

Hautsch, Nikolaus; Lehmann, Erik; Warning, Susanne; Frick, Bernd

Working Paper

Shirking or mismatch? Coach-team separation in German professional soccer

Diskussionsbeiträge - Serie I, No. 313

Provided in Cooperation with:

Department of Economics, University of Konstanz

Suggested Citation: Hautsch, Nikolaus; Lehmann, Erik; Warning, Susanne; Frick, Bernd (2001) : Shirking or mismatch? Coach-team separation in German professional soccer, Diskussionsbeiträge - Serie I, No. 313, Universität Konstanz, Fachbereich Wirtschaftswissenschaften, Konstanz

This Version is available at:

<https://hdl.handle.net/10419/68876>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

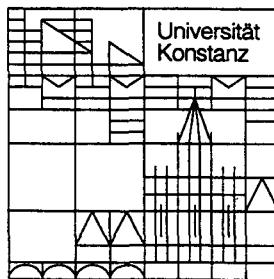
Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



52913523X

**Rechts-, Wirtschafts- und
Verwaltungswissenschaftliche Sektion**
Fachbereich
Wirtschaftswissenschaften

└ Nikolaus Hautsch
Erik Lehmann
Susanne Warning
Bernd Frick

**Shirking or Mismatch?
Coach-Team Separation
in German Professional Soccer**

Diskussionsbeiträge

W 284 (313)

**Shirking or Mismatch?
Coach-Team Separation in German Professional Soccer**

**Nikolaus Hautsch
Erik Lehmann
Susanne Warning
Bernd Frick**

Serie I – Nr. 313

September 2001

Shirking or Mismatch?

Coach-Team Separation in German Professional Soccer*

Nikolaus Hautsch^{a,b}, Erik Lehmann^{*,a} Susanne Warning^a
and Bernd Frick^c

a) University of Konstanz, Department of Economics

b) Center of Finance and Econometrics (COFE), Konstanz

c) University of Witten-Herdecke.

September 11, 2001

Abstract

Some authors suggest that firing a coach reflects a principal-agent problem between team managers and coaches. Another explanation emphasizes the matching problem between teams and coaches. This paper provides empirical evidence for the latter: Using German soccer league data, we analyze the determinants of coach dismissals in terms of the impact of a team's performance on the probability to be fired. It is shown that the probability for a coach dismissal increases over time.

*Erik Lehmann, Box D-144, 78457 Konstanz. E-mails: Nikolaus.Hautsch@uni-konstanz.de, Susanne.Warning@uni-konstanz.de, Erik.Lehmann@uni-konstanz.de. We are grateful to Oliver Fabel for helpful comments and critical remarks. We would also like to thank Rob Simmons and David Forrest on comments on an earlier draft of the paper.

1 Introduction

In every playing season in all professional team sports worldwide, several coaches are fired. Hiring a coach may thus be an act of trust. Adequate performance is not revealed within a reasonable time. It may take some time to determine a coach's performance. In this respect, sports teams are not different from other entertainment firms to a certain point employing various inputs (different skills of players and other player- and team-specific characteristics). In order to identify the determinants of team success and the contribution of each individual player to this success, a coach selects and prepares players before a match. Also, he implements tactical decisions and reorganizes during a match (see Klotz/Gerhard 2000).

Some authors are convinced that firing then reflects a principal-agent problem between team managers and coaches. Another explanation points at a matching problem between teams and coaches. In this paper we argue for the latter. As sports has its own rules we, combine economic theory and sports in order to describe this separation phenomenon. To test empirically which theory describes the situation in the German Soccer League best, we examine individual coach data. First, we analyze the determinants of coach dismissals in terms of the impact of a team's performance on the probability to be fired. The issue whether a coach is fired or not is subjected to binary regressions. The second part of the empirical investigation focuses on a specific determinant: the influence of time. Applying hazard rate models we examine if the probability for a coach dismissal decreases or increases with time.

The paper is organized as follows. The next section provides a brief overview explaining the rules of a soccer game and the possible tasks of a coach and presents the two competing theories addressing the turnover of coaches. Section three provides a description of the data and some descriptive statistics. The estimation procedure and empirical findings based on data from the German Soccer League are presented in section four. The paper ends with some concluding remarks.

2 Shirking or Mismatch in the Market for Coaches?

2.1 The rules of soccer, league competition and the tasks of coaches

A soccer match is played between two teams of 11 players. Each team is allowed three substitutes either as replacement for injured players or for tactical purposes. The match is divided into two periods of 45 minutes duration each plus a certain time added for injuries or other delays. The result of the match is determined by the difference of goals scored. A game is characterized by a variety of static plays (free kicks, throw-ins, corners or penalties) and of moves in open play. From an attacking perspective, these moves involve creating goal scoring chances through passing the ball to teammates, running or dribbling with or without the ball and shot attempts at the goal.

