DISCUSSION PAPER SERIES

IZA DP No. 8560

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October 2014

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

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IZA Discussion Paper No. 8560
October 2014

ABSTRACT

The Contribution of Managers to Organizational Success: Evidence from German Soccer*

We study the impact of managers on the success of professional soccer teams using data from the German "Bundesliga". We evaluate the performance impact of individual managers by estimating regression models that include both team and manager fixed effects, where we are exploiting the high turnover of managers between teams to disentangle the managers' contributions. We find that teams employing a manager at the 75% ability percentile gain on average 0:25 points per game more than those employing a manager at the 25% ability percentile, which corresponds to a sizeable difference of 18% of the average number of points awarded per game. Moreover, estimated abilities have significant predictive power for future performance.

JEL Classification: J24, J44, J63

Keywords: managerial skills, human capital, empirical, fixed effects, professional sports

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* Financial support from the State of North Rhine-Westfalia (NRW), Ministry for Family, Children, Culture and Sport (MFKJKS) is gratefully acknowledged. Moreover, we thank Impire AG for kindly providing a large part of the data used in the paper. We are also grateful to Herbert Dawid and Eberhard Feess for their valuable comments. Dennis Baufeld, Uwe Blank, Michaela Buscha, Stephan Göpfert, Merle Gregor, Dennis Hebben, and Stefanie Kramer provided excellent research assistance.

1 Introduction

It is widely believed that managers have a huge impact on the success of organizations. The ability of the person at the top affects an organization through a number of channels and should trickle down through the hierarchy and thus have a strong effect on organizational performance (Rosen, 1982). But how big are these effects? What difference does the quality of the single person at the top make for the overall performance of the organization? There is a recent empirical literature which aims at measuring the contribution of individual managers to the performance of their organization (see e.g., Bertrand and Schoar, 2003; Lazear et al., 2014; Graham et al., 2012) exploiting the variation which arises from the fact that, in the course of the careers, some managers are active in several organizations or functions which allows to disentangle their contribution from other factors. However, this is a difficult endeavor as CEOs, for instance, typically stay at the top of a specific firm for longer time periods and work as CEOs only for a very small number of different firms (very often only one) in their lifetime – which limits the scope to measure their contribution to organizational success.

In this paper, we consider this issue in the context of professional sports which has several advantages for the question at hand (apart from being of interest in its own right): (i) team performance is publicly observable on a weekly basis and (ii) managers move very frequently between teams – much more frequently than managers in firms. And observing the same manager in different organizations thus using different sets of resources and working with different people is crucial to measure a manager's contribution to overall success. We follow the approach applied by Abowd et al. (1999) (who use wages of employees working for different employers) and Bertrand and Schoar (2003) (who study CEO's working for different firms) and evaluate the impact of individual managers by estimating OLS regressions that include both team and manager fixed effects using data from the last 21 seasons of the *Bundesliga*, Germany's major soccer league.[1] We then

[1]Another strand of literature has followed a different route in order to measure managerial quality in professional sports: In a first step, a (stochastic) efficiency frontier is estimated for each team, and then in a second step, the quality of a manager is assessed in terms of the team's proximity to this frontier during his term, see e.g., Carmichael and Thomas (1995); Fizel and D'Itry (1997); Dawson

investigate the obtained manager fixed effects further and, for instance, find that teams employing a manager at the 75% ability percentile gain on average 0.25 points per game more than those employing a manager at the 25% ability percentile. This corresponds to a difference of 18% of the average number of points awarded per game. We also conduct a cross validation exercise by estimating manager fixed effects using the data only up to a certain season and then investigate whether these fixed effects are useful to predict future performance. We find that this indeed is the case: these measures of managerial ability have a substantial predictive power for future performance of the teams employing the respective manager.

The paper thus contributes to the growing literature empirically analyzing the impact of managers on different economic measures, such as corporate behavior (Bertrand and Schoar, 2003), corporate tax avoidance (Dyreng et al., 2010), managerial compensation (Graham et al., 2012), or disclosure choices (Bamber et al., 2010). In a prominent study, Bertrand and Schoar (2003) try to assess the impact of managers on firm performance, analyzing to what extent manager fixed effects can explain the observed heterogeneity in corporate behavior. They use a manager-firm matched panel data set that comprises different CEOs in different firms and focus only on those firms that have employed at least one *mover* manager, i.e. a manager who can be observed in at least two firms. The results show that manager fixed effects are important determinants in explaining corporate behavior. More recently, Lazear et al. (2014) study data from a large call center where supervisors move between teams (and team composition varies over time) which allows to disentangle the effect of different supervisors on performance. To the best of our knowledge, our paper is the first to apply this idea to the professional sports sector. Moreover, all managers in our study operate in the same industry, and this industry attracts a huge amount of public attention. As a result, most of these managers are very well-known to the interested public, so that the estimated individual fixed effects are of interest in their own right. Furthermore, we show that the estimated effects are useful to predict performance later in the managers' careers. Hence, our results can be helpful

et al. (2000a,b); Dawson and Dobson (2002); Kahane (2005); Hofler and Payne (2006).

in identifying "under-valued" managers.

The remainder of the paper is structured as follows: We first describe the data and the empirical framework in section 2. In section 3 we present the key results, in particular with respect to the estimated manager fixed effects and the resulting heterogeneity of managers. In section 4 we cross-validate our results by estimating first manager and team fixed-effects for a restricted sample, and then use these estimates to predict team performance for the remaining seasons in our data set. Section 5 discusses possible caveats of our framework and concludes.

2 Empirical Framework

2.1 Data

The German Bundesliga – one of the strongest and economically most viable soccer leagues in the world – consists of 18 teams, and in each season, each team plays twice against each other team (one home match for each team), resulting in two half-seasons with 17 match days each. In each match, a winning (losing) team is awarded 3 (0) points, a draw results in 1 point for each team, and teams are ranked according to their accumulated points.[2] Our data set contains all Bundesliga matches played in the 21 seasons from 1993/94 until 2013/14 (9 matches played on each of 714 match days leading to a total of 6426 matches).

In our analysis, the unit of observation is the performance of a manager-team pair during a half-season (that is, match days 1 through 17 and 18 through 34, respectively). Therefore our dependent variable (*Points*) is the average number of points per game gained in the course of a half-season.[3]

Throughout we refer to a *spell* as a non-interrupted relationship between a manager-

[2]When several teams have accumulated the same number of points, the goal difference is used as the tie-breaking rule. In the first two season covered 1993/94 and 1994/95 the Bundesliga still applied a "two-point rule" where the winner of a game was awarded two points instead of three. We converted the data from these two seasons to the three-point rule.

[3]Considering half-seasons has the advantage that a team faces each other team exactly once during that time, so that distortions due to different sets of opponents are reduced.

team pair.[4] To be considered in the subsequent analysis, we require that a spell must last for at least 17 consecutive matches in the Bundesliga, and throughout the paper we refer to this as the *Footprint* condition (F).[5] This condition excludes observations from managers who are responsible for a team only for a small number of games.[6] While such short-term managers might have an impact on the team's short-term performance, they are unlikely to "leave a footprint". Out of the 176 managers in our data set, 116 remain after condition F is applied.[7]

Spells satisfying condition F often stretch over several half-seasons (thereby leading to multiple observations for our dependent variable), but the time interval of a spell does typically not divide evenly into half-seasons. The reason is that managers are frequently hired and dismissed within (half-) seasons.[8] In these cases, we consider the performance in all half-seasons of the spell, weighted with the number of matches in the respective half-season.[9]

[4]In a small number of cases, the same manager-team pair has multiple spells, that is, a team has hired the same manager again after several years, e.g., Ottmar Hitzfeld (Bayern Munich) or Felix Magath (Wolfsburg). We count each of such periods as separate spells.

