tvrevenue	0.002	0.002 *	0.002 **	0.002 **	0.003 *	0.002	0.003 **
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
newstadium	-0.313	-0.316	-0.356	-0.320	-0.459	-0.451	-0.401
	(0.312)	(0.312)	(0.312)	(0.304)	(0.383)	(0.382)	(0.386)
spectators	-0.080 ***	0.079 ***	-0.083 ***	-0.076 ***	-0.061 ***	-0.067 ***	-0.079 ***
	(0.019)	(0.018)	(0.018)	(0.017)	(0.021)	(0.021)	(0.022)
stadiumfull	-2.016 *	-2.010 *	-1.998 *	-1.970 *	-46.27 [34]		
	(1.073)	(1.070)	(1.067)	(1.064)	.		
companies							0.016 ***
							(0.006)
Berlin	0.914	0.903		1.061	1.177	1.037	2.535 ***
	(0.698)	(0.697)		(0.657)	(0.841)	(0.840)	(0.987)
relegations	0.452 *	0.428 *	0.47 **	0.385 *	0.487	0.472	0.460
	(0.246)	(0.221)	(0.216)	(0.210)	(0.307)	(0.305)	(0.306)
timedummy	-0.004						
	(0.020)						
experience	-0.066 ***	-0.066 ***	-0.066 ***	-0.066 ***	-0.066 ***	-0.071 ***	-0.065 ***
	(0.020)	(0.020)	(0.020)	(0.019)	(0.022)	(0.022)	(0.022)
Log likelihood	-330.4	-330.3	-330.9	-330.3	-185.8	-189.5	-185.7
Wald Chi2	83.7	83.7	82.0	83.1	54.5	45.7	53.2
Clubs	50	50	50	50	40	40	40
Relegations	122	122	122	122	84	84	84
Time at risk	844	844	844	844	538	538	538

Table 3-3 Event history analyses results for different Cox models[35]

[34] As mentioned earlier, there is no company data available for Alemannia Aachen. Since Alemmania Aachen is the only club that was relegated despite the fact of having most of their home games sold out, there is no data set for this analysis that combines a full stadium with being relegated.

[35] All models were estimated in Stata 11; * significant at 10%, ** significant at 5%, *** significant at 1%; Standard errors are in parentheses.

In the beginning of the 'Bundesliga' the German Football Association tried to have a club from Berlin in the league for political reasons. For example, when Hertha BSC Berlin was relegated in 1964/65 due to a match fixing attempt, the 'Bundesliga' expanded to 18 clubs so that another club from Berlin could be promoted. I also tried population density in addition and instead of the 'population' variable, but 'population density' had no significant impact.[36]

GDP per capita has a statistically significant influence on the hazard rate with coefficients of -0.010 to -0.017, meaning that an increase in GDP per capita by €1000 would decrease the hazard by exp(-0.012)-1≈-1.2%. This is expected, since people in wealthier regions can buy more game tickets and merchandising. On the other hand, there are studies arguing that some sports are inferior goods (Cairns 1990). For soccer, in particular, the results have been mixed. The results of my study (see also all coefficients for GDP per capita in Table 3-3) are in favor of soccer being a normal rather than an inferior good.

The existence of other 'Bundesliga' club or a club from the first three divisions has no significant influence. Having other first league sports clubs around is also not significant. Since the significance levels are not even close to at least 10%, there is no need to interpret the coefficients. If you compare models 1b and 1d in Table 3-3, you can see that leaving the three variables out does not change the coefficients, nor does it change the fit of the model.[37]

An increase in TV revenues is significant in most models but shows just a minor increase in the hazard rates. A €1 million increase in TV revenues for the whole league increases the hazard of being relegated for all clubs by 0.2%. Unfortunately, the TV revenues for individual teams are not available. Since the TV revenues have increased steadily over the complete period, I expect this effect to be another time dummy.

The effect of a new stadium is not significant. This result does not support results of other authors analyzing the effect of stadiums. Noll determines that the novelty of a new stadium lasts somewhere between seven and 11 years (Noll 1974).

The higher the average attendance in a season, the lower the relegation hazard. More precisely, 1000 spectators more decrease the hazard rate by around 8%. Since the stadium capacity is restricted, I accounted for stadiums being sold out by inserting the dummy variable 'stadiumfull.' The

[36] Full results of these additional regressions are available from the author upon request.
[37] The Wald test shows a chi2 of 83.11 for the model without and of 83.66 for the model with the variables.

dummy was one if the stadium was sold out in more than 75% of the home games. This was the case in only 31 out of 844 data records. The coefficient of the dummy variable is statistically significant. If the stadium is sold out in more than 75% of the games the hazard decreases by around 90%. This is expected since normally stadiums are sold out at clubs that play for the championship. Indeed, only one[38] out of these 31 data sets ended in relegation.

The constant coefficient $h_{0k}(t)$, which is not estimated in the Cox model, is significant in the parametric models. This is the baseline hazard if all other covariates are equal to zero and it also accounts for other factors not included in the model. More interesting than the constant itself is the fact that in the stratified exponential and Gompertz models, the baseline hazard differs between the first and the other relegations. In the exponential model, the baseline hazard increases significantly from the first to the second relegation, again from the second to the third relegation and also from the third to fourth relegation. After that, the hazard decreases but is still higher for the fifth and later relegations than it is for the first and second. The data for the fifth and later relegations must be interpreted with caution since the number of observations is particularly low for these cases.

In addition to the 'berlin' variable that I discussed above, I controlled for three other factors. First, I included the number of teams that were relegated. This is necessary since the number of relegations has changed over time. During the first seasons (until 1974/75), only two clubs were relegated per season. After that, three clubs were relegated. In the 1980s, a relegation match was introduced between the sixteenth of the first league against the third of the second league. Since the first league club often won, there were a couple of seasons with only two relegations. As expected, the variable is statistically significant. If you increase the number of clubs being relegated by one, the hazard of being relegated increases by 50-60%. Second, I included a time dummy to account for all other developments that just have to do with the point in time we are looking at. The time dummy is not significant. If you look at Table 3-3, I excluded the time dummy in the second model and it did not change any coefficients significantly. Third, I controlled for the experience a club had before the respective season to account for any other factors that derive from earlier seasons. This variable is also significant at the 1% level. One more year of experience in the 'Bundesliga' decreases the hazard by around 7%.

Table 3-3 shows seven models. Model 1 is the same as model 1 in Table 3-2. The variations in models 1b, 1c, and 1d were already discussed earlier. Since I want to include the number of large companies in model 1g and I do not have information on companies before 1975 and after 2006, the number of

[38] Alemannia Aachen was relegated in 2006/07 despite the fact that they sold out 16 of their 17 home games.

observations decreases. Model 1d and 1e are identical except for the fact that model 1e has fewer observations. Since none of the clubs whose stadium was sold out more than 75% of the games was relegated,[39] the 'stadiumfull' variable becomes insignificant. I excluded the variable 'stadiumfull' in model 1f with no impact on the other variables. In model 1g I included the 'companies' variable. It is highly significant but the coefficient is unexpected. One more large company in the county increases the hazard by around 1%. In addition, three variables change. The population variable and the 'berlin' dummy become highly significant and the 'GDP per capita' variable becomes significant, as it also was in two other models in Table 3-2. All other variables retain their size and magnitude. Since the 'companies' and the 'population' variables are highly correlated, the results must be analyzed with caution. However, if you include a variable 'large companies per 1000 inhabitants,' then this variable is not statistically significant.[40]

3.8 Summary and Conclusions

In this article I analyze the survival time of German 'Bundesliga' soccer clubs in the seasons 1963/64 to 2009/2010. I estimated a regular Cox model, a conditional risk-set model, and two stratified parametric models (exponential and Gompertz). I find that they all yield similar results. GDP per capita, the number of viewers, and the experience of a club in the 'Bundesliga' have a significant and positive impact on success. The increase in the number of relegations has a significant and negative effect on team survival. In addition, the chances of being relegated increase with each further relegation. The impact of companies in the region is unexpected but it is also biased by the correlation between companies and population in the county. A more detailed analysis is needed.

Next to these significant factors, it is quite interesting that the presence of other clubs in the region has no impact on relegation chances. This could be an interesting topic of future research. Especially in American major leagues, competition by more than one franchise in a region is avoided with the argument that a newly established club would have an impact on the existing one.

[39] As mentioned earlier, there is no company data available for the region where Aachen is located.

[40] Regression results for additional analysis are available from the author upon request.

3.9 Appendix 3-1: Fit of Parametric Models

There are two strategies for choosing the adequate parametric model (Cleves et al. 2002).

- Fitting a gamma model and testing hypothesis with the Wald test
- Fitting each model and comparing the Akaike Information Criterion (AIC) values

Table 3-4 displays the results for the gamma model in column 5. The gamma model is the most general parametric model (available in Stata). Two hypotheses can be tested:

H_0: $\kappa = 1$, in which case if H_0 is true then the model is Weibull
H_0: $\kappa = 1$, $\sigma = 1$, in which case if H_0 is true then the model is exponential

From the results of my models I cannot preclude the use of neither the Weibull nor the exponential model.

The AIC is defined as

$$AIC = -2lnL + 2(k + c)$$

where L is the log likelihood, k is the number of model covariates, and c the number of model-specific distributional parameters. Akaike (1974) proposed that the models' log likelihood not simply be compared, but rather that it be adjusted by the number of parameters being estimated by each model and then for the adjusted value to be compared. The best fitting model is the one with the lowest AIC. It appears from Table 3-4 that the Gompertz model is the best fitting model. In addition to the Gompertz model, I used the exponential model. Since the number of relegations is more or less constant over the years, I expected the exponential model to be the best fitting model. However, looking at the parameters of the Gompertz and Weibull model, we find that both models are very close to the exponential model. The exponential model is a special case of the Gompertz model if gamma = 0 and is a special case of the Weibull model if p = 1. Looking at Table 3-4, it appears that gamma is 0.07 and p is 1.24. For these reasons, I used the exponential instead of the Weibull model.

Covariate	Model 3 Parametric exponential ROBUST SE	Model 4 Parametric Gompertz ROBUST SE	Model 5 Parametric Weibull ROBUST SE	Model 6 Parametric Lognormal ROBUST SE	Model 7 Parametric Loglogistic ROBUST SE	Model8 Parametric Gamma ROBUST SE
countypop	0.061	-0.181	0.029	0.052	0.306	-0.008
	(0.350)	(0.319)	(0.331)	(0.407)	(0.400)	(0.257)
countygdppc	-0.014	-0.011	-0.013	0.012	0.012	0.010
	(0.009)	(0.008)	(0.009)	(0.010)	(0.008)	(0.007)
1clubs	-0.048	-0.028	-0.046	-0.009	-0.005	0.032
	(0.094)	(0.082)	(0.089)	(0.119)	(0.113)	(0.071)
123clubs	0.034	0.020	0.035	-0.004	0.009	-0.027
	(0.051)	(0.047)	(0.051)	(0.050)	(0.053)	(0.039)
othersport	-0.036	-0.030	-0.038	0.014	0.024	0.031
	(0.070)	(0.067)	(0.070)	(0.085)	(0.098)	(0.052)
tvrevenue	0.002	0.002 *	0.002 *	-0.003 *	-0.003	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
newstadium	-0.351	-0.253	-0.393	0.876 **	0.645 **	0.278
	(0.302)	(0.315)	(0.305)	(0.355)	(0.299)	(0.270)
spectators	-0.063 *	-0.075 ***	-0.064 ***	0.041 **	0.026	0.050 ***
	(0.016)	(0.015)	(0.016)	(0.018)	(0.016)	(0.014)
stadiumfull	-1.884	-1.920 ***	-1.790 *	2.443 ***	2.664 ***	1.343
	(1.037)	(0.638)	(0.958)	(0.850)	(0.662)	(0.876)
berlin	0.707	1.075	0.756	-1.192	-1.921 *	-0.581
	(0.766)	(0.712)	(0.756)	(0.954)	(0.983)	(0.576)
relegations	0.442 ***	0.443 ***	0.460 ***	-0.314 *	-0.286	-0.362 ***
	(0.155)	(0.156)	(0.166)	(0.177)	(0.211)	(0.136)
timedummy	0.021	0.000	0.015	-0.008	-0.007	-0.012
	(0.016)	(0.017)	(0.017)	(0.018)	(0.019)	(0.014)
experience	-0.020	-0.075 ***	-0.041 **	0.041 *	0.060 **	0.033 ***
	(0.015)	(0.021)	(0.019)	(0.023)	(0.024)	(0.013)
constant	-1.650 ***	-1.278 **	-2.075 ***	1.030	1.073 *	1.734 ***
	(0.644)	(0.621)	(0.638)	(0.663)	(0.592)	(0.574)
gamma		0.065 ***				
		(0.015)				
ln_p			0.215 **			
			(0.088)			
ln_sigma				-0.307 ***		-0.217 **
				(0.087)		(0.090)
ln_gamma					-1.007 ***	
					(0.119)	
kappa						1.121 ***
						(0.355)
Log likelihood	-33.79	-25.29	-31.55	-44.12	-57.28	-31.45
Wald Chi2	67.66	89.87	72.72	117.52	236.31	56.85
AIC	95.58	80.58	93.1	118.25	144.55	94.91

Table 3-4 Regression analysis comparison for non-stratified models

3.10 Appendix 3-2: State vs. County Data

As discussed above, I used county population and GDP data from 2007 and growth rates for federal states to calculate the county population and GDP data for the other years that I used in my analysis. I will now show that the data is not significantly different if I use state data. Since there is often more than one club per state I divide the population and GDP data by the number of clubs in the state. See Table 3-5 for the comparison county vs. state data per club.

All coefficients point in the same direction and they are mostly quite similar in both county and state models. The coefficients for the covariate 'GDP per capita' vary a little more between the five tested models with the state data and they are more significant. The population data varies a bit more with the county data, and state data is also more significant than the county data.

Covariate	County data					State data				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3	Model 4	Model 5
countypop	-0.176	0.107	0.100	-0.088	0.005	0.040	0.049	0.051 *	0.043	0.049
	(0.284)	(0.323)	(0.283)	(0.283)	(0.286)	(0.030)	(0.033)	(0.029)	(0.029)	(0.030)
countybippc	-0.010	-0.017 **	-0.011	-0.013 *	-0.012 *	-0.032 *	-0.020	-0.041 **	-0.048 **	-0.042 **
	(0.008)	(0.007)	(0.008)	(0.007)	(0.007)	(0.019)	(0.022)	(0.019)	(0.020)	(0.021)
1clubs	-0.073	-0.116	-0.074	-0.081	-0.084	-0.124	-0.143	-0.115	-0.180	-0.150
	(0.108)	(0.097)	(0.077)	(0.083)	(0.083)	(0.121)	(0.121)	(0.112)	(0.116)	(0.115)
123clubs	0.018	0.029	0.033	0.026	0.028	0.016	0.038	0.018	0.022	0.022
	(0.044)	(0.043)	(0.046)	(0.046)	(0.045)	(0.043)	(0.040)	(0.043)	(0.043)	(0.043)
othersport	0.010	0.013	-0.024	-0.007	-0.008	-0.016	-0.012	-0.065	-0.040	-0.046
	(0.059)	(0.072)	(0.061)	(0.067)	(0.069)	(0.063)	(0.078)	(0.060)	(0.063)	(0.064)
tvrevenue	0.002	0.003 *	0.002 **	0.002 *	0.002 **	0.002	0.003 **	0.002 *	0.002	0.002
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
newstadium	-0.313	-0.184	-0.180	-0.228	-0.243	-0.391	-0.236	-0.221	-0.283	-0.302
	(0.312)	(0.314)	(0.294)	(0.300)	(0.290)	(0.314)	(0.315)	(0.284)	(0.293)	(0.292)
spectators	-0.080 ***	-0.082 ***	-0.069 ***	-0.080 ***	-0.074 ***	-0.084 ***	-0.077 ***	-0.070 ***	-0.083 ***	-0.076 ***
	(0.019)	(0.021)	(0.014)	(0.015)	(0.014)	(0.018)	(0.018)	(0.015)	(0.016)	(0.016)
stadiumfull	-2.016 *	-2.461 ***	-1.474	-2.054 ***	-1.438	-1.962 *	-2.480 ***	-1.481	-2.206 *	-1.474
	(1.073)	(0.614)	(1.003)	(0.578)	(0.898)	(1.079)	(0.586)	(1.038)	(1.245)	(1.049)
berlin	0.914	0.280	0.466	0.768	0.509	0.896 **	0.837 **	1.112 **	1.005 **	0.962 **
	(0.698)	(0.743)	(0.668)	(0.656)	(0.664)	(0.432)	(0.379)	(0.442)	(0.440)	(0.451)
relegations	0.452 *	0.387 *	0.493 ***	0.500 ***	0.505 ***	0.456 *	0.336	0.481 **	0.510 **	0.501 **
	(0.246)	(0.214)	(0.173)	(0.160)	(0.165)	(0.246)	(0.218)	(0.209)	(0.214)	(0.215)
timedummy	-0.004	0.001	-0.002	-0.005	-0.005	-0.004	-0.002	0.001	-0.002	-0.001
	(0.020)	(0.017)	(0.017)	(0.018)	(0.018)	(0.020)	(0.019)	(0.018)	(0.018)	(0.018)
experience	-0.066 ***	-0.079 ***	-0.022	-0.080 ***	-0.041 **	-0.057 **	-0.074 ***	-0.014	-0.078 ***	-0.038 *
	(0.020)	(0.026)	(0.014)	(0.023)	(0.020)	(0.022)	(0.027)	(0.014)	(0.028)	(0.020)
constant			-1.691 ***	-1.212 **	-1.357 **			-1.439 **	-1.018	-1.277 *
			(0.602)	(0.604)	(0.602)			(0.681)	(0.705)	(0.731)

Table 3-5 Regression analysis comparison between county and state population and GDP data

Covariate	County data					State data				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3	Model 4	Model 5
T2	-0.176	0.107	0.100	-0.088	0.005	0.040	0.049	0.051 *	0.043	0.049
	(0.284)	(0.323)	(0.283)	(0.283)	(0.286)	(0.030)	(0.033)	(0.029)	(0.029)	(0.030)
T3	-0.010	-0.017 **	-0.011	-0.013 *	-0.012 *	-0.032 *	-0.020	-0.041 **	-0.048 **	-0.042 **
	(0.008)	(0.007)	(0.008)	(0.007)	(0.007)	(0.019)	(0.022)	(0.019)	(0.020)	(0.021)
T4	-0.073	-0.116	-0.074	-0.081	-0.084	-0.124	-0.143	-0.115	-0.180	-0.150
	(0.108)	(0.097)	(0.077)	(0.083)	(0.083)	(0.121)	(0.121)	(0.112)	(0.116)	(0.115)
T5	0.018	0.029	0.033	0.026	0.028	0.016	0.038	0.018	0.022	0.022
	(0.044)	(0.043)	(0.046)	(0.046)	(0.045)	(0.043)	(0.040)	(0.043)	(0.043)	(0.043)
Gamma	0.010	0.013	-0.024	-0.007	-0.008	-0.016	-0.012	-0.065	-0.040	-0.046
	(0.059)	(0.072)	(0.061)	(0.067)	(0.069)	(0.063)	(0.078)	(0.060)	(0.063)	(0.064)
Gamma T2	0.002	0.003 *	0.002 **	0.002 *	0.002 **	0.002	0.003 **	0.002 *	0.002	0.002
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Gamma T3	-0.313	-0.184	-0.180	-0.228	-0.243	-0.391	-0.236	-0.221	-0.283	-0.302
	(0.312)	(0.314)	(0.294)	(0.300)	(0.290)	(0.314)	(0.315)	(0.284)	(0.293)	(0.292)
Gamma T4	-0.080 ***	-0.082 ***	-0.069 ***	-0.080 ***	-0.074 ***	-0.084 ***	-0.077 ***	-0.070 ***	-0.083 ***	-0.076 ***
	(0.019)	(0.021)	(0.014)	(0.015)	(0.014)	(0.018)	(0.018)	(0.015)	(0.016)	(0.016)
Gamma T5	-2.016 *	-2.461 ***	-1.474	-2.054 ***	-1.438	-1.962 *	-2.480 ***	-1.481	-2.206 *	-1.474
	(1.073)	(0.614)	(1.003)	(0.578)	(0.898)	(1.079)	(0.586)	(1.038)	(1.245)	(1.049)
ln_p	0.914	0.280	0.466	0.768	0.509	0.896 **	0.837 **	1.112 **	1.005 **	0.962 **
	(0.698)	(0.743)	(0.668)	(0.656)	(0.664)	(0.432)	(0.379)	(0.442)	(0.440)	(0.451)
ln_p 2	0.452 *	0.387 *	0.493 ***	0.500 ***	0.505 ***	0.456 *	0.336	0.481 **	0.510 **	0.501 **
	(0.246)	(0.214)	(0.173)	(0.160)	(0.165)	(0.246)	(0.218)	(0.209)	(0.214)	(0.215)
ln_p 3	-0.004	0.001	-0.002	-0.005	-0.005	-0.004	-0.002	0.001	-0.002	-0.001
	(0.020)	(0.017)	(0.017)	(0.018)	(0.018)	(0.020)	(0.019)	(0.018)	(0.018)	(0.018)
ln_p 4	-0.066 ***	-0.079 ***	-0.022	-0.080 ***	-0.041 **	-0.057 **	-0.074 ***	-0.014	-0.078 ***	-0.038 *
	(0.020)	(0.026)	(0.014)	(0.023)	(0.020)	(0.022)	(0.027)	(0.014)	(0.028)	(0.020)
ln_p 5			-1.691 ***	-1.212 **	-1.357 **			-1.439 **	-1.018	-1.277 *
			(0.602)	(0.604)	(0.602)			(0.681)	(0.705)	(0.731)
Log likelihood										

Table 3-5 continued

4 Up and Down: Competing Risks in Second Tier Soccer

4.1 Introduction

Every year the worst two to four clubs are relegated from each of the professional soccer leagues in Europe and replaced by the best teams from lower tier leagues. In those leagues there is generally less attendance, cheaper ticket prices and sponsors, and TV stations are likely to pay less since people prefer to watch better teams. As a consequence, revenues of relegated teams decrease dramatically. Additionally, higher tier teams' salaries and reputations attract the best talent from lower tier clubs. Therefore, relegated teams have to sell their best players. More and more contracts, however, include clauses that allow players to transfer to other teams without a (or for a low) transfer fee in case of relegation, leaving their clubs without adequate compensation. Thus, relegation has a huge financial impact on the affected teams. Still, only a few sports economists have researched determinants of relegation and promotion. Existing research only covers short time periods and focuses on first tier sports. Lower leagues where teams face the opportunity of promotion and the risk of relegation at the same time have not been subject to in-depth analysis so far. This paper works towards closing this gap.

The paper studies the determinants not only of relegation but also of promotion—a characteristic specific to lower leagues. I therefore focus my research on six second tier soccer leagues in Europe since their inaugural season. In England, second tier soccer was introduced in 1892. In total, my dataset contains 419 season-league-observations. I use competing risks analysis, a special case of event history analysis (also known as 'survival analysis'), to estimate determinants of promotion and relegation simultaneously.

Sports clubs, as any other enterprise, often identify potential chances as well as risks too late to take effective, strategic measures. Since buying players to increase playing talent is restricted to so-called transfer periods, one in summer and one in winter, reacting to a crisis or making use of an opportunity, respectively between those transfer windows, can hardly be done in the short-term. Therefore, having an early warning system is even more important in soccer. Early warning systems as suggested by e.g., Müller-Merbach (1977) have, in one way or the other, been implemented by most companies in most industries. Using my regression results and an out-of-sample forecast, I propose an early warning system, which identifies second tier soccer clubs with a high probability of promotion or relegation.

The paper proceeds as follows. In chapter 4.2, I give an overview of the literature on promotion and relegation. In chapter 4.3, my data is presented. I discuss the regression model in chapter 4.4 and the estimation results in chapter 4.5. In chapter 4.6, I point out the differences between the six leagues. In chapter 4.7, I suggest a forecasting model for future promotions and relegations and chapter 4.8 concludes.

4.2 Literature Review on Promotion and Relegation

The discussion of promotion and relegation is part of a broader issue in sports economics: open vs. closed leagues. In closed leagues the number and the identity of member teams do not change from season to season.[41] New clubs can only be added by the vote of the existing league members. On the other hand, in open leagues the worst teams—normally measured by winning percentage—are relegated to a lower tier league and the best teams from that league (or leagues[42]) are promoted. The former is widely used in the United States (e.g., the National Basketball Association, the National Football League, Major League Baseball) while the latter is e.g., used in European soccer leagues.[43]

The impact this structural difference has on the individual soccer club as well as consumer welfare has been studied by several authors. Ross and Szymanski (2002, p. 625) argue that "the institution of promotion and relegation tends to raise consumer welfare by increasing effective competition among the teams in a league." Noll (2002) finds that players earn higher wages and attendance is higher in an open league. Szymanski and Valletti (2005) show that an open league incentivizes each team to win. Even the bottom teams need to keep up their effort until the end of the season to avoid relegation. However, the willingness to share income (such as media or gate revenues) between the teams in open leagues is lower. While Ross and Szymanski (2002) use a theoretical approach only, Noll (2002) as well as Szymanski and Valletti (2005) empirically support their model by using the English football league as an example.

In their literature reviews on soccer economics, Matheson (2006) and Szymanski (2006b) point out that there is little research on the determinants of promotion or relegation. The reason for this may be that sports economic research is mainly focused on U.S. sports and, as mentioned earlier, U.S. sports use closed leagues and are therefore not affected by promotion and relegation.

[41] Only relocation of teams can change the cities that have a major league team.
[42] In many league systems there is more than one league at the next lower hierarchy level.
[43] Szymanski (2006b) gives a good overview of benefits and costs of the two systems.

In the following paragraph I will discuss the few available studies on the determinants of promotion and relegation. Dherbecourt and Drut (2009) analyzed promotion and relegation in the five biggest top tier European soccer leagues from 2004 to 2009. Their regression model includes socio-economic variables such as GDP, population and unemployment of the region. Club internal factors such as average age of the team, coach seniority, percentage of foreign players or championship history are also accounted for in their model. They find that regional factors play a significant role. Clubs from regions with a higher percentage of services industries and a higher percentage of educated people have a lower relegation probability. They suggest that while soccer used to be fueled by the industrial revolution—it was a way to socialize for people who moved to industrial cities from rural areas (see Kuper and Szymanski 2009)—globalization and the decrease of industry in Europe are responsible for the decline of elite clubs from industrial regions increasing the chances of clubs from other regions. Moreover, the promotion probability is negatively impacted by GDP growth and positively by unemployment as well as by the fact that another club from the same city is playing in the first tier league. In addition, experience in the top tier league, qualification for a European cup competition and stadium attendance reduce the probability of relegation. They also include the shareholder structure of the clubs in their analyses. The fact that a billionaire owns the majority of shares of a club—such as Roman Abramowitsch at Chelsea London or Silvio Berlusconi at AC Milan—also decreases (increases) its relegation (promotion) probability.

Wallbrecht (2010) uses a dataset from the German soccer 'Bundesliga' between 1963 and 2010 to analyze the impact of regional factors such as GDP or population as well as some club related factors (e.g., experience, attendance, previous relegations) on relegation chances. He finds that higher GDP, higher attendance, and more experience in the 'Bundesliga' decrease the chances of being relegated while previous relegations increase the chances of being relegated again.

Frick and Wallbrecht (2012) analyze seven top tier sports leagues in Europe from four different sports and four different countries for all seasons after World War II. Using an organizational ecology approach, they find that previous club performance (number of previous championship titles) and average attendance affect 'survival' in the league in a statistically significant and economically relevant sense. In line with results from Hoehn and Szymanski (1999) and Wallbrecht (2010), they find that the number of previous relegations increase the chances of being relegated again.

Frick and Prinz (2004) analyze 12 major European soccer leagues over a 25-year period (1976-2000) and find the 'Bosman-ruling' to have different effects on stronger than on weaker leagues.[44] In countries such as England, Italy or Spain, survival probabilities of newcomers have decreased since the 'Bosman-ruling.' The reason for this is the signing of many foreign-born players by established teams in these leagues. In countries such as Yugoslavia, Russia or Belgium, the dominant teams have lost their star players to foreign clubs. Therefore, survival chances of promoted teams have increased.

This article analyzes the determinants of promotion and relegation further. In particular, I add two aspects that have not been investigated before. First, my research covers leagues since their inaugural season. This gives me the opportunity to study up to 110 seasons in one league alone. The long timespan of the study should help to eliminate short-term trends. Second, I expand the research on promotion and relegation to second tier leagues. These leagues are interesting for several reasons. Two competitions can be studied at the same time. Some teams in the league are fighting for promotion while other teams fight against relegation. Additionally, there are no teams that dominate the leagues for a long period of time because if a team plays well, it is promoted to a higher tier league.