The team size in most German soccer clubs exceeds 30 players because a team is composed of players with different skills. Each team has a goalkeeper with the very specific function as the ultimate defender. He is the only player who can use his hands to stop the ball. The ten field players are generally categorized as defenders, midfielders and forwards. Apart from the purpose of scoring goals, there are many other aspects involving both constructive and destructive elements. Some of the more serious offences like physical 'fouls' or 'hand-ball' induce referee sanctions (yellow cards). Ultimately, a player can be 'sent off' for sanction without the possibility of substitution (red card). As a consequence, the team is reduced and therefore weakened on the field. This increases the opponent's possibility to win the match (see Carmichael/Thomas/Ward 2000).

The league competition in the German '*First Bundesliga*' works as follows. The winning team receives 3 points, the loser zero. A tie leads to one point for each club. In contrast to US-American Team-Sport Leagues, the 1st Soccer League in Germany (*First Bundesliga*), as well as in other European countries, is not organized as a 'winner-takes-it-all' competition. At the end of a season, each team is ranked by the points won in the competition. Clubs wish to do well enough within their domestic competitions in order to be allowed to take part in European competitions. The first two teams are directly qualified for the European Champions League. Due to its high revenues from broadcasting and

gate receipts, this League is the most profitable in Europe. The teams ranked third to sixth qualify to play in a parallel competition called the 'UEFA Cup' (Union European Football Association). Positions seven and eight allow clubs to participate in a relegation system for the UEFA Club. Those European competitions are highly attractive for teams due to high TV revenues. In general, introducing the UEFA Champions League - replacing the former European Cup - has increased the attractiveness of the UEFA Competitions. The recent decision to allow for runner-up entries in the Champions League has in fact doubled the chances of clubs from eight European countries to reach this event. These are countries with the highest ranking in the FIFA national evaluation such as Germany, England, Italy or Spain (see Morrow 1999).

There may be three general tasks of coaches. First he has to choose the strategy for the game, second he has to organize the training and third he has to motivate the players for both. One task of a coach is to choose the most efficient strategy based on the own and the opponent's league ranking before the game starts and to change the strategy during the game (see Klotz/Gerhard 2000). The latter will depend on the difference of goals during the game. In general, there are two possible strategies: first, a more aggressive or attacking strategy increases the possibility of scoring goals and winning the game. Alternatively, a defensive and less aggressive strategy aims at minimizing the probability of opponent scores.

In order to be able to decide about the applying strategy, the contrary team has to be analyzed by the coach with regard to its strengths and weaknesses. In connection with the abilities of the own team at the beginning of the match, the coach selects 10 field players and substitutes from his set of possible players in each game. To pursue the attacking strategy, the coach chooses players with more offensive skills. This, however, ignores defensive tasks. Thus, the key features of outfield players in the defensive strategy are tackling opponents with or without winning the ball, blocking and intercepting opposition passes and shots. While some players have more skills specific to their position and to a particular aspect of playing, all field players are involved in all aspects of the game to varying degrees. The coach organizes these players according to a more attacking or defensive strategy and various tactical formations. Hence, he

has to search for the right 'mix'. To present the suitable team to the opponent, the trainer's second task consists in organizing the training. Both condition and technical abilities are to be imposed. For realizing this, he has to offer adequate methods to increase a teams' performance. To be successful in organizing the team according to the efficient strategy before and during the game and coordinating the training activities, the coach has to motivate the players in both situations.

2.2 Turnover of coaches: Two different explanations

2.2.1 Determinants for the turnover of coaches

Before explaining two different theories for the turnover of football coaches some considerations about the determinants of trainer dismissals are made. The number of engagements of a trainer may signal that the coach was selected some time before. Hence, coaches with previous contracts are able to build some reputation. This increases their outside opportunities and negotiation positions in bargaining processes with managers. Therefore the probability of a dismissal should decrease with his age and experience. In contrast, higher experience can lead to a disadvantage if expectations imposed on a well experienced coach are higher than on a young 'no name' coach. Hence, managers, media and the fans are less patient with his work. Thus, contrarily, the probability of a dismissal may also increase with age and experience.

Summing up, we expect that the probability of being fired decreases if the club is ranked in the medium group, because there is nearly no chance on European Competition nor fear of relegation. An employment during the season mostly implies that the coach has a contract only until the end of the season and therefore the probability of being fired is small. Also the number of alternative trainers is small. Furthermore, the average number of points won decreases the probability of firing a coach. A higher probability can be assumed with the club's ranking in the top or low group and with the increase of points lost. No clear assumption can be made regarding the duration of a coach ('shirking or matching'), his age and the number of previous contracts.

2.2.2 Principal-agent theory

Many soccer experts believe that coaches are pivotal for team success. From an economic point of view, specialized tasks are delegated to an agent whose effort is only imperfectly verifiable by the principle. Hence, the usual principal-agent problem is seen to apply to such situations well (Holmstrom 1979; Hart/Holmstrom 1983).