[5]In a similar vein, Bertrand and Schoar (2003) require at least three joint years for a manager-firm pair to considered in the analysis. We have chosen 17 matches to limit the scope of distortions due to the strength of the opponent teams.

[6]For instance, there are interim coaches who are hired only for a small number of matches after a coach has been fired and before a permanent successor is found. In our sample, the average spell of such interim managers lasts for 2.35 matches only. But there are also some managers who are dismissed because of weak performance after being in office only for a small number of matches.

[7]The 60 managers and corresponding 109 spells which do not satisfy condition F are excluded from the further analysis. On average these spells lasted for a mere 6 matches only. See Appendix B for more details.

[8]Within-season dismissals are a very typical feature in European Professional Sports. On average, about 35-40% of the teams dismiss their manager within a given season at least once (see e.g. Hentschel et al., 2012; De Paola and Scoppa, 2012; Tena and Forrest, 2007; Audas et al., 2002). In the 21 seasons of our sample, we observe in total 192 such within-season dismissals.

[9]For example, when a manager is hired at match day 5, and fired after match day 30 of the same season, this spell satisfies condition F, and there are two observations for this manager-team pair (one for the first half-season encompassing match days 5 to 17 and one for the second with match days 18 to 30, respectively). To take into account that the spell covers none of these two half-season in full, the average points won in each half-season are weighed with the number of joint matches of the manager-team pair in that half-season.

2.2 Identification of Manager-Fixed Effects

We consider the following empirical model to explain the performance of team i under manager k in half season t

$$Points_{itk} = \gamma_i + \lambda_k + \alpha_t + \epsilon_{itk}, \tag{1}$$

where the dependent variable measures the average number of points per game won by team i during the half-season $t = 1, ...42$.

We apply a parsimonious approach and include only fixed effects for teams (γ_i), managers (λ_k), and half seasons (α_t) as explanatory variables. Including more controls such as the team's budgets (absolute or relative) is not necessarily desirable from a methodological point of view, as a team's budget will also depend on performance and thus will be influenced by the current manager.[10] Obviously, γ_i and λ_k cannot be identified separately when the respective teams and managers are only jointly observed (that is, team i is only observed with manager k, and manager k is only observed with team i) since both variables are perfectly collinear in this case. Hence, to identify the different fixed effects, (at least some) managers and teams must be observed with multiple partners (see e.g., Abowd et al., 1999; Bertrand and Schoar, 2003).

In the context of European professional soccer, the rate of manager turnover is quite high. One reason is the high frequency of within-season managerial change as discussed above, but replacing managers between seasons is also quite common.[11] As a result, our data contains a large number of managers which are observed with many different teams (up to 7), and many teams which are observed under many different managers (up to 13) which creates a large amount of variation in observed manager-team matches. From a methodological point of view, this renders this industry particularly suitable for the

[10]For instance, the top 5 teams at the end of a season are allowed to participate in the UEFA competitions *Champions League* or *Europe League* in the following season, both of which are financially very attractive. For example, the UEFA Champions League earned Bayern Munich an additional 58 Mio Euro in the season 2009/2010, as compared to an average Bundesliga team's budget of 39.5 Mio Euro for that season.

[11]In the 21 seasons in our data set, in addition to the 192 within-season dismissals, there are 59 cases of managerial change between seasons.

identification of manager fixed-effects.

Throughout, we distinguish between two types of managers: *movers* and *non-movers*. We refer to a manager as a (non-)mover when he is observed with at least two different (only one) team(s). Out of the 116 managers satisfying the footprint condition F, 44 (38%) managers are movers, while 72 (62%) are non-movers.

As already explained, for all teams employing only non-mover managers, it is not possible to disentangle team and manager fixed-effects, and therefore to identify a separate manager fixed-effect. In contrast, for all teams observed with at least one mover manager, manager fixed-effects can be estimated also for the non-mover managers. In line with Bertrand and Schoar (2003), we require that teams are observed with at least one mover, and refer to this as the mover-team (MT) condition. This condition is satisfied by 29 out of the 37 teams in our data set. The remaining 8 teams are excluded from the analysis.[12] The same is true for the 13 managers (none of them eliminated by condition F, all non-movers) who have been employed by these teams, leading to 13 excluded spells in addition to those already excluded due to condition F as explained above.[13] Our final data set covers 103 managers (44 movers, and 59 non-movers), 29 teams, 206 spells, and 764 observations for the dependent variable *Points*.

Table 1 gives an overview of all 103 managers in our final sample. As can be seen from the table, more than 80% of the 44 movers in our sample are either observed with two or three different teams. But we also observe managers who have worked for many more teams (up to seven as in the case of Felix Magath, for instance).

[12]Typically, these teams are small and enter the Bundesliga occasionally by promotion, and are relegated to the second division again after a small number of seasons. See Table 12 in Appendix C for more information on these teams and their managers.

[13]Note that we first apply condition F and then condition MT, thus excluding those (three) managers who did work for two different teams, but where one of the spells is eliminated by condition F, see Table 12 in Appendix C.