4.3 Data Description

The analysis focuses on six second tier soccer leagues in Europe: England, Spain, Italy, Germany, France and Portugal. The selection of these leagues is based on their Union of European Football Associations (UEFA) coefficients (retrieved summer 2011). There are two main reasons for studying the top countries: first, the top countries' second leagues are more relevant financially. The top 20 clubs, by revenues, are all from the top 5 countries of the UEFA ranking (Deloitte 2012). Secondly, weaker leagues are more receptive to corruption, match fixing, and so forth, which would compromise the results of my study. Forrest and Simmons (2003) as well as Preston and Szymanski (2003) conclude that corruption is more likely (a) the lower player wages and (b) the lower the probability of detection—both of which is true for weaker leagues. I use the complete history of these leagues from their foundation until the end of the 2010/2011 season. This covers 419 seasons in total, 110 seasons in England alone since the inaugural season of the second division in 1892. Seven hundred and twenty-eight clubs have played in these leagues during that time; 1060 promotions and 1431 relegations have taken place; 8896 team-season-observations are available. To

[44] Strength of a league is defined by its Union of European Football Associations (UEFA) coefficient.

my knowledge, this is the largest sample used in promotion/relegation analysis so far (see Table 4-1 for an overview).

	England	Germany	Italy	Spain	France	Portugal	Total
Start	1892	1974	1929	1929	1933	1990	
End	2011	2011	2011	2011	2011	2011	
Breaks (War time)	1916 - 1919 1940 - 1946	-	1943 - 1945	1936 – 1939	1939 - 1945	-	
Seasons	110	37	90	89	72	21	419
Clubs	100	119	136	159	154	60	728
Events	486	289	561	566	466	123	2491
Promotions	252	101	231	217	202	57	1060
Relegations	234	188	330	349	264	66	1431

Table 4-1 Overview of six leagues

On average, each club can be observed 12.2 seasons in my sample. One hundred and sixteen clubs only survived one season. Barnsley F.C. has the most experience in the second league, with 70 non-consecutive seasons. RCFC Besançon had the longest spell, with 41 consecutive seasons without being promoted or relegated from 1945 until 1986. Real Murcia has the most spells, with 16. The average number of promotions and relegations per club is 1.5 and 2, respectively. The two clubs with the most promotions from second to first league are Atalanta Bergamo and Birmingham City F.C.. They have been promoted 12 times. Amiens SC has the most relegations from second to the third tier league (10 times). The team with the longest absence from the second tier is Crewe Alexandra F.C., which played in the second league until 1896, when they were demoted. After playing in lower leagues for 101 years, they returned to the second league in 1997.

In the following paragraph I will discuss some assumptions:

Merger/Acquisitions: Mergers and acquisitions are rare in European soccer. For those rare cases that did occur, I proceeded as follows. If both teams were in the second tier league at the time of the merger, I treat the higher ranked club as if nothing happened and the lower ranked club as if it was relegated (e.g., the merger of U.S. Taranto and AS Taranto Calcio in 1947). If one club merged with a lower tier club, the club from the second tier was continued. If both clubs were not in the second tier at the time of the merger, I continued the club with more experience in the second tier (e.g., the merger of TuS Schloß Neuhaus and 1. FC Paderborn in 1985). No second tier clubs ever merged with a first tier club.

Refoundation: If a club was dissolved and a new club was founded, then there are two options. If the new club was founded directly after the dissolution of the old one with most of the same players, management, stadium, and so forth, then the new club was treated as if the old club continued. If the new club was founded years later with new players, the club was treated as a completely new club. The reasoning is the same as with mergers and acquisitions.

Time of War: The leagues in Italy, Spain and France were suspended once by war, respectively (World War II and the Spanish Civil War). The English league stopped twice (World War I and II). The German and Portuguese leagues were founded later and therefore not interrupted by war. Since almost all leagues continued after the war with the same clubs (or more) that had been in the league before the war, I treat the season after the war as if it had taken place immediately after the last season before the war. All teams that were in the second league before the war and did not play in the first season after the war were treated as relegated. This is a reasonable assumption because, in fact, the seasons were treated as if they had happened in subsequent years by the respective national soccer associations.

Forced relegation: There are several incidents when a club was relegated as punishment for e.g., match fixing or due to financial difficulties, even if the club did not finish the season in the relegation zone. In total, there are 15 cases of clubs being relegated from the first to the second tier level and 111 cases where a club was relegated from the second to the third tier level. In contrast to Dherbecourt and Drut (2009), who take only sportive results into account, I use the relegations that actually took place. For example, when Juventus F.C. was relegated for match fixing and Messina Peloro F.C. stayed in the league, despite the fact that they were the third worst team, Dherbecourt and Drut (2009) consider Messina as relegated and I consider Juventus as relegated. They argue that the sportive results are what should be analyzed by the model. I argue that if a team is relegated for e.g., match fixing, then the final table does not reflect the real sportive results that would have occurred without match fixing.

I chose variables to measure the success history of a club as well as club and league specific factors based on the hypothesis that these are the major determinants of relegation and promotion. Including control variables, my data comprises a set of 25 variables. The data is mainly taken from final tables of the respective seasons. Sources for the more recent seasons are accessible over the websites of the national soccer association and league administrators. Older tables are available from the following sources.

— England: "The Football League Match by Match" series (1892-1969) (Brown 2004-2007) and "Rothman's Football Yearbooks" (from 1970) (Rollin et al. 1969-2000)
— Germany: Kicker Magazine's website (www.kicker.de) and Soccer Database website (www.fußballdaten.de)

	Covariate	Description	Mean	Stand. dev.	Min	Max
Success history of club	title1	Number of championship titles in first tier since foundation of the respective first league	0.223	0.938	0	25
	Interaction: title1 x leagueage	Interaction term: title1 * leagueage	14.06	63.016	0	1875
	experience1	Years of experience in first tier since foundation of the respective first league	8.896	14.535	0	79
	Interaction: experience1 x leagueage	Interaction term: experience1 * leagueage	519.7	1117	0	8374
	title2	Number of championship titles in second tier	0.508	1.028	0	8
	Interaction: title2 x leagueage	Interaction term: title2 * leagueage	29.679	72.504	0	642
	experience2	Years of experience in second tier since foundation of the respective second league (=experience in second league / number of seasons)	12.024	10.918	0	69
	Interaction: experience2 x leagueage	Interaction term: experience2 * leagueage	662.64	900.65	0	7383
	pro1	Number of previous promotions of the club from second to first tier	1.296	1.899	0	11
	rel3	Number of previous relegations of the club from second to third tier	1.114	1.468	0	9
Club specific factors	proprev1	Team promoted in the previous season - 1 if the club was promoted in the previous season, 0 otherwise	0.161	0.367	0	1
	relprev1	Team relegated in the previous season - 1 if the club was relegated in the previous season, 0 otherwise	0.116	0.32	0	1
	otherteams	Other clubs from the same city in the first tier - 1 if there is a club from the same city in the first tier league in the same season, 0 otherwise	0.246	0.831	0	7
	bigcity	Club from a big city - 1 if the club is from a big city, 0 otherwise - big city if population was >100,000 in 2010 (≈ 50% of all clubs)	0.67	0.47	0	1
	forcedrel1	Forced relegation from first to second tier in the previous season - 1 if the club was forcibly relegated from the first to the second league in the previous season, 0 otherwise	0.002	0.041	0	1

Table 4-2 Variable description

Club specific factors	forcedrel2	Forced relegation from second to third in this season - 1 if the club is forcibly relegated from the second to the third league at the end of the current season, 0 otherwise	0.012	0.111	0	1
	reserveteam	Reserve team - 1 if the team is run as a reserve or farm team of a first tier club, 0 otherwise	0.012	0.109	0	1
League specific factors	league3prof	Third tier league professional - 1 if the third tier league is run professionally in the current season, 0 otherwise	0.512	0.5	0	1
	nrpro	Number of clubs being promoted from the second to the first league this season	2.694	0.713	0	6
	nrrel	Number of clubs being relegated from the second to the third league this season	4.122	3.607	0	33
	nrclubs	Number of clubs playing in the second league this season	24.232	7.949	10	60
	leagueage	Number of years since the foundation of the league	39.554	26.498	0	107
	england	Country dummy England - 1 if the club is from England, 0 otherwise	0.262	0.44	0	1
	germany	Country dummy Germany - 1 if the club is from Germany, 0 otherwise	0.096	0.295	0	1
	italy	Country dummy Italy - 1 if the club is from Italy, 0 otherwise	0.19	0.393	0	1
	spain	Country dummy Spain - 1 if the club is from Spain, 0 otherwise	0.203	0.403	0	1
	france	Country dummy France - 1 if the club is from France, 0 otherwise	0.206	0.404	0	1
	portugal	Country dummy Portugal - 1 if the club is from Portugal, 0 otherwise	0.042	0.2	0	1
Control variables	Interaction: bosman x small city	Interaction term: Bosman dummy (1 for all seasons since the Bosman ruling (since 1996), 0 otherwise) * Small city (1 if the club is from a small city, 0 otherwise - small city if population was <100,000 in 2010)	0.077	0.266	0	1
	Interaction: war5 x small city	Interaction term: War dummy (1 for the first five years after a league resumed after war time, 0 otherwise) * Small city (1 if the club is from a small city, 0 otherwise - small city if population was <100,000 in 2010)	0.026	0.158	0	1

Table 4-2 continued

	titel1	title1 x leagueage	experience1	experience1 x leagueage	titel2	title2 x leagueage	experience2	experience2 x leagueage	pro1	rel3	proprev1	relprev1	otherteams	bigcity	forcedrel1	forcedrel2	reserveteam	league3prof	nrpro	nrrel	nrclubs	leagueage	germany	italy	spain	france	portugal	bosman x small city	war5 x small city
titel1	1.00																												
title1 x leagueage	0.96	1.00																											
experience1	0.58	0.62	1.00																										
experience1 x leagueage	0.54	0.64	0.94	1.00																									
titel2	0.19	0.23	0.61	0.56	1.00																								
title2 x leagueage	0.23	0.30	0.65	0.69	0.92	1.00																							
experience2	0.06	0.12	0.36	0.42	0.48	0.54	1.00																						
experience2 x leagueage	0.12	0.20	0.44	0.55	0.46	0.60	0.92	1.00																					
pro1	0.20	0.24	0.68	0.65	0.82	0.81	0.60	0.58	1.00																				
rel3	-0.08	-0.06	0.00	0.05	0.12	0.17	0.58	0.56	0.21	1.00																			
proprev1	-0.07	-0.06	-0.15	-0.11	-0.11	-0.09	-0.16	-0.09	-0.14	0.09	1.00																		
relprev1	0.13	0.11	0.25	0.18	0.20	0.15	0.03	0.04	0.27	-0.04	-0.16	1.00																	
otherteams	-0.01	-0.01	0.03	0.04	0.00	0.02	0.08	0.12	0.02	0.01	-0.03	0.01	1.00																
bigcity	0.13	0.13	0.26	0.22	0.25	0.23	0.20	0.18	0.28	0.10	-0.09	0.10	0.20	1.00															
forcedrel1	0.11	0.10	0.05	0.04	0.01	0.01	-0.01	-0.01	0.01	-0.01	-0.02	0.11	0.00	0.00	1.00														
forcedrel2	-0.01	-0.02	-0.03	-0.04	-0.02	-0.03	-0.06	-0.05	-0.03	-0.05	0.03	0.00	0.00	-0.03	0.00	1.00													
reserveteam	-0.03	-0.03	-0.07	-0.05	-0.05	-0.04	-0.03	-0.02	-0.07	0.03	0.03	-0.04	0.19	0.07	0.00	0.03	1.00												
league3prof	0.18	0.20	0.33	0.35	0.27	0.34	0.49	0.54	0.34	0.34	-0.03	0.01	0.13	0.06	0.00	-0.05	0.02	1.00											
nrpro	0.03	0.04	0.10	0.11	0.15	0.18	0.20	0.24	0.20	0.26	0.02	0.05	-0.03	-0.02	0.00	-0.02	0.04	0.17	1.00										
nrrel	-0.06	-0.07	-0.13	-0.12	-0.07	-0.08	-0.14	-0.13	-0.10	-0.05	0.05	-0.04	-0.08	-0.10	-0.01	0.08	0.02	-0.12	0.09	1.00									
nrclubs	-0.03	-0.03	-0.11	-0.09	-0.08	-0.07	-0.12	-0.10	-0.11	-0.11	0.09	-0.08	-0.04	-0.12	-0.01	0.04	0.00	0.04	0.10	0.69	1.00								
leagueage	0.21	0.27	0.44	0.52	0.37	0.49	0.65	0.77	0.47	0.49	-0.03	0.04	0.15	0.13	0.00	-0.07	0.03	0.79	0.32	-0.16	-0.09	1.00							
germany	-0.05	-0.06	-0.09	-0.12	-0.09	-0.12	-0.18	-0.19	-0.11	-0.12	0.02	0.01	-0.04	0.11	-0.01	0.01	-0.04	-0.29	0.03	0.16	0.08	-0.30	1.00						
italy	-0.05	-0.06	-0.06	-0.08	-0.01	-0.02	-0.01	-0.04	0.06	0.15	0.05	0.03	-0.12	-0.07	0.04	-0.02	-0.05	-0.11	0.13	0.11	-0.07	-0.01	-0.16	1.00					
spain	-0.10	-0.10	-0.13	-0.13	0.05	0.01	-0.03	-0.05	0.02	0.11	0.06	-0.01	0.00	0.12	-0.02	0.01	0.21	-0.12	0.05	0.11	0.04	0.00	-0.17	-0.25	1.00				
france	0.02	-0.02	-0.08	-0.11	-0.03	-0.05	-0.06	-0.10	-0.07	-0.10	-0.02	-0.02	-0.11	-0.22	0.00	0.06	-0.05	0.16	0.09	0.03	0.25	-0.05	-0.17	-0.25	-0.26	1.00			
portugal	-0.05	-0.05	0.01	0.00	-0.09	-0.09	-0.15	-0.14	-0.09	-0.10	0.00	0.03	-0.04	-0.25	0.03	0.01	-0.02	-0.21	0.01	-0.05	-0.17	-0.23	-0.07	-0.10	-0.11	-0.11	1.00		
bosman x small city	-0.05	-0.05	-0.05	-0.03	-0.07	-0.06	-0.01	0.03	-0.05	0.04	0.03	0.00	-0.08	-0.41	0.01	0.00	-0.03	0.05	0.10	-0.07	-0.16	0.11	-0.04	-0.02	-0.07	0.02	0.44	1.00	
war5 x small city	-0.04	-0.04	-0.09	-0.07	-0.08	-0.07	-0.10	-0.10	-0.10	-0.06	0.06	-0.04	-0.05	-0.23	-0.01	0.04	-0.02	-0.13	-0.09	0.26	0.24	-0.15	-0.05	0.14	-0.01	-0.01	-0.03	-0.05	1.00

Table 4-3 Correlation table

— Italy: Italian soccer almanac: "Almanacco Illustrato del Calcio—La Storia 1898-2004" (Melegari 2005)
— Spain: Website of the "The Recreational Sport Soccer Statistics Foundation" (www.rsssf.com)
— France: Website of the "The Recreational Sport Soccer Statistics Foundation" (www.rsssf.com)
— Portugal: Online soccer database (www.fussballzz.de)

Table 4-2 provides a detailed description of the variables and Table 4-3 the correlation matrix.

Success history of club:
Clubs' long-term histories are an indicator of their level of experience and of today's potential. This is why I included six variables to measure the teams' success history. The first two variables include a club's former success in the first tier league, and the other four variables give information on the success in the second tier league. In addition to the number of second tier titles, I included the number of previous promotions. It appears from Table 4-3 that these two variables are positively correlated. There are three reasons for including both: first, often there are more teams than just the second tier champion promoted to first tier. Second, in some rare cases, no club—not even the champion—is promoted; and third, sometimes the best teams—including the champion—from the second league qualify for play-off games for the promotion. In this case, the champion may not win the play-offs. Since the leagues were founded at different points in time, I added four interaction terms by multiplying the titles/experience variables with league age. In general, I expect experience in the first and second league and championship titles in the first and second tier to have a positive effect on promotion and a negative effect on relegation. Regarding the interaction terms, I expect titles as well as experience in both leagues to have a decreasing effect on promotion and relegation. Previous promotions (relegations) should have a positive effect on future promotions. Table 4-4 shows the variables and the expected signs of the coefficients.

Club specific factors:
A number of variables related to recent sportive history and external influence factors are likely to influence success and failure. A promotion or relegation in the previous season should have a positive impact on relegation or promotion, respectively. This would be in line with the principle described as the ‘yoyo effect’ by Noll (2002). If there is already another team from the same city in the first tier league, I expect the impact on promotion to be negative. In line with earlier research on socio-economic determinants of sport performance (Jones and Ferguson 1988; Andreff 2001; Wallbrecht 2010), I expect clubs from larger cities to have increased (decreased) chances of being

promoted (relegated). The sources for the variable 'bigcity' are the official city homepages as well as the national statistical institutes that publish population data. If a forced relegation occurred in the previous season, I expect the clubs to be promoted again in the following season. In addition, I control for forced relegation in the respective season. Obviously, if a club is relegated as punishment or because of financial difficulties, then the probability of being relegated (promoted) increases (decreases) equals 100%. If a team is a reserve or farm team of a first tier club, I expect the chances of being promoted to be lower since the leagues' regulations prevent farm teams from being promoted to the same league as the first team. On the other hand, due to their link to first tier teams, farm teams are often better off financially than other second tier teams and therefore, I also expect the chances of relegation to be lower. The information regarding whether a team is a reserve/farm team was either given by league tables or could be found on the clubs' official homepages. Table 4-5 displays the variables and the expected signs of the coefficients.

Variable name	Expected impact on promotion	Expected impact on relegation
Number of championship titles in first tier	+	-
Number of experience in first tier	+	-
Number of championship titles in second tier	+	-
Number of experience in second tier	+	-
Interaction term: First tier titles x League age	-	+
Interaction term: First tier experience x League age	-	+
Interaction term: Second tier titles x League age	-	+
Interaction term: Second tier experience x League age	-	+
Number of previous promotions from second to first tier	+	-
Number of previous relegations from second to third tier	-	+

Table 4-4 Expected effect of success history of club variables

Variable name	Expected impact on promotion	Expected impact on relegation
Team promoted in the previous season	-	+
Team relegated in the previous season	+	-
Other clubs from the same city in the first tier	-	0
Club from a big city (>100.000 inhabitants in 2010 ≈ 50% of all clubs)	+	-
Forced relegation from first to second tier in the previous season	+	0
Forced relegation from second to third tier in this season	-	+
Reserve team	-	-

Table 4-5 Expected effect of club specific variables

League specific factors:

In addition to club specific factors there are a number of league specific ones which I expect to have an impact on the probabilities of promotion and relegation. If the third tier league is a professional one, meaning that players, coaches and management are professionals, then I expect the relegation chances to increase since the financial implications for a club being relegated from the second to the third tier are not as serious as they are if a team is relegated to the amateur level. The number of promotions, relegations, and clubs should have a significant impact on the promotion and relegation probabilities. More promotions (relegations) should increase the chances of promotion (relegation). More clubs in a league should decrease the chances of promotion and relegation since more teams compete for the same number of promotions/relegations. In addition, I controlled for league age, i.e., the number of years since the foundation of the respective league. I also included a dummy variable for each country. I do not expect these variables to have a significant impact on promotion or relegation. Table 4-6 displays the variables and the expected signs of the coefficients.

Variable name	Expected impact on promotion	Expected impact on relegation
Third tier league professional	0	+
Number of promotions this season	+	-
Number of relegations this season	-	+
Number of clubs this season	-	-
League age	0	0
Country dummy	0	0

Table 4-6 Expected effect of league specific variables

Control variables:

Finally, I added two more variables controlling for changes in the environment of the league. The interaction between the 'bosman dummy' (which equals 1 for all years since 1996 and 0 otherwise) and the 'small city' dummy is expected to have a negative (positive) effect on relegation (promotion) since better talent is available at a cheaper price from other countries’ player markets making the leagues more balanced. The interaction between the 'war' dummy (indicating the five years after an interruption of the league, due to war time) and the 'small city' dummy is also expected to have a negative (positive) effect on relegation (promotion). Small city teams could be able to use the external shock to catch up with bigger city clubs. Table 4-7 shows the variables and the expected signs of the coefficients.

Variable name	Expected impact on promotion	Expected impact on relegation
Interaction: bosman x small city	+	-
Interaction: war5 x small city	+	-

Table 4-7 Expected effect of the control variables

There are a number of other potential factors that are likely to have an impact on the probability of relegation and promotion such as club finances, player salaries and macro-economic factors such as GDP or unemployment. Many researchers have analyzed the impact of these factors on success in sport. Quirk and Fort (1999) first showed that there is a correlation between team salary and club performance for the NBA and NHL. Other authors extended the field of research to other major leagues in the U.S. (Forrest and Simmons 2002; Frick et al. 2002; Hall et al. 2002; Szymanski 2003; Wiseman and Chatterjee 2003). In Europe, several studies have shown the relationship between salary and team performance for soccer leagues (Lehmann and Weigand 1997; Szymanski and Smith 1997; Frick et al. 1999; Szymanski and Kuypers 1999; Szymanski 2000; Forrest and Simmons 2002; Hall et al. 2002; Forrest and Simmons 2004; Frick 2004). In addition, Frick (2004) showed that head coach salaries have a positive impact on team success in German 'Bundesliga.' Lehmann and Weigand (1997) found that the average age of players also affects team success. For the NHL, Jones and Ferguson (1988) showed that population size has a positive impact on team performance. On the other hand, they showed that per capita income has a negative effect, which led them to argue that hockey must be an inferior good. Wallbrecht (2010) showed that higher GDP, higher attendance, and more experience in the German 'Bundesliga' decrease the chances of being relegated while previous relegations increase the chances of being relegated again.

Due to the long time span of my study—e.g., England since 1892, Spain and Italy since 1929—variables to measure the factors discussed above are not available. Regional GDP, population size, and unemployment data are not available for all regions in all years. Financial data (e.g., club revenues, player salaries) has only been published in recent years (e.g., Deloitte's Football Money League (Deloitte 1998-2011) or German Kicker Magazine special editions (Kicker 1990-2011)). Annual reports are only available for clubs listed at the stock market.

4.4 Regression Model

Each season there is a population of clubs and at the end of each season some clubs leave this population, either by promotion or by relegation. The other clubs stay in the population and may leave the population at another point in time. In addition, clubs that are relegated from the first league or promoted from the third league are added to the population. For this kind of data, event history analysis (also called survival or duration analysis) can be used. It analyzes the determinants of the length of time until an event (promotion or relegation) occurs for each club in the six leagues. Survival analysis is based on the concept of a hazard function. The hazard gives the probability of the occurrence of an event at each point in time. The method of survival analysis was first introduced in medical research to analyze the time until the death of a patient. More recently, it was also used in the social sciences to determine e.g., the length of job spells (see, e.g., Cox 1972; Andersen and Gill 1982; Allison 1984; Cox and Oakes 1984). It has also been applied in sports economics research to examine quit decisions of baseball players by Ohkusa (1999; 2001), to analyze coach career durations in German 'Bundesliga' soccer by Barros, Frick and Passos (2009), and to investigate determinants of relegation from first tier soccer (Wallbrecht 2010; Frick and Wallbrecht 2012). Compared to traditional cross-section techniques such as OLS, Logit or Probit regression, duration analysis has several advantages: it can be used in the presence of right-censoring and it does not treat events at the beginning of a period as an event at the end of a period (see, e.g., Pérez et al. (2006) for a detailed analysis of the drawbacks of traditional models).

In my case, the event investigated with the survival analysis is leaving the second tier league. This can either be by relegation or by promotion. Since these events are mutually exclusive, I use a special case of survival analysis, the competing risks analysis, to analyze my data. In competing risk analysis, instead of the regular hazard, a cause specific hazard is estimated. The cause specific hazard for a cause j is the instantaneous failure rate from this cause in the presence of all other possible causes of failure.

$$\lambda_j(t) = \lim_{h \to 0} \left(\frac{Pr(t \leq T < t + h, C = j \mid T > t)}{h} \right)$$

From the cause specific hazards, a cumulative incidence (CI) function is derived that depends on all cause specific hazards. This CI for a specific cause is the probability of the occurrence of this cause until time t while being at risk of experiencing all other possible causes (Bakoyannis and Touloumi 2008).

$$F_j(t) = Pr(T \leq t, C = j) = \int_0^t \lambda_j(u)\, exp\left\{ -\int_0^u \sum_{c=1}^{k} \lambda_c(w)\, dw \right\} du, \qquad j = 1,2,\dots,k$$

Competing risks analysis, like survival analysis, was also first used in medical research to analyze different causes of death (Gichangi and Vach 2005). A historic example even dates back to Bernoulli's interest in estimating mortality rates (Kearns 1931). The first approach of analyzing competing risks was fitting two different regression models (Prentice et al. 1978; Kalbfleisch and Prentice 1980; Kay 1986). Obviously, having two different models makes it difficult to compare coefficients. Therefore, more complex models using Monte Carlo Simulation were introduced (Larson and Dinse 1985; Kuk 1992). Later Lunn and McNeil (1995) as well as Fine and Gray (1999) proposed different models that can be estimated using standard software.

I will use a model proposed by Lunn and McNeil (1995) to analyze my data. They use a data duplication method and Cox's proportional hazard regression model stratified by risk type δ to estimate the coefficients. The dataset is duplicated in such a way that each of the datasets is assigned to one cause of failure (in my case: one dataset for risk of promotion and one for risk of relegation). All other causes of failure are considered as being censored. With this model, the coefficients for both stratums are estimated simultaneously. Therefore, it is possible to estimate models where some covariates have the same effect on both risk types. The cause specific hazards, including the vector of covariates for a model with two competing risks, can be written as follows.

$$\lambda_1(t) = \lambda_{01}(t)\, exp(bx)$$

$$\lambda_2(t) = \lambda_{02}(t)\, exp(bx\; +\; \theta x)$$

where λ_{01}(t) and λ_{02}(t) are the baseline hazards for causes 1 and 2. b is a vector of regression coefficients and x is a vector of covariates. The hazards for causes 1 and 2 are different in their specific baseline hazard and the coefficient vector b differs by the vector θ. The partial likelihood for a Cox model stratified by risk type is

$$\prod_{t_i,\delta_i=0} \left(\frac{e^{bx_i}}{\sum_{R_i} e^{bx}} \right) \quad \prod_{t_i,\delta_i=1} \left(\frac{e^{bx_i+\theta x_i}}{\sum_{R_i} e^{bx+\theta x}} \right)$$

It is "treating the survival times of the two types of failure separately. In each case the risk set R_i consists of those subjects with the appropriate stratum identifier, $\delta_i = 0$ for the first cause and $\delta_i = 1$ for the second" (Lunn and McNeil 1995, p. 526).

As further specification of the model, I use single episode data. Each new appearance in the second league is treated as 'new' club. Therefore, I have 2577 observations but only 728 clubs. Models with multiple episodes for each club only change the baseline hazard (Wallbrecht 2010; Frick and Wallbrecht 2012). Since the baseline hazard is not specified by Cox models there is no need to use multiple episode data in my case. To address the issue of multiple episodes, I control for previous promotions and relegations with covariates.[45]

4.5 Regression Results

As described above, the Lunn and McNeil model estimates both competing risks (promotion and relegation) in one regression. Table 4-8 displays the regression results. I will discuss the results in the same order I presented the hypotheses.

Success history of club:

The results reveal that years of experience in the first tier league increase a club's chances of promotion and decrease its chances of relegation to almost the same extent. This is expected since first tier soccer is far more lucrative than second tier soccer. Clubs that played in the first tier are more likely to receive financing from different sources (e.g., sponsors, banks, private investors) even when playing in the second league. In addition, clubs that used to play in the first tier with higher revenues have money to invest in stadium and other infrastructure that gives them a competitive edge. One more year of experience increases (decreases) the hazard of being promoted (relegated) by 4% (3%). The interaction term between first league experience and league age is negative. This means that the effect of experience becomes less important with league age. This is to be expected, since the older the league, the more teams have experience and so the impact of more experience becomes less important. The interaction term for relegation is not significant.

Contrary to my expectation, first league titles have no significant impact on relegation or promotion. This can be attributed to the few occurrences in the sample. Only 59 of the 728 clubs that have played in the second league have also won a first league title before. In most cases, winning the championship lies in the distant past and therefore seems to have little effect on the present situation of the club.

[45] To my knowledge, there is currently no module in Stata available that is able to estimate competing risks models with multiple episode data.

	Covariate	Total: Promotion		Total: Relegation	
Success history of club	title1	0.043		-0.124	
		(0.100)		(0.204)	
	Interaction: title1 x leagueage[46]	-0.003		0.133	
		(0.143)		(0.268)	
	experience1	0.041	***	-0.033	***
		(0.009)		(0.012)	
	Interaction: experience1 x leagueage	-0.031	***	0.023	
		(0.012)		(0.016)	
	title2	0.009		0.108	
		(0.095)		(0.113)	
	Interaction: title2 x leagueage	-0.124		-0.141	
		(0.148)		(0.175)	
	experience2	-0.028	**	0.015	
		(0.013)		(0.011)	
	Interaction: experience2 x leagueage	0.049	***	-0.014	
		(0.019)		(0.016)	
	nrpro1	0.062	**	-0.017	
		(0.030)		(0.038)	
	nrrel3	-0.031		0.043	
		(0.035)		(0.031)	
Club specific factor	proprev1	-0.558	***	0.280	***
		(0.133)		(0.079)	
	relprev1	0.486	***	-0.629	***
		(0.080)		(0.134)	
	otherteams	0.088	**	-0.025	
		(0.040)		(0.042)	
	bigcity	0.448	***	-0.315	***
		(0.105)		(0.069)	
	forcedrel1	0.009		0.836	
		(0.480)		(0.727)	
	forcedrel2	-47.16		1.701	***
		(0.000)		(0.107)	
	reserveteam	-46.14		0.095	
		(0.000)		(0.209)	
League specific factor	league3prof	-0.037		0.059	
		(0.131)		(0.115)	
	nrpro	0.338	***	0.028	
		(0.052)		(0.045)	

Table 4-8 Overall regression results

[46] Regression coefficients and standard errors are multiplied by 100 for readability reasons.

