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Empirical Evidence on the "Never Change a Winning Team" Heuristic

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Summary

"Never change a winning team" is a well-known heuristic that recommends not altering the composition of successful teams. Using game-level observations of the highest German soccer league over a period of seven seasons, we find that the number of changes in the starting line-up is significantly lower after wins than after losses, taking suspensions and unobserved team heterogeneity into account. We show that teams of coaches who follow the heuristic do not win significantly more often, and that coaches significantly decrease the number of changes in the starting line-up even after wins caused by the exogenous home field advantage. These results provide first suggestive evidence that coaches may be influenced by behavioural concerns when following the heuristic to not change winning teams.

1 Introduction

This paper uses the team sports industry to examine the well-known heuristic "never change a winning team" that recommends not altering the composition of successful teams. Selecting players for the starting line-up is a complex and risky decision, because it is uncertain which combination of players is most likely to succeed. Given this uncertainty, coaches are likely to be susceptible to heuristics. After testing the existence of the "never change a winning team" heuristic, we analyse the effectiveness of this heuristic. In particular, we test if successful teams that change their composition win less often in the subsequent game than successful teams whose composition remains unchanged, controlling for potential confounders. In addition, we test if coaches adjust the team composition even to exogenous performance shocks that are unrelated to the unobserved quality of the teamwork.

We investigate the "never change a winning team" heuristic employing game-level data of the highest German soccer league, *Bundesliga*, over a period of seven seasons (n=4032). Using field data from the team sports industry is advantageous for exploring the "never change a winning team" heuristic for four reasons: First, doing research in the team sports industry imitates laboratory research, as hypotheses can be tested in a controlled but yet natural field environment with real efforts and high financial incentives.

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All teams are governed by standardized rules of competition that eliminate factors that would otherwise substantially increase complexity and reduce the power of our study. Second, winning games by scoring more goals than the opposition team is an objective measure of team effectiveness. Third, panel data is easily available due to the frequency and regularity of league games (Kahn 2000). Fourth, the well-established home field advantage (e. g., Courneya/Carron 1992; Nevill et al. 1996; Carmichael/Thomas 2005) creates exogenous team performance shocks that can be used to examine behavioural explanations of the "never change a winning team" heuristic. One reason for the home field advantage is referee favouritism. Several studies show that referees tend to favour home teams in decisions concerning stoppage time, critical goals and penalties (e. g., Garicano et al. 2003; Sutter/Kocher 2004; Dohmen 2008). This implies that the same combination of players may win the home game and lose the away game, even though they collaborated equally well in both games. Thus, from a sporting perspective, coaches should not react to performance variations caused by the home field advantage.

This paper shows that the number of changes in the starting line-up between two consecutive games is significantly lower after wins than after losses, controlling for suspensions and unobserved team heterogeneity. To analyse the reasons for such behaviour, we perform two tests: Firstly, we show that teams of coaches who follow the "never change a winning team" heuristic are not more likely to win the next game, ceteris paribus, than teams of coaches who do not follow the heuristic. Secondly, we find evidence that coaches significantly decrease the number of changes in the starting line-up after wins even when we use the home field advantage as instrument of the previous team success. The home field advantage creates performance variations that we argue to be unrelated to the unobserved quality of teamwork. Thus, our results provide first suggestive evidence that coaches may be influenced by behavioural concerns when following the heuristic to not change winning teams. The psychological scenario study of Zeelenberg et al. (2002) shows that behaving according to the "never change a winning team" heuristic decreases regret, irrespective of the team performance. Herding (Banjeree 1992; Bikhchandani et al. 1992) and social pressure (Akerlof 1980; Bernheim 1994) may be other behavioural reasons why coaches follow the "never change a winning team" heuristic.

The remainder of this paper is structured as follows: Section 2 gives a short introduction to the theoretical background of the "never change a winning team" heuristic. Section 3 describes the data and the empirical models and presents the results. Section 4 concludes.

2 Theoretical background of the "never change a winning team" heuristic

Do teams benefit from not changing a winning team or is the heuristic just a behavioural artefact that has no effect on, or even compromises, future team performance? The following two sections present two competing – but not mutually exclusive – types of explanations: a sporting explanation and behavioural explanations.

The sporting explanation of the "never change a winning team" heuristic is simple: Winning serves as an indicator that a particular combination of fielded players functions well. Losing instead signals that the players do not fit well together. The team's previous performance reveals aspects of the otherwise unobserved quality of a team combination. Consequently, "never change a winning team" helps to increase (future) team performance.

