Coaching for Survival:
The Hazards of Head Coach Careers in the German “Bundesliga”

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Abstract

This article analyzes how long head coaches survive in the clubs of the first German football league (“Bundesliga”), where the dismissal of a presumably weak coach is a generally adopted procedure in case of a poor sporting performance of the team. We use duration models for repeated events to accommodate the correlation within individuals.

We find that the head coaches of successful teams and those working during the more recent “three points rule” period are more likely to survive in the Bundesliga. Moreover, the head coaches of clubs with relatively high team wage bills are likely to survive for shorter periods of time.

Keywords: Duration Models, Head Coach Dismissal, Soccer, Bundesliga, Germany

JEL-Code: L83, M12, M51

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1. Introduction

The empirical study of head coach career duration in professional football can benefit from the application of event history analysis, a technique that focuses on the effects of factors that determine the length of time until the occurrence of some event, such as the death of a patient or the dismissal of an employee (Yamaguchi 1991, Allison 1984, Cleves, Gould and Gutierrez 2002, Cox and Oakes 1984). This technique has been previously used in sports by Okhusa (1999, 2001) and Frick, Pietzner and Prinz (2006) and is currently being adopted elsewhere in fields such as labour economics (Carrasco 1999), in international relations (Box Steffensmeier, Reiter and Zorn 2003; Barros, Passos and Alana, 2005) as well as corporate finance (Holtz-Eakin et al. 1994).

In this paper we analyze the determinants of head coach career length using a hitherto unavailable data set from the “Bundesliga”, the first division in German football. Although this is not the first paper applying event history analysis to the duration of head coach careers in European football, our data set is unique in that we have information on the salaries of head coaches as well as on their career performance.

The motivation for this research is the following: First, coach dismissals have always been and still are used occasionally when (professional) teams perform poorly on the pitch. However, dismissing the old and hiring a new head coach not necessarily leads to positive results. It is, therefore, important to ascertain the covariates which explain the decision to dismiss a coach. Second, a dismissal is a decision in time which in an individual coach’s career happens once in a while - possibly depending on the duration of his career in the league. This time event characteristic of career length and dismissal allow their analysis using an event history model. Finally, it is important for policy purposes to investigate the covariates of head coach dismissals. If one knew the characteristics leading to these events, then one could better allocate resources used in countering such events.

The paper contributes to the theme’s literature in three ways. First, by adopting a panel data framework, it uses a hazard model, previously applied by Okhusa (1999, 2001). Second, it specifically analyzes head coach dismissals, an issue that so far has not inspired much research in Europe, despite its increasing importance. Finally, it analyzes data from one of the major European football leagues which, in turn, allow some broader generalizations.
This paper is organised as follows. In section 2 we summarize the literature that is of relevance in our context. Section 3 describes the contextual setting, i.e. the labour market for head coaches in German soccer. In section 4 we present the theoretical framework that underlies the empirical analysis, in section 5 the data and in section 6 the results. Section 7 discusses the limitations and some possible extensions of our research and, finally, section 8 concludes.

2. Literature Survey

The number of papers adopting event history analysis in (professional) sports has been increasing considerably over the past few years as more and more data has been made available.


Using data from two of the four Major Leagues in the US (Baseball, 1901-1989 and Basketball, 1949/50-1989/90, Scully (1992a) finds that firing the manager is rational in the sense that clubs improve their rank order finish the season after the head coach had been fired. Borland and Lye (1996) analyze coach separations in Australian rules football over a period of more than sixty years (1931-1994).

Mixon and Trevino (2004) and Kahn (2004) study the impact of race on the career duration of head coaches in college football and in the NBA, respectively.


3. The Labour Market for Head Coaches in German Football

In all but one of the 22 seasons for which we have been able to compile the data used in this paper (see below) 18 teams were playing in the German first division (“Bundesliga”). At the end of each season the three weakest teams are relegated and replaced by the three best-performing teams from the second division.1

In the history of the Bundesliga more than 300 head coach dismissals have been recorded. The annual number of dismissals varies between 4 and 14. While some coaches have been working for one team only, others have been employed by as many as seven different clubs.2

1 In 1991/92, when the two best teams from the first division of the former German Democratic Republic (“Oberliga”) were admitted to the Bundesliga, the number of teams was temporarily increased to 20. After that season, four teams were relegated to division 2 while only two were promoted to division 1, resulting in the well-known size of the league again.