	Covariate	Total	
		Promotion	Relegation
League specific factor	nrrel	0.014	0.080 ***
		(0.016)	(0.008)
	nrclubs	-0.028 ***	-0.023 ***
		(0.007)	(0.005)
	leagueage	-0.015 ***	0.010 ***
		(0.004)	(0.003)
	germany	-0.046	0.686 ***
		(0.159)	(0.133)
	italy	0.131	0.376 ***
		(0.134)	(0.115)
	spain	0.211	0.347 ***
		(0.129)	(0.109)
	france	0.150	0.127
		(0.123)	(0.114)
	portugal	-0.053	0.627 ***
		(0.218)	(0.192)
Control variable	Interaction: bosman x small city	0.482 ***	-0.319 ***
		(0.166)	(0.120)
	Interaction: war5 x small city	-0.150	-0.264 *
		(0.338)	(0.160)
	Observations	17,792	
	No of subjects	2,577	
	No of failures	2,491	
	LR chi2(56)	1,115	
	Prob > chi2	0	
	Log Likelihood	-11,525	

Table 4-8 continued

More experience in the second league has a significant negative impact on promotion. The interaction term with league age suggests that the effect becomes less negative for older leagues. This is unexpected but can be explained by a phenomenon stated by Hoehn and Szymanski (1999).

They show that if clubs are not promoted again in the first couple of years, then they are "trapped" in the second league. Dherbecourt and Drut (2009) find that experience in the second division is dependent on the tier level the team played in before the current second tier spell. Only experience after a relegation from the first league has a positive impact on promotion. For their small sample, it is easy to differentiate between experience after a promotion and experience after a relegation. There are two reasons why it is not possible for my data sample to differentiate in the same way: First, there are many teams in my sample that have experience after both a promotion and a relegation. Second, since my research includes the whole history of the leagues, the founding clubs' experience cannot be assigned to an origin state (i.e., experience after promotion or experience after relegation). The impact on relegation is not significant.

The only other significant coefficient in this group of variables is the number of previous promotions which is significant at the 10% level. Teams that had been promoted before increase their chances of being promoted again. The number of previous promotions has no significant effect on relegation. Other than expected, the results for the effect of second league titles is also not significant. There are no statistically significant results for previous relegations, either. As discussed before, I use single episode data. The effect of previous relegations and promotions might be accounted for in the baseline hazard but the baseline hazard is not estimated in a Cox model. Earlier research also shows that the number of previous relegations has no significant impact on future relegations (Frick and Wallbrecht 2012).

Club specific factor:

The fact that a club was relegated or promoted in the previous season has a statistically significant effect on the performance of the team. As expected, if a club was promoted from the third league, then its risk of being relegated is higher and its chances of being promoted again to the first league are lower. On the other hand, if a club was relegated from the first league, then the probability of it being promoted is higher and the probability of relegation into the third league are lower. The coefficients are significant at the 1% level and the hazard changes by up to 62%. These results extend earlier research by Hoehn and Szymanski (1999). They show that clubs are more likely to be promoted again in the first years following their demotion.

The next two variables are closely related and thus call for a common explanation. First, clubs from big cities with more than 100,000 inhabitants have increased (decreased) probabilities of being promoted (relegated) with a significance level of 1% each. In addition, another team from the same city that plays in the first league has a positive effect on promotion. The results are driven by large cities such as London, Manchester, Barcelona, Madrid, Milan, Rome, Munich, Hamburg, Paris and Porto. This result is unexpected and conflicts with earlier research by Kuper and Szymanski (2009) as well as Dherbecourt and Drut (2009). They show that other teams in the first league decrease chances of promotion. Their explanation is that the majority of revenues from attendance and merchandizing already go to the soccer club of the city that plays in the higher tier. Therefore, there is little consumer demand for a second club. I argue that very large cities can afford two or more teams and that the demand for soccer exceeds the soccer provided by one club only. Since city derbies are, in some cases, the main event of the year (Rome, Milan) and some clubs take advantage of synergies and even use the same stadium (Munich), first tier clubs can have an incentive to promote a second club from the same city in the same league.

I control for forced relegations from the second league with the covariate 'forcedrel2'. Both coefficients (for promotion) are significant at the 1% level. For a team that is forcibly relegated from the first league in the previous season, the influence on promotion and relegation is—contrary to expectations—not significant. This can be attributed to the fact that I cannot separate the different reasons for forced relegations. On the one hand, if a team is relegated because of financial difficulties, one would expect that this will decrease the quality of the talent pool as well. On the other hand, if a team is relegated because of e.g., match fixing charges, assuming that the quality of the team can be maintained, then an immediate return to the first league is likely (see Juventus Turin in 2006/07). Since the effects point in opposite directions, the results for this compound variable are non-significant. One can only speculate that the variables may be significant if the reasons for the forced relegation could be tracked. Due to the long time frame of my analysis, it is difficult to find the exact reason for each forced relegation. This could be a topic for future research.

In some countries, reserve or farm teams are (or have been) allowed to play in the second league by the national soccer associations (France and Spain). In the other leagues, farm teams are only allowed in lower leagues. No national soccer association allows both teams of one club in the same division. Therefore, the results of this variable are as expected. Being a reserve team is highly significant and decreases the probability of being promoted into the first league, i.e., the same league as the first team of the club by 100%. The impact on relegation to the third league is not significant.

League specific factor:[47]

The fact that the third tier league is a professional one does not have a significant impact on promotion or relegation. One explanation may be that even without the official professional status of the third league, many third leagues operate as if they were professional. Players and coaches receive salaries that allow them to focus on the sport without having to work another job. Therefore, the assumed financial implications may not be so serious even if the third league is not professional.[48]

[47] I also tested the competitive balance as a league specific variable, but it has no impact on promotion or relegation.

[48] I also tested if it has an effect on promotion and relegation whether a club that was promoted from a professional third tier league (vs. a club that was promoted from an amateur league). The effect is not statistically significant for relegation probability. However, the probability of promotion increases significantly.

The number of promotions, the number of relegations, and the number of clubs competing in a given season impact relegations and promotions in line with expectations. The more clubs are promoted, the higher the probability of promotion. The more clubs are relegated, the higher the chances of relegation. And if there are more clubs in the league, then the chances of both promotion and relegation are reduced significantly to almost the same extent.

The age of the league has a negative (positive) impact on promotion (relegation). For every year a league gets older, the hazard of promotion (relegation) decreases (increases) by 1-2%. Since the variable is used in four interaction terms, it is difficult to interpret the results for league age alone. The interaction terms are discussed above.

The country dummies are significant for relegation coefficients and insignificant for promotion coefficients. For Germany, Italy, Spain and Portugal, the relegation hazard is significantly higher than for England. We will discuss differences between the countries in the next chapter.

Control variable:
The interaction term between the 'Bosman dummy' (reflecting the time after the 'Bosman-ruling' of the European Court of Justice in December 1995) and the 'small city' variable (indicating clubs from cities with less than 100,000 inhabitants) has a significant and positive (negative) effect on promotion (relegation). If a club comes from a small city and the observation is after the 'Bosman-ruling,' its promotion (relegation) hazard changes by +62% (-27%). These results support earlier findings by Frick and Wallbrecht (2012). They argue that due to the liberalization of the labor market for soccer players and the lower income of players from e.g., Eastern European countries, it is easier for small market teams to sign high quality players from abroad that they would have been unable to sign before the 'Bosman-ruling.'

The interaction term between the 'small city' variable and the 'war5' variable, indicating the first five seasons after a league resumed after a war, decreases the relegation hazard by 23%. It is insignificant for the promotion hazard. In the time after a war, many leagues started with the same clubs. In some cases, leagues were extended to more clubs in the first year after the war and shrunk in the following years. Since I have already controlled for the number of clubs and number of relegations, this cannot be the explanation. I therefore argue that for most clubs, the war meant that they had to begin with a new team and probably a new management—eliminating factors such as previous experience and financial status due to recent success. Many players as well as managers died or were injured serving in their country's military, or they were simply too old to play afterwards. Therefore, the established ranking was mixed up and all teams including the yoyo teams from before the war, which usually came from smaller cities, had the chance to find new talent. Therefore, by 'leveling the playing field,' the chances of relegation decreased for small city clubs during that time.

4.6 Differences in Regression Results Between Countries

In addition to the overall model discussed in chapter 4.5, I estimate a number of separate country models. I insert interaction terms between different variables and the respective country dummies to identify differences between the countries (see Table 4-9 for the details on the new variables and Table 4-10 for the regression results).

To explain all differences between the six countries, a more detailed socio-economic analysis would be necessary. In this paper, I can only present the results of my analysis. Differences in e.g., the effect of big cities could be attributed to the fact that people in some countries are more attached to their home town even if they moved to a city generations before, while in other countries, people identify with a new city faster. Therefore, the support for smaller cities and countryside clubs deteriorates more or less quickly. This might be an interesting field for future research in sports economics. In the following paragraphs I will discuss the differences between the six countries.

Experience in first tier soccer has the same effect in all countries. The more experienced a club in the first league is, the higher (lower) its chances of being promoted (relegated). Almost all coefficients are significant. As the interaction term between experience and the country dummies show, there is no significant difference between England (as the base country for this analysis) and the other countries. As well as experience in first tier soccer, the effect of experience in second tier soccer is not different between the countries.

The coefficient for the number of previous promotions that is significant at a 10% level for the overall model is not significant in any of the individual countries. On the other hand, the coefficient for number of previous relegations is not significant in the overall model while in England it significantly decreases the promotion hazard and in Germany it significantly increases the relegation hazard. Both results are in line with my expectations.

	Interaction Covariate	Description	Mean	Stand. dev.	Min	Max
Team's success history	experience1 x england	Interaction term: (Years of experience in first tier since foundation of the respective first league) * (Country dummy - 1 if the club is from the respective country, 0 otherwise)	4.279	12.681	0	79
	experience1 x germany		0.458	2.923	0	42
	experience1 x italy		1.353	5.861	0	74
	experience1 x spain		1.067	4.715	0	68
	experience1 x france		1.353	5.568	0	56
	experience1 x portugal		0.385	3.156	0	72
	experience2 x england	Interaction term: (Years of experience in second tier since foundation of the respective second league) * (Country dummy - 1 if the club is from the respective country, 0 otherwise)	4.460	9.985	0	69
	experience2 x germany		0.585	2.524	0	26
	experience2 x italy		2.254	6.451	0	52
	experience2 x spain		2.323	6.485	0	49
	experience2 x france		2.230	6.089	0	41
	experience2 x portugal		0.171	1.112	0	18
Team specific	proprev1 x england	Interaction term: (Team promoted in the previous season - 1 if the club was promoted in the previous season, 0 otherwise) * (Country dummy - 1 if the club is from the respective country, 0 otherwise)	0.028	0.165	0	1
	proprev1 x germany		0.018	0.131	0	1
	proprev1 x italy		0.037	0.190	0	1
	proprev1 x spain		0.041	0.199	0	1
	proprev1 x france		0.030	0.171	0	1
	proprev1 x portugal		0.006	0.080	0	1
	relprev1 x england	Interaction term: (Team relegated in the previous season - 1 if the club was relegated in the previous season, 0 otherwise) * (Country dummy - 1 if the club is from the respective country, 0 otherwise)	0.027	0.163	0	1
	relprev1 x germany		0.012	0.110	0	1
	relprev1 x italy		0.025	0.157	0	1
	relprev1 x spain		0.023	0.149	0	1
	relprev1 x france		0.021	0.145	0	1
	relprev1 x portugal		0.007	0.082	0	1
	otherteams x england	Interaction term: (Other clubs from the same city in the first tier - 1 if there is a club from the same city in the first tier league in the same season, 0 otherwise) * (Country dummy - 1 if the club is from the respective country, 0 otherwise)	0.153	0.762	0	7
	otherteams x germany		0.015	0.124	0	2
	otherteams x italy		0.008	0.094	0	2
	otherteams x spain		0.051	0.302	0	3
	otherteams x france		0.014	0.149	0	3
	otherteams x portugal		0.004	0.070	0	2
	bigcity x england	Interaction term: (Club from a big city - 1 if the club is from a big city, 0 otherwise - big city if population was >100,000 in 2010 (≈ 50% of all clubs)) * (Country dummy - 1 if the club is from the respective country, 0 otherwise)	0.215	0.411	0	1
	bigcity x germany		0.080	0.272	0	1
	bigcity x italy		0.115	0.320	0	1
	bigcity x spain		0.159	0.365	0	1
	bigcity x france		0.096	0.295	0	1
	bigcity x portugal		0.005	0.069	0	1

Table 4-9 Additional variable description

	Covariate	Description	Mean	Stand. dev.	Min	Max
Control	bosman x small city x england	Interaction term: (Bosman dummy (1 for all seasons since the Bosman ruling (since 1996), 0 otherwise)) * (Small city (1 if the club is from a small city, 0 otherwise - small city if population was <100,000 in 2010)) * (Country dummy - 1 if the club is from the respective country, 0 otherwise)	0.007	0.083	0	1
	bosman x small city x germany		0.005	0.068	0	1
	bosman x small city x italy		0.013	0.112	0	1
	bosman x small city x spain		0.008	0.088	0	1
	bosman x small city x france		0.018	0.132	0	1
	bosman x small city x portugal		0.027	0.161	0	1
	war5 x small city x england	Interaction term: (War dummy (1 for the first five years after a league resumed after war time, 0 otherwise)) * (Small city (1 if the club is from a small city, 0 otherwise - small city if population was <100,000 in 2010)) * (Country dummy - 1 if the club is from the respective country, 0 otherwise)	0.021	0.145	0	1
	war5 x small city x germany		0.000	0.000	0	0
	war5 x small city x italy		0.009	0.092	0	1
	war5 x small city x spain		0.010	0.099	0	1
	war5 x small city x france		0.007	0.085	0	1
	war5 x small city x portugal		0.000	0.000	0	0

Table 4-9 continued

The coefficients for being promoted or relegated in the previous season are similar between the country models and the overall model discussed in chapter 4.5. Most coefficients are significant and all coefficients point in the expected direction. Having been promoted recently increases (decreases) the relegation (promotion) hazard while having been relegated recently increases (decreases) the promotion (relegation) hazard. The interaction terms do not show any differences between the countries for clubs that have been relegated from the first league in the previous season. That is surprising because especially in England, demoted clubs receive larger shares of the TV revenues as a 'parachute' so they do not have to sell all their players when being relegated (James 2006). On the other hand, clubs that have been promoted from the third division have significantly higher chances of being relegated in Germany, France and Portugal compared to England. The reason could be that the third tier leagues have less financial backing than the respective second tier leagues. In Germany, a professional third league was established as late as 2008 and in Portugal, the third division is still operating at an amateur level. In Italy, Spain and England the third league has been professional at least since the 1970s. Teams that are promoted from the amateur to the professional level are more likely to be relegated again.

The fact that other teams from the same city have a positive effect on promotion cannot be supported by the results for all countries. Only in England and Italy is the coefficient significant. The coefficients for England can be explained by the fact that in England almost 25% of all events (promotion or relegation) happened to teams from cities with other clubs in the first league, compared to 5-15% in the other countries. In Italy, almost 50% of the teams that played in a city with another first division club were either promoted or relegated. The most interesting finding is that in

Italy, another club in the same city increases both the promotion and the relegation hazard. The results for the impact on the relegation hazard are significant at the 10% level only.

The results for teams from big cities are similar and significant across the countries. Only the coefficients for Portugal show no significant results. This may be due to the fact that Portugal has only eight cities with more than 100,000 inhabitants. The interaction terms between the 'bigcity' variable and the country dummies show that the effect on the promotion hazard is much smaller in Italy than it is in England. There is no difference between England and the other countries (except for Portugal where the results from the separate country model show insignificant results).

The results for a forced relegation from the first league are in line with the overall model. However, the sample size is very small in all countries—e.g., the Italian league has the most forced relegations, with eight. Therefore, the results are either insignificant because the sample size is just too small or highly significant because e.g., in France all three teams[49] that suffered forced relegation stayed at least two seasons in the second league and were neither promoted nor relegated in the season following the forced relegation.

The league specific variables are either insignificant or show the same results in all countries, as in the overall model. The coefficients of the country dummies are still significant for some of the leagues. These differences between the leagues are not explained by any other variable. Future research should focus on explaining those differences with more detailed analysis on the country specific factors.

The results from the overall model, that small city teams benefit more from the 'Bosman-ruling' than do big city teams, cannot be supported by the more detailed country analysis. In the individual country analyses, only the promotion hazards in England and Spain are significantly and positively affected by that variable.

The same is true for the result that small city teams benefit from a war break more so than are big city teams. In the individual country analysis, only Spain shows a significant result for the promotion hazard.

[49] Lyon OU 1946, FC Rouen 1970, Olympique de Marseille in 1994.

	Total		Country total		England		Germany		Italy		Spain		France		Portugal	
	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation
title1	0.043	-0.124	0.022	-0.131	0.091	-0.054	0.013	0.214	0.032	-0.195	0.146	-0.797	-0.022	0.045	-0.974	22.290 ***
	(0.100)	(0.204)	(0.101)	(0.209)	(0.068)	(0.111)	(0.155)	(0.343)	(0.059)	(0.219)	(0.136)	(1.015)	(0.056)	(0.106)	(0.000)	(0.000)
Interaction: title1 x leagueage	-0.003	0.133	0.018	0.146												
	(0.143)	(0.268)	(0.145)	(0.272)												
experience1	0.041***	-0.033***	0.043***	-0.032*	0.013*	-0.017*	0.052***	-0.050**	0.019**	-0.007	0.027**	-0.040**	0.037***	-0.033*	0.025**	-0.014
	(0.009)	(0.012)	(0.012)	(0.018)	(0.007)	(0.010)	(0.016)	(0.022)	(0.009)	(0.013)	(0.012)	(0.019)	(0.013)	(0.018)	(0.010)	(0.015)
Interaction: experience1 x leagueage	-0.031***	0.023	-0.029**	0.019												
	(0.012)	(0.016)	(0.014)	(0.020)												
Interaction: experience1 x germany			0.013	-0.007												
			(0.012)	(0.018)												
Interaction: experience1 x italy			-0.009	-0.004												
			(0.007)	(0.011)												
Interaction: experience1 x spain			-0.004	-0.020												
			(0.008)	(0.015)												
Interaction: experience1 x france			0.002	0.004												
			(0.007)	(0.012)												
Interaction: experience1 x portugal			-0.005	0.011												
			(0.010)	(0.015)												
title2	0.009	0.108	0.001	0.080	0.077	0.145	0.157	-0.103	-0.238**	-0.052	-0.143*	-0.014	-0.090	-0.005	0.372	-0.511
	(0.095)	(0.113)	(0.098)	(0.116)	(0.092)	(0.127)	(0.224)	(0.264)	(0.100)	(0.116)	(0.084)	(0.103)	(0.118)	(0.144)	(0.416)	(0.568)
Interaction: title2 x leagueage	-0.124	-0.141	-0.110	-0.114												
	(0.148)	(0.175)	(0.152)	(0.179)												
experience2	-0.028**	0.015	-0.029*	0.028*	0.017	0.003	0.029	0.001	-0.004	0.015	0.026	0.013	-0.019	0.010	0.029	0.093
	(0.013)	(0.011)	(0.017)	(0.015)	(0.011)	(0.009)	(0.045)	(0.028)	(0.013)	(0.013)	(0.017)	(0.015)	(0.016)	(0.013)	(0.081)	(0.095)
Interaction: experience2 x leagueage	0.049***	-0.014	0.046**	-0.028												
	(0.019)	(0.016)	(0.021)	(0.019)												
Interaction: experience2 x germany			0.002	-0.012												
			(0.023)	(0.019)												

Table 4-10 Country specific regression results

	Total		Country total		England		Germany		Italy		Spain		France		Portugal	
	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation
Interaction: experience2 x italy			0.007	-0.012												
			(0.010)	(0.010)												
Interaction: experience2 x spain			0.015	-0.005												
			(0.011)	(0.010)												
Interaction: experience2 x france			-0.001	-0.009												
			(0.012)	(0.011)												
Interaction: experience2 x portugal			0.026	-0.048												
			(0.050)	(0.046)												
nrpro1	0.062**	-0.017	0.044	0.019	0.016	-0.092	0.027	0.175	-0.003	-0.001	0.067	0.018	0.072	0.097	-0.425	0.441
	(0.030)	(0.038)	(0.033)	(0.042)	(0.091)	(0.107)	(0.168)	(0.183)	(0.058)	(0.069)	(0.064)	(0.088)	(0.102)	(0.124)	(0.329)	(0.360)
nrrel3	-0.031	0.043	-0.037	0.042	-0.213**	-0.090	0.196	0.326**	-0.058	0.115	-0.014	-0.016	0.069	0.005	-0.626	0.307
	(0.035)	(0.031)	(0.038)	(0.034)	(0.101)	(0.084)	(0.214)	(0.130)	(0.076)	(0.074)	(0.071)	(0.066)	(0.093)	(0.077)	(0.414)	(0.311)
proprev1	-0.558***	0.280***	-0.163	-0.117	-0.299	0.001	-0.695	0.339	-0.626**	0.156	-0.657**	0.272*	-0.471	0.624***	-0.209	0.846**
	(0.133)	(0.079)	(0.272)	(0.219)	(0.308)	(0.256)	(0.482)	(0.211)	(0.261)	(0.168)	(0.296)	(0.161)	(0.343)	(0.199)	(0.623)	(0.415)
relprev1	0.486***	-0.629***	0.412**	-0.525	0.342*	-0.656**	0.667**	-0.518	0.519***	-0.588**	0.487***	-0.989***	0.472**	-0.454	1.042**	-1.048*
	(0.080)	(0.134)	(0.165)	(0.320)	(0.178)	(0.324)	(0.293)	(0.362)	(0.176)	(0.254)	(0.187)	(0.337)	(0.197)	(0.340)	(0.409)	(0.607)
Interaction: proprev1 x germany			-0.670	0.685**												
			(0.511)	(0.274)												
Interaction: proprev1 x italy			-0.443	0.318												
			(0.365)	(0.255)												
Interaction: proprev1 x spain			-0.518	0.249												
			(0.379)	(0.249)												
Interaction: proprev1 x france			-0.283	0.620**												
			(0.407)	(0.265)												
Interaction: proprev1 x portugal			-0.384	0.741**												
			(0.607)	(0.372)												
Interaction: relprev1 x germany			0.047	0.115												
			(0.299)	(0.476)												

Table 4-10 continued

	Total		Country total		England		Germany		Italy		Spain		France		Portugal	
	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation
Interaction: relprev1 x italy			0.115	-0.058												
			(0.228)	(0.401)												
Interaction: relprev1 x spain			0.049	-0.485												
			(0.234)	(0.459)												
Interaction: relprev1 x france			0.009	0.018												
			(0.244)	(0.456)												
Interaction: relprev1 x portugal			0.288	-0.193												
			(0.362)	(0.561)												
otherteams	0.088**	-0.025	0.119***	-0.076	0.146***	-0.093*	-0.020	-0.213	0.633**	0.503*	-0.016	0.037	-0.215	0.200	0.017	0.025
	(0.040)	(0.042)	(0.045)	(0.054)	(0.047)	(0.056)	(0.316)	(0.261)	(0.284)	(0.284)	(0.153)	(0.102)	(0.244)	(0.185)	(0.417)	(0.494)
Interaction: otherteams x germany			-0.159	-0.199												
			(0.308)	(0.256)												
Interaction: otherteams x italy			0.141	0.613**												
			(0.265)	(0.289)												
Interaction: otherteams x spain			-0.036	0.077												
			(0.141)	(0.111)												
Interaction: otherteams x france			-0.362	0.264												
			(0.246)	(0.181)												
Interaction: otherteams x portugal			-0.144	0.155												
			(0.399)	(0.394)												
bigcity	0.448***	-0.315***	0.962***	-0.290*	1.196***	-0.341*	1.332*	-0.478**	0.050	-0.279*	1.177***	-0.305**	0.568***	-0.212	-0.420	0.154
	(0.105)	(0.069)	(0.323)	(0.175)	(0.343)	(0.194)	(0.732)	(0.206)	(0.184)	(0.144)	(0.379)	(0.151)	(0.200)	(0.175)	(0.609)	(0.578)
Interaction: bigcity x germany			0.285	-0.185												
			(0.796)	(0.261)												
Interaction: bigcity x italy			-0.923**	0.016												
			(0.370)	(0.225)												
Interaction: bigcity x spain			0.287	0.112												
			(0.494)	(0.228)												

Table 4-10 continued

	Total		Country total		England		Germany		Italy		Spain		France		Portugal	
	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation
Interaction: bigcity x france			-0.407	-0.049												
			(0.373)	(0.238)												
Interaction: bigcity x portugal			-1.224*	0.366												
			(0.632)	(0.557)												
forcedrel1	0.009	0.836	0.081	0.735	2.137	-41.70	omitted	omitted	0.220	0.674	omitted	omitted	-38.93	-37.13	-44.34	-17.72***
	(0.480)	(0.727)	(0.480)	(0.742)	(1.431)	(0.000)			(0.623)	(1.060)			(4E+08)	(3E+08)	(0.000)	(1.976)
forcedrel2	-47.16	1.701***	-46.53	1.754***	-43.68	2.750***	-44.75	1.707***	-32.51	1.565***	-44.24	1.391***	-38.33	2.394***	-45.10	3.108***
	(0.000)	(0.107)	(0.000)	(0.113)	(0.000)	(0.658)	(0.000)	(0.331))	(7E+06)	(0.300)	(0.000)	(0.277)	(9E+07)	(0.214)	(0.000)	(0.799)
reserveteam	-46.14	0.095	-46.46	-0.059	omitted	omitted	omitted	omitted	omitted	omitted	-46.02	0.011	1.138	-0.635	omitted	omitted
	(0.000)	(0.209)	(0.000)	(0.240)							(0.000)	(0.257)	(7E+08)	(0.786)		
league3prof	-0.037	0.059	-0.039	0.054	-0.221	0.465	-0.098	0.017	0.003	0.179	0.154	-0.444*	0.323	0.966*	omitted	omitted
	(0.131)	(0.115)	(0.134)	(0.117)	(0.373)	(0.378)	(0.748)	(0.601)	(0.346)	(0.287)	(0.329)	(0.265)	(0.676)	(0.551)		
nrpro	0.338***	0.028	0.359***	0.014	0.456**	-0.051	0.536	-0.067	0.308**	0.119	0.432***	0.050	0.363***	-0.006	2.019	-4.275
	(0.052)	(0.045)	(0.055)	(0.046)	(0.210)	(0.210)	(0.393)	(0.295)	(0.129)	(0.106)	(0.115)	(0.090)	(0.130)	(0.124)	(3.542)	(3.496)
nrrel	0.014	0.080***	0.006	0.082***	0.048	0.609***	0.003	0.060***	-0.005	0.073***	-0.005	0.109***	0.028	0.157***	0.522	-0.957
	(0.016)	(0.008)	(0.017)	(0.009)	(0.155)	(0.170)	(0.049)	(0.023)	(0.031)	(0.014)	(0.043)	(0.023)	(0.046)	(0.031)	(1.104)	(1.072)
nrclubs	-0.028***	-0.023***	-0.023***	-0.023***	-0.041	-0.046	-0.032	-0.027	-0.024	-0.024**	-0.032*	-0.040***	-0.040	-0.047**	-0.755	2.298
	(0.007)	(0.005)	(0.008)	(0.006)	(0.076)	(0.084)	(0.032)	(0.024)	(0.019)	(0.012)	(0.017)	(0.012)	(0.026)	(0.019)	(2.179)	(2.110)
leagueage	-0.015***	0.010***	-0.017***	0.011***	-0.008	0.004	-0.039	0.010	-0.023**	-0.002	-0.020**	0.014**	-0.023	0.005	0.061	-0.054
	(0.004)	(0.003)	(0.004)	(0.003)	(0.008)	(0.007)	(0.028)	(0.022)	(0.010)	(0.007)	(0.009)	(0.006)	(0.014)	(0.010)	(0.076)	(0.080)
germany	-0.046	0.686***	-0.434	0.817***												
	(0.159)	(0.133)	(0.800)	(0.280)												
italy	0.131	0.376***	0.985***	0.426**												
	(0.134)	(0.115)	(0.367)	(0.213)												
spain	0.211	0.347***	-0.157	0.376*												
	(0.129)	(0.109)	(0.490)	(0.219)												
france	0.150	0.127	0.590	0.081												
	(0.123)	(0.114)	(0.373)	(0.215)												

Table 4-10 continued

	Total		Country total		England		Germany		Italy		Spain		France		Portugal	
	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation	Promotion	Relegation
portugal	-0.053	0.627***	0.736	0.592*												
	(0.218)	(0.192)	(0.463)	(0.340)												
Interaction: bosman x small city	0.482***	-0.319***	0.988	-0.494	1.658***	-0.701	1.125	-0.612	0.054	0.148	1.514***	-0.217	0.545	-0.169	-0.169	0.164
	(0.166)	(0.120)	(0.615)	(0.432)	(0.624)	(0.444)	(0.928)	(0.425)	(0.371)	(0.271)	(0.582)	(0.302)	(0.387)	(0.322)	(0.574)	(0.595)
Interaction: bosman x small city x germany			-0.246	0.026												
			(1.083)	(0.562)												
Interaction: bosman x small city x italy			-0.705	0.299												
			(0.682)	(0.478)												
Interaction: bosman x small city x spain			0.477	0.219												
			(0.801)	(0.502)												
Interaction: bosman x small city x france			-0.325	0.285												
			(0.677)	(0.487)												
Interaction: bosman x small city x portugal			-1.041	0.214												
			(0.724)	(0.539)												
Interaction: war5 x small city	-0.150	-0.262	-0.190	-0.249	0.458	0.511	omitted	omitted	-0.260	-0.065	-44.08	-0.565	0.153	0.410	omitted	omitted
	(0.338)	(0.160)	(0.350)	(0.176)	(1.073)	(0.479)			(0.580)	(0.294)	(0.000)	(0.352)	(0.562)	(0.454)		
Interaction: war5 x small city x germany			omitted	omitted												
Interaction: war5 x small city x italy			-0.023	-0.126												
			(0.454)	(0.297)												
Interaction: war5 x small city x spain			0.030	-0.233												
			(0.336)	(0.249)												
Interaction: war5 x small city x france			-0.067	-0.320												
			(0.386)	(0.471)												
Interaction: war5 x small city x portugal			omitted	omitted												
Observations	17,792		17,792		4,668		1,714		3,386		3,620		3,664		740	
No of subjects	2,577		2,577		503		302		576		581		480		135	
No of failures	2,491		2,491		486		289		561		566		466		123	
LR chi2(56)	1,115		1,190		201		159		186		243		323		64	
Prob > chi2	0.000		0.000		0.000		0.000		0.000		0.000		0.000		0.000	
Log Likelihood	-11,525		-11,487		-1,407		-926		-1,728		-1,786		-1,455		-357	

Table 4-10 continued

4.7 Promotion and Relegation Forecasts

In many business contexts, potential chances and risks are often detected too late. Early warning systems as suggested by Müller-Merbach (1977) have been established and have helped companies to detect risks early on. In soccer clubs, early warning systems could be similarly helpful. Each year there are different teams in the second league. Up to 1/3 of the teams are exchanged by promotion and relegation. The clubs' chances of promotion and risks of relegation can be higher or lower, depending on the relative advantages of their competitors. If e.g., three particularly strong teams are relegated from the first division, then chances of promotion are lower for all other teams in the second division. Knowing about these increased risks and chances can be useful to clubs. Saving money in seasons where chances of promotion (risks of relegation) are low and investing in another seasons when the chances are better (risks are higher) could boost a clubs' success. In addition, short-term reactions are very difficult in the soccer business since players can only be transferred twice a year during the so-called transfer windows or transfer periods. And during the winter transfer period there are not many players on the market. Therefore, early warning systems are even more crucial in soccer.