The relationship between managers or team owners and their coaches may in fact be a prominent example for a principal-agent relationship (Scully 1994). The outcome strictly depends on the ability of managers to control shirking within a team production setting (Alchian/Demsetz 1972). The principal - the team manager or president of a club - hires the coach with specialized skills. His task is to transform a set of relative offensive and defensive playing skills into club victories (see Scully 1994, Horowitz 1994). Since deterministic long-term contracts are known to overcome the moral hazard problem, stochastic contract terminations are necessary in order to induce the typical second-best solution in coaching contracts. In fact, it often has proven possible that the principal himself can actually perform this task. An example is Franz Beckenbauer, president of the FC Bayern München, who first fired the coach Otto Rehaagel and then coached the team until the end of the season.

By hiring a coach, club owners seek to maximize their residual income. Given the highly profitable chances to participate in European events, this implies minimizing the team's ranking in the domestic league. Obviously, this corresponds to maximizing the number of team victories. Scully (1994) assumes that each owner can monitor the effort of his coach relative to others. Over time, owners will learn by experience and distinguish good from poor coaches. According to this argument, competent coaches will tend to survive longer and incompetent or shirking coaches will be fired more frequently. Thereby shirking can mean training only twice a week and the other days the assistant-coach has to organize the training. Furthermore, training methods without changes and variations over time may be a result of no engagement of the trainer in learning new training concepts or not being familiar with physical and psychical research results. Thus, coach tenure signals the coach's possible effort.

Using survival time estimations, Scully shows that managerial tenure is

linked to managerial efficiency defined as the ability of the coach to extract the largest percentage of victories from a given set of player inputs. However, the results differ between baseball, basketball and football. The expected survival time is highest in basketball, followed by baseball and football. In the latter case, expected tenure increases very little with managerial efficiency.

Thus, if the principal-agent hypothesis holds, controlling a coach constitutes the central aspect. Given that abilities vary, personal coach characteristics should therefore influence the probability of being fired. More importantly, however, tenure should be negatively correlated with this probability as learning reduces the problem of asymmetric information over time. Hence, according to this relationship, the probability of being fired should decrease over time. Statistically this is associated with a decreasing hazard rate:

Hypothesis 1: The probability of being fired decreases with time which implies a non-increasing hazard rate.

2.2.3 Matching theory

Jovanovic (1979) shows that workers remain on jobs in which their productivity is revealed to be relatively high. They quit jobs in which their productivity expectation is low (Jovanovic, 1979, p.974). This approach is based on two basic assumptions. First, the productivity of a worker depends on the match between a worker and his job or task. Second, both the employer and the employee learn about productivity on the job. Thus, the worker constitutes an 'experience input'. Jovanovic (1979) uses the hazard rate concept in order to assess the tenure effect on job separations. According to the matching model this probability first increases and then decreases.

In sports, the 'matching theory' offers an alternative explanation of the relationship between coaches and their teams or their managers. A team is represented by a production function with playing skills as input factors. Both players and clubs are heterogeneous. Hence, the matching between them may thus lead to a misallocation of resources. The output or team performance can be measured by goals, victories or earnings.

Even if the matching theory in economics and in sports is very similar up to

a certain point, there occurs one essential difference. After an economic match without an external interruption the organization 'works' well for a long time. In sports, however, a match will first effect a better performance of the team, but even without an exogenous shock one can observe decreasing marginal utility of the training methods due to physical and psychical reasons. Another difference from economic organizations is the revelation of success every week.

Moral hazard problems can only arise from specific team effects of shirking. Clearly, the competition in teams as well as mass media effects reduce individual shirking incentives. At the same time, Idson and Kahane (1999) demonstrate the complementary feature of players in the National Hockey League (NHL). Team performance is strongly influenced by the interaction of players. The task of a soccer coach is not only to select any eleven players from a portfolio of players but to form a team. Thus, status, prestige, social distance and group behaviour effects must be accounted for. The high turnover of players in a team reflects the integration effort of a coach. However, differences in playing skills and the individual characters of players generate a matching problem for the coach. Moreover, matching a coach and a team constitutes an additional problem from the point of view of the team owners. Following Kräkel (2000) the risk of mismatching players increases with time, since new players have to be integrated in the team.

Chapman and Southwick (1991) examine the market for Major League Basketball exploring data from 1930 to 1988. Using the percentage of victories as a performance measure, they analyze the effects of matching between managers and teams on managers' productivity. The conditional probability of being fired, given the elapsed employment duration, associated with the hazard rate of employment duration increases in the first three years on the job and declines subsequently. This is seen to support the matching hypothesis. It also contrasts with Scully's (1994) findings, based on the principal-agent approach.

Ohtake and Ohkusa (1994) examine the robustness of the Chapman/Southwick (1991) findings for the Japanese professional baseball league. Additionally, they conduct an alternative test of the matching hypothesis using wage data on individual managers. They compare the behaviour of managers who had no previous experience when they joined their present teams with managers who

had managed one or more teams before. Using OLS regressions and hazard rates analysis, they show that the productivity of managers does not depend on the specific team. Furthermore, they find that the probability of job separation first increases and then decreases with tenure only for rookie managers. No such effect can be verified for veteran managers. Comparing their results with Chapman and Southwick (1991), Ohtake and Ohkusa (1994) conclude that there may be differences in baseball strategies between Japan and the United States. Treating managers as supervisors and players as workers, Ohkusa and Ohtake (1996) confirm their former results. In the latter approach they control for playing skills (pitchers and hitters) using data from 1977 to 1990. Again, player matching does not exhibit significant effects on team performance. Furthermore, the typical bell shape curve for hazard rates of employment duration cannot be verified - neither for batters nor for pitchers.