	Manager	No. of teams	No. of obs		Manager	No. of teams	No. of obs
1	Advocaat, Dick	1	2	53	Löw, Joachim	1	4
2	Augenthaler, Klaus	3	13	54	Magath, Felix	7	34
3	Babbel, Markus	3	6	55	Marwijk, Bert van	1	5
4	Berger, Jörg	3	11	56	Maslo, Uli	1	4
5	Bommer, Rudi	1	2	57	McClaren, Steve	1	2
6	Bongartz, Hannes	3	6	58	Meyer, Hans	3	13
7	Bonhof, Rainer	1	2	59	Middendorp, Ernst	1	6
8	Brehme, Andreas	1	5	60	Mos, Aad de	1	1
9	Daum, Christoph	3	13	61	Möhlmann, Benno	2	7
10	Demuth, Dietmar	1	2	62	Neubarth, Frank	1	2
11	Doll, Thomas	2	9	63	Neururer, Peter	3	13
12	Dutt, Robin	3	8	64	Oenning, Michael	1	1
13	Dörner, Hans-Jürgen	1	4	65	Olsen, Morten	1	5
14	Engels, Stephan	1	2	66	Pacult, Peter	1	4
15	Fach, Holger	2	4	67	Pagelsdorf, Frank	2	15
16	Favre, Lucien	2	12	68	Pezzaiuoli, Marco	1	1
17	Fink, Thorsten	1	5	69	Rangnick, Ralf	4	17
18	Finke, Volker	1	20	70	Rapolder, Uwe	2	3
19	Fringer, Rolf	1	2	71	Rausch, Friedel	2	8
20	Frontzeck, Michael	3	9	72	Rehhagel, Otto	3	13
21	Funkel, Friedhelm	6	27	73	Reimann, Willi	2	4
22	Gaal, Louis van	1	4	74	Ribbeck, Erich	2	5
23	Gerets, Erik	2	7	75	Rutten, Fred	1	2
24	Gerland, Hermann	1	2	76	Röber, Jürgen	3	16
25	Gisdol, Markus	1	3	77	Sammer, Matthias	2	10
26	Gross, Christian	1	3	78	Scala, Nevio	1	2
27	Guardiola, Pep	1	2	79	Schaaf, Thomas	1	29
28	Götz, Falko	2	9	80	Schaefer, Frank	1	2
29	Hecking, Dieter	3	16	81	Schlünz, Juri	1	3
30	Heesen, Thomas von	1	4	82	Schneider, Thomas	1	2
31	Herrlich, Heiko	1	2	83	Sidka, Wolfgang	1	3
32	Heynckes, Jupp	5	15	84	Skibbe, Michael	3	14
33	Hitzfeld, Ottmar	2	23	85	Slomka, Mirko	2	13
34	Hyypiä, Sami	1	2	86	Solbakken, Stale	1	2
35	Jara, Kurt	2	8	87	Soldo, Zvonimir	1	3
36	Jol, Martin	1	2	88	Sorg, Marcus	1	1
37	Keller, Jens	1	3	89	Stanislawski, Holger	2	4
38	Klinsmann, Jürgen	1	2	90	Stepanovic, Dragoslav	1	4
39	Klopp, Jürgen	2	18	91	Stevens, Huub	3	21
40	Koller, Marcel	2	9	92	Streich, Christian	1	5
41	Korkut, Tayfun	1	1	93	Toppmöller, Klaus	4	17
42	Krauss, Bernd	1	7	94	Trapattoni, Giovanni	2	8
43	Kurz, Marco	1	4	95	Tuchel, Thomas	1	10
44	Köppel, Horst	1	3	96	Veh, Armin	5	18
45	Körbel, Karl-Heinz	1	3	97	Verbeek, Gertjan	1	2
46	Köstner, Lorenz-Günther	2	6	98	Vogts, Berti	1	2
47	Labbadia, Bruno	3	11	99	Weinzierl, Markus	1	4
48	Latour, Hanspeter	1	1	100	Wiesinger, Michael	1	2
49	Lewandowski, Sascha	1	3	101	Wolf, Wolfgang	3	17
50	Lienen, Ewald	5	17	102	Zachhuber, Andreas	1	4
51	Lorant, Werner	1	15	103	Zumdick, Ralf	1	2
52	Luhukay, Jos	3	6		Total	∅2.62	$\sum$764

Only managers after application of conditions F and MT.
Unit of observation: Half-season
Time period: The 21 seasons from 1993/94 - 2013/14.

Table 1: The Bundesliga Managers in the Final Data Set

	Team	No. of managers	No. of movers	No. of non-movers	No. of obs
1	1860 Munich	3	1	2	22
2	Aachen	1	1	0	2
3	Augsburg	2	1	1	6
4	Bayern Munich	9	6	3	43
5	Bielefeld	6	3	3	19
6	Bochum	5	3	2	25
7	Bremen	7	3	4	45
8	Cologne	13	7	6	32
9	Dortmund	7	5	2	42
10	Duisburg	4	3	1	15
11	Frankfurt	9	8	1	30
12	Freiburg	4	1	3	30
13	Hamburg	11	9	2	46
14	Hannover	6	5	1	27
15	Hertha Berlin	8	8	0	30
16	Hoffenheim	5	3	2	13
17	Kaiserslautern	7	5	2	31
18	Leverkusen	12	8	4	47
19	Mainz	2	1	1	16
20	Mönchengladbach	13	9	4	44
21	Nürnberg	7	4	3	25
22	Rostock	7	5	2	26
23	Schalke	9	6	3	44
24	St. Pauli	3	1	2	8
25	Stuttgart	13	9	4	48
26	Uerdingen	1	1	0	4
27	Unterhaching	1	1	0	4
28	Wattenscheid	1	1	0	2
29	Wolfsburg	10	9	1	38
	Total	∅6.41	∅4.38	∅2.03	$\sum$764

Only teams after application conditions F and MT.
Unit of observation: Half-season.
Time period: The 21 seasons from 1993/94 - 2013/14.

Table 2: The Bundesliga Teams in the Final Data Set

Moreover, Table 2 shows descriptive information for the 29 teams in our final data set, which illustrates again the frequency of managerial changes: For example, almost 60 % of these teams have employed at least five (non-interim) managers. And 20 % of the teams have even had at least ten managers during the last 21 seasons.

Finally, Figure 1 and Table 3 give further descriptive information concerning the dependent variable *Points* and the spells in our final data. Figure 1 shows the distribution of team performance measured by the average number of points per game in the relevant half-season.

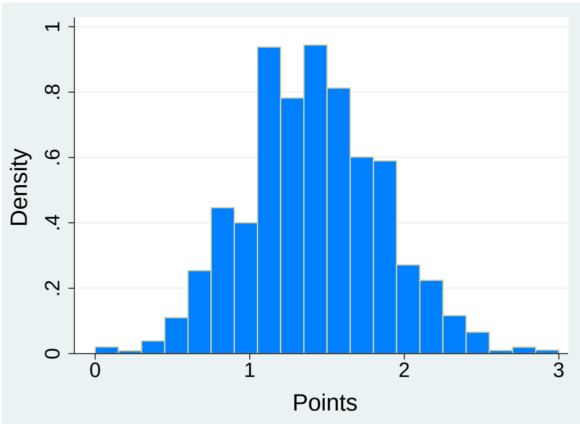


Figure 1: Histogram of dependent variable *Points* (all managers, weighted)

Variable		Obs.	Mean	Std. Dev.	Min	Max
*Points**	all managers	764	1.410	0.452	0	3
	only movers	533	1.435	0.452	0	3
Matches per spell	all managers	206	58.903	53.483	17	479
	only movers	133	59.872	40.639	17	204
Obs. per spell	all managers	206	3.93	3.154	1	29
	only movers	133	4.008	2.404	1	12
Number of spells	all managers	103	1.981	1.350	1	8
	only movers	44	3.159	1.293	2	8

Obs. per spell refers to the number of half-seasons per spell.
Only teams after application conditions F and MT.
* Points refer to the average number of points per game per half-season, weighted by the number of games of the respective manager-team pair in a half-season.

Table 3: Descriptive Statistics

Note that manager-team pairs win on average 1.41 points per game. On average, a spell lasts for slightly less than 60 matches, and the 103 managers in the final data set are observed with about two spells on average, but this number can be as large as eight.

3 Empirical Analysis

We now investigate whether the identity of the managers indeed has a significant impact on the team's performance. In a first step, we follow Bertrand and Schoar (2003) and start with analyzing the joint effect of managers and teams on the outcome variable and whether and to what extent the explanatory power of the regressions increases

	Model 1	Model 2	Model 3
Half-Season_FE	Yes	Yes	Yes
Team_FE	No	Yes	Yes
Manager_FE	No	No	Yes
N	764	764	764
R2	0.007	0.355	0.469
adj. R2	-0.049	0.291	0.316
F-test			8.633
p-value			0.000

Clustered on half-season level, weighted with the number of matches per manager-team pair in half-season

Table 4: The Joint Impact of Managers on Team Performance

once manager fixed-effects are included (Section 3.1). In a next step, we analyze the coefficients of the individual manager fixed-effects in more detail (Section 3.2).