In this section, I will discuss a promotion and relegation forecast calculated from the regression results that can help soccer clubs identify chances of promotion and risks of relegation before a season starts. It also gives them information for the summer transfer period. I used the country specific regression results shown in chapter 4.6 to calculate the forecast. Table 4-11 shows the promotion forecast for the season 2010/2011 and Table 4-12 shows the relegation forecast for the same season.

There are three columns for each country showing the club's name, their actual final ranking in the season, and the survival hazard increase or decrease, given their characteristics at the beginning of the season. The teams are ordered by hazard change, beginning with the teams that have the highest hazard increase. In both forecast tables, the clubs that where actually promoted/relegated are typed in bold font. The thick line divides the teams above and below the mean hazard change. The shaded areas show the 90% confidence intervals around the mean hazard change.

If being above the average hazard change is regarded as an early warning signal, then seven out of 16 promotions and eight out of 18 relegations are predicted correctly by the forecast model. Including a confidence interval at the 90% level around the mean hazard change, it can be seen that almost all teams are within this interval. This is in line with Dherbecourt and Drut (2009), who find that for second league clubs "almost each club stands a chance to finish in the upper level."

There are limitations to the forecast model: only the promotion forecasts in Spain and Italy and the relegation forecasts in Germany and Spain are quite accurate. More than half of the promoted teams are above the mean hazard change. In addition, in Germany, VfL Bochum's final ranking was third place and they were not promoted because they lost the relegation game against Borussia Mönchengladbach. Otherwise, the two top teams from the German promotion forecast would have been promoted. To compare the forecast and the regression results I use the Nagelkerke (1991) predictor as a measure for the predictive power of the regression.

$$\rho_n^2 = 1 - exp\left(\frac{X^2}{n}\right)$$

to define the strength of dependence of outcome on the predictors. Since this predictor is negatively correlated with the proportion of censored observations, O'Quigley et al. (2005) proposed a measure that includes uncensored observations instead of total observations. Since the number of censored observations is limited, I use Nagelkerke's predictor for the comparison. It can be interpreted similarly to R-squared in linear models as the percentage of the variance of the dependent variable that is explained by the independent variables (see Table 4-13 for the results).

Table 4-13 displays that only a small portion of the variance is explained by the variables included in the model. Therefore, promotions and relegations are not predicted perfectly by my regression models. These results point to the fact that some relevant determinants may be missing in the analysis, i.e., financial data on the clubs, player strength, and so forth. As explained above, these factors were not available for the long time span of my model.

England			Germany			Italy			Spain			France			Portugal		
Club	Hazard change	Final ranking	Club	Hazard change	Final ranking	Club	Hazard change	Final ranking	Club	Hazard change	Final ranking	Club	Hazard change	Final ranking	Club	Hazard change	Final ranking
Leicester City F.C.	21.25	10	VfL Bochum	33.78	3	Torino	-0.05	8	Real Valladolid CF	13.02	7	FC Metz	4.46	17	Belenenses	-0.983	13
Burnley F.C.	20.07	8	**Hertha BSC**	27.51	1	**Atalanta Bergamo**	-0.66	1	RC Celta de Vigo	12.61	6	FC Nantes	1.49	13	Leixões	-0.991	6
Derby County F.C.	15.83	19	Karlsruher SC	16.79	15	**AC Siena**	-0.7	2	**Real Betis**	9.62	1	CS Sedan-Ardennes	0.55	5	**Gil Vicente**	-0.996	1
Nottingham Forest F.C.	12.38	6	MSV Duisburg	12.69	8	AS Livorno	-0.73	7	CD Tenerife	8.06	20	SC Nîmes	0.36	19	Trofense	-0.997	3
Middlesbrough F.C.	11.51	12	Arminia Bielefeld	10.95	18	Sassuolo	-0.75	16	**Rayo Vallecano**	5.05	2	Le Mans UC	0.23	4	Santa Clara	-0.998	9
Sheffield United F.C.	10.25	23	TSV 1860 München	10.04	9	Grosseto	-0.75	15	Elche CF	4.89	4	Le Havre AC	0.11	9	Arouca	-0.998	5
Crystal Palace F.C.	10.14	20	Fortuna Düsseldorf	9.07	7	Frosinone Calcio	-0.75	22	UD Salamanca	4.54	19	SCO Angers	0.07	6	Estoril	-0.998	10
Portsmouth F.C.	10.02	16	Rot-Weiß Oberhausen	5.31	17	FC Empoli	-0.75	9	UD Las Palmas	3.67	15	FC Grenoble	0.01	20	D. Aves	-0.998	8
Leeds United A.F.C.	9.42	7	Alemannia Aachen	3.69	10	Reggina	-0.76	6	Recreativo Huelva	2.87	12	Stade de Reims	-0.05	10	Penafiel	-0.998	12
Preston North End F.C.	8.56	22	VfL Osnabrück	2.6	16	AlbinoLeffe	-0.76	18	Xerez CD	2.65	8	US Boulogne	-0.16	8	Oliveirense	-0.998	4
Queens Park R. F.C.	8.08	1	**FC Augsburg**	2.52	2	US Triestina	-0.77	20	Córdoba CF	2.27	16	Stade Lavallois	-0.18	15	Fátima	-0.999	16
Ipswich Town F.C.	7.11	13	FSV Frankfurt	2.35	13	AS Cittadella	-0.77	14	CD Numancia	2.12	10	**AC Ajaccio**	-0.2	2	Varzim	-0.999	15
Barnsley F.C.	4.54	17	SpVgg Greuther Fürth	2.29	4	FC Crotone	-0.78	11	Girona FC	1.78	11	Clermont Foot	-0.28	7	**Feirense**	-0.999	2
Watford F.C.	4.52	14	FC Energie Cottbus	1.51	6	Calcio Padova	-0.81	5	Gimnàstic Tarragona	1.63	18	Tours FC	-0.29	12	Freamunde	-0.999	11
Coventry City F.C.	4.32	18	SC Paderborn 07	1.43	12	Ascoli Calcio	-0.81	17	Albacete Balompié	1.58	22	FC Istres	-0.33	11	Moreirense	-0.999	7
Norwich City F.C.	3.6	2	1. FC Union Berlin	0.94	11	Piacenza	-0.83	19	**Granada CF**	1.12	5	Vannes	-0.33	18	Sporting da Covilhã	-1	14
Scunthorpe United F.C.	2.64	24	FC Ingolstadt 04	-0.11	14	Vicenza Calcio	-0.84	12	SD Huesca	1.11	14	AS Troyes	-0.33	16			
Cardiff City F.C.	2.2	4	FC Erzgebirge Aue	-0.18	5	Portogruaro	-0.86	21	FC Cartagena	0.47	13	**Dijon FCO**	-0.37	3			
Swansea City A.F.C.	2.09	3				FC Modena	-0.87	10	SD Ponferradina	0.05	21	LB Châteauroux	-0.55	14			
Hull City A.F.C	2.06	11				**Novara**	-0.9	3	Alcorcón	-0.25	9	**CS Thonon**	-0.6	1			
Millwall F.C.	1.67	9				Pescara Calcio	-0.92	13	FC Barcelona B	-1	3						
Reading F.C.	1.42	5				AS Varese	-0.94	4	Villarreal B	-1	17						
Doncaster Rovers F.C.	1.19	21															
Bristol City F.C.	0.81	15															

Table 4-11 Promotion forecast

England			Germany			Italy			Spain			France			Portugal		
Club	Hazard change	Final ranking	Club	Hazard change	Final ranking	Club	Hazard change	Final ranking	Club	Hazard change	Final ranki	Club	Hazard change	Final ranking	Club	Hazard change	Final ranking
Reading F.C.	1.34	5	VfL Osnabrück	3.23	16	FC Modena	1.36	10	FC Barcelona B	0.79	3	AS Troyes	4.07	16	D. Aves	1E+12	8
Swansea City A.F.C.	1.15	3	**Rot-Weiß Oberhausen**	0.78	17	**Pescara Calcio**	1.23	13	SD Ponferradina	0.53	21	CS Thonon	2.95	1	Moreirense	8E+11	7
Ipswich Town F.C.	0.84	13	FC Augsburg	0.56	2	**AS Varese**	1.2	4	**Alcorcón**	0.4	9	Stade de Reims	2.12	10	**Varzim**	8E+11	15
Norwich City F.C.	0.79	2	FSV Frankfurt	0.26	13	Novara	1.09	3	Girona FC	0.34	11	LB Châteauroux	1.86	14	Penafiel	7E+11	12
Scunthorpe United F.C.	0.71	24	FC Ingolstadt 04	0.13	14	FC Empoli	0.91	9	**Recreativo Huelva**	0.3	12	FC Istres	1.43	11	Feirense	7E+11	2
Coventry City F.C.	0.52	18	SC Paderborn 07	0.12	12	Calcio Padova	0.86	5	Villarreal B	0.24	17	Tours FC	1.36	12	Sporting da Covilhã	5E+11	14
Bristol City F.C.	0.43	15	FC Erzgebirge Aue	0	5	FC Crotone	0.79	11	SD Huesca	0.2	14	Le Havre AC	1.29	9	Estoril	4E+11	10
Barnsley F.C.	0.4	17	SpVgg Greuther Fürth	-0.18	4	Piacenza	0.57	19	Rayo Vallecano	0.19	2	Clermont Foot	1.09	7	Freamunde	3E+11	11
Doncaster Rovers F.C.	0.34	21	1. FC Union Berlin	-0.18	11	AS Cittadella	0.55	14	CD Numancia	0.18	10	Dijon FCO	1.07	3	Santa Clara	3E+11	9
Cardiff City F.C.	0.31	4	Alemannia Aachen	-0.19	10	Portogruaro	0.52	21	Gimnàstic Tarragona	0.09	18	SCO Angers	0.99	6	Arouca	2E+11	5
Leicester City F.C.	0.22	10	**Arminia Bielefeld**	-0.26	18	Ascoli Calcio	0.45	17	FC Cartagena	0.08	13	Vannes	0.98	18	Oliveirense	1E+11	4
Millwall F.C.	0.19	9	TSV 1860 München	-0.35	9	AlbinoLeffe	0.44	18	Córdoba CF	0.05	16	**FC Grenoble**	0.94	20	Fátima	1E+11	16
Watford F.C.	0.18	14	FC Energie Cottbus	-0.38	6	US Triestina	0.44	20	Granada CF	0.03	5	AC Ajaccio	0.92	2	**Gil Vicente**	1E+11	1
Crystal Palace F.C.	0.02	20	MSV Duisburg	-0.51	8	Frosinone Calcio	0.38	22	Albacete Balompié	-0.01	22	Stade Lavallois	0.79	15	Trofense	1E+11	3
Queens Park Rangers F.C.	0.01	1	Fortuna Düsseldorf	-0.51	7	Grosseto	0.36	15	UD Salamanca	-0.03	19	US Boulogne	0.78	8	Leixões	7E+10	6
Preston North End F.C.	-0.03	22	Karlsruher SC	-0.56	15	Sassuolo	0.34	16	**Elche CF**	-0.25	4	SC Nîmes	0.7	19	Belenenses	4E+10	13
Leeds United A.F.C.	-0.08	7	Hertha BSC	-0.82	1	Reggina	0.3	6	Xerez CD	-0.53	8	CS Sedan-Ardennes	0.64	5			
Hull City A.F.C	-0.1	11	VfL Bochum	-0.88	3	Vicenza Calcio	0.26	12	UD Las Palmas	-0.58	15	**Le Mans UC**	0.55	4			
Nottingham Forest F.C.	-0.11	6				AC Siena	0.08	2	CD Tenerife	-0.62	20	FC Nantes	-0.09	13			
Middlesbrough F.C.	-0.18	12				**AS Livorno**	-0.28	7	RC Celta de Vigo	-0.72	6	**FC Metz**	-0.38	17			
Derby County F.C.	-0.25	19				Atalanta Bergamo	-0.55	1	Real Betis	-0.87	1						
Portsmouth F.C.	-0.37	16				Torino	-0.73	8	Real Valladolid CF	-0.87	7						
Sheffield United F.C.	-0.44	23															
Burnley F.C.	-0.723	8															

Table 4-12 Relegation forecast

	England	Germany	Italy	Spain	France	Portugal
Rank	6	1	5	4	2	3
Nagelkerke's predictor	0.042	0.089	0.053	0.065	0.084	0.082

Table 4-13 Predictive power of the country models

4.8 Summary and Conclusions

In this article I analyze the determinants of promotion and relegation in six second tier soccer leagues in Europe since their respective foundation (the oldest league started in 1892) until today and suggest an early warning system for teams with increased chances of being promoted or relegated. I use a competing risks analysis—a special case of survival analysis—with a data augmentation method and a Cox regression model as suggested by Lunn and McNeil (1995) to estimate coefficients for promotion and relegation simultaneously.

I find that—ceteris paribus—experience of a club in the first division as well as being located in a big city increases the chances of being promoted and decreases the chances of being relegated by the same amount. Experience in the second league reduces chances of promotion. Teams get pulled down into the second league if they are not promoted shortly after being relegated from the first league. Surprisingly, previous promotions and relegations have no significant effect on promotion and relegation. Contrary to previous research, I find that another team from the same city playing in the first league has a positive impact on the promotion probability of a second tier team. The result is driven by large cities such as London or Madrid where more than one first tier club exists. Thus, my findings suggest that the demand for soccer in larger cities exceeds soccer supplied by one club alone. The principle known as the yoyo effect, meaning that teams that are relegated from (or promoted to) the first division have a higher probability of being immediately promoted (or relegated), is again confirmed by my findings. The same holds true for promotion from the third league. In addition, I find that small cities teams benefit from the 'Bosman-ruling'—increasing the freedom of movement of players within Europe—more so than do teams from big cities. In the years after the 'Bosman-ruling' their chances of promotion (relegation) increase (decrease) significantly.

Looking at the country level, I find that most results are similar across countries. Most coefficients do not differ significantly from one another. The identified differences cannot be explained by my model alone. For example, being a team from a big city has a larger effect in England than it does in Italy. This could be related to the fact that Italians are more connected to their home town even after moving to a big city. A more detailed socio-economic analysis is required to explain these differences.

The suggested early warning system using an out of sample forecast does not predict the teams promoted and demoted accurately. Only seven out of 16 promotions and eight out of 18 relegations are predicted correctly. Most likely the lack of data—specifically financial data of the clubs or player strength, which is only available for recent years—is one major shortcoming. Future research should include financial data such as net transfer revenues and total salaries of players and coaches even if this means restricting the data to a shorter time scale.

5 Increasing Competitive Balance Differently: How Schedule Design Can Help Promoted Teams

5.1 Introduction

In his seminal paper on the baseball players' labor market, Rottenberg (1956) stated that if specific teams "will get the most capable players, there will be wide variation among teams in quality of play, contest will become certain, and attendance will decline." A few years later Neale (1964) confirmed that the "doubt about the competition is what arouses interest." And interest is essential for the revenues of sport leagues.

The discussion about balanced competition is as old as sport itself. The first professional baseball league, the National Association of Professional Base Ball Players, failed in 1875 after only five years of existence. It was general practice that the richer clubs would buy the best players of the smaller clubs, causing the collapse of these clubs in mid-season, leaving the rich clubs without opponents and the players unpaid and unemployed[50] (Congress 1952). The successor league, the National League, therefore introduced the reserve rule in 1879, which allowed all teams to reserve up to five players that could not be contracted by other teams.

The discussion about competitive balance has been one of the major research areas in sports economics. Due to recent developments in professional European soccer, where the rich clubs get richer due to additional revenues from European cup competitions and the gap to the smaller teams widens (Hoehn and Szymanski 1999), competitive balance is as relevant as it was back in the 1870s. In Europe's professional soccer leagues, only a few teams actually compete for the respective national championship. The extreme is certainly Spain where only two clubs (Real Madrid and FC Barcelona) are 'real' competitors. To increase competitive balance in sports leagues, researchers and sports officials have suggested different measures, some of which have already been implemented (e.g., the draft system in U.S. sports leagues, broadcasting revenue sharing in European soccer leagues). This paper shows a different approach by suggesting the use of schedule design to improve competitive balance.

Despite (a) suggestions by scientists that developed schedule design software and (b) increased computing power, soccer league administrators all over the world have designed their schedules manually until recently (Duran et al. 2007). In the German 'Bundesliga,' the first schedule, calculated by a sophisticated computer program including thousands of variables, was used in the 2007/08

[50] Quote by A.G. Mills, who first proposed the reserve rule.

season (Westphal 2011). Due to the number of different requirements from teams, TV stations, fans, police, European cup competitions, and so forth, even these new programs can only compute a 'best' solution. Fulfilling all requirements is impossible. To produce a 'fair' schedule, these programs treat all teams equally by trying to avoid games against many hard or easy opponents in consecutive games.

Nevertheless, in the beginning and at the end of each season there is always a discussion among players, coaches, on TV shows and in newspapers about which team's schedule is particularly easy or hard.

This paper analyzes the impact of game schedules on the teams' performance in German 'Bundesliga' soccer. In doing so, I find easy and difficult schedules. These results can be used to produce a schedule that improves competitive balance in giving the weak teams an easy schedule and the strong teams a difficult one. League authorities and legislators thus have an alternative to improve competitive balance that a) does not cost anything and b) has a minimum impact on the autonomy of the clubs and their financials.

In the following chapters I give an overview of the work that has been done on competitive balance as well as schedule design. In chapter 5.3 I describe the data. Chapter 5.4 includes the model design and results. In chapter 5.5 I discuss my findings and chapter 5.6 concludes.

5.2 Literature Review

To the best of my knowledge, no empirical or theoretical analysis of the impact of schedule design on team performance in sports is available to date. In addition, no research has been done on the use of schedule design for competitive balance.

5.2.1 Competitive Balance

5.2.1.1 Concept and Measures

At first, competitive balance seems like an easy concept. Buzzacchi et al. (2003) describe competitive balance as the fans' expectations about who will be the winner. If the competition is perfectly balanced, fans think that all outcomes are equally possible. This would be a situation of complete outcome uncertainty. If the contest is perfectly unbalanced, on the other hand, then the winner is already known for sure in advance.

In more detail, competitive balance is a multifaceted concept. Do we want every game to be balanced so that both teams win with a probability of 0.5? Or do we want the championship race to be balanced, meaning that e.g., all 18 teams in the 'Bundesliga' have a probability of winning the championship of 1/18? Or do we want to have different champions over a longer period of time? Szymanski (2006d) divides competitive balance in two areas: match uncertainty and championship uncertainty. Kringstad and Gerrard (2007) divide it even further into three dimensions: the distribution of wins within a single season, the persistence of teams' records of wins over a longer period of time, and the degree of concentration of overall championship titles over a period of time.

The first to address the topic of outcome uncertainty was Topkins (1949) when he mentioned that teams want to come close to a perfect team but they realize that it cannot be too perfect since "there would not be any money in that." The 'uncertainty of outcome' hypothesis explains that fans' interest in a competition is maximized if the outcome is perfectly uncertain. It was first stated by Rottenberg (1956) and Neale (1964) and it has been used as a justification for different policy and rule changes since then. In an unrestricted competition there would be an equilibrium for the distribution of wins. The theoretical condition would be that the marginal revenue of an additional win should be equal to the marginal cost. Since the labor market is unrestricted as well, the marginal cost for a win should be equal for all teams. Unfortunately, this equilibrium does not generate enough outcome uncertainty. E.g., teams with larger stadiums would gain more from an additional win than a team with a smaller stadium. Therefore, the 'bigger' team would buy more talent than the 'smaller' team and the outcome would become more and more certain (see, e.g., Késenne 2004).

Today, most economists agree that a perfectly balanced league would not be ideal for a league. Szymanski (2006c), for example, suggests that a team in a large city that has more supporters should have a higher percentage of wins to generate the highest possible interest. He presents econometric evidence that a less balanced distribution of wins would have led to more attendance over the last 25 years in MLB. Brandes and Franck (2007) analyze different European soccer leagues. For the German 'Bundesliga,' they find no evidence that competitive balance affects attendance. They argue that due to the promotion and relegation system and the qualification for European cup competitions, there are several competitions occurring simultaneously in one league. Therefore, lower levels of competitive balance are accepted by fans in European compared to nonacceptance in U.S. leagues. In addition, Borland and Macdonald (2003) surveyed 18 studies about the effect of outcome uncertainty on attendance and found that fans would prefer to have their home team win rather than see a balanced game. More accurately, a probability of the home team to win of 60% maximizes attendance. In addition, see Szymanski (2003) for a literature review on uncertainty of outcome.

Competitive imbalance is caused mainly by the difference in actual or potential market size of the teams in a league (Sloane 1976). Measures to change competitive balance can therefore either directly control the distribution of playing talent, or they can work indirectly by redistributing the revenues between clubs. As mentioned before, several measures have been suggested to improve competitive balance. Over the years, some of these measures have even been implemented in professional sports leagues. Salary caps, payroll minimums, luxury taxes, the draft system, gate and media revenue sharing are commonly used methods in the U.S. Compared to the U.S., European sports leagues in general and soccer leagues in particular[51] are quite unrestricted. Only media revenue sharing is practiced in some European leagues. Broadcasting rights are often sold by the league and not by the clubs individually and revenues are distributed more or less equally among all teams in the league. In some national cup competitions, gate revenues are shared due to the fact that there is only one game and not two legs with a home game for both teams. Recently UEFA—the administrative and controlling body of European soccer—has designed the "Financial Fair Play Rules" (UEFA 2010), which all clubs have to fulfill from 2012 on in order to be able to compete in European soccer competitions. Though the document is quite long, it boils down to the fact that clubs need to make sure that they do not repeatedly spend more than they earn. Clubs will try to bend those rules and UEFA accountants will have quite a bit of work to do, but these regulations seem a step in the direction of increasing competitive balance. However, since the rules become effective in 2012, evidence of this has to be shown in future research.

All of these measures that have been introduced in professional sports leagues strongly affect the management of the clubs. They either directly restrict the free movement of players and the right to contract all players that a club wants to sign or they are highly restrictive on the clubs' financial sovereignty. Table 5-1 evaluates the different measures along three dimensions: administrative cost for the league governing body, financial burden for the clubs and financial burden for the players. Column 5 shows studies on the different measures and their effect on competitive balance.

[51] We focus our research on European soccer.

5.2.1.2 Measurement of Competitive Balance

As described above, the issue of outcome uncertainty is widely discussed in the literature and different authors have suggested different methods of calculating competitive balance. The simplest measure is the standard deviation of win percentages at the end of a season (Quirk and Fort 1992). According

	Administrative cost	Financial burden for clubs	Financial burden for players	Studies on the effect of the measure
Draft system	High	Low	High	Fort (2003), Booth (2004), Taylor and Trogdon (2002)
Salary cap, luxury tax	High	Low	High	Quirk and Fort (1992), Késenne (2000), Quirk (1997), Berri (2006), Lavoie (2006), Vrooman (2009)
Revenue sharing	High	Low (small clubs), High (big clubs)	Low	Vrooman (2009), Szymanski (2003), Szymanski and Késenne (2004)
Roster Limits	Low	Low	High	To the best of my knowledge there are no studies that analyze the effect of roster size on competitive balance
Reserve clause (Retain and transfer system)	Medium	Low	High	Rottenberg (1956), El-Hodiri and Quirk (1971), Daly and Moore (1981)
Promotion relegation	Low	High	Low	Buzzacchi et al. (2003)
UEFA financial fair play rule	High	High	Low	Not implemented yet

Table 5-1 Assessment of measures to increase competitive balance

to this measure, a league is unbalanced if the deviation of win percentages in a league is high. Other authors have suggested using the number of games/points a specific team (e.g., the 5^{th} ranked) is behind the leader. A measure for concentration of championship titles can be the number of teams winning the championship within a certain period. Depken (1999) uses a Herfindahl-Hirschman index (HHI) which was originally used to measure the degree of concentration of market shares within an industry. Leeds and von Allmen (2005) apply the HHI to the concentration of championship wins over a period of seasons.[52]

Due to the problem that the standard deviation of win percentages cannot be compared across different leagues with e.g., a different number of teams, Fort and Quirk (1995) adjusted their earlier model (Quirk and Fort 1992). In comparing the standard deviation of the league with a standard deviation for a completely balanced league with the same number of clubs, they made different leagues comparable. In this completely balanced league, all wins are distributed randomly, i.e., each team has a win probability of 0.5 in every game.

For the purpose of this paper, I will use the measure developed by Fort and Quirk (see Figure 5-1 for the development of competitive balance since the inaugural season of the German 'Bundesliga' in 1963). For comparison, in 2009/10 Italy had a competitive balance of 1.59, Spain, of 2.01 and England, of 2.04.

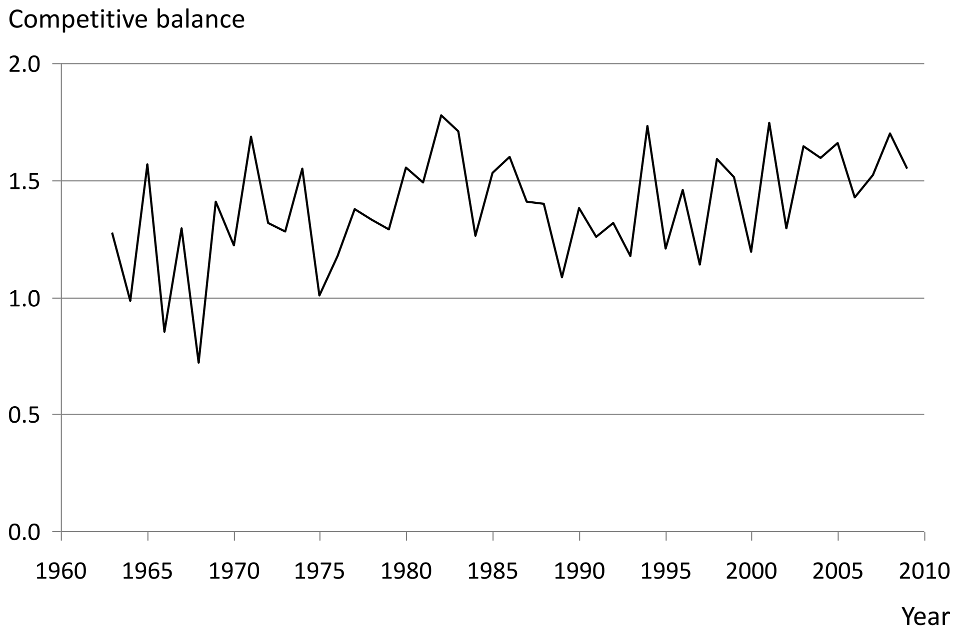

Figure 5-1 Competitive balance in the German 'Bundesliga' since 1963

5.2.2 Schedule Design

According to Kendall et al. (2010), the schedule can have significant financial implications for the teams involved in the competition. In addition, it interferes with the performance of every team.