Based on data from Australian Rules Football Coaches between 1931 and 1994, Borland and Lye (1996) test the influence of the coach-team match on team performance. The probability of coach-team separation decreases with the coach's tenure and experience. Thus, the hazard rate increases over the initial period of a contract and decreases later on. This also characterises the relationship between the hazard rate of employment duration and the coach's professional experience. More experience and learning from different teams before his training has become more various and he could have learnt from matches before.

Hypothesis 2: As team managers learn about a coach's quality, the 'matching approach' implies that the probability of coach dismissal should increase during early periods and decrease later on. However, since integrating new players continuously restructures a team and, thus, introduces new mismatch risks, this probability may also be monotonically increasing.

3 Data and descriptive statistics

Our empirical investigation is based on a dataset which contains 449 observations of coach employment relationship data from the German Soccer League between 1963 and 1998. The average duration a coach stayed at a club is 507

days. The sample is divided into two subsamples. The first subsample contains those coach's who were fired which amounts to 52% of the whole sample (table 2, panel A). These coaches worked for their club for 479 days on average. The second panel contains coaches who fulfilled their contracts (table 2, panel B). They show a 12% longer club membership of 537 days on average. The data contains also 40 coaches who are still employed, i.e. who neither finished their contract in 1998 nor were fired. Note that these observations are (right-) censored, thus the reason for contract termination after 1998 is unobservable. Since we are interested in the determinants of coach-team separations, we exclude these observations from the dataset. The realized 'duration' of a contract measured in days is treated as the dependent variable. Table 1 in the appendix exhibits the descriptive statistics of the whole sample, whereas Table 2 presents descriptive statistics of the coaches who were fired (panel A), or whose contract expired (panel B), respectively.

The independent variables consist of performance measures as well as of individual characteristics. To evaluate the performance of a team we use the following criteria:

In order to control for the different types of competition, the 18 clubs in the *First Bundesliga* are divided into three groups of 6 teams. The first group is called 'top' and includes teams ranked 1st to 6th. Such teams play for domestic championship but also in order to start in a European competition. Within the group 'medium' - including teams ranked 7th to 12th - competition can be taken to be least developed. Those clubs cannot reach an international qualification, nor must they fear relegation. In contrast, teams in the 'low'-group are threatened by relegation. This group contains teams ranked 12th to 18th at the end of each season. Three of them have to leave the *First Bundesliga* and enter the *Second Division*. Clearly, the mean value of 'medium' is much higher for coaches who have been fired than for coaches who completed their contract (see table 2). The reverse holds for 'low'. Thus, coaches may have been fired in order to improve the team's competitive strength in avoiding relegation.

The average number of points won (lost) per game, 'points+' ('points-'), until the coach is fired constitutes a further performance indicator. Obviously, this value is higher for coaches who reached full contract length (panel B) and

lower for trainers who have been fired (panel A).

Moreover, the data includes individual coach characteristics. On first sight, if an unemployed coach is hired during the season ('during'), this may signal low quality. This effect may depend on the market for coaches. If the market for quality coaches is generally of fixed size and most contracts are signed at the beginning of the season, the probability of finding a qualified coach during a season is small. Hence, teams may prefer not to dismiss a coach more than once and thus will rather contract only for a short period of time. On the other hand, the hiring club clearly believes that this coach will be successful. Hence, the probability of a coach dismissal is expected to be lower when the coach is hired during the playing season.

The age of the coach when being fired ('age'), and the number of contracts before coming to the current club ('previous') are additional individual characteristics. Whereas the mean value of hirings during the season is higher in panel B, other individual characteristics do not appear to differ between the two groups. However, age and experience may capture two separate effects.

4 Empirical results

Analyzing coach-team separation in German soccer, as a first step we run various probit regressions to reveal the determinants of coach dismissals. In a second step the impact of employment duration on dismissal is analyzed using proportional hazard models.

4.1 Determinants of coach dismissals

In order to analyze the impact of the explanatory variables on the probability of firing the coach, two different probit specifications are employed. As basic regressors we use the time a coach stayed with his club and his personal characteristics like experience, measured by the number of previous engagements, age and the variable indicating whether he was hired prior to or during a playing season. Furthermore, two different performance measures are used: first, the rank of the team in the league and, second, the average points won in league games. Both types of variables are highly correlated, and should therefore not

be included in the regression together. Note that the regressions are only carried out for non-censored observations.

Table 3 presents the two different probit specifications. In both specifications, the time a coach has spent with his team exhibits no significant impact on the probability of being fired. Furthermore, this probability decreases with the success of a team measured by the number of points won. Similarly, the probability of being fired is lower in teams ranked in the middle of the league - i.e., neither competing for championship, nor threatened by relegation.