2 Otto Rehhagel, currently head coach of the Greek national team, was formerly employed by Kickers Offenbach, Werder Bremen, Borussia Dortmund, Arminia Bielefeld, Fortuna Dusseldorf, Bayern Muenchen and 1. FC Kaiserslautern. Moreover, a number of head coaches had up to six different employers in the first division (Guyla Lorant, Joerg Berger, Rudi Gutendorf, Kuno Kloetzer, Manfred
Our analysis, however, concentrates on the period 1981/82-2002/03 since we have information on head coach salaries for these 22 consecutive seasons only.

4. Theoretical Framework

The focus of this paper is on football coaches in the German Bundesliga in the years 1981/82- 2002/2003. The length of a football coach’s career depends on three critical factors: The individual’s football specific skills and the characteristics of the local labour market (preferences for a certain type of football are likely to differ between the clubs in a league) are certainly important. What is of prime importance, however, is the head coach’s performance, i.e. his win percentage in a particular job. Coaches are usually dismissed once their team’s expected performance is poorer than expected.

Krafft and Branco Zebec). Some of these coaches have not only been working in the first, but also in the second division. Moreover, some coaches have been working for a team not only once, but have been hired again after a while.
The hypotheses to be tested in the empirical part of our paper are as follows:

**H1:** The relative salary of a head coach determines his career length. Coaches with relatively high salaries are more likely to remain in their position even in case of poor performance, because the opportunity costs of replacing them are quite high.

Previous research has already tested this assumption (see Dawson, Dobson and Gerrard 2000, 2002; Porter and Scully 1982). We are, however, the first to use detailed salary information over a long period of time.

**H2:** The career length of the coaches is also determined by the relative wage bills of their teams. We assume that coaches working with expensive teams, i.e. those with relatively high wage bills, are more likely to be fired when performance lags behind expectations.

It is one of the few “stylized facts” in the sports economics literature that expensive teams are performing better than clubs with moderate or even low wage bills (see Szymanski 2003, Forrest and Simmons 2004).

**H3:** There is a positive trend for the career durations of head coaches, i.e. the probability of being dismissed has decreased over time.

Although competitive pressures have increased for the players following the “Bosman verdict” of the European Court of Justice (see Frick, Pietzner and Prinz 2006), the globalization of the European football industry has not yet affected head coaches in Germany. The number of foreign coaches is low and dismissed coaches can expect to be rehired soon by another team.

**H4:** Career duration of head coaches in football is positively affected by their win percentage, i.e. their career length increases with the number of relative points won by their teams.

Coaches are constantly monitored not only by the management of their clubs but also by millions of football fans. Since the coaches are responsible for the teams’ performance on the pitch, more successful coaches are likely to survive longer.
H5: Coaching experience increases the probability of surviving in the current job. The longer a coach has been working in professional football, the more human capital he has accumulated which, in turn, reduces the probability of getting fired.

In one of his seminal publications Mincer (1974) analyzed the relationship between experience and earnings showing that career length is a good predictor of current income (this relationship, however, is not a linear one).

5. Research Design

In the study of the career durations of head coaches in German professional football the event we want to explain is the dismissal, i.e. the premature end to an employment relationship. A dismissal can either mean that the coach has to end his career or that he is later on re-employed by another team. Many of the coaches whose careers we study have held a number of different jobs in the Bundesliga. Since such repeated events are unlikely to be independent the Cox proportional hazard model for single event data is inadequate for estimation. Ignoring this dependence might lead to erroneous variance estimates and possibly biased estimates. One possible solution to this problem is considering only the time until the first occurrence of an event. This specification, however, makes the strong assumption that the time to the first event is similar to the time to all events. Moreover this specification implies throwing away some data.