52 Several other measures have been developed by e.g., Schmidt and Berri (2001) or Horowitz (1997).

Finding a schedule is highly difficult: in a league with 18 teams that play against one another two times, there are 6,402,373,710,000,000 possible schedules (Westphal 2011). While designing a schedule, the league governing body has to consider different objectives and constraints by different stakeholders (clubs, media, sponsors, minor leagues, national teams, and so forth). Therefore, the schedule design literature often divides the objectives of schedules into three areas: organization, attractiveness, and fairness.

One may be tempted to think that highly sophisticated computer programs are used to design schedules, as there are 6.4 quadrillion possibilities and often thousands of variables. For the German 'Bundesliga,' this is true—but only since 2007 (Westphal 2011). Before that, as it is common in most professional sports leagues, templates were used and teams were moved around until the schedule fitted most requirements (see Appendix 5-1 for an example illustrating the template style of schedules from the German 'Bundesliga'). In 1996, Bartsch et al. (2006) suggested a model with 13 variables (organization: 4, attractiveness: 6, fairness: 3). Most important in that model were the requests/objectives from the broadcasting companies. Fairness objectives were considered 'nice to have' but not 'required' (see Appendix 5-2 for details on the variables). In 2007, Stephan Westphal from the University of Göttingen designed a program that was able handle a large number of variables. For the 2010/11 season, this program was expanded and improved to fulfill more of the requirements simultaneously. Even with today's computer programs, it is not possible to fulfill all requirements. In literature on schedule design, fairness is considered inferior to attractiveness and other restraints.

In the U.S., sports schedules are even more complicated since leagues are not playing a simple round-robin tournament where every team plays each other team twice. The U.S. leagues are divided into conferences and divisions. For example, in the NBA 82, games are played in the regular season (before the playoffs). Every team has to play four games against teams from the same division, either three or four times against the teams from the other two divisions of the same conference, and twice against the teams from the other conference. While in the NBA every team plays each team at least twice, the schedule in the NFL can be much more difficult for some teams. Every team plays each other team of the same division twice, each team from one other division in the same conference once (on a rotating three year cycle), each team from one division of the other conference once (on a rotating four year cycle), and each team in its own conference that finished in the same place in their respective division once. Weiss (1986) states that schedules in U.S. sports are always biased since division winners continue to the playoffs even if teams from other divisions (that did not win their division) have better winning records. Teams with high (low) winning percentage are biased negatively (positively) by these schedules.

Furthermore, it is difficult to quantify fairness. The models that are currently being discussed divide teams in groups of different strengths according to their final ranks in the previous season. In a league with 18 teams, there is a 'hard' group (ranks 1 to 6), a 'medium' group (ranks 7 to 12), and a 'weak' group (ranks 13 to 18[53]). In a schedule that is considered 'fair,' teams should either not play against two teams from the same strength group in two consecutive games (group-changing) or they should not play against two teams from the same strength group within x games (group-balanced) (Briskorn and Knust 2010).

Two problems arise from this way of handling fairness. First, last year's table may be a good approximation of the strength of a team but it is certainly not ideal. Instead, one could use betting odds or expert predictions to account for the quality of transfers, new coaches, new management, etc. Second, a fair schedule as it is currently implemented in scheduling software tries to fulfill the requirements equally for all teams. While that might be considered fair, the discussion about competitive balance suggests that a more balanced league (that could be achieved by giving more difficult schedules to stronger teams) could be favored over an equally hard schedule for all teams.

In the following paragraphs, I analyze schedules of the German 'Bundesliga' and find hard and easy schedules. By giving weaker teams an easier schedule and stronger teams harder schedules, league governing bodies could increase competitive balance. An increased competitive balance would increase the survival probabilities for promoted teams (or reduce the promotion probabilities of relegated teams in the second division).

5.3 Data Description

To analyze the impact of schedule design on competitive balance, I use the German 'Bundesliga' since its inaugural season in 1963. Due to different league sizes in the first two seasons of the 'Bundesliga' (1963/64 and 1964/65 only 16 teams competed) and after the German Unification in 1991 (1991/92 20 teams competed) I excluded these seasons. In total, I analyze 44 seasons with 18 teams each.

[53] Depending on the number of promotions and relegations the ranks 15-18 are used for the promoted teams that ranked 1-4 in the second tier last season.

As the dependent variable, I use the delta in win percentage[54] compared to the previous season to measure how much better or worse a team performed in a particular season. A positive value means that the team has a higher win percentage in the observed season than in the previous one. For example, Borussia Dortmund had 59 points at the end of the 2008/09 season and 57 points at the end of the 2009/10 season. The maximum number of points in both seasons was 102.[55] Therefore, the win percentage for Borussia Dortmund was 57.84% in 2008/09 and 55.88% in 2009/10. This is a change in win percentage of -1.96 basis points. To check for robustness I use two different calculations:

— Converting all season before the introduction of the 3-point-rule[56] in 1995 to the 3-point-rule (hence called 'Delta WP3')
— Keeping the 'old' 2-point-rule win percentages for the years before 1995 (hence called 'Delta WP2') and the 3-point-rule win percentages for the years after 1995

My primary independent variables are the opponents' strength on each of the game days. The final ranking of the opponent in the previous season is used as an approximation of their playing strength. The stronger teams have lower values and the weaker teams have higher values according to their rank. The opponents of Borussia Dortmund in the 2009/10 season are displayed in Table 5-2. Column 3 shows their ranking in 2008/09 as an approximation of their strength. Since Borussia Dortmund itself was ranked sixth in 2008/09 there is obviously no opponent in 2009/10 with final rank of six.

I use one independent variable per game day. The German 'Bundesliga' is designed as a mirrored round-robin tournament where every team plays each other team twice and the second leg is identical to the first leg except for the stadium where the game is played. Each team has one home and one away game against each opponent. Therefore, I use only variables for the first 17 games.

Using the ranking of the previous season as an indicator of the strength of a team can be criticized but better indicators such as betting odds and expert predictions are only available for shorter time periods. Compared to schedule design software, I not only use three strength groups but also the actual ranking.

54 Win percentage is understood here as the number of points achieved by a team divided by the maximum number of points possible in a season.
55 34 game days times 3 points for a win = 102 points.
56 Starting in 1995/96 a win was worth three points. Prior to 1995 a win was worth 2 points. The returns of a draw which gives 1 point to each team were not affected by the introduction of the 3-point-rule.

Game day	Opponent	Opponent's final rank in 2008/09
1	1. FC Köln	12
2	Hamburger SV	5
3	VfB Stuttgart	3
4	Eintracht Frankfurt	13
5	FC Bayern Munich	2
6	Hannover 96	11
7	FC Schalke 04	8
8	Borussia M'gladbach	15
9	VfL Bochum	14
10	Bayer Leverkusen	9
11	Hertha BSC Berlin	4
12	SV Werder Bremen	10
13	1. FSV Mainz 05	17
14	1899 Hoffenheim	7
15	1. FC Nuremberg	18
16	VfL Wolfsburg	1
17	SC Freiburg	16

Table 5-2 Borussia Dortmund's schedule in 2009/10

In addition, I use several other variables to check the robustness of my 17 game day variables. The source of the following variables is the final season tables accessed on www.kicker.de:

- Own ranking previous season
- Own win percentage previous season
- Dummy for 3-point-rule
- Dummy for participation in a European cup competition
- Dummy for starting a season with a home game
- Dummy for each season following a European or World Cup
- One dummy for each club (in total 50 club dummies)

The information for the following transfer related variables is retrieved from www.weltfußball.de:

- Number of arriving players
- Number of departing players
- Dummy for change in coach before the season

In addition, I use two measures to account for a change in playing strength compared to the last season. Unfortunately, these variables are not available for all seasons. The data is drawn from the special edition of the Kicker magazine that is published before each season.

— Market value of team – only seasons 1995/96 to 2008/09
— Net transfer revenues – only seasons 1992/93 to 2009/10

Covariate	Abbreviation	Obser-vations	Mean	Stand. dev.	Min	Max
Delta win percentage (2- and 3-point-rule)	Delta WP2	792	-0.07	10.67	-38.24	33.33
Delta win percentage (only 3-point-rule)	Delta WP3	792	0.64	11.29	-38.24	36.80

Table 5-3 Descriptive Statistics: Dependent variables

Tables 5-3 and 5-4 display descriptive statistics of the used variables. Since the game day variables and club dummies are all almost identical in mean and standard deviation, I do not show them in detail here.[57]

Covariate	Abbreviation	Obser-vations	Mean	Stand. dev.	Min	Max
Own ranking previous season	OR	792	9.50	5.19	1	18
Own win percentage previous season (2- and 3-point-rule)	OWP2	792	0.49	0.12	0.25	0.81
Own win percentage previous season (only 3-point-rule)	OWP3	792	0.45	0.13	0.18	0.77
Dummy for 3-point-rule	3PR	792	0.34	0.47	0	1
Dummy for participation in a European club competition	UEFA	792	0.36	0.48	0	1
Number of players bought	Buy	792	4.74	3.10	0	18
Number of players sold	Sell	792	4.38	2.78	0	15
Dummy for change in coach	Coach	792	0.20	0.40	0	1
Dummy for starting a season with a home game	Home start	792	0.50	0.50	0	1
Dummy for season following a European or World Cup	World Cup	792	0.50	0.50	0	1
Market value in million	Market value	252	36.71	19.45	9.10	116.30
Net transfer revenues in million	Transfer	324	-2.45	7.31	-52.10	19.40

Table 5-4 Descriptive Statistics: Control variables

57 Details can be obtained from the author upon request.

5.4 Regression Model and Results

The impact of the schedule on team performance was estimated using an ordinary least squares model:

$$\Delta WP_{t,c} = \beta_0 + \sum_{i=1}^{17} \beta_i OppR_{i,t,c} + \left(\sum_{j=1}^{n} \beta_j V_{j,t,c} \right) + e$$

where	$\Delta WP_{t,c}$	=	Delta of win percentage of club c between seasons t and t-1 (WP_t - WP_{t-1})
	$OppR_{i,t,c}$	=	Last season's final rank of the opponent of club c on game day i in season t
	$V_{j,t,c}$	=	Other variable j[58] in season t for club c
	e	=	Error term

Table 5-5 displays the regression results of a model with opponent's strength variables as independent variables and no further control variables. The dependent variable is the change in a team's win percentage based on the 3-point-rule.

It appears from Table 5-5 that the constant β_0 is 166.43 and all other regression coefficients are negative. To calculate the change in win percentage of a team, one has to subtract a value (regression coefficient * opponent strength) for each game day from β_0.

I now get back to my example of Borussia Dortmund from Table 5-2. The following equation shows the estimated change in win percentage for Borussia Dortmund between seasons 2008/09 and 2009/10:

$$\begin{aligned}\Delta WP_{t,c} &= 166.434 + (-1.115) * 12 + (-1.070) * 5 + (-1.116) * 3 + (-0.930) * 13 \\ &+ (-1.123) * 2 + (-0.986) * 11 + (-1.004) * 8 + (-1.154) * 15 + (-0.971) * 14 \\ &+ (-1.042) * 9 + (-1.171) * 4 + (-0.926) * 10 + (-0.966) * + (-0.964) * 7 \\ &+ (-0.899) * 18 + (-1.020) * 1 + (-0.994) * 16 \\ &= 0.640\end{aligned}$$

[58] I used different regression models with different sets of variables from Table 5-4 to test the robustness of my results. See Tables 5-9 and 5-10 for the regression results.

The team had a win percentage of 57.84% (59 points) in 2008/09. The estimated change in win percentage is 0.64 base points. The calculated win percentage for 2009/10 is therefore 58.48%. This means that Borussia Dortmund should have reached 59.7 points in the championship in 2009/10.

To maximize $\Delta WP_{t,c}$ for a team, a schedule must be designed in a way that the team plays against the most difficult opponent (value=1) on the game day that has the highest regression coefficient β_i. In this regression model, this would be the coefficient of game day 15, which is -0.899. The easiest opponent (value=18) should be played on game day 11 where the coefficient is lowest at -1.171.

In my analysis, the actual value of the regression coefficient is of minor importance for identifying an easy or difficult schedule. More important is the order of the coefficients from highest to lowest. Since it is hard to see at a glance which regression coefficients are highest and lowest in a regular regression results table, I will present my findings differently throughout this paper. The x-axis of Figure 5-2 shows the game days and the y-axis shows the regression coefficients. This way it is easier to see that e.g., the highest coefficient is on game day 15 and the lowest on game day 11.

I estimate 22 different regression models with the two different dependent variables and different sets of independent variables (see Appendix 5-3 for detailed regression results). The game day variables always show almost the same pattern (see Figure 5-3[59]) as in the regressions without any further variables. On game days 4, 12 and 15 it is best to play against an easy opponent, whereas on game days 5, 8 and 11 it is better to play against a strong one. The results displayed in Figure 5-2 are displayed in bold in Figure 5-3. The correlation between the different regression results ranges from 0.927 to 1.000.

Including the market value and net transfer revenues a different pattern emerges. However, these two variables are only available for a shorter time period (1995-2008). Comparing the pattern with the ones obtained from the regression models without these two variables but for the same time period, the correlation is again very high at 0.867 and 1.000 (see Figures 5-4 for 5-5 different regression models).

[59] To avoid "overcomplexity" I did not include all 22 models in the figure. See Appendix 5-3 for the other regression results.

Covariate	Delta WP3	
Game day 1	-1.115	***
	(0.000)	
Game day 2	-1.070	***
	(0.000)	
Game day 3	-1.116	***
	(0.000)	
Game day 4	-0.930	***
	(0.000)	
Game day 5	-1.123	***
	(0.000)	
Game day 6	-0.986	***
	(0.000)	
Game day 7	-1.004	***
	(0.000)	
Game day 8	-1.154	***
	(0.000)	
Game day 9	-0.971	***
	(0.000)	
Game day 10	-1.042	***
	(0.000)	
Game day 11	-1.171	***
	(0.000)	
Game day 12	-0.926	***
	(0.000)	
Game day 13	-0.966	***
	(0.000)	
Game day 14	-0.964	***
	(0.000)	
Game day 15	-0.899	***
	(0.000)	
Game day 16	-1.020	***
	(0.000)	
Game day 17	-0.994	***
	(0.000)	
Constant	166.434	***
	(0.000)	
Number of obs	792	
F(17, 774)	15.61	
Prob > F	0.000	
R-squared	0.260	
Adj R-squared	0.240	
Root MSE	9.850	

Table 5-5 Regression results for dependent variable 'Delta WP3' with game day variables only

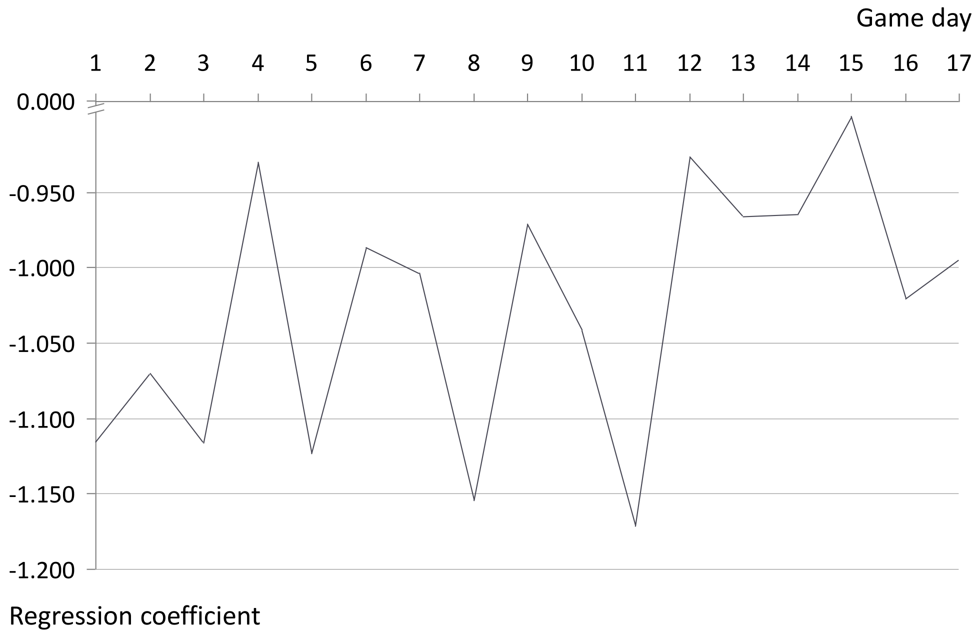

Figure 5-2 Example regression results

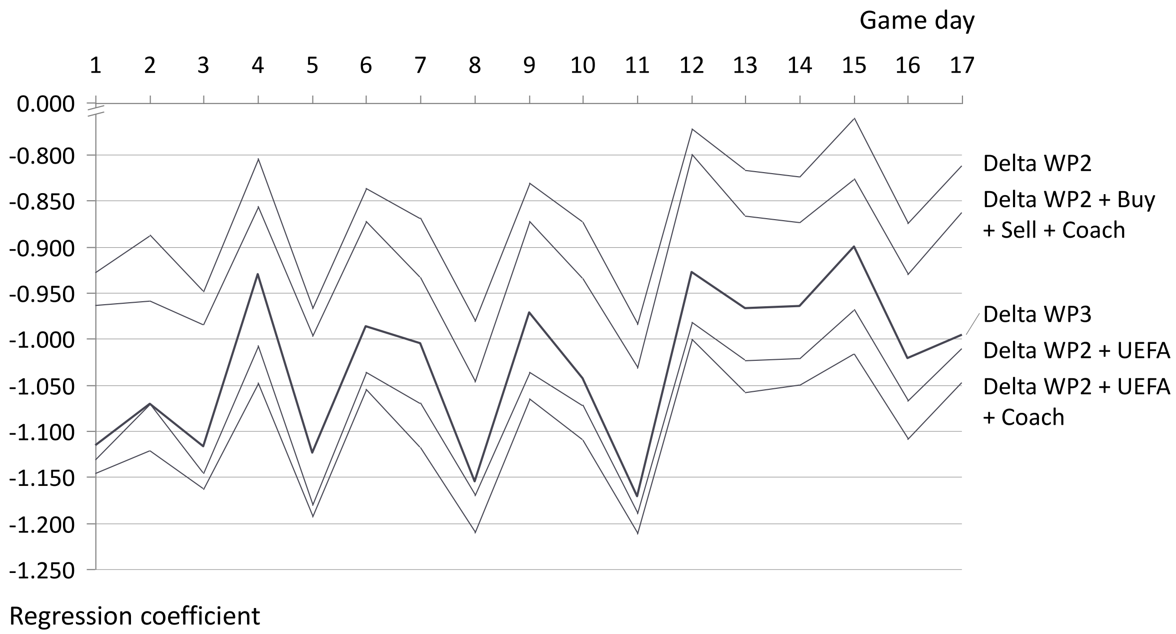

Figure 5-3 Regression results[60]

[60] The legend of the respective figure displays the dependent variables used and the additional control variables. Descriptions of the variables can be found in Tables 5-3 and 5-4.

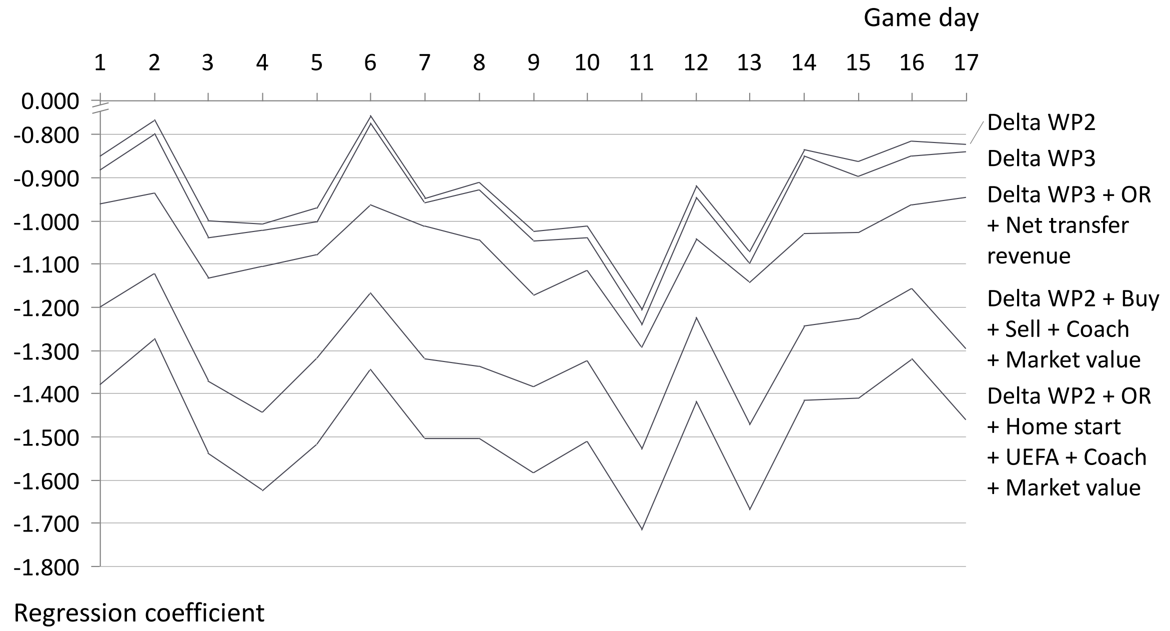

Figure 5-4 Regression results including market value and net transfer revenues for 1995 to 2008

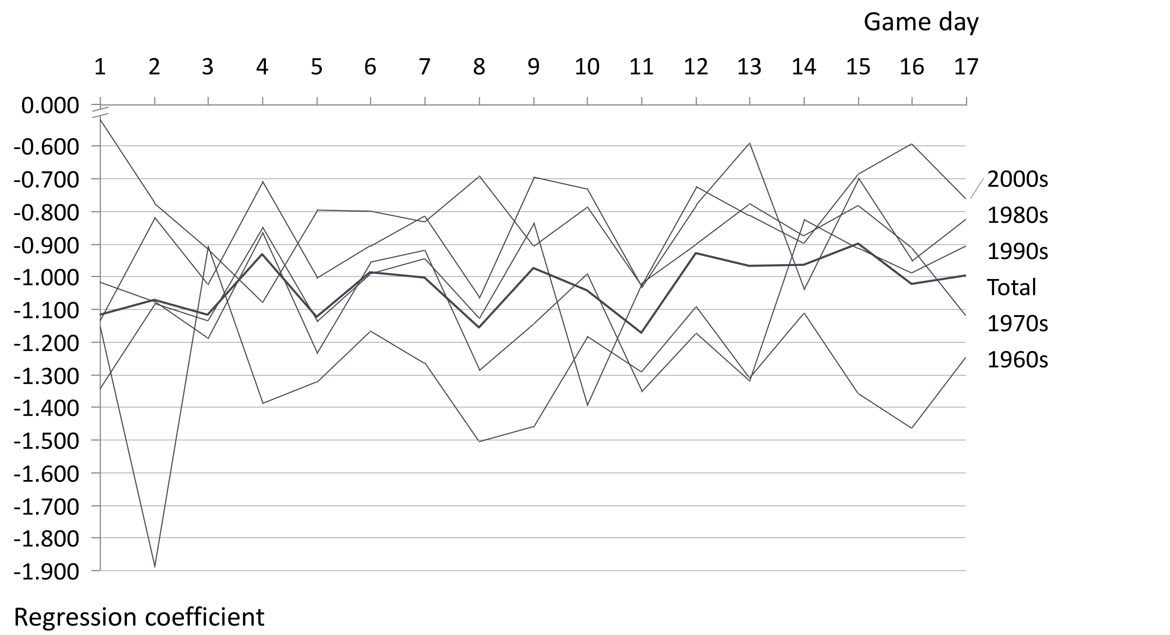

Figure 5-5 Regression results – Decade models

I conclude that the regression results—while being very robust for different regression models for a specific time period—are not robust over different time periods (see Figure 5-5 for different regressions for the five decades (1960s, 1970s, 1980s, 1990s and 2000s)). As we have seen in the two figures above, the pattern of coefficients is almost identical for different models. In the remainder of this paper I therefore use the model with 'Delta WP3' as the dependent variable, the primary independent variables for the opponent's strength on the 17 game days and no further control variables.

5.5 Findings and Discussion

5.5.1 Win Percentage

Since the results are not robust over time, we have to decide on the model that fits the data best. There are good reasons to use the complete model and not to divide the data by e.g., decades. First, using decades, only 180 instead of 792 observations remain for each decade (for the 1960s and the 1990s there are even less observations[61]). Since each of the 17 game day variables can take 18 different values, a data base with 180 observations will not be a large enough population. The second reason is that schedule designers have recently used programs that prevent schedules from being random. As mentioned earlier, schedules are now set in such a way that teams do not consecutively play against teams of similar strength. In addition, I have no information on any changes in the schedule design templates used earlier and therefore cannot account for any changes made.

To see the impact of schedule design, I use my findings for the 'Delta WP3' model without further control variables. For these regression results, the easiest possible schedule for last season's champion is displayed in Figure 5-6. In this easy schedule the team would play against the sixth team of the last season on game day one, against the seventh team on game day two, and so forth.

The influence of having an easy compared to a hard schedule can be seen (Table 5-6) when calculating the values of the dependent variable for the easiest and hardest schedule. The first of the previous season obviously cannot play against the first and the second cannot play against the second. Therefore, the value of the dependent variable differs for the teams. If the first ranked team from the previous season has the easiest possible schedule, the win percentage decreases statistically by 1.36 basis points. It may seem counter-intuitive that a team's win percentage

[61] The league started in 1963 with 16 teams. In 1965 the league expanded to 18 teams. Since I only look at seasons with 18 teams, the observations for the 1960s are reduced by five seasons. Since 20 teams played in 1991/92 the there are only nine seasons observed in the 1990s.

decreases with the easiest schedule. However, a club must have played an exceptional season to become champion. Even with an easy schedule it will be hard to repeat last year's performance.[62] If the first gets the hardest schedule possible, the win percentage decreases by 14.79 basis points. For the tenth of the last season, the win percentage decreases by 6.15 basis points with the hardest and increases by 8.45 basis points with the easiest schedule.

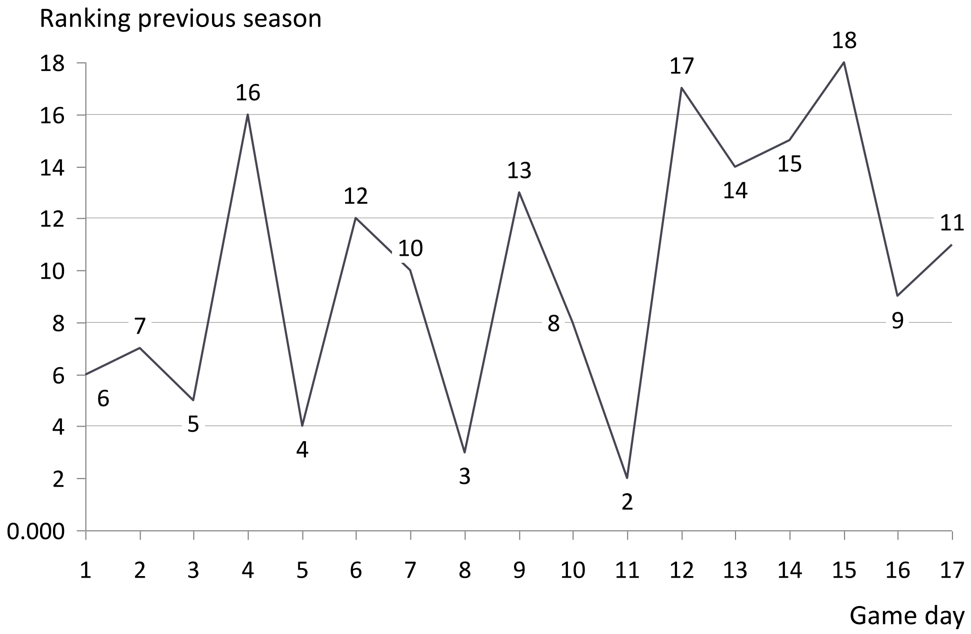

Figure 5-6 Easiest possible schedule for the team ranked first in the previous season

5.5.2 Degree of Schedule Difficulty

In Table 5-6 the change in win percentage with the easiest/hardest possible schedule is presented. To be able to assess a real schedule I now introduce an additional measure: degree of schedule difficulty (DSD). The DSD compares the real schedule to the easiest and hardest schedule possible. It is calculated on a linear scale between the values of the change in win percentage for the easiest and hardest schedule as displayed in Table 5-6. If the real schedule is equal to the easiest schedule, then the DSD is zero and if it is equal to the hardest schedule, then it is one. It appears from Figure 5-7 that Hoffenheim and Hannover had the most difficult schedules, while Mainz and Stuttgart had the easiest ones in the season 2009/10.

62 For the team that ranked last in the previous season (or the last team that was promoted respectively), the reasoning is similar. If a team is relegated, they played a bad season. As with an exceptionally good season, it is also hard to repeat a particularly bad one.