Finally, the time of employment has a significant impact on a coach being fired, whereas experience measured by the number of previous teams which have hired the coach and age do not reveal a statistically significant impact on the individual firing probability.

In fact, the assumptions made about the impact of the variables in the previous section are stated by the empirical results. Concluding, only performance and employment during the running season matters for a coach dismissal compared to regular completion of the contract and supports the matching hypothesis. A longer membership and therefore more information for the club-managers about the coach's effort has nearly no impact on firing a coach and therefore contradicts the principal-agent interpretation.

4.2 The impact of employment

The main objective concerns the analysis of employment duration. In particular, we are interested in the time pattern of the probability of being fired. Note that in this framework we only consider trainers who have been fired before the completion of the contract ¹. Though, the sample includes only data on realized coach dismissals. This limits the dataset to 273 observations. A natural approach to this issue is to model hazard functions of coach durations. See Lancaster (1979, 1990), Kalbfleisch/Prentice (1980), Kiefer (1988) and Han/Hausman (1990) for more details on hazard rate modelling.

Let T be a positive random variable measuring the time a trainer works for a certain football club in the First German Soccer League. Furthermore, $F(t)$ denotes the distribution function of coach dismissals with density function $f(t)$.

¹A survival analysis of trainers who completed their contract regularly is not useful because durations are determined exogenously.

The hazard function which is associated with the conditional probability that a coach is fired in the next short time period, given he has been employed until period t and is defined as:

$$\lambda(t) = \lim_{\Delta t \rightarrow 0^+} \frac{P(t \leq T < t + \Delta t \mid T \geq t)}{\Delta t} = \frac{f(t)}{S(t)},$$

where $S(t) = 1 - F(t)$ denotes the 'survivor' function. Kaplan and Meier (1958) introduced a nonparametric estimator for the survivor function. Let $t_1 < t_2 < \dots < t_k$ be the observed, ordered, durations in the sample and d_j denotes the number of trainers who have been fired after t_j days. Furthermore, define $n_j = d_j + d_{j+1} + \dots + d_k$ as the number of coaches at risk prior to t_j . Then the Kaplan-Meier estimator (product limit estimator) of the survivor function is given by²

$$\hat{F}(t) = \prod_{j|t_j < t} \left(\frac{n_j - d_j}{n_j} \right).$$

Figure 1 in the appendix depicts the Kaplan-Meier survivor function of the time until being fired in the sample. Obviously, it decreases at almost constant rates.

In order to investigate the impact of covariates on the hazard function, it is necessary to apply a hazard rate model. A widespread class of models are proportional hazard approaches. In this framework a function of covariates interacts multiplicatively with a baseline hazard function. Thus, explanatory variables possess a proportional effect on the conditional probability of completing a spell. The proportional hazard model is given by

$$\lambda(t, x) = \lambda_0(t) \exp(-x'\beta)$$

where x is the vector of explanatory variables, β the corresponding coefficient vector, and λ_0 the baseline hazard rate reflecting the underlying distribution of the durations.

The most simple model is obtained by assuming a Weibull distribution for T implying

$$\lambda_0(t) = pt^{p-1},$$

²More generally, the estimator also accounts for right-censoring of the data. Note that we only analyze coaches who have been fired before the end of the contract, thus, censoring effects do not occur.

where p is a shape parameter to be estimated from the data. For $p > 1$ the hazard function increases, while it decreases for $p < 1$. If $p = 1$ the exponential regression model appears as a special case of the Weibull model which implies a constant hazard function.

Table 4 in the appendix presents the results of the Weibull regression model. As in the previous section, two specifications based on the two different performance measures are used.³

Coaches of top teams exhibit significantly longer survival times than coaches of middle or lower ranked teams. Similarly, the average number of points won by a coach also exhibits a significant positive impact on the coach's duration in the team. This is not surprising as there is no reason to replace a successful coach. Thus team performance again appears to be a major determinant of coach dismissals.

Also, the experience of a coach, indicated by the number of previous engagements, exhibits a significant positive impact on the survival time. It is interesting that the age of a coach reveals a significantly negative coefficient. Thus, older coaches take a higher risk of being fired in the next instant of time. As assumed, age and experience actually capture two separate effects on coach dismissals. Finally, it is obvious that the variable indicating an employment during the season ('during') is insignificant. Hence, no influence on the survival time of a trainer is found whether he is hired during the running season or not.

The parametric estimations reveal that the shape of the Weibull distribution is significantly larger than 1 in both specifications. Hence, the hazard rate computed from the underlying duration data is increasing, which implies that the conditional probability of a trainer being fired in the next period increases with time. Therefore, long-lasting employment has a positive impact on being fired.

This contrasts completely with the principal-agent approach, which implies a constant hazard rate and thus that the conditional probability is time independent. Therefore, the matching theory surely offers a more convincing explanation for the employment of coaches in professional soccer.

³Note that the covariates enter the regressions negatively, i.e. a negative coefficient increases the hazard rate and, thus, decreases the expected waiting time until being fired.