Some semi-parametric proportional hazard-type models have been proposed in the literature to be used in case of repeated events, such as the independent increments model of Anderson and Gill (1982), the conditional risk-set model in either elapsed or gap time of Prentice, Williams and Peterson (1981), and the marginal risk-set model of Wei, Lin and Weissfeld (1989). All these models are variance-correction models for repeated events and differ in the way they define the risk set and the event time, e.g., Box-Steffensmeier and Zorn (2002). In this paper we use the conditional risk-set model in gap time developed by Prentice, Williams and Peterson (1981). In this model, an individual is not at risk for a later event until all prior events have occurred and event time is defined as time elapsed since the previous event. To estimate this model we cluster on coach identification and stratify by event number. The hazard is then specified as
\[ h_{ik}(t \mid X_{ik}) = h_{0k}(t - t_{k-1}) \exp(\beta X_{ik}) \]

where \( k \) denotes event number, \( h_{0k}(\cdot) \) is the baseline hazard and varies by event number, \( X \) is a vector of covariates which can be time dependent and \( \beta \) is a vector of parameters.

The parameters are estimated using the partial likelihood which is given by

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

where \( \delta \) is a censoring indicator equal to one if observed and zero if censored and \( Y \) is a risk indicator which is equal to one if the individual is at risk for the current event and zero otherwise.

We also consider two parametric specifications: the exponential and the Weibull model. In the exponential model the baseline hazard is stratified by event number and is constant at each event \( k \), with hazard rate,

\[ h_{ik}(t \mid X_{ik}) = \theta_k I_k(t - t_{k-1}) \exp(\beta X_{ik}) \]

where \( I_k(t - t_{k-1}) \) is an indicator function for durations in event \( k \) and \( \theta_k \) the estimated baseline at event number \( k \).

In the Weibull model the baseline is defined by

\[ h_{0k}(t - t_{k-1}) = \alpha_k(t - t_{k-1})^{\alpha_k-1} \]

where the time dependent parameter, \( \alpha_k \), is estimated separately for each event. Both models are estimated through maximum likelihood.
6. Data and Findings

The data used to study the determinants of head coach career duration cover the seasons 1981/82-2002/2003. The data come from a Sunday newspaper (*Die Welt*) that publishes team wage bills and head coach salaries immediately before the start of a season. Supplementary data on team playing records were obtained from *Kicker* soccer magazine. These data give us an unbalanced panel of 398 team-season observations featuring 39 teams. Six of these (Bayern Muenchen, Werder Bremen, Borussia Dortmund, Hamburger Sportverein, Bayer Leverkusen and VfB Stuttgart) have appeared in Bundesliga 1 over the entire sample period; five clubs (Blau-Weiss Berlin, Darmstadt 98, VfB Leipzig, Kickers Offenbach and SSV Ulm) were relegated after just one season. During the period under consideration we observe different 114 coaches.

Table 1 presents the characteristics of the data used in the analysis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT</td>
<td>Binary variable equal to one if coach is dismissed; zero otherwise</td>
<td>0</td>
<td>1</td>
<td>0.450</td>
<td>0.498</td>
</tr>
<tr>
<td>RSAL</td>
<td>Relative salary of the head coach (individual salary divided by average salary of all head coaches in respective season)</td>
<td>0.226</td>
<td>3.079</td>
<td>1.000</td>
<td>0.507</td>
</tr>
<tr>
<td>CWP</td>
<td>Win percentage of head coach</td>
<td>0</td>
<td>0.850</td>
<td>0.448</td>
<td>0.194</td>
</tr>
<tr>
<td>CEXP</td>
<td>Experience of head coach in the Bundesliga measured in years</td>
<td>0</td>
<td>27</td>
<td>4.369</td>
<td>4.815</td>
</tr>
<tr>
<td>RWB</td>
<td>Relative wage bill of the team (team wage bill divided by average wage bill of all teams in respective season)</td>
<td>0.230</td>
<td>4.147</td>
<td>1.000</td>
<td>0.533</td>
</tr>
<tr>
<td>SEASON</td>
<td>Season (1981/82=1… 2002/03=22)</td>
<td>1</td>
<td>22</td>
<td>11.497</td>
<td>6.336</td>
</tr>
<tr>
<td>TPR</td>
<td>Dummy variable equal to one for period where a win is rewarded with three points; zero otherwise</td>
<td>0</td>
<td>1</td>
<td>0.362</td>
<td>0.481</td>
</tr>
<tr>
<td>RP</td>
<td>Relative points won (points accumulated by team divided by average number of points won by average team in respective season)</td>
<td>0.206</td>
<td>0.779</td>
<td>0.484</td>
<td>0.121</td>
</tr>
</tbody>
</table>