Ranking previous season	Win percentage increase/decrease with	
	Easiest schedule	Hardest schedule
1	-1.36	-14.79
2	-0.19	-13.89
3	0.96	-12.96
4	2.08	-12.03
5	3.20	-11.07
6	4.31	-10.10
7	5.38	-9.13
8	6.43	-8.15
9	7.45	-7.15
10	8.45	-6.15
11	9.44	-5.13
12	10.43	-4.09
13	11.40	-3.02
14	12.37	-1.90
15	13.33	-0.79
16	14.26	0.34
17	15.19	1.49
18	16.09	2.66

Table 5-6 Change in win percentage with easiest and hardest schedule

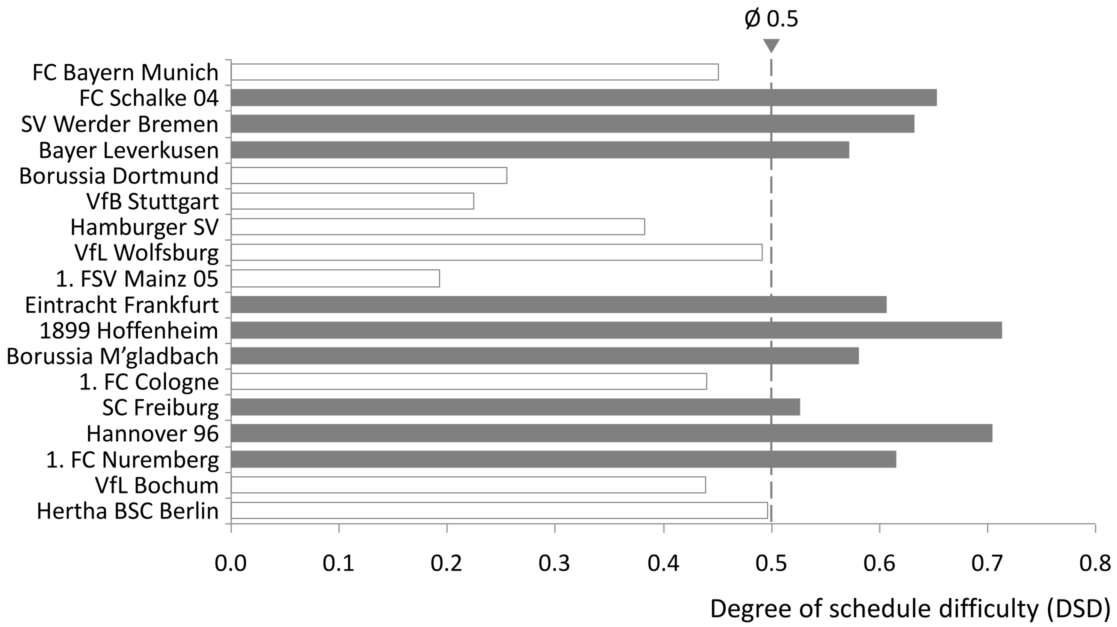

Figure 5-7 Degree of schedule difficulty for season 2009/10

Comparing all teams across all seasons (as shown in Figure 5-8) reveals that the average DSD is quite similar for all teams that participated for more than ten seasons. Some had slightly harder schedules (e.g., Mönchengladbach, Cologne, and Leverkusen) and some had easier ones (e.g., Stuttgart, Duisburg, and Düsseldorf). The DSD varies more for the teams with fewer seasons. Fortuna Cologne only played one season. Despite their easy schedule they were relegated at the end of the 1973/74 season.

Figure 5-7 displays the DSD for one season, Figure 5-8 displays the DSD for the complete history of the 'Bundesliga.' Now, I discuss the DSD per decade. As presented in the previous section, the regression results are not identical for different periods of time. The base regression for calculating the DSD so far has been the complete regression model from Table 5-5. Now, I compare the DSD calculated from the complete regression model with the DSD calculated from the decade regression models (see Figure 5-5). In Figure 5-9 there are two DSDs for each club per decade (one on the x-axis and one on the y-axis). Since only some of the 50 teams have been in the 'Bundesliga' in all decades, Figure 5-9 displays only 143 (instead of five decades * 50 teams = 250) observations.

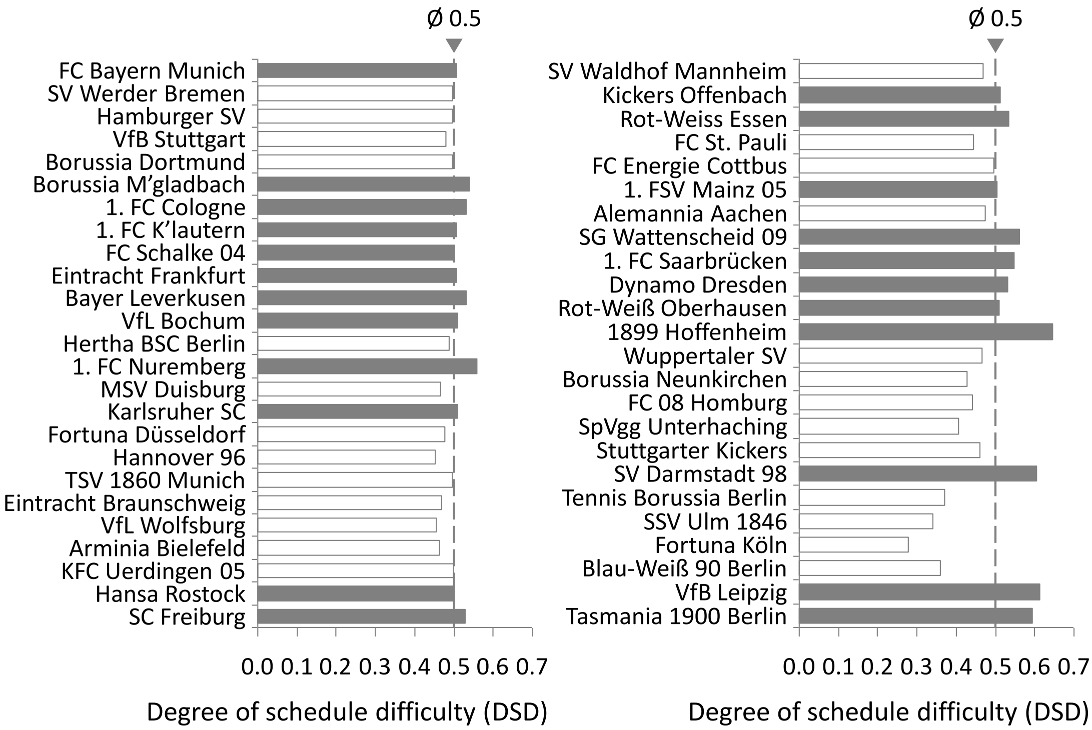

Figure 5-8 Average degree of schedule difficulty for all 'Bundesliga' clubs since 1964/65

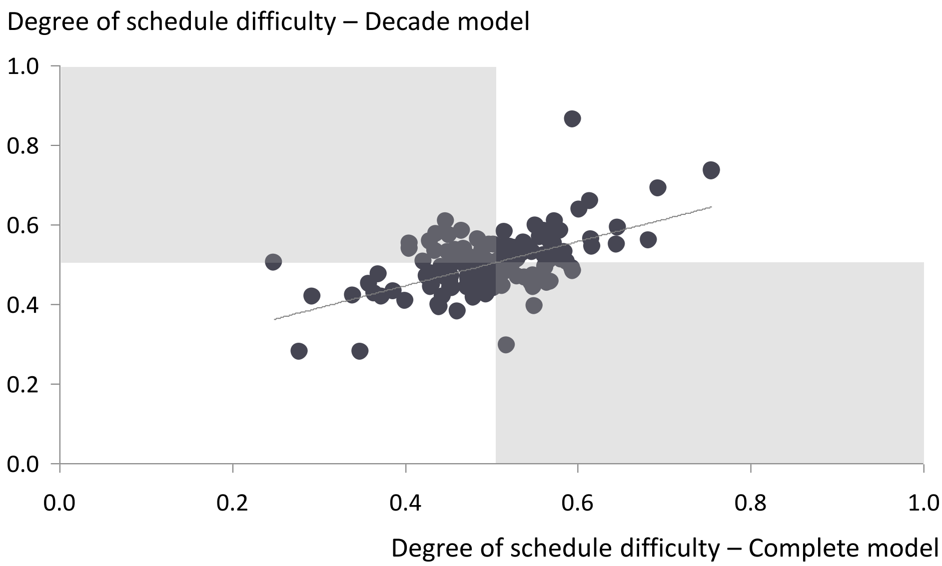

Figure 5-9 Comparison of degree of schedule difficulty for complete model vs. decade models

In the white areas of the graph, both DSDs are either above or below 0.5. The results in the grey areas include observations where the decade model implies an average DSD above 0.5 and the complete model implies an average DSD below 0.5 (and vice versa). Only about a third of the observations are in the grey areas. The results are positively correlated at 0.83.

5.5.3 Competitive Balance

The dependent variable indicates an increase/decrease of the win percentage compared to the previous season. Using the 'real' schedules with the regression estimates, I can now calculate the final ranking for all seasons. From the final rankings, the competitive balance can be derived. Figure 5-10 displays the real competitive balance (as seen in Figure 5-1) and the one calculated from my model using the 'real' schedule.

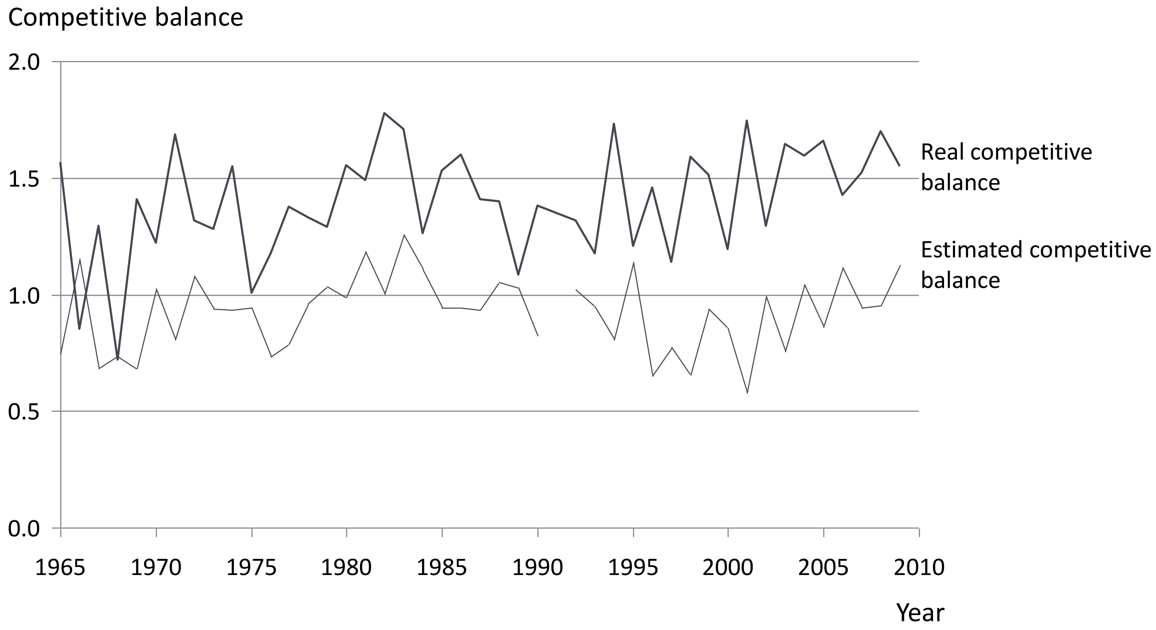

Figure 5-10 Real and estimated competitive balance

5.6 Summary and Conclusions

In this article I have analyzed the impact of schedule design on team performance in the German 'Bundesliga' between 1965 and the most recent seasons. Using several linear regression models, I extracted schedules that are easy and schedules that are difficult, i.e., leading to a better or worse performance of the respective team.

I use these results to estimate the competitive balance for all seasons[63] of the 'Bundesliga' since 1965. Figure 5-11 shows the competitive balance estimated with my model given the real schedule (black line/triangle markers), as well as the range between the most balanced and most unbalanced schedules possible. In the most unbalanced (balanced) schedule, the best team of the previous season gets the easiest (hardest) schedule and the last team gets the hardest (easiest). This range is indicated by the grey bars.

[63] In 1991/92 there were 20 teams in the league. Therefore, we excluded this season from our analyses.

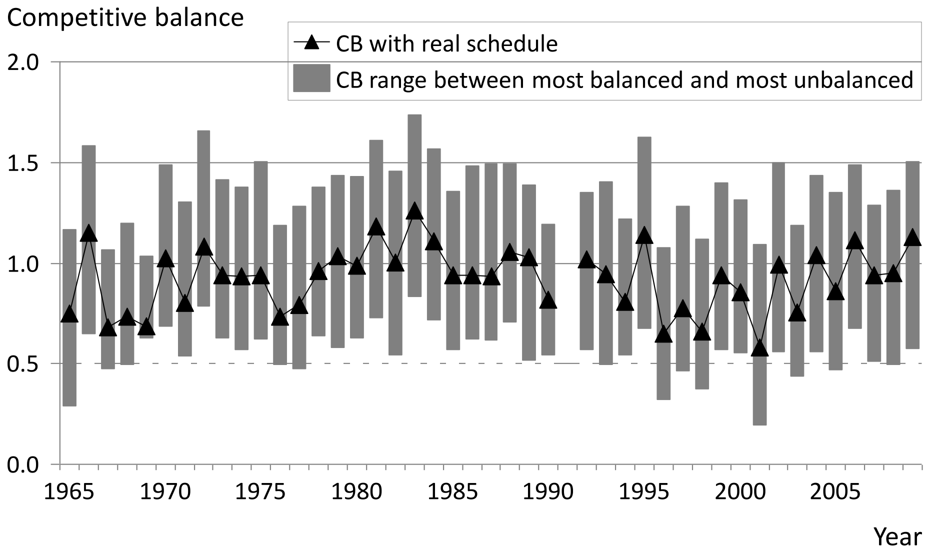

Figure 5-11 Competitive balance with real, most balanced, and most unbalanced schedule

If a league governing body wants to increase or decrease competitive balance, schedule design is a 'cheap' measure. In addition, scheduling can be used as a new revenue stream by the league if easy schedules are auctioned to the teams. These revenues could then be used e.g., to close the financial gap between the rich and the poor clubs.

Regarding future research goals, I have to mention that I have not taken into account the difference between home and away games in my analysis. In addition, future research could focus on a shorter time span to be able to include the difference between the actual ranking at the end of the season and the estimated ranking calculated from betting odds at the beginning of the season as dependent variable.

5.7 Appendix 5-1: Schedule Example of German 'Bundesliga' from 1983/84

To give an example of the templates that were used I have randomly picked a season. In my case, it is the 1983/84 season. As displayed in Table 5-7, there are sequences of games that most teams share. E.g., most teams play against the 15th, 16th and 13th of the previous season in a row (see the white areas with a black border). The teams that were 15th, 16th or 13th (Braunschweig, Mannheim, and Bochum) themselves still have the same sequence with just one different opponent. There are more identical sequences marked grey and black and there are even more that I have not marked in this example. E.g., teams often play against the 11th and 8th of the last season after they played the grey sequence.

Club	Ranking previous season	Opponent's strength on game day																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
VfB Stuttgart	3	15	6	16	7	13	18	12	11	5	8	4	9	14	17	10	2	1
Hamburger SV	1	6	7	18	8	9	11	17	2	15	16	13	12	5	4	14	10	3
Borussia M'gladbach	12	9	17	2	15	16	13	3	5	4	14	10	1	6	7	18	11	8
FC Bayern München	4	11	8	9	17	2	15	16	13	12	5	3	14	10	1	6	7	18
SV Werder Bremen	2	16	13	12	5	4	14	10	1	6	7	18	11	8	9	17	3	15
1. FC Köln	5	8	9	17	2	15	16	13	12	3	4	14	10	1	6	7	18	11
Bayer Leverkusen	11	4	14	10	6	7	1	18	3	8	9	17	2	15	16	13	12	5
Arminia Bielefeld	8	5	4	14	10	1	6	7	18	11	3	9	17	2	15	13	12	16
Eintracht Braunschweig	15	3	16	13	12	5	4	14	10	1	6	7	18	11	8	9	17	2
KFC Uerdingen 05	18	14	10	1	6	7	3	11	8	9	17	2	15	16	13	12	5	4
SV Waldhof Mannheim	16	2	15	3	13	12	5	4	14	10	1	6	7	18	11	9	17	8
1. FC K'lautern	6	1	7	3	18	11	8	9	17	2	15	16	13	12	5	4	14	10
Borussia Dortmund	7	10	6	1	3	18	11	8	9	17	2	15	16	13	12	5	4	14
Fortuna Düsseldorf	9	12	5	4	14	10	1	6	7	18	11	8	3	17	2	15	16	13
VfL Bochum	13	17	2	15	16	3	12	5	4	14	10	1	6	7	18	11	8	9
Eintracht Frankfurt	10	7	18	11	8	9	17	2	15	16	13	12	5	4	14	3	1	6
Kickers Offenbach	17	13	12	5	4	14	10	1	6	7	18	11	8	9	3	2	15	16
1. FC Nürnberg	14	18	11	8	9	17	2	15	16	13	12	5	4	3	10	1	6	7

Table 5-7 Example for schedule template for German 'Bundesliga' 1983/84

5.8 Appendix 5-2: Variables of Bartsch et al. for Scheduling German 'Bundesliga' 1995/96

Area	Variable name	Description	Required
Organizational	Stadium availability	Stadiums are also used for other purposes (concerts, etc.)	X
	Regions	In some regions (e.g., North Rhine-Westphalia) many clubs are located. To avoid heavy traffic and high demand for local safety staff, only a maximum number of home games should take place.	X
	Security aspects	Some games between clubs with well-known hooligans have to be scheduled e.g. in day time.	X
	League interdependent	Other leagues / competitions have to be taken into consideration. 2nd league, national and European cup competitions are relevant.	O
Attractiveness	Breaks	The number of breaks has to be minimized. In a 'normal' schedule each team should have home and away games alternately. If this pattern is broken, one speaks of a break.	X
	Min # days/match	Every team plays each other team twice. The competition is divided into two half-seasons. The time between the games of the same teams has to be minimized.	X
	Home preferences	Some teams have preferences for home game dates. E.g., Bayern Munich wants to play at home during 'Oktoberfest'. In addition, promoted teams should start with a home game. All other teams that started with an away game in the previous season should have a home game, too.	
	Attractive games	Broadcasting companies require that attractive games (games between teams that performed well last season or local derbies are evenly distributed over the whole season).	X
	Fixed matches	'Fixing' matches means that specific matches should be scheduled in the last three rounds of the season (e.g., the first and the second of the previous season should play against each other at the end of the season).	X
	Min/max # of games	A minimum and maximum number of games has to be scheduled on every weekday to fulfill broadcasting, radio, and lottery companies' requirements.	X
Fairness	Days without games	Teams should have at least two days between two matches (incl. national and European cup competitions).	X
	Opponent strength	Tough and weak opponents have to be distributed evenly over the season. Tough and weak is measured by the final score at the end of the previous season. The six teams with the highest score are 'hard', the next six teams are 'medium' and the last six teams are 'weak'. The schedule is then designed in a way that no two teams belonging to the same group are scheduled against each other in two consecutive rounds.	O
	Forbidden breaks	In the second and last round, there should be no breaks, so no team starts or ends with two away games.	X

Table 5-8 Constraints for designing a schedule for the German 'Bundesliga'

5.9 Appendix 5-3: Detailed Regression Results

Covariate	Delta WP2	Delta WP2 + World cup	Delta WP2 + World cup + 3PR	Delta WP2 + Home start	Delta WP2 + UEFA	Delta WP2 + UEFA + OWP2	Delta WP2 + UEFA + OR	Delta WP2 + OR
Number of obs	792	792	792	792	792	792	792	792
F(17, 774)	11.67	11.04	10.46	11.05	11.58	11.62	11.04	11.10
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.20	0.20	0.20	0.20	0.21	0.22	0.21	0.21
Adj R-squared	0.19	0.19	0.19	0.19	0.19	0.20	0.19	0.19
Root MSE	9.62	9.62	9.63	9.62	9.58	9.52	9.57	9.62
Game day 1	-0.927 ***	-0.927 ***	-0.927 ***	-0.921 ***	-1.130 ***	-0.572 ***	-11.964	-12.297
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)	(0.217)	(0.207)
Game day 2	-0.886 ***	-0.886 ***	-0.886 ***	-0.881 ***	-1.070 ***	-0.511 **	-11.898	-12.251
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.015)	(0.219)	(0.208)
Game day 3	-0.948 ***	-0.948 ***	-0.948 ***	-0.942 ***	-1.145 ***	-0.574 ***	-11.973	-12.313
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.217)	(0.206)
Game day 4	-0.803 ***	-0.802 ***	-0.802 ***	-0.801 ***	-1.007 ***	-0.447 **	-11.838	-12.171
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.034)	(0.222)	(0.211)
Game day 5	-0.966 ***	-0.966 ***	-0.966 ***	-0.964 ***	-1.180 ***	-0.624 ***	-12.008	-12.331
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.215)	(0.205)
Game day 6	-0.835 ***	-0.836 ***	-0.836 ***	-0.834 ***	-1.035 ***	-0.477 **	-11.868	-12.205
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.023)	(0.221)	(0.210)
Game day 7	-0.868 ***	-0.867 ***	-0.867 ***	-0.868 ***	-1.068 ***	-0.520 **	-11.895	-12.232
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.014)	(0.219)	(0.209)
Game day 8	-0.980 ***	-0.980 ***	-0.980 ***	-0.981 ***	-1.170 ***	-0.619 ***	-11.999	-12.346
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.216)	(0.205)
Game day 9	-0.830 ***	-0.830 ***	-0.830 ***	-0.832 ***	-1.035 ***	-0.477 **	-11.867	-12.199
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.026)	(0.221)	(0.210)
Game day 10	-0.873 ***	-0.873 ***	-0.873 ***	-0.875 ***	-1.072 ***	-0.511 **	-11.902	-12.240
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.016)	(0.219)	(0.209)
Game day 11	-0.983 ***	-0.983 ***	-0.983 ***	-0.983 ***	-1.188 ***	-0.619 ***	-12.022	-12.354
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.215)	(0.205)
Game day 12	-0.771 ***	-0.771 ***	-0.771 ***	-0.768 ***	-0.981 ***	-0.429 **	-11.813	-12.139
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.041)	(0.223)	(0.212)
Game day 13	-0.816 ***	-0.816 ***	-0.816 ***	-0.812 ***	-1.023 ***	-0.470 **	-11.858	-12.189
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.026)	(0.221)	(0.211)
Game day 14	-0.823 ***	-0.823 ***	-0.824 ***	-0.821 ***	-1.020 ***	-0.471 **	-11.848	-12.187
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.024)	(0.221)	(0.210)
Game day 15	-0.759 ***	-0.759 ***	-0.759 ***	-0.752 ***	-0.967 ***	-0.404 *	-11.801	-12.129
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.060)	(0.223)	(0.213)
Game day 16	-0.873 ***	-0.872 ***	-0.872 ***	-0.866 ***	-1.067 ***	-0.509 **	-11.897	-12.241
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.016)	(0.220)	(0.209)
Game day 17	-0.811 ***	-0.811 ***	-0.811 ***	-0.805 ***	-1.009 ***	-0.456 **	-11.842	-12.180
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.031)	(0.222)	(0.211)
Own ranking previous season		0.433					-10.831	-11.366
		(0.527)					(0.264)	(0.243)
Own win percentage previous season						-26.710 ***		
						(0.002)		
Dummy for 3-point-rule			-0.403					
			(0.578)					
Dummy for being a in a EC competition					3.015 ***	3.280 ***	2.992 ***	
					(0.004)	(0.002)	(0.005)	
Number of players bought								
Number of players sold								
Dummy for change in coach								
Dummy for starting the season with a home game				-0.572				
				(0.415)				
Dummy for season following a EC/WC			0.415					
			(0.545)					
Constant	140.097 ***	139.867 ***	140.004 ***	139.918 ***	171.454 ***	94.291 ***	2023.529	2083.927
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.222)	(0.211)

Table 5-9 Regression results – Regular models

Covariate	Delta WP2 + Buy + Sell + Coach	Delta WP2 + OR + Home start + UEFA + Coach	Delta WP2 + UEFA + Coach	Delta WP2 +OR + OWP2 + World cup + 3PR + Home start + UEFA + Buy + Sell + Coach	Delta WP2 +OR + World cup + 3PR + Home start + UEFA + Buy + Sell + Coach	Delta WP2 + OR + World cup + 3PR + Home start + UEFA + Coach	Delta WP2 + OR + World cup + 3PR + Home start + Coach	Delta WP2 + OWP2
Number of obs	792	792	792	792	792	792	792	792
F(17, 774)	14.50	14.19	15.61	12.82	12.25	12.94	12.98	11.59
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.27	0.28	0.28	0.30	0.29	0.28	0.27	0.21
Adj R-squared	0.25	0.26	0.26	0.28	0.26	0.26	0.25	0.19
Root MSE	9.21	9.18	9.18	9.05	9.16	9.19	9.24	9.57
Game day 1	-0.963 ***	-10.580	-1.145 ***	-7.078	-8.912	-10.361	-10.759	-0.396 *
	(0.000)	(0.255)	(0.000)	(0.442)	(0.338)	(0.266)	(0.251)	(0.051)
Game day 2	-0.958 ***	-10.551	-1.120 ***	-7.046	-8.882	-10.332	-10.750	-0.357 *
	(0.000)	(0.256)	(0.000)	(0.444)	(0.340)	(0.267)	(0.251)	(0.083)
Game day 3	-0.983 ***	-10.592	-1.162 ***	-7.068	-8.923	-10.374	-10.778	-0.406 *
	(0.000)	(0.254)	(0.000)	(0.442)	(0.337)	(0.265)	(0.250)	(0.052)
Game day 4	-0.855 ***	-10.483	-1.047 ***	-6.968	-8.803	-10.263	-10.662	-0.271
	(0.000)	(0.260)	(0.000)	(0.449)	(0.344)	(0.271)	(0.255)	(0.185)
Game day 5	-0.996 ***	-10.626	-1.193 ***	-7.124	-8.954	-10.408	-10.796	-0.437 **
	(0.000)	(0.253)	(0.000)	(0.439)	(0.336)	(0.264)	(0.249)	(0.033)
Game day 6	-0.872 ***	-10.493	-1.054 ***	-6.986	-8.819	-10.274	-10.677	-0.305
	(0.000)	(0.259)	(0.000)	(0.448)	(0.343)	(0.270)	(0.254)	(0.134)
Game day 7	-0.933 ***	-10.551	-1.117 ***	-7.056	-8.874	-10.332	-10.734	-0.347 *
	(0.000)	(0.256)	(0.000)	(0.443)	(0.340)	(0.267)	(0.251)	(0.089)
Game day 8	-1.046 ***	-10.647	-1.210 ***	-7.163	-8.985	-10.428	-10.841	-0.458 **
	(0.000)	(0.252)	(0.000)	(0.436)	(0.334)	(0.263)	(0.247)	(0.024)
Game day 9	-0.871 ***	-10.504	-1.065 ***	-6.990	-8.826	-10.285	-10.683	-0.299
	(0.000)	(0.259)	(0.000)	(0.447)	(0.343)	(0.270)	(0.254)	(0.148)
Game day 10	-0.934 ***	-10.547	-1.109 ***	-7.045	-8.880	-10.329	-10.732	-0.341 *
	(0.000)	(0.257)	(0.000)	(0.444)	(0.340)	(0.268)	(0.252)	(0.099)
Game day 11	-1.030 ***	-10.652	-1.211 ***	-7.134	-8.985	-10.433	-10.830	-0.442 **
	(0.000)	(0.252)	(0.000)	(0.438)	(0.334)	(0.263)	(0.248)	(0.032)
Game day 12	-0.799 ***	-10.436	-0.999 ***	-6.932	-8.757	-10.217	-10.609	-0.245
	(0.000)	(0.262)	(0.000)	(0.451)	(0.347)	(0.273)	(0.257)	(0.226)
Game day 13	-0.866 ***	-10.496	-1.058 ***	-6.991	-8.819	-10.276	-10.672	-0.291
	(0.000)	(0.259)	(0.000)	(0.448)	(0.343)	(0.270)	(0.255)	(0.153)
Game day 14	-0.873 ***	-10.482	-1.049 ***	-6.998	-8.815	-10.264	-10.669	-0.301
	(0.000)	(0.259)	(0.000)	(0.447)	(0.343)	(0.270)	(0.254)	(0.136)
Game day 15	-0.825 ***	-10.449	-1.016 ***	-6.935	-8.777	-10.231	-10.624	-0.224
	(0.000)	(0.261)	(0.000)	(0.451)	(0.346)	(0.272)	(0.257)	(0.281)
Game day 16	-0.930 ***	-10.539	-1.108 ***	-7.026	-8.861	-10.319	-10.728	-0.344 *
	(0.000)	(0.257)	(0.000)	(0.445)	(0.341)	(0.268)	(0.252)	(0.093)
Game day 17	-0.861 ***	-10.480	-1.045 ***	-6.977	-8.803	-10.261	-10.664	-0.285
	(0.000)	(0.260)	(0.000)	(0.448)	(0.344)	(0.271)	(0.255)	(0.164)
Own ranking previous season		-9.439		-6.744	-7.736	-9.218	-9.822	
		(0.310)		(0.463)	(0.406)	(0.322)	(0.294)	
Own win percentage previous season				-40.864 ***				-24.591 ***
				(0.000)				(0.004)
Dummy for 3-point-rule				-2.725 ***	-1.295	-0.271	-0.143	
				(0.007)	(0.184)	(0.695)	(0.837)	
Dummy for being a participant in a European club competition		3.014 ***	3.049 ***	3.768 ***	3.204 ***	3.038 ***		
		(0.003)	(0.003)	(0.000)	(0.002)	(0.003)		
Number of players bought	-0.140			-0.111	-0.072			
	(0.334)			(0.507)	(0.672)			
Number of players sold	0.336 **			0.384 **	0.406 **			
	(0.038)			(0.018)	(0.014)			
Dummy for change in coach	-6.963 ***	-6.791 ***	-6.813 ***	-7.084 ***	-6.958 ***	-6.769 ***	-6.763 ***	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Dummy for starting the season with a home game		-0.504		-0.441	-0.435	-0.505	-0.545	
		(0.451)		(0.505)	(0.515)	(0.451)	(0.418)	
Dummy for season following a European or World cup				0.123	0.196	0.243	0.253	
				(0.849)	(0.764)	(0.710)	(0.701)	
Constant	148.7 ***	1791.7	178.0 ***	1219.3	1504.2	1754.2	1825.8	66.5 **
	(0.000)	(0.260)	(0.000)	(0.438)	(0.344)	(0.271)	(0.254)	(0.016)