3.1 The (Joint) Impact of Managers on Team Performance

Table 4 shows the results of three different models which differ with respect to the set of independent variables used. Model 1 contains only half-season fixed effects, Model 2 contains both half-season and team fixed effects, while in Model 3 manager fixed-effects are included in addition. Of course, the explanatory power sharply increases once team fixed effects are included (Model 2).[14] When comparing Models 2 and 3, the inclusion of manager fixed-effects leads to an increase of the R^2 by 11.4 percentage points (or 32.1%), and the adjusted R^2 increases by 2.5 percentage points (or 8.6%). Moreover, the F-Test for the joint significance of the manager fixed-effects is highly significant ($p < 0.01$).

[14] Note that half-season fixed effects have very low explanatory power and the reason for this is simple: if there were no draws, performance in soccer would be a zero-sum game. Hence, half-season fixed effects capture changes in the frequencies of draws (where one point is awarded to each of the two teams) and wins (three and zero points are awarded to the winner and loser, respectively) across half-seasons.

3.2 Estimation of Manager Fixed Effects: Comparing the Performance Contributions of Managers

We now analyze the individual manager fixed-effects in more detail. As explained above and analogous to the argument by Abowd et al. (1999), manager fixed-effects can be estimated not only for the 44 movers in our sample, but also for the 59 non-movers (such as Pep Guardiola, Luis van Gaal) as long as their only team is also observed with at least one mover, i.e., satisfies condition MT. Note however, that the identification of the fixed effect of non-movers must come from disentangling it from the fixed effect of their (only) team. This might be problematic if this team is only observed with a few other managers. In contrast, for movers we can exploit the larger variation since several teams and their respective team fixed-effects are involved. Consequently, we first focus our discussion on the fixed effects for the mover managers.

Table 5 presents the estimated fixed-effects for the 44 mover managers in our final sample, ranked by size. In this ranking, the coefficient for each manager measures his deviation from a reference category, where we use the median manager (Bruno Labbadia) as a reference category. For example, the coefficient of 0.46 for the Jürgen Klopp (rank 1 on left part of Table 5) means that his teams have won *ceteris paribus* on average 0.46 points per match more than a team coached by a manager of median ability.[15] This performance increase corresponds to 33% of the 1.41 points awarded on average per game during a half-season (see Table 3), and hence would on average lead to an additional $34 \cdot 0.46 = 15.64$ points per season for the respective team. For the season 2012/13, for example, this amount of additional points won would have pushed a team from rank 13 (in the middle of the table) to rank 4, which would have allowed the team to participate in the highly prestigious and financially attractive UEFA Champions League.

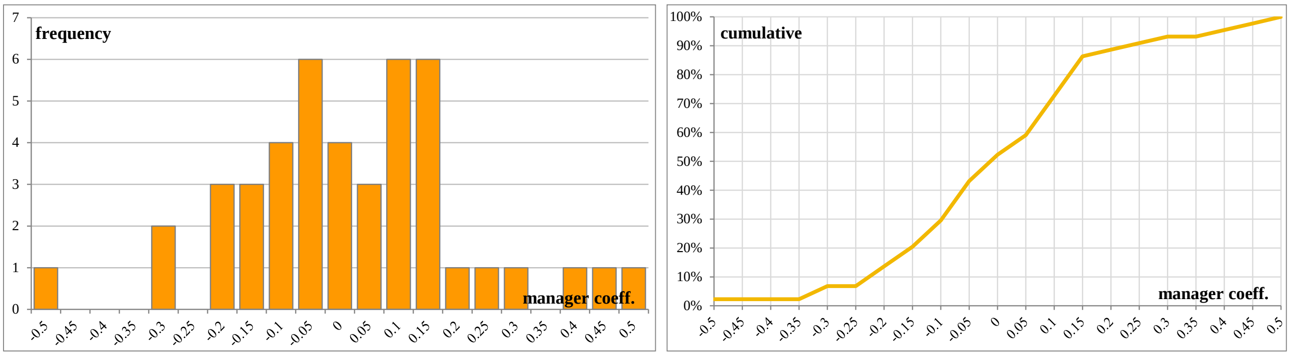
[15] The top rank for Jürgen Klopp seems reasonable, as he was very successful with his first team (Mainz), and has led his second (and current) team Borussia Dortmund to two national championships and to the final of the UEFA Champions League. Recently, Brazil's former national coach Luiz Felipe Scolari (who led Brazil to winning the world cup in 2002) said "I think Jürgen Klopp is extraordinary, just wonderful. [..] I'd love to sit and watch Borussia Dortmund in training for a week, to find out how he leads a team, how he connects with the players. He is an extraordinary coach with a sense for team building and leading a team." (see www.espnfc.com/fifa-world-cup/story/1864828).

	Estimated Fixed Effect			*Average Points Won Per Match**	
Rank	**Manager**	**Coeff.**	**Rank**	**Manager**	**Avg. Points**
1	Klopp, Jürgen	0.459	1	Hitzfeld, Ottmar	2.008
2	Favre, Lucien	0.411	2	Trapattoni, Giovanni	1.820
3	Slomka, Mirko	0.378	3	Heynckes, Jupp	1.788
4	Hecking, Dieter	0.264	4	Sammer, Matthias	1.759
5	Rehhagel, Otto	0.202	5	Rehhagel, Otto	1.729
6	Sammer, Matthias	0.164	6	Klopp, Jürgen	1.712
7	Götz, Falko	0.148	7	Daum, Christoph	1.687
8	Heynckes, Jupp	0.146	8	Magath, Felix	1.644
9	Röber, Jürgen	0.127	9	Slomka, Mirko	1.556
10	Magath, Felix	0.121	10	Favre, Lucien	1.545
11	Rangnick, Ralf	0.114	11	Stevens, Huub	1.530
12	Meyer, Hans	0.112	12	Doll, Thomas	1.508
13	Neururer, Peter	0.098	13	Röber, Jürgen	1.496
14	Hitzfeld, Ottmar	0.097	14	Rausch, Friedel	1.481
15	Daum, Christoph	0.078	15	Skibbe, Michael	1.473
16	Veh, Armin	0.073	16	Labbadia, Bruno	1.439
17	Stevens, Huub	0.067	17	Ribbeck, Erich	1.431
18	Lienen, Ewald	0.053	18	Rangnick, Ralf	1.425
19	Köstner, Lorenz-Günther	0.040	19	Jara, Kurt	1.384
20	Babbel, Markus	0.035	20	Veh, Armin	1.367
21	Rausch, Friedel	0.018	21	Hecking, Dieter	1.362
22	Labbadia, Bruno	0 (Ref)	22	Toppmöller, Klaus	1.360
23	Bongartz, Hannes	-0.009	23	Götz, Falko	1.356
24	Doll, Thomas	-0.014	24	Babbel, Markus	1.321
25	Stanislawski, Holger	-0.042	25	Augenthaler, Klaus	1.317
26	Pagelsdorf, Frank	-0.051	26	Pagelsdorf, Frank	1.303
27	Funkel, Friedhelm	-0.058	27	Berger, Jörg	1.299
28	Skibbe, Michael	-0.066	28	Gerets, Erik	1.289
29	Toppmöller, Klaus	-0.073	29	Neururer, Peter	1.287
30	Wolf, Wolfgang	-0.079	30	Wolf, Wolfgang	1.284
31	Jara, Kurt	-0.084	31	Meyer, Hans	1.240
32	Koller, Marcel	-0.119	32	Dutt, Robin	1.215
33	Augenthaler, Klaus	-0.127	33	Lienen, Ewald	1.203
34	Fach, Holger	-0.136	34	Möhlmann, Benno	1.164
35	Gerets, Erik	-0.148	35	Köstner, Lorenz-Günther	1.149
36	Trapattoni, Giovanni	-0.170	36	Fach, Holger	1.127
37	Dutt, Robin	-0.171	37	Bongartz, Hannes	1.113
38	Berger, Jörg	-0.174	38	Funkel, Friedhelm	1.087
39	Rapolder, Uwe	-0.217	39	Koller, Marcel	1.053
40	Frontzeck, Michael	-0.225	40	Rapolder, Uwe	1.041
41	Luhukay, Jos	-0.240	41	Luhukay, Jos	1.022
42	Möhlmann, Benno	-0.333	42	Reimann, Willi	1.017
43	Reimann, Willi	-0.342	43	Stanislawski, Holger	0.981
44	Ribbeck, Erich	-0.514	44	Frontzeck, Michael	0.942