Note that the Weibull distribution only allows for monotonic hazard shapes. Often more flexible distributional assumptions are required to fit the data. Hence, instead of relying on a parametric distribution, semiparametric specifications of the hazard rate may be more adequate. In this respect, the semiparametric proportional hazard model (Cox 1972) appear to provide a useful approach. Here, the baseline hazard rate λ_0 is not specified and has to be estimated nonparametrically.

In duration literature it is shown (see e.g. Meyer 1990) that the coefficients β can be estimated consistently when the hazard rate is unknown. According to Cox (1972), the estimation of β and of the unspecified baseline hazard rate λ_0 can be separated. The main idea is that, since $\lambda_0(t)$ is completely unspecified, the rank statistics of the ordered durations are sufficient for the estimation of β . Thus, Cox proposes a partial likelihood approach leading to a consistent estimate.

Let $\mathcal{R}(t_j)$ denote the risk set at time t_j , i.e. the set of all coaches who have retained their job. Then the partial likelihood, sufficient for the estimation of β , is given by

$$\mathcal{L}(\beta) = \prod_{j=1}^k \frac{\exp(-x'_j \beta)}{\sum_{l \in \mathcal{R}(t_j)} \exp(-x'_l \beta)}.$$

Based on the estimates of β , a nonparametric estimate of the baseline hazard rate at time t_j is given by

$$\hat{\lambda}_0(t_j) = 1 - \hat{\xi}_t,$$

where $\hat{\xi}_t$ is the solution to the equation

$$\sum_{l \in \mathcal{D}(t_j)} \frac{\exp(-x'_l \hat{\beta})}{1 - \hat{\xi}_j^{\exp(-x'_l \hat{\beta})}} = \sum_{l \in \mathcal{D}(t_j)} \exp(-x'_l \hat{\beta}),$$

and $\mathcal{D}(t_j)$ denotes the set of trainers who are fired at time t_j (for further details see e.g. Kalbfleisch/Prentice 1980).

Table 5 in the appendix presents the estimation results based on the semiparametric proportional hazard model. They are very similar to those derived from the parametric Weibull regression model. The coefficients and also their levels of significance differ only slightly, which indicates the general robustness

of the results. Figures 2 and 3 depict the resulting baseline survivor function and the baseline hazard function. Again, the survivor function is very similar to the Kaplan-Meier estimation.

Summarizing the results we find that the matching model receives greater empirical support. The increasing baseline hazard function indicates that the probability of being fired increases the longer a coach stays at one club. This contrasts strongly with the predictions of the principal-agent approach and confirms the estimation results of the Weibull model.

5 Conclusions

In contrast with the prominent view, the empirical evidence does not support the principal-agent approach to modelling coach dismissals in the 'First Bundesliga' in Germany. This may be due to differences between professional sports leagues in the United States and Germany - as discussed similarly by Ohtake and Ohkusa (1994). It is not obvious that the information asymmetry between managers and their coaches really varies with the monitoring time. Hence, the hazard rates of a trainer's employment duration are increasing.

For examining coach-team separation in German soccer we focus on two aspects. First we run different probit regressions to reveal the determinants of coach dismissals. As a result we found that only performance indicators influence the individual probability of a coach being fired. Individual characteristics deliver no significance on this probability. Furthermore, the impact of employment duration on dismissal is analyzed using proportional hazard models. A principal-agent approach and the matching theory are proved for explanation of the employment of coaches in professional soccer. In different specifications the parametric Weibull- as well as the semiparametric Cox-model indicate increasing baseline hazard functions, which shows that the probability of being fired in the next instant of time increases the longer a coach stays with a club. This supports the matching theory and contradicts the principal-agent approach in this special employment situation.

Based on these findings, coaches in the 'First German Bundesliga' should examine the option to quit pro-actively. Nevertheless, such decisions as well as firings hinge on the market for coaches.

References

- [1] Alchian, Armen and Harold Demsetz (1972): Production, Information Costs and Economic Organization, *American Economic Review* 62, pp. 777-795.
- [2] Borland, Jeff and Jenny Lye (1996): Matching and Mobility in the Market for Australian Football Coaches, *Industrial and Labor Relations Review*, Vol. 50, No. 1, pp. 143-158.
- [3] Carmichael, Fiona, Dennis Thomas and Robert Ward (2000): Team Performance: The Case of English Premiership Football, in: *Managerial and Decision Economics* 21, p. 31-45.
- [4] Chapman, Kenneth S. and Lawrence Southwick Jr. (1991): Testing the Matching Hypothesis: The Case of Major-League Baseball, *American Economic Review*, Vol. 81, No. 5, pp. 1352-1360.
- [5] Cox, David R. (1972): Regression Models and Life-Tables (with discussion), *Journal of the Royal Statistical Society*, pp. 187-220.
- [6] Han, A., J.A. and Hausman (1990): Flexible Parametric Estimation of Duration and Competing Risk Models, *Journal of Applied Econometrics*, Vol. 5, pp. 1-28.
- [7] Hart, Oliver and Bengt Holmström (1983): The Theory of Contracts, in: T. F. Bewerly (ed.), *Advances in Economic Theory*, 5th World Congress of the Econometric Society, *Econometric Society Monographs* No. 12, Cambridge University Press, pp. 71-155.
- [8] Holmström, Bengt (1979): Moral Hazard and Observability, *Bell Journal of Economics* 10, pp. 74-91.
- [9] Horowitz, Ira (1994): On the Manager as Principal Clerk, *Managerial and Decision Economics* 15, pp. 413-419.
- [10] Jovanovic, Boyan (1979): Job Matching and the Theory of Turnover, *Journal of Political Economy*, Vol. 87, No. 5, pp. 972-990.