Table 2 presents the results of our estimations. We present a number of different duration models for comparative purposes. The dependent variable is always tenure with the current team, measured in years. The estimated coefficients are always in the proportional-hazard metric.
Model 1 (M1) is the Cox proportional hazard model considering only the first occurrence of an event. Model 2 is the conditional risk-set model in gap time of Prentice, Williams and Peterson (1981). Model 3 is the parametric exponential model with the baseline hazard stratified by event. Finally, Model 4 is the Weibull model where the baseline hazard parameter, $\alpha_k$, $k=2,\ldots,6$, is estimated separately at each occurrence of an event.

Table 2
Estimation Results

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>s.e.</td>
<td>Coef.</td>
<td>s.e.(2)</td>
</tr>
<tr>
<td>$RSAL$</td>
<td>0.106</td>
<td>0.293</td>
<td>0.011</td>
<td>0.237</td>
</tr>
<tr>
<td>$CWP$</td>
<td>0.327</td>
<td>0.531</td>
<td>0.436</td>
<td>0.480</td>
</tr>
<tr>
<td>$CEXP$</td>
<td>0.001</td>
<td>0.038</td>
<td>0.030</td>
<td>0.018</td>
</tr>
<tr>
<td>$RWB$</td>
<td>0.815</td>
<td>0.218</td>
<td>0.683</td>
<td>0.183</td>
</tr>
<tr>
<td>$TPR$</td>
<td>-0.656</td>
<td>0.217</td>
<td>-0.772</td>
<td>0.156</td>
</tr>
<tr>
<td>$RP$</td>
<td>-8.493</td>
<td>0.993</td>
<td>-8.415</td>
<td>0.726</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td></td>
<td></td>
<td>0.023</td>
<td>0.122</td>
</tr>
<tr>
<td>$\theta_3$</td>
<td></td>
<td></td>
<td>0.118</td>
<td>0.139</td>
</tr>
<tr>
<td>$\theta_4$</td>
<td></td>
<td></td>
<td>0.075</td>
<td>0.195</td>
</tr>
<tr>
<td>$\theta_5$</td>
<td></td>
<td></td>
<td>-0.035</td>
<td>0.409</td>
</tr>
<tr>
<td>$\theta_6$</td>
<td></td>
<td></td>
<td>0.723</td>
<td>0.162</td>
</tr>
<tr>
<td>Constant</td>
<td>1.356</td>
<td>0.176</td>
<td>1.519</td>
<td>0.238</td>
</tr>
<tr>
<td>$\ln(\alpha_2)$</td>
<td></td>
<td></td>
<td>0.160</td>
<td>0.086</td>
</tr>
<tr>
<td>$\ln(\alpha_3)$</td>
<td></td>
<td></td>
<td>0.269</td>
<td>0.126</td>
</tr>
<tr>
<td>$\ln(\alpha_4)$</td>
<td></td>
<td></td>
<td>0.373</td>
<td>0.082</td>
</tr>
<tr>
<td>$\ln(\alpha_5)$</td>
<td></td>
<td></td>
<td>0.497</td>
<td>0.152</td>
</tr>
<tr>
<td>$\ln(\alpha_6)$</td>
<td></td>
<td></td>
<td>0.813</td>
<td>0.075</td>
</tr>
<tr>
<td>$\ln(\text{Const})$</td>
<td></td>
<td></td>
<td>0.587</td>
<td>0.089</td>
</tr>
<tr>
<td>$LL$</td>
<td>-369.3</td>
<td>-544.4</td>
<td>-205.3</td>
<td>-159.3</td>
</tr>
</tbody>
</table>

(1) – All models were estimated in Stata 9
(2) – Robust standard errors
$\theta_k$ - baseline parameter for event, $k=2,\ldots,6$,
$\alpha_k$ - parameter of the Weibull base line hazard for event $k=2,\ldots,6$
$LL$ - Log Likelihood
There are 114 coaches in the sample who are responsible for 179 events and 10 censored observations (models M2 - M4). The frequency of events is shown in Table 3.