* *Average Points Won Per Match* refers to the average number of points gained in spells satisfying conditions F and MT.

Table 5: Ranking of Mover Managers. Fixed Effects Versus Average Points Won

For the sake of comparison, the right part of Table 5 ranks the managers simply with respect to the average number of points won with their respective teams in the considered spells. As is evident, this procedure favors those managers who have worked for the big teams such as Bayern Munich, Borussia Dortmund or Schalke 04, which have more financial resources to hire the best players. Comparing these two rankings leads to remarkable differences: For example, Giovanni Trappatoni is ranked second using this



(a) Frequency of coefficients (b) Cumulative distribution of the coefficients

Figure 2: Frequency and Distribution of Manager Fixed Effects

simple procedure, while our empirical analysis suggests that his quality is below average (rank 36). On the other hand, we find a strongly positive value for Dieter Hecking (rank 4), who has never coached a top team, and hence is only listed at position 21 in the ranking purely based on points won. Overall, the correlation between the two measures of ability is not too high ($\rho = 0.5$).

Figure 2 also reveals that Bundesliga managers seem to be quite heterogenous with respect to their abilities. Panel (a) shows the distribution of fixed effects as reported in the left part of Table 5, giving rise to a difference of up to 1 point per match between the managers at the top and bottom of the ranking. A more detailed view on the degree of heterogeneity emerges from panel (b) which shows the cumulative distribution of the coefficients. For example, comparing the managers at the 90%– and 10%–percentile leads to a difference of 0.45 points per match. This accumulates into a 7.65 point difference in the course of a half-season. For the comparison of the managers at the 75%– and 25%–percentile, the difference is still 0.25 points per match and hence 4.25 points per half-season – corresponding to a difference of roughly 18% compared to the average 1.41 points won by all teams (see Table 3).

In summary, our results are in line with previous results from other industries such as Bertrand and Schoar (2003) and Graham et al. (2012) who find that executives are an important factor determining organizational performance. Moreover, the degree of heterogeneity between individuals with respect to this ability seems remarkable, in particular as we take into account only the top segment of the labor market for football managers, i.e. our sample of managers already contains a selected group of the most able ones as each single year, only 24 new managers complete a mandatory training program for head coaches organized by the German Football Association (DFB). All in all, our results do not support the argument that such mandatory training programs would make the population of Bundesliga managers quite homogenous (see e.g., Breuer and Singer, 1996).

Furthermore, our results indicate that the sporting and financial implications of decisions concerning the hiring of managers can be substantial: for example, 33 out of the 63 teams which were either directly relegated to the second division or had to play an additional relegation round to avoid relegation, would have been saved from relegation respectively the relegation round if they had won 5 additional points in the course of the season.[16] According to our analysis, this corresponds to the difference between a manager at the 20%- and 50%-percentile.

Table 8 in Appendix A reports also the fixed effects estimates for non-mover managers (in grey), i.e. those that we observe only with a single team (and where this team satisfies condition MT). As argued by Abowd et al. (1999), these fixed effects are also identified, but the estimates rely on a precise estimation of the respective team fixed-effects. This seems a strong requirement for those teams who are observed with only a few other managers (mostly non-movers themselves). Given the few sources of variation and the small number of observations in such cases, the disentangling of the two fixed effects does not always seem convincing and leads to implausible results. Two cases in point here are Thomas Tuchel (Mainz) and Peter Pacult (1860 Munich) whose manager fixed-effects seem excessively high (rank 1 and 3, respectively, in Table 8) in the light of their accomplishments. In contrast, as can be seen from Table 9 (also in Appendix A), the estimated team fixed effects for their teams Mainz and 1860 Munich (left column) appear to be excessively low (rank 29 and 26, respectively) compared to the performance of these

[16]From 1993/94 to 2007/08 the last three teams were relegated directly to the second division. As of season 2008/09, the team ranked third to last and the team ranked third in the second division compete in two extra matches for the final Bundesliga slot for the next season.

teams measured in terms of points won (rank 11 and 13, respectively, right column). Hence, we feel that the estimates for such non-mover managers that were employed by teams that did not employ many movers have to be interpreted with caution.

4 Cross Validation: Predicting Future Performance

Finally, we want to cross-validate our estimates of the managers' abilities, by analyzing whether the estimated fixed effects are able to predict future performance. The question we ask is the following: if we use our approach to obtain estimates of managers' abilities using all the data up to a certain date t which corresponds to the beginning of a season – to what extent do these estimates help to predict performance of the teams employing these managers in the season that follows? In order to do so, we proceed in several steps: First, starting with the beginning of season 2004/05 (which corresponds to half-season 23 in our data set) we estimate manager and team fixed effects restricting the data set to all outcomes prior to the season we want to predict. Hence, for each manager k and team i and date $t \in \{23, 25, 27, ..41\}$, we obtain a moving time series of fixed effects $\hat{\lambda}_k^{t-1}$ and $\hat{\gamma}_i^{t-1}$ up to date $t-1$. We then run a simple OLS regression with the average number of points obtained by a team in a half-season $t \geq 23$ as the dependent variable and the fixed effects for managers and teams (evaluated at the end of the previous full season) as independent variables.