- [11] Kalbfleisch, John D. and Ross L. Prentice (1980): *The Statistical Analysis of Failure Time Data*, Wiley, New York.
- [12] Kaplan, E.L. and Paul Meier (1958): Nonparametric estimation from incomplete observations, in: *Journal of the American Statistical Association*, 53, pp. 457-481.
- [13] Kiefer, Nicholas M. (1988): Economic Duration and Hazard Functions, in *Journal of Economic Literature*, pp. 646-679.
- [14] Klotz, Stefan and Frank Gerhard (2000): What is won by the third point for a soccer victory?, Konstanz, mimeo.
- [15] Kräkel, Matthias (2000): Strategic Mismatch and Competing Teams, Bonn, mimeo.
- [16] Lancaster, Tony (1979): Econometric methods for the duration of unemployment, in: *Econometrica*, Vol. 47, No. 5, pp. 939-956.
- [17] Lancaster, Tony (1990): *The Econometric Analysis of Transition Data*, Cambridge: Cambridge University Press.
- [18] Meyer, Bruce D. (1990): Unemployment insurance and unemployment spells, in: *Econometrica*, Vol. 58, No. 4, pp.757-782.
- [19] Morrow, Stephen (1999): *The New Business of Football*, MacMillan Press: London.
- [20] Ohkusa, Yasushi and Fumio Ohtake (1996): The relationship between supervisor and workers. - The case of professional baseball in Japan, *Japan and the World Economy* 8, pp. 475-488.
- [21] Ohtake, Fumio and Yasushe Ohkusa (1994): Testing the matching hypothesis: The case of professional baseball in Japan with comparison to the US, *Journal of the Japanese and International Economies* 8, pp. 204-219.
- [22] Scully, Gerald W. (1994): Managerial Efficiency and Survivability in Professional Team Sports, *Managerial and Decision Economics* 15, pp. 403-411.

Table 1: Descriptive statistics of coach data from German soccer league 1963-1998, 449 observations.

Variable	Mean	Std.Dev.	Minimum	Maximum
duration	506.75	542.06	16	5113
censored	0.0891	0.2852	0	1
dismissal	0.5212	0.5001	0	1
Performance Indicators				
top	0.2027	0.4024	0	1
medium	0.2227	0.4165	0	1
low	0.5746	0.4949	0	1
points+	0.8929	0.2834	0	2.6176
points-	1.1098	0.2688	0.333	2
Individual Characteristics				
during	0.4855	0.5003	0	1
previous	3.1959	2.0038	1	8
age	45.616	7.7852	30.84	74.428

Table 2: Descriptive statistics by reason of contract termination: Panel A (234 observations) for coaches fired and Panel B (215 observations) for coaches reaching full contract length.

Variable	Panel A				Panel B			
	Mean	Std.dev.	Min	Max	Mean	Std.dev.	Min	Max
duration	478.90	428.81	16	3921	537.07	642.76	31	5113
Performance Indicators								
top	0.1966	0.3983	0	1	0.2093	0.4078	0	1
medium	0.1795	0.3846	0	1	0.2698	0.4449	0	1
low	0.6239	0.4854	0	1	0.5209	0.5007	0	1
points+	0.8631	0.2691	0	1.7391	0.9253	0.2955	0	2.6176
points-	1.1492	0.2582	0.5404	2	1.0670	0.2741	0.333	2
Individual Characteristics								
during	0.4273	0.4958	0	1	0.5488	0.4988	0	1
previous	3.1838	1.9947	1	8	3.2093	2.0181	1	8
age	45.363	7.2297	31.906	68.226	45.891	8.3562	30.843	74.428

Table 3: Estimates of a probit model for coach dismissals. Based on coach data from German Soccer League 1963-1998, 409 observations. Dependent variable 'quit': Dismissal before the end of the contract (1) or completing the contract (0). P-values based on asymptotic t-statistics.

Variable	Specification 1		Specification 2	
	Coefficient	p-value	Coefficient	p-value
duration	-0.00024	0.051	-0.00016	0.196
Performance Indicators				
top	-0.20365	0.224	-	-
medium	-0.42696	0.008	-	-
points+	-	-	-0.71370	0.009
Individual Characteristics				
during	-0.38962	0.003	-0.34273	0.010
previous	-0.26191	0.421	-0.01215	0.714
age	-0.00945	0.257	-0.00722	0.376
constant	1.15526	0.004	1.45254	0.001

Table 4: Estimates of a Weibull model for coach dismissals. Based on coach data from German Soccer League 1963-1998, 234 observations. Dependent variable: Time until being fired. P-values based on asymptotic t-statistics.