### Table 3
Frequencies

<table>
<thead>
<tr>
<th>No. of Events</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequencies</td>
<td>114</td>
<td>48</td>
<td>20</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

In all four models the results are quite similar in the main effects. The relative wage bill \((RWB)\) has a positive effect in the hazard implying that coaches of more expensive teams tend to be fired earlier, i.e. expectations of management and fans are apparently higher than in teams that spend less money for their players. The sporting performance of the team \((RP)\) and the regime shift \((TPR, rewarding three points instead of two for a win)\) have a negative impact on the hazard rate. This means that coaches achieving more points for their teams and coaches working under the “three point regime” tend to survive longer.

Finally, in model 4 the coaches’ career win percentage is negative and statistically significant. This implies that better (in the sense of more successful) coaches tend to survive longer, too. Moreover, the time dependent parameter of the baseline hazard, \(\alpha_k\), is greater than one for all the occurrences of an event and its value increases with event number, implying that the risk of being fired increases with repeated events. This conclusion, however, should be taken with care because there are only a few observations for recurrent events greater than 3 (recall from Table 3 that only 7 out of 114 coaches experience more than 3 events). Thus, further research using a much larger dataset is required.

### 7. Discussion

In our paper we analyze the determinants of head coach dismissals in the top tier of the German football league using a number of different survival models. We first have to reject \(H1\) because the coefficient of \(RSAL\) has the expected sign, but is not statistically significant. We find support for our \(H2\) because the respective coefficient is statistically significant, i.e. the coaches of more expensive teams (those with higher values of \(RWB\)) are more likely to be fired. Moreover, we find that coaches working under the “three point regime” \((TPR)\) tend to survive longer, leading us to accept \(H3\). We also find sup-
port for $H4$ which suggests that coaches producing more wins (i.e. whose teams have a better sporting performance) tend to survive longer. Finally, $H5$ has to be rejected again, because prior coaching experience has no influence on the probability of surviving in a particular job.

What are the implications of these results? They are, of course, intuitive: Success on the pitch is the major determinant of survival. Head coaches who are able to produce more wins are likely to survive longer. Working with an expensive team makes the coach more vulnerable: Since the team’s team wage bill and the management’s as well as the fans expectations are highly correlated, a poor performance very often leads to an immediate dismissal (sometimes after a few weeks of the season already). Surprisingly, however, clubs seem not to blame coaches for a poor performance as quickly as they did in the past. In more recent years, coaches tend to survive longer. This outcome may be due to a number of reasons: First, coaching talent may be an even more scarce resource than it used to be (the teams in Germany rarely hire foreign coaches, i.e. the globalization of football has not contributed to an increased inflow of talent as opposed to the market for players). Second, since the salaries of head coaches went up considerably over the last years, it may simply be too expensive to dismiss a head coach with a valid contract. Third, replacing a head coach in the middle of the season may be a difficult task: If the teams at the beginning of the season hire the most able coaches it is clear that those still looking for a job in the middle of the season are, on average, of lower quality. This, in turn, may very often be a reason to keep the incumbent job - the available alternatives are even worse.

What are the policy implications of our findings? The most important result here is that organizational changes have an impact on the survival of head coaches in the German Bundesliga. Thus, organizational changes should be taken into account when studying head coach departures over time. Head coaches themselves should take into account that although their salary reflects talent, it has no statistical influence on the probability of surviving in the present position. What as an impact, however, is the money spent on player salaries (head coach salaries and team wage bills are only moderately correlated with $r=+0.45$).

How does our research compare with previous papers that have been published on this topic? Prior research using survival methods in professional sports settings has usually relied on a single model. The results, however, are clearly conditional on the models
used. After having applied a number of different models we conclude that the Weibull survival model is the most adequate for our data set.

8. Summary and Conclusions

In our paper we analyze the survival of head coaches in the first division in German professional soccer over the period 1981/82-2002/03. Using a unique and hitherto unavailable data set with information on team wage bills and head coach salaries we compare the results of different estimations. We estimate, first, a Cox proportional hazard model, second, a conditional risk-set in gap time, third a parametric exponential model and, fourth, a Weibull model. We find that while the salary of the head coach is statistically insignificant in explaining survival, the opposite holds for the team wage bill. Head coach experience as well as the career win percentage are statistically insignificant. Finally, organizational changes matter in the sense that the introduction of the “three point rule” had a positive influence on the survival probabilities of head coaches.

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