The key question is whether these estimated manager fixed effects have predictive power for the team's performance in the subsequent year. Table 6 shows the regression results, where column (1) includes only our estimates for team strength while in column (2), we add our estimates for managers' abilities. We find indeed that both our measures of team strength and managers' abilities are helpful in predicting subsequent performance. Including our proxies for the managers' abilities raises the adjusted R^2 by 33% from 0.144 to 0.191 and the coefficient of managerial ability is significant at the 1% level. Following Angrist and Pischke (2008) in interpreting regressions as approximations to the conditional expectation function, we thus conclude that our estimates

	Model 1	Model 2		Model 3	Model 4
Team FE	0.660***	0.782***	*Team Points*	0.962***	0.933***
	(0.0983)	(0.100)		(0.103)	(0.119)
Manager FE		0.354***	*Manager Points*		0.0554
		(0.0891)			(0.114)
Constant	1.354***	1.364***	Constant	0.0861	0.0460
	(0.0301)	(0.0294)		(0.148)	(0.169)
Obs.	262	262	Obs.	262	262
R2	0.148	0.197	R2	0.250	0.251
adj. R2	0.144	0.191	adj. R2	0.247	0.245

Standard errors in parentheses, * $p<0.1$, ** $p<0.05$, *** $p<0.01$.
Dependent variable: Average points per game per half-season for the seasons 2004/05 to 2013/14.
In columns (1) und (2) the fixed effects for teams and managers are the estimates obtained from season 1993/94 up to the end of the full season preceding the half-season under consideration. Similarly, in columns (3) und (4), the average points won by teams and managers are obtained up to the end of the full season preceding the half-season under consideration.

Table 6: Using Fixed Effects to Predict Future Performance

of managerial ability indeed substantially affect conditional expectations and are thus valuable predictors of future performance.

In columns (3) and (4) we compare these predictive regressions to an alternative way of predicting team performance on the basis of the average number of points won by a team (with all its previous managers) and its current manager (with all his previous teams) in the past. While the average number of points won by teams in the past is indeed a valuable predictor for future performance (see column (3)), the average number of points won by its manager in the past has no additional explanatory power at all (column (4)). Hence, if we want to disentangle the contribution of a manager from the underlying strength of a team to predict the team's performance, our "purged" measure of ability is more valuable than measures which are simply based on past performance outcomes.

Finally, Table 7 is very similar to Table 6, where we have only replaced the fixed effects of managers and teams as estimated up to date $t-1$ with their respective percentile scores (i.e. the manager with the highest fixed effect at date $t-1$ has a percentile score of 1 and the median manager a percentile score of 0.5). Again, the percentile rank of managers has predictive power only when the ranking occurs according to their fixed

	Model 1	Model 2		Model 3	Model 4
Team FE	0.674***	0.731***	*Team-Points*	1.004***	0.899***
(Percentile)	(0.102)	(0.101)	*(Percentile)*	(0.125)	(0.144)
Manager FE		0.335***	*Manager-Points*		0.229
(Percentile)		(0.0956)	*(Percentile)*		(0.159)
Constant	1.023***	0.759***	Constant	0.724***	0.633***
	(0.0692)	(0.101)		(0.0934)	(0.113)
Obs.	262	262	Obs.	262	262
R2	0.144	0.183	R2	0.199	0.205
adj. R2	0.141	0.176	adj. R2	0.196	0.199

Standard errors in parentheses, * p<0.1, ** p<0.05, *** p<0.01.
Dependent variable: Average points per game per half-season for the seasons 2004/05 to 2013/14.
In columns (1) und (2) the fixed effects for teams and managers are the estimates obtained from season 1993/94 up to the end of the full season preceding the half-season under consideration. Similarly, in columns (3) und (4), the average points won by teams and managers are obtained up to the end of the full season preceding the half-season under consideration.

Table 7: Using Fixed Effects to Predict Future Performance

effects (column (2)), but not when ranked with respect to their average points won in the past (column (4)). Moreover, it is interesting to note that the slope of the manager rank (0.335) attains a value of about 46% of the slope of the team strength (0.731). Given that it seems much easier to replace a manager with a better one than to replace a whole team, picking a better manager indeed seems to be a key lever to increase team performance.

5 Conclusion

We have analyzed the impact of managers on the performance of their teams in the context of professional sports. In particular, we have estimated average additional performance contributions for individual managers by making use of the high turnover rates in the Bundesliga which allows to disentangle manager effects from the strength of their respective teams. We found a strong variation in these performance contributions. For instance, our estimates indicate that a manager at the 25% percentile in the ability distribution wins 18% more points per game than one at the 75% percentile. Moving from the median to the best manager in the sample is associated with a 33% higher performance in terms of the points awarded.

Of course the approach also has potential limitations. For example, one could argue that the estimate for managers in top teams like Bayern Munich are computed comparing them only with other top managers while managers in bad teams are compared only with lower qualified managers. However, we observe a substantial number (26) of managers who have worked in teams of very different strengths. For instance, one manager (Felix Magath) has worked in 7 different teams (including Bayern Munich, but also substantially weaker ones such as Nürnberg or Frankfurt). These high frequency movers connect managers across different skill levels and facilitates the identification of their individual effects (see also the argument in Graham et al., 2012). But of course, the individual ability estimates have to be treated with caution for those managers who have worked only in teams which have employed only a few other managers.

A more problematic assumption is the stability of the (relative) strengths of teams across the considered time period which may vary over time due to changes in the financial strength of teams, or the quality their executive and/or supervisory boards. Using shorter time intervals (for example, by including team/season fixed effects covering, say, five seasons) would relax the stability assumption. However, apart from the fact that any such division of our data set into 5-year periods would appear arbitrary to some degree, this also raises collinearity issues due to a larger congruence of the time periods in which manager-team pairs are observed. For example, when a manager is observed with a team for a whole five-year period, then part of his impact will be picked up by the respective team/season fixed effect and vice versa. Clearly, this problem could be relaxed as data from more upcoming seasons becomes available, and it would be an interesting topic for future research to further investigate the robustness of our results. This might also generate more precise estimators of the fixed effects of those managers who have not yet terminated their career, and are currently only observed for small number of seasons (and with a small number of teams).

Moreover, we have shown that our ability estimates have predictive power. Using past data to estimate abilities disentangling manager's contributions helps to form better expectations about future performance. In turn, it can help teams to spot talent and to detect undervalued managers on the market.

Appendix

A Estimated Fixed Effect for All Managers (Movers and Non-movers)

The subsequent table provides a ranking of all (mover and non-mover) managers in the final data set.