Variable	Specification 1		Specification 2	
	Coefficient	p-value	Coefficient	p-value
Performance Indicators				
top	-0.34966	0.018	-	-
points+	-	-	-2.57576	0.000
Individual Characteristics				
during	0.52064	0.738	0.00788	0.965
previous	-0.06880	0.070	-0.01636	0.663
age	0.03397	0.002	0.03863	0.000
constant	-7.91567	0.000	-8.82047	0.000
shape parameter p	1.27273		1.42194	

Table 5: Estimates of a Cox model for coach dismissals. Based on coach data from German Soccer League 1963-1998, 234 observations. Dependent variable: Time until being fired. P-values based on asymptotic t-statistics.

Variable	Specification 1		Specification 2	
	Coefficient	p-value	Coefficient	p-value
Performance Indicators				
top	-0.40306	0.005	-	-
points+	-	-	-2.63291	0.000
Individual Characteristics				
during	-0.01920	0.893	-0.04213	0.796
previous	-0.08886	0.006	-0.03978	0.215
age	0.03008	0.004	0.03479	0.001

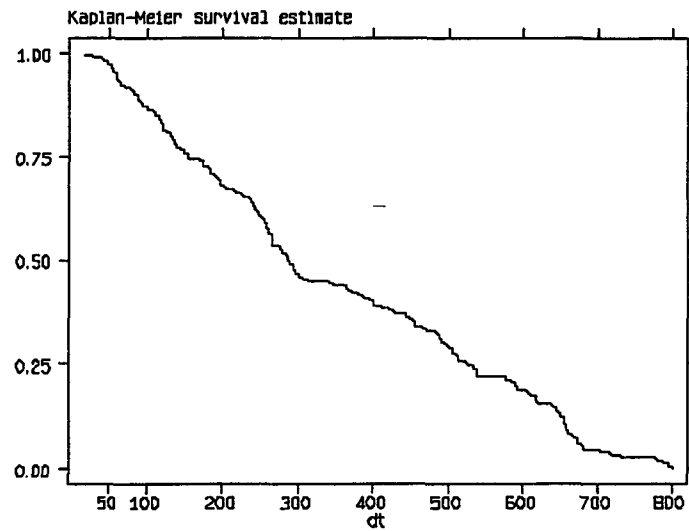


Figure 1: Kaplan-Meier Survival Estimate of the time until being fired

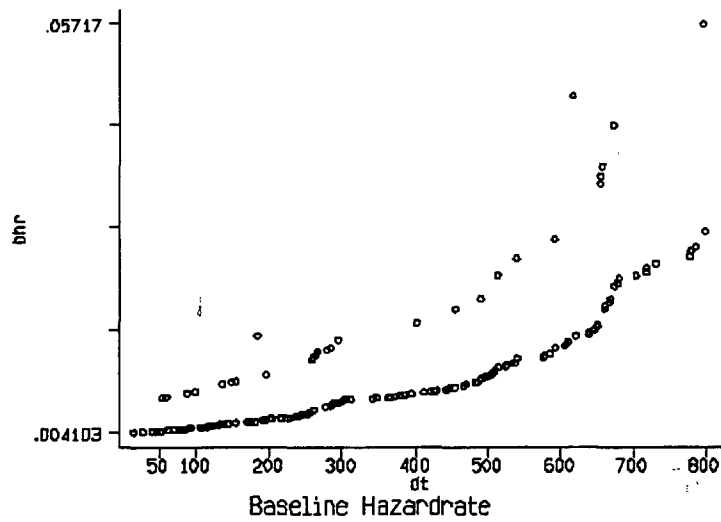


Figure 2: Baseline Hazardrate of the time until being fired

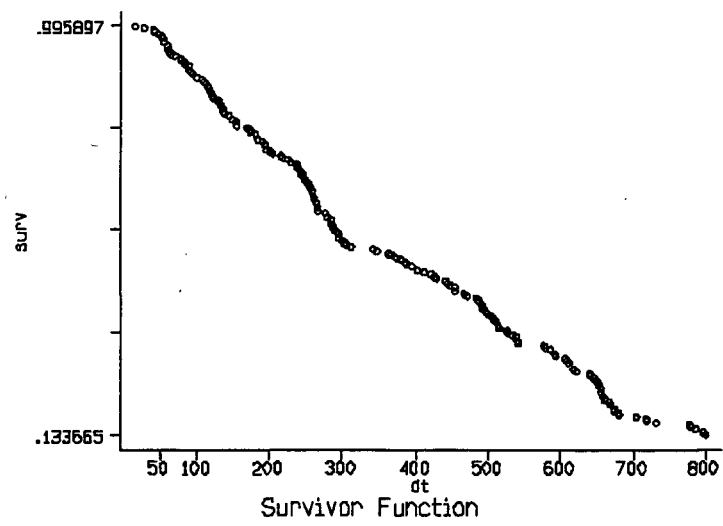


Figure 3: Baseline Survivor Function of the time until being fired