Table 5-9 continued

Covariate	Delta WP3	Delta WP3 + OR	Delta WP3 + OR + 50 club dummies	Delta WP3 + 50 club dummies	Delta WP3 + OWP3	Delta WP2 + OR + Coach
Number of obs	792	792	792	792	792	792
F(17, 774)	15.61	14.82	6.30	6.37	17.02	15.03
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.26	0.26	0.36	0.36	0.28	0.27
Adj R-squared	0.24	0.24	0.31	0.31	0.27	0.25
Root MSE	9.85	9.85	9.40	9.41	9.67	9.22
Game day 1	-1.115 ***	-12.543	-12.616	-1.598 ***	0.010	-10.719
	(0.000)	(0.208)	(0.191)	(0.000)	(0.965)	(0.251)
Game day 2	-1.070 ***	-12.492	-12.555	-1.543 ***	0.050	-10.710
	(0.000)	(0.210)	(0.193)	(0.000)	(0.822)	(0.251)
Game day 3	-1.116 ***	-12.538	-12.639	-1.626 ***	0.022	-10.738
	(0.000)	(0.208)	(0.190)	(0.000)	(0.923)	(0.250)
Game day 4	-0.930 ***	-12.355	-12.423	-1.408 ***	0.171	-10.619
	(0.000)	(0.215)	(0.197)	(0.000)	(0.433)	(0.255)
Game day 5	-1.123 ***	-12.546	-12.620	-1.607 ***	-0.008	-10.753
	(0.000)	(0.208)	(0.190)	(0.000)	(0.970)	(0.249)
Game day 6	-0.986 ***	-12.414	-12.489	-1.472 ***	0.124	-10.632
	(0.000)	(0.213)	(0.195)	(0.000)	(0.571)	(0.255)
Game day 7	-1.004 ***	-12.425	-12.485	-1.475 ***	0.089	-10.689
	(0.000)	(0.212)	(0.195)	(0.000)	(0.683)	(0.252)
Game day 8	-1.154 ***	-12.577	-12.617	-1.605 ***	-0.051	-10.794
	(0.000)	(0.207)	(0.190)	(0.000)	(0.814)	(0.248)
Game day 9	-0.971 ***	-12.398	-12.467	-1.451 ***	0.140	-10.636
	(0.000)	(0.214)	(0.196)	(0.000)	(0.529)	(0.255)
Game day 10	-1.042 ***	-12.466	-12.535	-1.521 ***	0.077	-10.686
	(0.000)	(0.211)	(0.193)	(0.000)	(0.730)	(0.252)
Game day 11	-1.171 ***	-12.600	-12.635	-1.617 ***	-0.020	-10.785
	(0.000)	(0.206)	(0.190)	(0.000)	(0.930)	(0.248)
Game day 12	-0.926 ***	-12.353	-12.378	-1.361 ***	0.175	-10.566
	(0.000)	(0.215)	(0.199)	(0.000)	(0.423)	(0.258)
Game day 13	-0.966 ***	-12.396	-12.448	-1.429 ***	0.139	-10.631
	(0.000)	(0.214)	(0.197)	(0.000)	(0.528)	(0.255)
Game day 14	-0.964 ***	-12.386	-12.418	-1.407 ***	0.129	-10.625
	(0.000)	(0.214)	(0.197)	(0.000)	(0.554)	(0.255)
Game day 15	-0.899 ***	-12.327	-12.397	-1.380 ***	0.223	-10.586
	(0.000)	(0.216)	(0.198)	(0.000)	(0.319)	(0.257)
Game day 16	-1.020 ***	-12.445	-12.452	-1.438 ***	0.096	-10.690
	(0.000)	(0.212)	(0.196)	(0.000)	(0.664)	(0.252)
Game day 17	-0.994 ***	-12.422	-12.456	-1.439 ***	0.116	-10.625
	(0.000)	(0.213)	(0.196)	(0.000)	(0.601)	(0.255)
Own ranking previous season		-11.423	-11.014			-9.777
		(0.252)	(0.253)			(0.295)
Own win percentage previous season					-47.976 ***	
					(0.000)	
Dummy for 3-point-rule						
Dummy for being a participant in a European club competition						
Number of players bought						
Number of players sold						
Dummy for change in coach						-6.786 ***
						(0.000)
Dummy for starting the season with a home game						
Dummy for season following a European or World cup						

Table 5-9 continued

Covariate	Delta WP3	Delta WP3 + OR	Delta WP3 + OR + 50 club dummies		Delta WP3 + 50 club dummies		Delta WP3 + OWP3	Delta WP2 + OR + Coach
Dummy for SV Werder Bremen			-7.100	***	-7.105	***		
			(0.001)		(0.001)			
Dummy for Hamburger SV			-7.087	***	-7.084	***		
			(0.001)		(0.001)			
Dummy for VfB Stuttgart			-7.744	***	-7.466	***		
			(0.000)		(0.000)			
Dummy for Borussia Dortmund			-8.374	***	-8.371	***		
			(0.000)		(0.000)			
Dummy for Borussia M'gladbach			-7.975	***	-7.959	***		
			(0.000)		(0.000)			
Dummy for 1. FC Köln			-8.439	***	-8.440	***		
			(0.000)		(0.000)			
Dummy for 1. FC K'lautern			-10.006	***	-9.995	***		
			(0.000)		(0.000)			
Dummy for FC Schalke 04			-9.213	***	-9.202	***		
			(0.000)		(0.000)			
Dummy for Eintracht Frankfurt			-10.584	***	-10.591	***		
			(0.000)		(0.000)			
Dummy for Bayer Leverkusen			-6.503	***	-6.491	***		
			(0.004)		(0.004)			
Dummy for VfL Bochum			-14.928	***	-14.902	***		
			(0.000)		(0.000)			
Dummy for Hertha BSC Berlin			-9.371	***	-9.362	***		
			(0.000)		(0.000)			
Dummy for 1. FC Nürnberg			-13.626	***	-13.595	***		
			(0.000)		(0.000)			
Dummy for MSV Duisburg			-15.515	***	-15.511	***		
			(0.000)		(0.000)			
Dummy for Karlsruher SC			-14.436	***	-14.410	***		
			(0.000)		(0.000)			
Dummy for Fortuna Düsseldorf			-12.341	***	-12.324	***		
			(0.000)		(0.000)			
Dummy for Hannover 96			-16.492	***	-16.482	***		
			(0.000)		(0.000)			
Dummy for TSV 1860 München			-11.438	***	-11.408	***		
			(0.000)		(0.000)			
Dummy for Eintracht Braunschweig			-11.860	***	-11.842	***		
			(0.000)		(0.000)			
Dummy for VfL Wolfsburg			-10.724	***	-10.727	***		
			(0.000)		(0.000)			
Dummy for Arminia Bielefeld			-17.323	***	-17.309	***		
			(0.000)		(0.000)			
Dummy for KFC Uerdingen 05			-13.918	***	-13.877	***		
			(0.000)		(0.000)			
Dummy for Hansa Rostock			-15.313	***	-15.312	***		
			(0.000)		(0.000)			
Dummy for SC Freiburg			-16.282	***	-16.252	***		
			(0.000)		(0.000)			
Dummy for SV Waldhof Mannheim			-14.001	***	-14.015	***		
			(0.000)		(0.000)			
Dummy for Kickers Offenbach			-9.879	**	-9.883	**		
			(0.013)		(0.013)			
Dummy for Rot-Weiss Essen			-13.711	***	-13.695	***		
			(0.001)		(0.001)			
Dummy for FC St. Pauli			-18.777	***	-18.790	***		
			(0.000)		(0.000)			
Dummy for FC Energie Cottbus			-17.250	***	-17.258	***		
			(0.000)		(0.000)			

Table 5-9 continued

Covariate	Delta WP3		Delta WP3 + OR	Delta WP3 + OR + 50 club dummies		Delta WP3 + 50 club dummies		Delta WP3 + OWP3	Delta WP2 + OR + Coach
Dummy for 1. FSV Mainz 05				-11.850	**	-11.864	**		
				(0.018)		(0.018)			
Dummy for Alemannia Aachen				-14.299	***	-14.270	***		
				(0.004)		(0.004)			
Dummy for SG Wattenscheid 09				-15.573	***	-15.543	***		
				(0.007)		(0.007)			
Dummy for 1. FC Saarbrücken				-16.487	***	-16.449	***		
				(0.001)		(0.001)			
Dummy for Dynamo Dresden				-24.380	***	-24.288	***		
				(0.000)		(0.000)			
Dummy for Rot-Weiß Oberhausen				-17.464	***	-17.476	***		
				(0.001)		(0.001)			
Dummy for 1899 Hoffenheim				-7.267		-7.214			
				(0.292)		(0.295)			
Dummy for Wuppertaler SV				-18.729	***	-18.729	***		
				(0.001)		(0.001)			
Dummy for Borussia Neunkirchen				-20.807	***	-20.779	***		
				(0.003)		(0.003)			
Dummy for FC 08 Homburg				-16.766	***	-16.773	***		
				(0.004)		(0.004)			
Dummy for SpVgg Unterhaching				-16.933	**	-16.974	**		
				(0.015)		(0.015)			
Dummy for Stuttgarter Kickers				-9.675		-9.725			
				(0.317)		(0.315)			
Dummy for SV Darmstadt 98				-17.015	**	-17.026	**		
				(0.015)		(0.015)			
Dummy for Tennis Borussia Berlin				-22.000	***	-21.962	***		
				(0.002)		(0.002)			
Dummy for SSV Ulm 1846				-15.651		-15.683			
				(0.106)		(0.105)			
Dummy for Fortuna Köln				-14.309		-14.262			
				(0.140)		(0.141)			
Dummy for SC Preußen 06 e.V Münster				(omitted)		(omitted)			
Dummy for Blau-Weiß 90 Berlin				-25.207	***	-25.180	**		
				(0.009)		(0.010)			
Dummy for VfB Leipzig				-22.018	**	-22.011	**		
				(0.023)		(0.023)			
Dummy for Tasmania 1900 Berlin				-35.004	***	-34.916	***		
				(0.000)		(0.000)			
Constant	166.4	***	2120.2	2135.7		252.2	***	8.2	1818.3
	(0.000)		(0.214)	(0.195)		(0.000)		(0.788)	(0.255)

Table 5-9 continued

Covariate	Delta WP3 + OR + Net transfer revenue	Delta WP2+ OR + Market value	Delta WP2 + Market value	Delta WP2 + Buy + Sell + Coach + Market value	Delta WP2 + Coach + Market value	Delta WP2 + OR + World cup + 3PR + Home start + UEFA + Buy + Sell + Coach + Market value	Delta WP2 +OR + Home start + UEFA + Coach + Market value	Delta WP2 + Home start + UEFA + Coach + Market value	Delta WP2 + UEFA + Coach + Market value	Delta WP3	Delta WP2
Number of obs	270	252	252	252	252	252	252	252	252	252	252
F(17, 774)	5.15	5.32	5.32	7.43	8.08	6.77	7.47	7.47	7.77	4.50	4.23
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.27	0.29	0.29	0.40	0.40	0.42	0.41	0.41	0.40	0.25	0.24
Adj R-squared	0.22	0.24	0.24	0.35	0.35	0.36	0.35	0.35	0.35	0.19	0.18
Root MSE	10.23	9.98	9.98	9.21	9.22	9.17	9.20	9.20	9.21	10.27	10.35
Game day 1	-0.958 ***	-1.331 ***	-1.331 ***	-1.197 ***	-1.233 ***	-1.346 ***	-1.376 ***	-1.376 ***	-1.400 ***	-0.879 ***	-0.849 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 2	-0.935 ***	-1.232 ***	-1.232 ***	-1.122 ***	-1.153 ***	-1.244 ***	-1.271 ***	-1.271 ***	-1.292 ***	-0.796 ***	-0.764 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 3	-1.132 ***	-1.469 ***	-1.469 ***	-1.370 ***	-1.402 ***	-1.509 ***	-1.538 ***	-1.538 ***	-1.553 ***	-1.038 ***	-0.998 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 4	-1.103 ***	-1.482 ***	-1.482 ***	-1.442 ***	-1.478 ***	-1.590 ***	-1.624 ***	-1.624 ***	-1.629 ***	-1.021 ***	-1.006 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 5	-1.077 ***	-1.383 ***	-1.383 ***	-1.315 ***	-1.347 ***	-1.488 ***	-1.514 ***	-1.514 ***	-1.519 ***	-1.000 ***	-0.968 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 6	-0.960 ***	-1.262 ***	-1.262 ***	-1.166 ***	-1.191 ***	-1.321 ***	-1.342 ***	-1.342 ***	-1.348 ***	-0.771 ***	-0.754 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 7	-1.010 ***	-1.399 ***	-1.399 ***	-1.318 ***	-1.365 ***	-1.457 ***	-1.501 ***	-1.501 ***	-1.510 ***	-0.956 ***	-0.947 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 8	-1.042 ***	-1.362 ***	-1.362 ***	-1.335 ***	-1.356 ***	-1.483 ***	-1.502 ***	-1.502 ***	-1.498 ***	-0.927 ***	-0.910 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 9	-1.170 ***	-1.489 ***	-1.489 ***	-1.383 ***	-1.425 ***	-1.544 ***	-1.582 ***	-1.582 ***	-1.589 ***	-1.045 ***	-1.022 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 10	-1.114 ***	-1.482 ***	-1.482 ***	-1.322 ***	-1.353 ***	-1.482 ***	-1.509 ***	-1.509 ***	-1.512 ***	-1.037 ***	-1.010 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 11	-1.290 ***	-1.627 ***	-1.627 ***	-1.528 ***	-1.561 ***	-1.687 ***	-1.714 ***	-1.714 ***	-1.719 ***	-1.238 ***	-1.205 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 12	-1.040 ***	-1.303 ***	-1.303 ***	-1.221 ***	-1.256 ***	-1.387 ***	-1.416 ***	-1.416 ***	-1.426 ***	-0.943 ***	-0.917 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 13	-1.140 ***	-1.489 ***	-1.489 ***	-1.471 ***	-1.511 ***	-1.636 ***	-1.667 ***	-1.667 ***	-1.682 ***	-1.096 ***	-1.069 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 14	-1.028 ***	-1.305 ***	-1.305 ***	-1.242 ***	-1.270 ***	-1.390 ***	-1.413 ***	-1.413 ***	-1.418 ***	-0.848 ***	-0.833 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 15	-1.024 ***	-1.355 ***	-1.355 ***	-1.225 ***	-1.263 ***	-1.377 ***	-1.409 ***	-1.409 ***	-1.436 ***	-0.895 ***	-0.859 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 5-10 Regression results – 1995 to 2008 models

Covariate	Delta WP3 + OR + Net transfer revenue	Delta WP2+ OR + Market value	Delta WP2 + Market value	Delta WP2 + Buy + Sell + Coach + Market value	Delta WP2 + Coach + Market value	Delta WP2 + OR + World cup + 3PR + Home start + UEFA + Buy + Sell + Coach + Market value	Delta WP2 +OR + Home start + UEFA + Coach + Market value	Delta WP2 + Home start + UEFA + Coach + Market value	Delta WP2 + UEFA + Coach + Market value	Delta WP3	Delta WP2
Game day 16	-0.960 ***	-1.276 ***	-1.276 ***	-1.155 ***	-1.192 ***	-1.284 ***	-1.318 ***	-1.318 ***	-1.338 ***	-0.848 ***	-0.814 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 17	-0.945 ***	-1.320 ***	-1.320 ***	-1.296 ***	-1.334 ***	-1.422 ***	-1.461 ***	-1.461 ***	-1.482 ***	-0.839 ***	-0.821 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Own ranking previous season	(omitted)	(omitted)				(omitted)	(omitted)				
Own win percentage previous season											
Dummy for 3-point-rule						(omitted)					
Dummy for being a participant in a European club competition						2.534	2.360	2.360	2.426		
						(0.203)	(0.233)	(0.233)	(0.220)		
Number of players bought				0.117		0.104					
				(0.661)		(0.699)					
Number of players sold				0.262		0.290					
				(0.307)		(0.261)					
Dummy for change in coach				-9.330 ***	-9.087 ***	-9.269 ***	-9.043 ***	-9.043 ***	-9.063 ***		
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
Dummy for starting the season with a home game						-1.287	-1.390	-1.390			
						(0.286)	(0.249)	(0.249)			
Dummy for season following a European or World cup						1.699					
						(0.144)					
Market value		0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.162 ***	0.172 ***	0.172 ***	0.168 ***		
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
Net transfer revenue	-0.243 ***										
	(0.004)										
Constant	169.683 ***	216.765 ***	216.765 ***	203.010 ***	210.898 ***	226.150 ***	234.260 ***	234.260 ***	235.487 ***	153.806 ***	149.271 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 5-10 continued

Covariate	Delta WP3 - 1960s	Delta WP3 - 1970s	Delta WP3 - 1980s	Delta WP3 - 1990s	Delta WP3 - 2000s
Number of obs	90	180	180	162	180
F(17, 774)	3.19	6.16	4.51	4.18	2.68
Prob > F	0.00	0.00	0.00	0.00	0.00
R-squared	0.43	0.39	0.32	0.33	0.22
Adj R-squared	0.30	0.33	0.25	0.25	0.14
Root MSE	10.13	9.35	9.07	10.27	10.33
Game day 1	-1.152 ***	-1.341 ***	-1.133 ***	-1.015 ***	-0.516 **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.022)
Game day 2	-1.886 ***	-1.079 ***	-0.817 ***	-1.073 ***	-0.775 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Game day 3	-0.904 ***	-1.132 ***	-1.022 ***	-1.186 ***	-0.913 ***
	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 4	-1.386 ***	-0.845 ***	-0.707 ***	-0.862 ***	-1.078 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 5	-1.321 ***	-1.136 ***	-1.003 ***	-1.232 ***	-0.793 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Game day 6	-1.166 ***	-0.988 ***	-0.904 ***	-0.953 ***	-0.795 ***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 7	-1.263 ***	-0.944 ***	-0.812 ***	-0.917 ***	-0.830 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 8	-1.503 ***	-1.126 ***	-1.062 ***	-1.286 ***	-0.689 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Game day 9	-1.457 ***	-0.833 ***	-0.694 ***	-1.141 ***	-0.904 ***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Game day 10	-1.181 ***	-1.393 ***	-0.729 ***	-0.990 ***	-0.784 ***
	(0.002)	(0.000)	(0.000)	(0.000)	(0.001)
Game day 11	-1.290 ***	-1.017 ***	-1.032 ***	-1.351 ***	-1.026 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 12	-1.089 ***	-0.897 ***	-0.777 ***	-1.170 ***	-0.721 ***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Game day 13	-1.307 ***	-0.775 ***	-0.589 ***	-1.317 ***	-0.810 ***
	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)
Game day 14	-1.111 ***	-0.871 ***	-1.039 ***	-0.823 ***	-0.895 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Game day 15	-1.357 ***	-0.779 ***	-0.695 ***	-0.910 ***	-0.682 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)
Game day 16	-1.462 ***	-0.911 ***	-0.951 ***	-0.987 ***	-0.592 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.007)
Game day 17	-1.242 ***	-1.118 ***	-0.819 ***	-0.905 ***	-0.762 ***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Constant	210.950 ***	164.282 ***	141.310 ***	172.846 ***	128.785
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 5-11 Regression results – Decade models

6 Conclusion and Outlook

To address the main research questions stated in the introduction, this dissertation analyzes determinants of promotion and relegation in professional soccer leagues. Using survival analysis and data that often contains more than 50 seasons per country, I identify factors that have a significant effect on promotion and relegation.

In chapter 2 I show—in line with findings presented by other authors for (many) other industries—that 'liability of newness' and 'liability of smallness'—two theory fragments of organizational ecology—can be used to explain the pattern of relegation in sports leagues. Clubs that just entered a first tier sports league are more likely to be relegated (i.e., 'liability of newness'). In addition, small clubs have a higher risk of relegation than big clubs (i.e., 'liability of smallness'). Controlling for 'founding conditions,' i.e., conditions in the first season a club played in the first tier league, we show that the 'Bosman-ruling'[64] has a significant effect. In line with other labor market research, we show that small market teams may benefit the most from the opportunity to sign high quality players from abroad. Our analysis shows that applying organizational ecology and survival analysis specifically to success in soccer yields significant and plausible results that can be used to explain determinants of relegation.

In the subsequent chapter 3—in line with more general studies on Olympic success, but contrary to a study on location in the National Hockey League (NHL)—I show that soccer is a normal and not an inferior good. The higher the wealth of a region, measured in GDP per capita, the more successful a soccer team is. Contrary to expectations, I find that the size of the population surrounding a soccer club plays no significant role. One reason could be that clubs do not recruit their players from the regional talent pool anymore using country-wide and even global scouting departments to find young talent. Most interestingly, being geographically close to other first, second or even third tier clubs seems to have no significant impact on relegation probabilities. This point, if shown for U.S. sports leagues, could support new clubs in becoming members of a professional sports league in the U.S. (NHL, NBA, NFL, MLB). In the U.S., new clubs are often rejected because existing members from the same city or region expect a negative impact on their own (athletic and financial) success in the league.

[64] In 1995, the European Court of Justice decided in the so called “Bosman-ruling” that EU football players were given the right to transfer without any transfer fee at the end of their contracts. In addition, the restriction on the number of players from other EU countries was lifted.

In the following chapter 4, I find that—ceteris paribus—the experience of a club in the first division as well as it being located in a big city increases the chances of being promoted and decreases the chances of being relegated equally. Experience in the second league reduces the chances of promotion. Surprisingly, previous promotions and relegations have no significant effect on promotion and relegation. Contrary to previous research, I find that another team from the same city playing in the first league has a positive impact on the promotion of a second tier team. Regarding differences between leagues in Europe, I find that coefficients—while varying slightly from country to country—are of similar magnitude and significance levels. Comparing promotion with relegation, I show that the regression coefficients for the variables are similar in magnitude and significance while pointing in opposite directions. In addition, I propose a forecast model that identifies the promotion and relegation probabilities. This forecast model needs to be adjusted by future research to include club internal variables such as player salaries, transfer fees and so forth. I could then help club managers to save money in seasons with low chances of promotion and risks of relegation and invest in seasons with more pronounced chances or risks.

In chapter 5, I analyze the impact of schedules on win percentage of the individual clubs using the schedules of all clubs playing in the German 'Bundesliga' since 1965. With these estimation results, I develop easy and difficult schedules for clubs. These findings can be used in two ways by the league governing body to improve competitive balance. First, they could give the easier schedules to the weaker teams. Second, auctioning the right of an easy schedule to the clubs could also create revenues for the league governing body. This money could be given to the weaker clubs to invest in better players, thus, increasing competitive balance.

As I already mentioned in the individual chapters, there are some shortcomings that could be interesting topics for future research. In future research on promotion and relegation, the following ideas could be incorporated:

- Some theory fragments of organizational ecology are used in chapter 2 of this dissertation. Using other theory fragments such as organizational change or organizational foundings could enrich the interpretation of the empirical results.
- The human capital of players and head coaches as well as the transfers of players and head coaches is likely to affect the promotion and relegation probabilities of teams. Therefore, the composition as well as changes in the composition of the teams (e.g., player strength measured e.g., by grades from sports magazines, average age of teams, cultural factors such

as countries of origin of players) should be taken into account when estimating more elaborate models.

— Differences in the institutional arrangements across leagues and changes in these arrangements or other changes in the environment of the league over time are likely to affect the survival probabilities of new and established teams perhaps in similar, perhaps in different ways. In chapter 4, I included interruptions in leagues due to war and I also included the "Bosman-ruling" in chapters 2 and 4. However, the impact of other changes (introduction of the 3-point-rule, increase in TV revenues and so forth) on promotion and relegation should be analyzed in more detail.

— Using financial data such as total revenues, net transfer revenues or salaries of players and coaches, which will only be available in more recent years, could give more information on promotion and relegation probabilities—even if this means restricting the analysis to a shorter time period.

Bibliography

Akaike, H. (1974). A New Look at the Statistical Model Identification. IEEE Transaction on Automatic Control 19(6): 716-723.

Aldrich, H. E. and E. R. Auster (1986). Even Dwarfs Started Small: Liability of Age and Size and Their Strategic Implications. Research in Organizational Behavior. B. M. Staw and L. L. Cummings. Greenwich, JAI. 8: 165-198.

Allison, P. D. (1984). Event History Analysis: Regression for Longitudinal Event Data. Newbury Park, London, New Delhi, Sage Publications.

Andersen, P. K. and R. D. Gill (1982). Cox's Regression Model for Counting Processes: A Large Sample Study. The Annals of Statistics 10(4): 1100-1120.

Andreff, W. (2001). The Correlation Between Economic Underdevelopment and Sport. European Sport Management Quarterly 1(4): 251-279.

Andreff, W. (2006). Team Sports and Finance. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 689-699.

Antonioni, P. and J. Cubbin (2000). The Bosman Ruling and the Emergence of a Single Market in Soccer Talent. European Journal of Law and Economics 9(2): 157-173.

Baade, R. A. (1994). Stadiums, Professional Sports, and Economic Development: Assessing the Reality. Detroit, Heartland Institute Policy Study.

Baade, R. A. (1996). Professional Sports as Catalysts for Metropolitan Economic Development. Journal of Urban Affairs 18(1): 1-17.

Baade, R. A. and R. F. Dye (1988). Sports Stadiums a dn Area Development: A Critical Review. Economic Development Quarterly 2(3): 265-275.

Baade, R. A. and R. F. Dye (1990). The Impact of Stadiums and Professional Sports on Metropolitan Area Development. Growth and Change 21(1): 1-14.

Baade, R. A. and V. Matheson (2002). Bidding for the Olympics: Fool's Gold. Transatlantic Sport: The Comparative Economics of North American and European Sports. C. P. Barros, M. Ibrahimo and S. Szymanski. Cheltenham, UK and Northhampton, MA, USA, Edward Elgar: 127-151.

Baade, R. A. and V. A. Matheson (2000). An Assessment of the Economic Impact of the American Football Championship, the Super Bowl, on Host Communities. Reflets et Perspectives de la vie économique 39(2-3): 35-46.

Baade, R. A. and V. A. Matheson (2004). The Quest for the Cup: Assessing the Economic Impact of the World Cup. Regional Studies 38(4): 343-345.

Badenhausen, K. (2011). The World's Highest-Paid Athletes. Retrieved from http://www.forbes.com/sites/kurtbadenhausen/2011/05/31/the-worlds-highest-paid-athletes (last accessed on May 15, 2012).

Baim, D. (1990). Sports Stadiums as Wise Investment: An Evaluation. Detroit, Heartland Institute Policy Study.

Baim, D. (1992). The Sports Stadium and a Municipal Investment. Westport, CT, Greenwood Press.

Bakoyannis, G. and G. Touloumi (2008) A Practical Guide on Modeling Competing Risk Data. 1-34 DOI:

Ball, D. W. (1972). Olympic Games Competition: Structural Correlates of National Success. International Journal of Comparative Sociology 15(3-4): 186-200.

Barron, D. N., et al. (1994). A Time to Grow and a Time to Die: Growth and Mortality of Credit Unions in New York, 1914-1990. American Journal of Sociology 105(4): 960-1012.

Barros, C. P. (2006). Local Government and Regional Development in Sport. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK and Northhampton, MA, USA, Edward Elgar: 287-298.

Barros, C. P., et al. (2009). Coaching for Survival: the Hazards of Head Coaching Careers in the German 'Bundesliga'. Applied Economics 41(25): 3303-3311.

Barros, C. P., et al. (2010). Analyzing Head Coach Dismissals in the German “Bundesliga” with a Mixed Logit Approach. European Journal of Operational Research 200(1): 151-159.

Bartsch, T., et al. (2006). Scheduling the Professional Soccer Leagues of Austria and Germany. Computers & Operations Research 33(7): 1907-1937.

Battré, M. and A. Meyer (2010). Die Bedeutung der letzten Karrierestation für die Entlohnung von Fußballspielern. Mimeo. Paderborn, Management Department, Universität Paderborn.

Baumann, R. W., et al. (2009). Bowling in Hawaii: Examining the Effectiveness of Sports-Based Tourism Strategies. Journal of Sports Economics 10(1): 107-123.