Estimated Fixed Effects					
Rank	Manager	Coeff.	Rank	Manager	Coeff.
1	Tuchel, Thomas	0.829	53	Sidka, Wolfgang	-0.019
2	Guardiola, Pep	0.694	54	Solbakken, Stale	-0.028
3	Pacult, Peter	0.552	55	Gaal, Louis van	-0.028
4	Klopp, Jürgen	0.459	56	Stanislawski, Holger	-0.042
5	Keller, Jens	0.428	57	Pagelsdorf, Frank	-0.051
6	Favre, Lucien	0.411	58	Funkel, Friedhelm	-0.058
7	Gross, Christian	0.401	59	Skibbe, Michael	-0.066
8	Jol, Martin	0.379	60	Weinzierl, Markus	-0.070
9	Korkut, Tayfun	0.378	61	Toppmöller, Klaus	-0.073
10	Slomka, Mirko	0.378	62	Wolf, Wolfgang	-0.079
11	Lewandowski, Sascha	0.361	63	Jara, Kurt	-0.084
12	Lorant, Werner	0.338	64	Klinsmann, Jürgen	-0.100
13	Schaefer, Frank	0.333	65	Fink, Thorsten	-0.114
14	Schaaf, Thomas	0.314	66	Koller, Marcel	-0.119
15	Hecking, Dieter	0.264	67	Augenthaler, Klaus	-0.127
16	Krauss, Bernd	0.257	68	Verbeek, Gertjan	-0.133
17	Rehhagel, Otto	0.202	69	Fach, Holger	-0.136
18	Löw, Joachim	0.168	70	Vogts, Berti	-0.139
19	Wiesinger, Michael	0.164	71	Engels, Stephan	-0.140
20	Sammer, Matthias	0.164	72	Körbel, Karl-Heinz	-0.143
21	Olsen, Morten	0.148	73	Gerets, Erik	-0.148
22	Götz, Falko	0.148	74	Trapattoni, Giovanni	-0.170
23	Heynckes, Jupp	0.146	75	Dutt, Robin	-0.171
24	Brehme, Andreas	0.133	76	Berger, Jörg	-0.174
25	Röber, Jürgen	0.127	77	Marwijk, Bert van	-0.185
26	Magath, Felix	0.121	78	Heesen, Thomas von	-0.193
27	Gisdol, Markus	0.116	79	Advocaat, Dick	-0.195
28	Rangnick, Ralf	0.114	80	Middendorp, Ernst	-0.206
29	Meyer, Hans	0.112	81	Rapolder, Uwe	-0.217
30	Neururer, Peter	0.098	82	Pezzaiuoli, Marco	-0.217
31	Hitzfeld, Ottmar	0.097	83	Frontzeck, Michael	-0.225
32	Daum, Christoph	0.078	84	Herrlich, Heiko	-0.234
33	Veh, Armin	0.073	85	Luhukay, Jos	-0.240
34	Stevens, Huub	0.067	86	Bommer, Rudi	-0.242
35	Maslo, Uli	0.066	87	Fringer, Rolf	-0.251
36	Köppel, Horst	0.064	88	Finke, Volker	-0.268
37	Lienen, Ewald	0.053	89	Kurz, Marco	-0.275
38	Dörner, Hans-Jürgen	0.049	90	Demuth, Dietmar	-0.276
39	Streich, Christian	0.044	91	McClaren, Steve	-0.303
40	Köstner, Lorenz-Günther	0.040	92	Oenning, Michael	-0.332
41	Latour, Hanspeter	0.039	93	Möhlmann, Benno	-0.333
42	Schlünz, Juri	0.038	94	Reimann, Willi	-0.342
43	Rutten, Fred	0.035	95	Zumdick, Ralf	-0.358
44	Babbel, Markus	0.035	96	Scala, Nevio	-0.379
45	Zachhuber, Andreas	0.032	97	Gerland, Hermann	-0.401
46	Rausch, Friedel	0.018	98	Schneider, Thomas	-0.421
47	Soldo, Zvonimir	0.017	99	Stepanovic, Dragoslav	-0.424
48	Labbadia, Bruno	0 (Ref)	100	Mos, Aad de	-0.452
49	Neubarth, Frank	-0.003	101	Bonhof, Rainer	-0.466
50	Hyypiä, Sami	-0.003	102	Ribbeck, Erich	-0.514
51	Bongartz, Hannes	-0.009	103	Sorg, Marcus	-0.562
52	Doll, Thomas	-0.014			

Avg. Points per Game					
Rank	Manager	∅Points	Rank	Manager	∅Points
1	Guardiola, Pep	2.647	53	Berger, Jörg	1.299
2	Hitzfeld, Ottmar	2.008	54	Lorant, Werner	1.291
3	Lewandowski, Sascha	1.975	55	Gerets, Erik	1.289
4	Gaal, Louis van	1.937	56	Neururer, Peter	1.287
5	Klinsmann, Jürgen	1.862	57	Wolf, Wolfgang	1.284
6	Keller, Jens	1.843	58	Fink, Thorsten	1.266
7	Trapattoni, Giovanni	1.820	59	Fringer, Rolf	1.265
8	Jol, Martin	1.794	60	Scala, Nevio	1.265
9	Heynckes, Jupp	1.788	61	Weinzierl, Markus	1.250
10	Gross, Christian	1.769	62	Meyer, Hans	1.240
11	Sammer, Matthias	1.759	63	Köppel, Horst	1.231
12	Rehhagel, Otto	1.729	64	Körbel, Karl-Heinz	1.229
13	Klopp, Jürgen	1.712	65	Dutt, Robin	1.215
14	Daum, Christoph	1.687	66	Schlünz, Juri	1.205
15	Löw, Joachim	1.662	67	Lienen, Ewald	1.203
16	Hyypiä, Sami	1.655	68	Zachhuber, Andreas	1.180
17	Magath, Felix	1.644	69	Möhlmann, Benno	1.164
18	Schaaf, Thomas	1.618	70	Finke, Volker	1.162
19	Vogts, Berti	1.591	71	Wiesinger, Michael	1.160
20	Slomka, Mirko	1.556	72	Köstner, Lorenz-Gün..	1.149
21	Brehme, Andreas	1.547	73	Fach, Holger	1.127
22	Favre, Lucien	1.545	74	Bongartz, Hannes	1.113
23	Stevens, Huub	1.530	75	Middendorp, Ernst	1.108
24	Doll, Thomas	1.508	76	Kurz, Marco	1.100
25	Neubarth, Frank	1.500	77	McClaren, Steve	1.095
26	Röber, Jürgen	1.496	78	Heesen, Thomas von	1.091
27	Krauss, Bernd	1.487	79	Funkel, Friedhelm	1.087
28	Rausch, Friedel	1.481	80	Latour, Hanspeter	1.059
29	Rutten, Fred	1.480	81	Pezzaiuoli, Marco	1.059
30	Skibbe, Michael	1.473	82	Koller, Marcel	1.053
31	Pacult, Peter	1.469	83	Maslo, Uli	1.048
32	Marwijk, Bert van	1.447	84	Rapolder, Uwe	1.041
33	Labbadia, Bruno	1.439	85	Luhukay, Jos	1.022
34	Ribbeck, Erich	1.431	86	Reimann, Willi	1.017
35	Dörner, Hans-Jürgen	1.426	87	Advocaat, Dick	1.000
36	Rangnick, Ralf	1.425	88	Engels, Stephan	1.000
37	Stepanovic, Dragoslav	1.414	89	Mos, Aad de	1.000
38	Korkut, Tayfun	1.412	90	Soldo, Zvonimir	1.000
39	Tuchel, Thomas	1.406	91	Stanislawski, Holger	0.981
40	Jara, Kurt	1.384	92	Solbakken, Stale	0.967
41	Veh, Armin	1.367	93	Schneider, Thomas	0.952
42	Schaefer, Frank	1.364	94	Frontzeck, Michael	0.942
43	Hecking, Dieter	1.362	95	Herrlich, Heiko	0.909
44	Toppmöller, Klaus	1.360	96	Verbeek, Gertjan	0.909
45	Götz, Falko	1.356	97	Gerland, Hermann	0.882
46	Gisdol, Markus	1.341	98	Zumdick, Ralf	0.857
47	Streich, Christian	1.341	99	Bommer, Rudi	0.853
48	Sidka, Wolfgang	1.333	100	Sorg, Marcus	0.765
49	Babbel, Markus	1.321	101	Oenning, Michael	0.706
50	Augenthaler, Klaus	1.317	102	Bonhof, Rainer	0.696
51	Olsen, Morten	1.314	103	Demuth, Dietmar	0.647
52	Pagelsdorf, Frank	1.303			

All managers not eliminated by conditions F and MT.
Non-mover managers are highlighted in gray.

