

The impact of referees on match outcomes in professional sports: Evidence from the German Football Bundesliga

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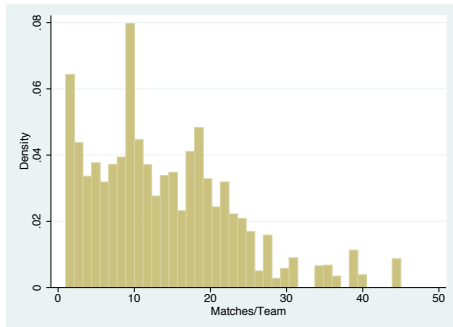


Referees in football should behave as a neutral and impartial observer. But often player, manager and fans suppose that referees make biased decisions or do not act as this neutral monitor. Aim of this study is to find evidence whether these impressions are only the result of a "bad day" of the referee or whether referees and their decisions systematically influence the result of a football match.

1. Data

The data-set contains 4,590 matches from 1st Bundesliga in Germany from season 1993/94 until 2007/08. Further, there are 67 referees with up to 20 years of experience and at least two matches in the data-set.

Figure 2: Distribution of referees and teams within a referee's career



2. Individual Effects

$$y_{it} = \beta_0 + \alpha_t + \gamma_i + \gamma_j + \beta_1 * \chi_{it} + \beta_2 * \chi_{jt} + \beta_3 * \tau_i + \beta_4 * \tau_j + \beta_5 * \mu_{it} + \beta_6 * \mu_{jt} + \beta_7 * \theta_{it} + \beta_8 * \theta_{jt} + \lambda_{referee} + \epsilon_{it} \quad (1)$$

- y_{it} : Variables for match outcomes and referee decisions
- α_t : Season fixed effects
- γ_i, γ_j : Team fixed effects (i=home, j=away)
- χ_{it}, χ_{jt} : Vector of time-varying performance variables
- τ_i, τ_j : Relative budget within a season
- μ_{it}, μ_{jt} : Relevance of a match
- θ_{it}, θ_{jt} : Number of drives within a match
- $\lambda_{referee}$ referee fixed effects

To estimate individual referee effects, equation (1) is first run without the dummy variables for referees. After that, equation (1) is repeated with referee fixed effects. Evidence for influence of referees on match outcome is found if the adjusted R^2 increases after referee fixed effects are included and moreover the F-test for joint significance of these referee dummy variables must be significant. Further, equation (1) is run for home and away teams.

Table 1: Referee fixed effects in home and away matches

y_{it}	Home			Away		
	N	adj. R^2	F-test	N	adj. R^2	F-test
Result	4,182	0.088	-	3,838	0.092	-
Result	0.0000 (14.68, 32)	4,182	0.089	0.0000 (83.67, 32)	3,838	0.089
Goal Difference	4,182	0.108	-	3,838	0.112	-
Goal Difference	0.0000 (19.53, 32)	4,182	0.112	0.0000 (18.35, 32)	3,838	0.116
Yellow Card	2,231	0.048	-	2,048	0.075	-
Yellow Card	0.0000 (39.09, 26)	2,231	0.062	0.0000 (25.91, 26)	2,048	0.083
Yellow-Red Card	2,231	0.017	-	2,048	0.008	-
Yellow-Red Card	0.0000 (29.45, 26)	2,231	0.018	0.0000 (16.51, 26)	2,048	0.009
Red Card	2,231	0.013	-	2,048	0.001	-
Red Card	0.0000 (32.36, 26)	2,231	0.021	0.0468 (1.95, 26)	2,048	-0.004
Not awarded red card	1,973	0.032	-	1,625	0.004	-
Not awarded red card	0.0000 (59.45, 26)	1,973	0.042	0.0000 (8.05, 26)	1,625	-0.008
Goal	4,182	0.086	-	3,838	0.084	-
Goal	0.0000 (9.69, 32)	4,182	0.087	0.0000 (46.62, 32)	3,838	0.084
Not awarded goal	1,991	-0.001	-	1,650	-0.009	-
Not awarded goal	0.0000 (8.14, 26)	1,991	-0.002	0.0000 (51.03, 26)	1,650	0.013
Penalty	4,182	0.001	-	3,838	0.010	-
Penalty	0.0000 (231.53, 32)	4,182	0.006	0.0000 (48.39, 32)	3,838	0.012
Not awarded penalty	1,973	0.018	-	1,625	0.053	-
Not awarded penalty	0.0072 (2.68, 26)	1,973	0.017	0.0000 (14.35, 26)	1,625	0.046

a. Standard errors are clustered at the team level.
b. Reported are F-tests for the joint significance of the referee fixed effects.
c. For each F-test the p-value, the value of the F-statistic and the number of constraints are reported.

3. Referee Styles

If referees have a significant effect on match outcome or referee decisions, does this effect influence other referee decisions?

$$F.E.(y)_{ijt} = \alpha + \beta F.E.(z)_{ijt} + \epsilon_{ijt} \quad (2)$$

$F.E.(y)_{ijt}$ and $F.E.(z)_{ijt}$ are fixed effects for match outcome and referee decisions where a significant individual referee effect is found.

Table 2: Referee styles in home matches

y_{it}	Result	Yellow card	Yellow-red card	Red card	Not aw. red card	Goal	Penalty
Result	-	-	-	-	-	-	-
Yellow card	2.98***	-	-	-	-	-	-
Yellow-red card	0.19***	0.08***	-	-	-	-	-
Red card	0.49***	-0.032**	7.72***	-	-	-	-
Not awarded red card	0.37***	0.19***	19.4***	-6.1***	-	-	-
Goal	4.82***	0.57***	20.51***	12.36***	-0.15	-	-
Penalty	0.32***	0.01	-21.39***	-0.12	-0.42**	0.53***	-

*p<0.05, **p<0.01, ***p<0.001
Coefficients are presented as the standard z-score.

Table 3: Referee styles in away matches

y_{it}	Result	Yellow card	Red card	Goal	Penalty
Result	-	-	-	-	-
Yellow card	-3.55***	-	-	-	-
Red card	-0.36***	0.3***	-	-	-
Goal	4.03***	0.3***	-16.72***	-	-
Penalty	0.11***	0.04**	11.83	0.46***	-

*p<0.05, **p<0.01, ***p<0.001
Coefficients are presented as the standard z-score.

4. Referee Characteristics

$$y_{it} = \beta_0 + \alpha_t + \gamma_i + \gamma_j + \beta_1 * \chi_{it} + \beta_2 * \chi_{jt} + \beta_3 * \tau_i + \beta_4 * \tau_j + \beta_5 * \mu_{it} + \beta_6 * \mu_{jt} + \beta_7 * \theta_{it} + \beta_8 * \theta_{jt} + \beta_9 * age_{it} + \beta_{10} * experience_{it} + \beta_{11} * fifa_{it} + \beta_{12} * kicker_{it-1} + \beta_{13} * height_{it} + \beta_{14} * X_z + \beta_{15} * Y_z + \epsilon_{it} \quad (3)$$

- age_{it} : Referees age in years
- $experience_{it}$: Years since a referee is a referee from 1st Bundesliga
- $fifa_{it}$: Dummy variable whether a match is refereed by a Fifa referee
- $kicker_{it-1}$: Referee's kicker mark from the last match
- $height_{it}$: Referee's height in centimeter
- X_z : Referee's national association
- Y_z : Referee's professional job

- Observable referee characteristics cannot explain individual referee effects.
- Small evidence that referees follow career concerns in home matches.
- Professional jobs can slightly explain referee's behavior in away matches.