Bayer AG. (2010). Geschäftsbericht 2009. Retrieved from http://www.geschaeftsbericht2009.bayer.de/de/Bayer-Geschaeftsbericht-2009.pdfx (last accessed on May 15, 2012).

Bayern München AG. (2010). Jahresabschluss der FC Bayern München AG. Retrieved from http://www.fcbayern.telekom.de/media/native/pressemitteilungen/jahresabschluss_ag_09_10.pdf (last accessed on May 15, 2012).

Bernard, A. B. and M. R. Busse (2004). Who Wins the Olympic Games: Economic Resources and Medal Totals. The Review of Economics and Statistics 86(I): 413-417.

Berri, D. J. (2006). Labour economics on the hardwood: the NBA. Handbook on the economics of sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 523-529.

Bhattacharjee, S. et al. (2007). The Effect of Digital Sharing Technologies on Music Markets: A Survival Analysis of Albums on Ranking Charts. Management Science 53(9): 1359-1374.

Binder, J. J. and M. Findlay (2012). The Effects of the Bosman Ruling on National and Club Teams in Europe. Journal of Sports Economics 13(2): 107-129.

Blossfeld, H.-P., et al. (2007). Event History Analysis With Stata. Mahwah, NJ, Lawrence Erlbaum.

Bolotny, F. (2006). Football in France. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 497-513.

Booth, R. (2004). Labour market intervention, revenue sharing and competitive balance in the Australian Football League, 1897-2002. International Sports Economics Comparisons. R. Fort and J. Fizel. Greenwich, CT, Praeger.

Borland, J. and R. Macdonald (2003). The demand for sports. Oxford Review of Economic Policy 19(4): 478-502.

Box-Steffensmeier, J. M. and C. Zorn (2002). Duration Models for Repeated Events. The Journal of Politics 64(4): 1069-1094.

Brandes, L. and E. Franck (2007). Who made who? An empirical analysis of competitive balance in European soccer leagues. Eastern Economic Journal 33(3): 379-403.

Breuer, C. (2010). Phone Interview.

Briskorn, D. and S. Knust (2010). Constructing Fair Sports League Schedules with Regard to Strength Groups. Discrete Applied Mathematics 158(2): 123-135.

Bröcheler, V., et al. (2004). Auditor Human Capital and Audit Firm Survival: The Dutch Audit Industry in 1930-1992. Accounting, Organizations and Society 29(7): 627-646.

Brown, T. (2004-2007). Football League Match By Match 1888/89 - 1969/70. Nottingham, UK, Tony Brown.

Brüderl, J. and R. Schüssler (1990). Organizational Mortality: The Liabilities of Newness and Adolescence. Administrative Science Quarterly 35(3): 530-547.

Brüderl, J. et al. (2007). Der Erfolg neugegründeter Betriebe: Eine empirische Studie zu den Chancen und Risiken von Unternehmensgründungen. Berlin, Duncker & Humbold.

Buzzacchi, L., et al. (2003). Equality of opportunity and equality of outcome: Open leagues, closed leagues and competitive balance. Journal of Industry, Competition and Trade 3(3): 167-186.

Cairns, J. A. (1990). The Demand for Professional Team Sports. British Review of Economic Issues 12(1): 1-20.

Carlino, G. and N. E. Coulson (2004a). Compensating Differentials and the Social Benefits of the NFL. Journal of Urban Economics 56(1): 25-50.

Carlino, G. and N. E. Coulson (2004b). Should Cities Be Ready for Some Football? Assessing the Social Benefits of Hosting an NFL Team. Business Review.

Carroll, G. R. (1985). Concentration and Specialization: Dynamics of Niche Width in Populations of Organizations. American Journal of Sociology 90(6): 1262-1283.

Carroll, G. R. and J. Delacroix (1982). Organizational Mortality in the Newspaper Industries of Argentina and Ireland: An Ecological Approach. Administrative Science Quarterly 27(2): 169-198.

Carroll, G. R. and M. T. Hannan (2000). The Demography of Corporations and Industries. Princeton, N.J., Princeton University Press.

Carroll, G. R. and Y. P. Huo (1986). Organizational Task and Institutional Environments in Ecological Perspective: Findings from the Local Newspaper Industry. American Journal of Sociology 91(4): 838-873.

Carroll, G. R., et al. (1993). Brewery and Brauerei: The Organizational Ecology of Brewing. Organizational Studies 14(2): 155-188.

City of Munich Statistical Institute. (2011). Das Bruttoinlandsprodukt (BIP) der Stadt München. Retrieved from http://www.mstatistik-muenchen.de/themen/wirtschaft/jahreszahlen/jahreszahlen_2010/p_jt110501.pdf (last accessed on May 15, 2012).

Clement, M. et al. (2007). Do Critics Make Bestsellers? Opinion Leaders and the Success of Books. Journal of Media Economics 20(2): 77-105.

Cleves, M. A., et al. (2002). An Introduction to Survival Analysis Using Stata. College Station, TX, Stata Press.

Coates, D. and B. R. Humphreys (1999). The Growth Effects of Sport Franchises, Stadia, and Arenas. Journal of Policy Analysis and Management 18(4): 601-624.

Commission, E. (1998) The European Model of Sport. DOI:

Congress, U. S. (1952). Organized baseball. Report of the subcommittee on the study of monopoly power of the committee of the judiciary, Government Printing Office.

Cox, D. R. (1972). Regression Models and Life Tables. Journal of the Royal Statistical Society Series B 34(2): 187-202.

Cox, D. R. and D. Oakes (1984). Analysis of Survival Data. London, UK, Chapman and Hall/CRC Press.

Daly, G. and W. J. Moore (1981). Externalities, property rights and the allocation of resources in major league baseball. Economic Inquiry 19(1): 77-95.

Dawson, P., et al. (2000a). Estimating coaching efficiency in professional team sports: evidence from English association football. Scottish Journal of Political Economy 47(4): 399-421.

Dawson, P., et al. (2000b). Stochastic frontiers and the temporal structure of managerial efficiency in English soccer. Journal of Sports Economics 1(4): 341-362.

Delacroix, J., et al. (1989). Density Dependence Versus Population Dynamics: An Ecological Study of Failings in the California Wine Industry. American Sociological Review 54(2): 245-262.

Deloitte (1998-2011). Football Money League, Deloitte LLP.

Deloitte (2010). Die wirtschaftliche Entwicklung deutscher Profisportligen. Düsseldorf.

Deloitte (2011). Annual Review of Football Finance: Pressure to Change. Manchester.

Deloitte (2012). Fan power - Football Money League, Deloitte LLP.

Depken, C. A., II (1999). Free-Agency and the Competitiveness of Major League Baseball. Review of Industrial Organization 14(3): 205-217.

DFL (2007). Lizensierungsordnung (LO), DFL: 1-24.

Dherbecourt, J.-B. and B. Drut (2009). Who Will Go Down this Year? The Determinants of Promotion and Relegation in European Soccer Leagues, Solvay School of Economics and Management, University of Brussels.

Duran, G., et al. (2007). Scheduling the Chilean Soccer League by Integer Programming. Interfaces 37(6): 539-552.

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

Eschweiler, M. and M. Vieth (2004). Preisdeterminanten bei Spielertransfers in der Fußball-Bundesliga. Die Betriebswirtschaft 64(6): 671-692.

Euchner, C. C. (1993). Playing the Field: Why Sports Teams Move and Cities Fight to Keep Them. Baltimore, John Hopkins University Press.

Fichman, M. and D. Levinthal (1991). Honeymoons and the Liability of Adolescence: A New Perspective on Duration Dependence in Social and Organizational Relationships. Academy of Management Review 16(2): 442-468.

Fine, J. P. and R. J. Gray (1999). A Proportional Hazards Model for the Subdistribution of a Competing Risk. Journal of the American Statistical Association 94(446): 496-509.

Finer, J. (2002). The Grand Illusion. Far Eastern Economic Review 57(March 7): 32-36.

Fleming, T. R. and D. P. Harrington (1991). Counting Process and Survival Analysis. New York, John Wiley and Sons.

Forrest, D. and R. Simmons (2002). Team Salaries and Playing Success in Sports: A Comparative Perspective. Zeitschrift für Betriebswirtschaft 72(Ergänzungsheft 4, Sportökonomie): 221-237.

Forrest, D. and R. Simmons (2003). Sport and gambling. Oxford Review of Economic Policy 19(4): 598-611.

Forrest, D. and R. Simmons (2004). Buying success: relationships between team performance and wage bills in the US and European Sports Leagues. International Sports Economics Comparisons. R. Fort and J. Fizel. Westport, CT: Praeger: 123-140.

Fort, R. (2003). Sports Economics. Upper Saddle River, NJ, Prentice-Hall.

Fort, R. and J. Quirk (1995). Cross-Subsidization, Incentives, and Outcomes in Professional Team Sports Leagues. Journal of Economic Literature 33(3): 1265-1299.

Freeman, J., et al. (1983). The Liability of Newness: Age Dependence in Organizational Death Rates. American Sociological Review 48(5): 692-710.

Freeman, J. and M. T. Hannan (1983). Niche Width and the Dynamics of Organizational Populations. The American Journal of Sociology 88(6): 1116-1145.

Frick, B. (2004). Die Voraussetzungen sportlichen und wirtschaftlichen Erfolges in der Fußball-Bundesliga. Sportökonomie aktuell des Arbeitskreis Sportökonomie e.V. 2004(9): 1-25.

Frick, B. (2005). "… und Geld schießt eben doch Tore": Die Voraussetzungen sportlichen und wirtschaftlichen Erfolges in der Fußball-Bundesliga. Sportwissenschaft 35(3): 250-270.

Frick, B. (2006). Football in Germany. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 486-496.

Frick, B. (2007). The Football Players' Labor Market: Empirical Evidence from the Major European Leagues. Scottish Journal of Political Economy 54(3): 422-446.

Frick, B. (2009a). Globalization and Factor Mobility: The Impact of the "Bosman-Ruling" on Player Migration in Professional Soccer. Journal of Sports Economics 10(1): 88-106.

Frick, B. (2011a). Career Duration in Professional Football: The Case of German Soccer Referees. Forthcoming. Handbook of Sports Economics. L. Kahane and S. Shmanske. Oxford, Oxford University Press.

Frick, B. (2011b). Panel Econometrics in Sports Economics Research. Forthcoming Handbook of Research on Sport and Business. H. Dolles and S. Södermann. Northhampton, Edward Elgar, in print.

Frick, B., et al. (2002). Arbeitsmarktregulierung und nachvertraglicher Opportunismus: Die Verhaltensfolgen garantierter Handgeldzahlungen in der National Football League. Zeitschrift für Betriebswirtschaft 72 (Ergänzungsheft 4, Sportökonomie): 163-180.

Frick, B., et al. (1999). Kooperationserfordernisse und Wettbewerbsintensität im professionellen Team-Sport: Sind exogene Regelungen überflüssig oder unverzichtbar? Kooperation im Wettbewerb. J. Engelhard and E. Sinz. Wiesbaden, Gabler: 495-523.

Frick, B., et al. (2007). Career Duration in a Competitive Environment: The Labor Market for Soccer Players in Germany. Eastern Economic Journal 33(3): 429-442.

Frick, B., et al. (2009). Team Performance and Individual Career Duration: Evidence from the German "Bundesliga." Myths and Facts about Football: The Economics and Psychology of the World's Greatest Sport. P. Andersson, P. Ayton and C. Schmidt. Cambridge, Cambridge Scholars Press 2009: 327-348.

Frick, B. and J. Prinz (2004). Revenue Sharing Arrangements and the Survival of Promoted Teams: Empirical Evidence from the Major European Soccer Leagues. International Sports Economics Comparisons. R. Fort and J. Fizel. Westport, CT: Praeger: 141-156.

Frick, B. and R. Simmons (2008). The Impact of Managerial Quality on Organizational Performance: Evidence from German Soccer. Managerial and Decision Economics 29(7): 593-600.

Frick, B. and B. Wallbrecht (2012). Infant Mortality of Professional Sports Clubs: An Organizational Ecology Perspective. Accepted for publication: Journal of Economics and Statistics 232(2).

García, J. and P. Rodrígues (2006). The Economics of Soccer in Spain. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 474-485.

Gerrard, B. (2006). Financial Innovation in Professional Team Sports: The Case of English Premiership Soccer. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 709-718.

Gichangi, A. and W. Vach (2005). The analysis of competing risks data: A guided tour. Odense, University of Southern Denmark.

Gompertz, B. (1825). On the Nature of the Function Expressive of the Law of Human Mortality, and on a New Mode of Determining the Value of Life Contingents. Philosophical Transactions of the Royal Society 115: 513-580.

Greco, A. L. (1993). Sports Value More Myth than Reality. Standard and Poor's Creditweek.

Grimes, A. R., et al. (1974). A Socioeconomic Model of National Olympic Performance. Social Science Quarterly 55(3): 777-783.

Hall, S., et al. (2002). Testing Causality Between Team Performance and Payroll: The Cases of Major League Baseball and English Soccer. Journal of Sports Economics 3(2): 149-168.

Hannan, M. T. (1986). A Model of Competitive and Institutional Processes in Organizational Ecology. Technical Report 86–13, Department of Sociology, Cornell University.

Hannan, M. T. (2005). Ecologies of Organizations: Diversity and Identity. Journal of Economic Perspectives 19(1): 51-70.

Hannan, M. T., et al. (1998). Organizational Mortality in European and American Automobile Industries, Part I: Revisiting the Effects of Age and Size. European Sociological Review 14(3): 279-303.

Hannan, M. T. and J. Freeman (1977). The Population Ecology of Organizations. The American Journal of Sociology 82(5): 929-964.

Hannan, M. T. and J. Freeman (1984). Structural Inertia and Organizational Change. American Sociological Review 49(2): 149-164.

Hinz, T. (1994). Ost-West-Netzwerke: Neugründungen in Ostdeutschland und ihre Beziehungen in die alten Bundesländer. Neue Unternehmen. Interdisziplinäre Beiträge zur Gründungsforschung. Schmude, J. Heidelberg, Physica: 180-194.

Hoehn, T. and S. Szymanski (1999). The Americanization of European Football. Economic Policy 28: 205-233.

Horowitz, I. (1997). The Increasing Competitive Balance in Major League Baseball. Review of Industrial Organization 12(3): 373-387.

James, S. (2006). Why clubs may risk millions for riches at the end of the rainbow. Retrieved from http://www.guardian.co.uk/football/2006/aug/05/championship200607 (last accessed on March 1, 2012).

Johnson, D. K. N. and A. Ali (2000). Coming to Play or Coming to Win: Participation and Success at the Olympic Games, Wellesly College.

Jones, J. C. H. and D. G. Ferguson (1988). Location and Survival in the National Hockey League. The Journal of Industrial Economics XXXVI(4): 443-457.

Kahn, L. (1993). Managerial quality, team success, and individual player performance in Major League Baseball. Industrial and Labor Relations Review 46(3): 531-47.

Kalbfleisch, J. D. and R. L. Prentice (1980). The Statistical Analysis of Failure Time Data. New York, John Wiley & Sons.

Kalbfleisch, J. D. and R. L. Prentice (2002). The Statistical Analysis of Failure Time Data. New York, John Wiley and Sons.

Kaplan, E. L. and P. Meier (1958). Nonparametric estimation from incomplete observations. Journal of the American Statistical Association 53(282): 457-481.

Kay, R. (1986). Treatment effects in competing-risks analysis of prostate cancer data. Biometrics 42(1): 203-211.

Kearns, M. H. (1931). An inquiry into various death rates and the comparative influence of certain diseases on the duration of life. Annals of Human Eugenics 4(3): 279-326.

Kendall, G., et al. (2010). Scheduling in Sports: An Annotated Bibliography. Computers & Operations Research 37(1): 1-19.

Késenne, S. (2000). The impact of salary caps in professional team sport. Scottish Journal of Political Economy 47(4): 341-370.

Késenne, S. (2004). Revenue sharing and competitive balance if rich clubs have poor teams. Journal of Sports Economics 5(2): 206-212.

Kicker (1990-2011). Sonderheft Bundesliga, Published Annually at the Beginning of the Season. Nurnberg, Olympia-Verlag.

Kicker (2011). Dynamos Lizenz in Gefahr. Retrieved from http://www.kicker.de/news/fussball/3liga/startseite/552665/artikel_dynamos-lizenz-in-gefahr.html (last accessed on July 7, 2011).

Kringstad, M. and B. Gerrard (2007). Beyond competitive balance. International Perspectives on the Management of Sport. M. M. Parent and T. Slack. Burlington, MA, Butterworth-Heinemann: 149-172.

Kuk, A. Y. C. (1992). A semiparametric mixture model for the analysis of competing risks data. Australian Journal of Statistics 34(2): 169-180.

Kuper and S. Szymanski (2009). Why England Lose: and Other Curious Phenomena Explained. London, HarperCollinsPublishers.

Kurscheidt, M. (2006). The World Cup. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK and Northhampton, MA, USA, Edward Elgar: 197-213.

Lago, U. (2006). The State of the Italian Football Industry. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 463-473.

Larson, M. G. and G. E. Dinse (1985). A mixture model for the regression analysis of competing risks data. Applied Statistics 34(2): 201-211.

Lavoie, M. (2006). Ice hockey. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 542-551.

Le Mens, G., et al. (2011). Founding Conditions, Learning, and Organizational Life Chances: Age-Dependence Revisited. Administrative Science Quarterly 56(1): 95-126.

Leeds, M. and P. von Allmen (2005). The Economics of Sport. Boston, MA, Pearson Addison Wesley.

Lehmann, E. and J. Weigand (1997). Fußball als ökonomisches Phänomen: Money Makes the Ball Go Round. Thünen-Reihe Angewandter Volkswirtschaftstheorie. I. o. E. University of Rostock, Germany.

Levine, N. (1974). Why Do Countries Win Olympic Medals? Some Structural Correlates of Olympic Games Success. Sociology and Social Research 58(4): 353-360.

Levinthal, D. and H. E. Posen (2007). Myopia of Selection: Does Organizational Adaptation Limit the Efficacy of Population Selection?. Administrative Science Quarterly 52(4): 586-620.

Levinthal, D. A. (1991). Random Walks and Organizational Mortality. Administrative Science Quarterly 36(3): 397-420.

Lewis, M. (2001). Franchise Relocation and Fan Allegiance. Journal of Sport and Social 25(1): 6-19.

Lunn, M. and D. McNeil (1995). Applying Cox Regression to Competing Risks. Biometrics 51(2): 524-532.

Makeham, W. M. (1859). On the Law of Mortality and Construction of Annuity Tables. The Assu Magazine 8: 310-328.

Matheson, V. (2006). European Football: a Survey of the Literature. Handbook of Sports Economics Research. J. Fizel. New York, M.E. Sharpe Publishers: 118-135.

Melegari, F. (2005). Almanacco Illustrato del Calcio - La Storia 1898-2004, Panini Edizioni Modena.

Mezias, S. J. and E. Boyle (2005). Blind Trust: Market Control, Legal Environments, and the Dynamics of Competitive Intensity in the Early American Film Industry. Administrative Science Quarterly 50(1): 1-34.

Müller-Merbach, H. (1977). Frühwarnsysteme zur betrieblichen Krisenerkennung und Modelle zur Beurteilung von Krisenabwehrmaßnahmen. Computergestützte Unternehmensplanung - Wirtschaftsinformatik Symposium 1976, IBM Deutschland. H. D. Plötzeneder. Stuttgart: 419-438.

Nagelkerke, N. J. D. (1991). A note on a general definition of the coefficient of determination. Biometrika 78(3): 691–692.

Neale, W. C. (1964). The Peculiar Economics of Professional Sports: A Contribution to the Theory of the Firm in Sporting Competition and in Market Competition. The Quarterly Journal of Economics 78(1): 1-14.

Noll, R. G. (1974). Attendance and Price Setting. Government and the Sports Business. R. G. Noll. Washington, D.C., Brookings Institute: 115-157.

Noll, R. G. (2002). The Economics of Promotion and Relegation in Sports Leagues. Journal of Sports Economics 3(2): 169-203.

O’Quigley, J., et al. (2005). Explained randomness in proportional hazards models. Statistics in Medicine 24(3): 479–489.

Oberhofer, H., et al. (2010). Firm Survival in Professional Sports: Evidence from the German Football League. Working Papers in Economics and Finance No. 2010-16. Salzburg, University of Salzburg.

Ohkusa, Y. (1999). Additional Evidence for the Career Concern Hypothesis with Uncertainty of the Quit Period: The Case of Professional Baseball Players in Japan. Applied Economics 31(11): 1481-1487.

Ohkusa, Y. (2001). An Empirical Examination of the Quit Behavior of Professional Baseball Players in Japan. Journal of Sports Economics 2(1): 80-88.

Okner, B. A. (1974). Subsidies of Stadiums and Arenas. Government and the Sports Business. R. G. Noll. Washington D.C., Brookings Institute: 325-347.

Parlasca, S. (2006). Collective Selling of Broadcast Rights in Team Sports. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 719-729.

Pennings, J. M., et al. (1998). Human and Social Capital and Organizational Dissolution. Academy of Management Journal 41(4): 425-440.

Pennings, J. M. and F. C. Wezel (2010). Faraway, Yet So Close: Organizations in Demographic Flux. Organization Science 21(2): 451-468.

Pérez, S. E., et al. (2006). A Competing Risks Analysis of Strike Duration in Spain: Agreement and Non-Agreement Outcomes. Revista de Economía Laboral 3(1): 14-45.

Porter, P. (1999). Mega-Sports Events as Municipal Investments: A Critique of Impact Analysis. Sports Economics: Current Research. J. Fizel, E. Gustafson and L. Hadley. Westport, CT, Preager Press: 61-74.

Prentice, R. L., et al. (1978). The Analysis of Failure Times in the Presence of Competing Risks. Biometrics 34(4): 541-554.

Prentice, R. L., et al. (1981). On the Regression Analysis of Multivariate Failure Time Data. Biometrika 68(2): 373-379.

Preston, I. and S. Szymanski (2003). Cheating in contests. Oxford Review of Economic Policy 19(4): 612-624.

Quirk, J. (1987). The Quirk Study: A Close Look at the Two Proposals. St. Louis Post Dispatch. St. Louis: 8i.

Quirk, J. (1997). The salary cap and the luxury tax: affirmative action programs for weak-drawing franchises. Stee-rike four! What's wrong with the business of baseball? D. R. Marburger. Westport, CT, Praeger: 97-109.

Quirk, J. and R. Fort (1992). Pay Dirt: The Business of Professional Team Sports. Princeton, Princeton University Press.

Quirk, J. and R. Fort (1999). Hard Ball: The Abuse of Power in Pro Team Sports. Princeton, NJ, Princeton University Press.

Ranger-Moore, J. (1997). If Bigger is Better, Is Older Wiser? Organizational Age and Size in the New York Life Insurance Industry. American Sociological Review 58(6): 901-920.

Rollin, J., et al. (1969-2000). Rothmans Football Yearbook. London, UK, Headline Book Publishing.

Rosentraub, M. S., et al. (1994). Sport and Downtown Development Strategy: If You Build It, Will Jobs Come? Journal of Urban Affairs 16(3): 221-239.

Ross, S. F. and S. Szymanski (2002). Open Competition in League Sports. Wisconsin Law Review 2002(3): 625-656.

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

Ruef, M. (2004). For Whom the Bell Tolls: Ecological Perspectives on Industrial Decline and Resurgence. Industrial and Corporate Change 13(1): 61-89.

Schmidt, M. B. and D. J. Berri (2001). Competitive Balance and Attendance: The Case of Major League Baseball. Journal of Sports Economics 2(2): 145-167.

Scully, G. (1974). Pay and performance in Major League Baseball. American Economic Review 64(6): 915-930.

Siegfried, J. and T. Peterson (2000). Who is Sitting in the Stands? The Income Levels of Sports Fans. The Economics of Sports: Winners and Losers. W. Kern. Kalamazoo, MI: Upjohn Institute: 51-73.

Simmons, R. (1997). Implications of the Bosman ruling for football transfer markets. Scottish Journal of Political Economy 17(2): 121-146.

Simonoff, J. S. and L. Ma (2003). An Empirical Studyof Factors Relating to the Success of Broadway Shows. Journal of Business 76(1): 135-150.

Singh, J. V. and C. J. Lumsden (1990). Theory and Research in Organizational Ecology. Annual Review of Sociology 16(1): 161-195.

Singh, J. V., et al. (1986). Organizational Legitimacy and the Liability of Newness. . Administrative Science Quarterly 31(2): 171-193.

Sloane, P. J. (1969). The labour market in professional football. British Journal of Industrial Relations 7(2): 181-199.

Sloane, P. J. (1971). The economics of professional football: the football club as a utility maximizer. Scottish Journal of Political Economy 17(2): 121-146.

Sloane, P. J. (1976). Restriction of competition in professional team sports. Bulletin of Economic Research 28(1): 3-22.

Sloane, P. J. (2002). Cup offers Japan economic free kick, XtraMSN.

Stinchcombe, A. L. (1965). Organizations and Social Structure. Handbook of Organizations. J. G. March. Chicago, Rand McNally.

Szymanski, S. (2000). A Market Test for Discrimination in the English Professional Soccer Leagues. Journal of Political Economy 108(3): 590-603.

Szymanski, S. (2003). The Economic Design of Sporting Contests. Journal of Economic Literature 41(4): 1137-1187.

Szymanski, S. (2006a). Football in England. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 459-462.

Szymanski, S. (2006b). The Promotion and Relegation System. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 685-688.

Szymanski, S. (2006c). Tilting the playing field: why a sports league planner would choose less, not more, competitive balance. Mimeo, Tanaka Business School, Imperial College London.

Szymanski, S. (2006d). Uncertainty of Outcome, Competitive Balance and the Theory of Team Sports. Handbook on the Economics of Sport. W. Andreff and S. Szymanski. Cheltenham, UK, Northhampton, MA, USA, Edward Elgar: 597-600.

Szymanski, S. and S. Késenne (2004). Competitive Balance and Gate Revenue Sharing in Team Sports. The Journal of Industrial Economics LII(1): 165-177.

Szymanski, S. and T. Kuypers (1999). Winners and Losers: The Business Strategy of Football. London, Viking.

Szymanski, S. and R. Smith (1997). The English Football Industry: Profit, Performance and Industrial Structure. International Review of Applied Economics 11(1): 135-153.

Szymanski, S. and T. Valletti (2005). Promotion and Relegation in Sporting Contests. Rivista di Politica Economica 95(5/6): 3-39.

Szymanski, S. and A. Zimbalist (2005). National Pastime: How Americans Play Baseball and the Rest of the World Plays Soccer. Washington, D.C., Brookings Institution Press.

Taylor, B. A. and J. G. Trogdon (2002). Losing to win: Tournament incentives in the National Basketball Association. Journal of Labor Economics 20(1): 23-41.

Topkins, J. H. (1949). Monopoly in Professional Sports. Yale Law Journal 58: 691-712.

UEFA (2010). UEFA club licensing and financial fair play regulations. Retrieved from http://www.uefa.com (last accessed on May 1, 2012).

van Witteloostuijn, A. and C. Boone (2006). A Resource-Based Theory of Market Structure and Organizational Form. Academy of Management Review 31(2): 409-426.

Volkswagen AG. (2010). Driving ideas. Geschäftsbericht 2009. Retrieved from http://www.volkswagenag.com/content/vwcorp/content/de/investor_relations/corporate_governance.bin.html/downloadfilelist/downloadfile/downloadfile_5/file/GB_2009_d_ungesch%C3%BCtzt.pdf (last accessed on April 12, 2012).

Vrooman, J. (2009). Theory of the perfect game: Competitive balance in monopoly sports leagues. Review of Industrial Organization 34(1): 5-44.

Wallbrecht, B. (2010). Location and success in German 'Bundesliga' soccer. Unpublished manuscript, University of Paderborn.

Wei, L. J., et al. (1989). Regression Analysis of Multivariate Incomplete Failure Time Data by Modeling Marginal Distributions. Journal of the American Statistical Association 84(408): 1065-1073.

Weiss, H. J. (1986). The Bias of Schedules and Playoff Systems in Professional Sports. Management Science 32(6): 696-713.

Westphal, S. (2011). Email communication.

Wiseman, F. and S. Chatterjee (2003). Team Payroll and Team Performance in Major League Baseball: 1985-2002. Economics Bulletin 1(2): 1-10.

Woywode, M. (1998). Determinanten der Überlebenswahrscheinlichkeit von Unternehmen: eine empirische Überprüfung organisationstheoretischer und industrieökonomischer Erklärungsansätze. Baden-Baden, Nomos-Verlagsgesellschaft.

Yamaguchi, K. (1991). Event History Analysis. Newbury Park, CA, Sage.

Zhou, C. and A. v. Witteloostuijn (2010). Institutional Constraints and Ecological Processes: Evolution of Foreign-Invested Enterprises in the Chinese Construction Industry, 1993-2006. Journal of International Business Studies 41(3): 539-556.

Internet Sources

http://www.basketball-bund.de

http://www.deb-online.de

http://www.destatis.de

http://www.dhb.de

http://www.f-archiv.de

http://www.fff.fr

http://www.figc.it

http://www.fpf.pt

http://www.fussballdaten.de

http://www.fussballzz.de

http://www.ine.es

http://www.ine.pt

http://www.insee.fr

http://www.istat.it

http://www.kicker.de

http://www.rfef.es

http://www.rsssf.com

http://www.statistics.com.uk

http://www.thefa.com

http://www.transfermarkt.de

http://www.uefa.com

http://www.weltfussball.de