Table 8: Ranking of Mover and Non-Mover Managers by Size of Fixed Effect

Estimated Fixed Effects			*Average Points per Game*		
Rank	**Team**	**Coeff**	**Rank**	**Team**	**Points**
1	Bayern Munich	0.751	1	Bayern Munich	2.082
2	Leverkusen	0.460	2	Dortmund	1.755
3	Dortmund	0.347	3	Leverkusen	1.677
4	Schalke	0.230	4	Schalke	1.604
5	Hamburg	0.207	5	Bremen	1.546
6	Stuttgart	0.177	6	Stuttgart	1.510
7	Augsburg	0.147	7	Hamburg	1.444
8	Wolfsburg	0.147	8	Kaiserslautern	1.444
9	Kaiserslautern	0.143	9	Hertha Berlin	1.418
10	Freiburg	0.117	10	Wolfsburg	1.383
11	Bremen	0.058	11	Mainz	1.301
12	Hertha Berlin	0.033	12	Hannover	1.296
13	Hoffenheim	0.032	13	1860 Munich	1.293
14	Bielefeld	0.015	14	Hoffenheim	1.292
15	Frankfurt	0 (Ref)	15	Mönchengladbach	1.239
16	Bochum	-0.034	16	Frankfurt	1.212
17	Aachen	-0.046	17	Augsburg	1.206
18	Duisburg	-0.116	18	Freiburg	1.178
19	Rostock	-0.124	19	Bochum	1.175
20	Mönchengladbach	-0.128	20	Unterhaching	1.162
21	Unterhaching	-0.142	21	Rostock	1.160
22	Nürnberg	-0.165	22	Duisburg	1.135
23	Hannover	-0.187	23	Nürnberg	1.127
24	Cologne	-0.216	24	Cologne	1.114
25	St. Pauli	-0.353	25	Bielefeld	1.044
26	1860 Munich	-0.354	26	Aachen	1.000
27	Uerdingen	-0.477	27	St. Pauli	0.892
28	Wattenscheid	-0.583	28	Wattenscheid	0.826
29	Mainz	-0.621	29	Uerdingen	0.821

Table 9: Ranking of Teams. Fixed Effects (left) and Average Points per Game (right)

B Managers and Spells Eliminated by Condition F

	Manager		Manager
1	Achterberg, Eddy	31	Krautzun, Eckhard
2	Adrion, Rainer	32	Lattek, Udo
3	Arnesen, Frank	33	Lieberwirth, Dieter
4	Balakov, Krassimir	34	Lippert, Bernhard
5	Beckenbauer, Franz	35	Littbarski, Pierre
6	Bergmann, Andreas	36	Minge, Ralf
7	Brunner, Thomas	37	Moniz, Ricardo
8	Cardoso, Rudolfo	38	Moser, Hans-Werner
9	Dammeier, Detlev	39	Nemet, Klaus-Peter
10	Dohmen, Rolf	40	Neu, Hubert
11	Ehrmantraut, Horst	41	Preis, Ludwig
12	Eichkorn, Josef	42	Prinzen, Roger
13	Entenmann, Willi	43	Reck, Oliver
14	Erkenbrecher, Uwe	44	Renner, Dieter
15	Fanz, Reinhold	45	Reutershahn, Armin
16	Geideck, Frank	46	Rolff, Wolfgang
17	Gelsdorf, Jürgen	47	Schafstall, Rolf
18	Halata, Damian	48	Schehr, Ralf
19	Hartmann, Frank	49	Scholz, Heiko
20	Heine, Karsten	50	Schulte, Helmut
21	Heinemann, Frank	51	Sundermann, Jürgen
22	Henke, Michael	52	Thom, Andreas
23	Hermann, Peter	53	Tretschok, Rene
24	Hieronymus, Holger	54	Vanenburg, Gerald
25	Hrubesch, Horst	55	Völler, Rudi
26	Hörster, Thomas	56	Weber, Heiko
27	John, Christoph	57	Wilmots, Marc
28	Jonker, Andries	58	Wosz, Dariusz
29	Kohler, Jürgen	59	Ziege, Christian
30	Kramer, Frank	60	Zobel, Rainer

Table 10: Managers without a spell satisfying condition F

	Manager	Team	Matches (in Spell)	Year
1	Adrion, Rainer	Stuttgart	11	1998
2	Beckenbauer, Franz	Bayern Munich	14	1993
3	Bergmann, Andreas	Hannover	16	2009
4	Ehrmantraut, Horst	Frankfurt	16	1998
5	Entenmann, Willi	Nürnberg	15	1993
6	Gelsdorf, Jürgen	Bochum	12	1994
7	Götz, Falko	Hertha Berlin	13	2001
8	Hartmann, Frank	Wattenscheid 09	11	1993
9	Heesen, Thomas von	Nürnberg	15	2007
10	Henke, Michael	Kaiserslautern	13	2005
11	Hörster, Thomas	Leverkusen	11	2002
12	Kohler, Jürgen	Duisburg	11	2005
13	Köstner, Lorenz-Günther	Wolfsburg	15	2009
14	Krauss, Bernd	Dortmund	11	1999
15	Krautzun, Eckhard	Kaiserslautern	11	1995
16	Kurz, Marco	Hoffenheim	10	2012
17	Marwijk, Bert van	Hamburg	15	2013
18	Meier, Norbert	Mönchengladbach	11	1997
19	Meier, Norbert	Duisburg	15	2005
20	Minge, Ralf	Dresden	15	1994
21	Oenning, Michael	Hamburg	14	2010
22	Rangnick, Ralf	Schalke	13	2011
23	Rausch, Friedel	Nürnberg	16	1998
24	Rehhabel, Otto	Hertha Berlin	12	2011
25	Reimann, Willi	Nürnberg	15	1998
26	Schäfer, Winfried	Stuttgart	15	1998
27	Schafstall, Rolf	Bochum	13	2000
28	Schulte, Helmut	Schalke	11	1993
29	Slomka, Mirko	Hamburg	13	2013
30	Stevens, Huub	Stuttgart	10	2013
31	Zobel, Rainer	Nürnberg	14	1993

Table 11: Eliminated Spells with at least 10, but less then 17 matches

C Teams Eliminated by Condition MT

	Team	No. of managers	No. of obs	Managers	No. of obs
1	Braunschweig*	1	2	Lieberknecht, Torsten	2
2	Cottbus	3	13	Geyer, Eduard Prasnikar, Bojan Sander, Petrik	6 4 3
3	Dresden	1	3	Held, Siegfried	3
4	Düsseldorf*	3	7	Meier, Norbert** Ristic, Aleksandar Wojtowicz, Rudolf	2 3 2
5	Fürth*	1	2	Büskens, Michael**	2
6	Karlsruhe	2	14	Becker, Edmund Schäfer, Winfried**	4 10
7	Leipzig	1	2	Stange, Bernd	2
8	Ulm	1	2	Andermatt, Martin	2
		$\sum 13$	$\sum 45$		$\sum 45$

Unit of observation: Half-season
* Some of team's managers are observed with other teams, but these spells do not satisfy condition F.
** Manager observed with several teams, but only one spell satisfies condition F so that manager is not a mover.

Table 12: Teams eliminated by condition MT and their managers

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