Alternatively, the "never change a winning team" heuristic can be explained by behavioural reasons. Coaches could be guided by expected emotions associated with the team performance and the way it is achieved when not changing a winning team. Given the high uncertainty in which combinations of players are most likely to succeed, the coaches are likely to be susceptible to emotions. The psychological scenario study of Zeelenberg et al. (2002) explains the "never change a winning team" heuristic by regret aversion: Student participants considered that if the soccer team had won the previous game, a soccer coach who persisted with the same starting line-up would feel less regret than a coach who made changes, although both teams likewise lose the next game. Herding behaviour (Banjeree 1992; Bikhchandani et al. 1992) and social pressure (Akerlof 1980; Bernheim 1994) could be alternative behavioural explanations to not change winning teams. If coaches are guided by behavioural reasons for following the "never change a winning team" heuristic, they should even react to previous wins caused by exogenous factors that are unrelated to the unobserved quality of teamwork.

3 Empirical framework

This paper analyses the decision of the coach on the number of changes in the starting line-up between two consecutive games. Soccer teams compete in one 90-minute game per week. Seventy-five minutes before a game begins, the coach has to announce the eleven players in the starting line-up. As the rules of the game in soccer – unlike in other team sports, such as basketball or ice hockey – restrict the maximum number of substitutions during the game to three, selecting the starting line-up is an important strategic decision.

3.1 Data

Our data consist of game-level observations of all teams appearing in the highest German soccer league, the *Bundesliga*, during the seven seasons beginning with the 1999/00 season and lasting until the 2005/06 season. As the *Bundesliga* consists of 18 teams playing each other twice during the season, the full season includes 306 games, generating 612 team observations. Since European soccer clubs can change their roster twice a year, namely in the summer and winter breaks, we exclude the first game after each break.[1] Thus, 576 team-game observations per season and 4032 observations in total remain.

3.2 Dependent variable and descriptive statistics

To construct the dependent variable, we first calculated the raw number of replacements in a team's starting line-up between two consecutive games in the national league. We neglected changes among the substitutes, as the actual score of the game may influence which and how many players the coach replaces during a game. Teams that are ahead not only substitute more than teams that are behind (Franck/Nüesch 2010), they are also more likely to make risk-reducing substitutions by replacing offensive players with defensive ones (Grund/Gürtler 2005). By analysing the changes in the starting line-up, we can exclude such influences. Because replacements due to suspensions are beyond the coach's range of influence, we adjusted the raw number of replacements in the starting line-up for suspensions.

[1] Since the transfer period lasted until the fourth game after the summer and winter breaks in some seasons, we also estimated models in which we exclude the first four games after the summer and winter breaks. The results do not change in any significant way, however, when using a more restricted data sample.

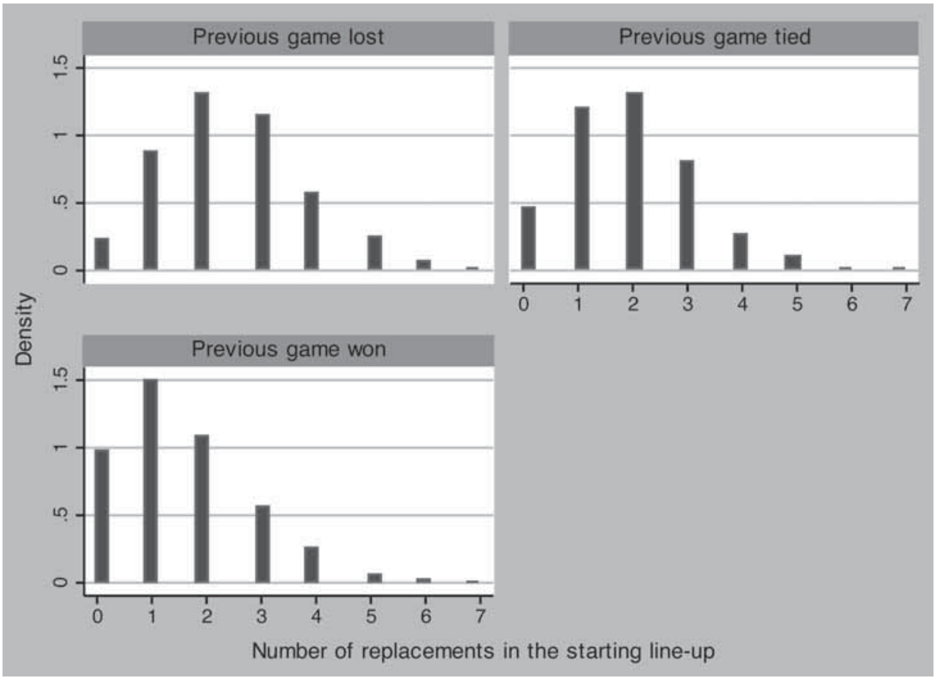

Figure 1 Histograms of the number of replacements in the starting line-up conditional on the previous game result

We determined individual suspensions based on game- and player-specific data on red and yellow cards. The rules of the game in professional German soccer state that a player is suspended for one game once he has accumulated five yellow cards. If a player receives a second yellow card during the same game, he is sent off the field for the remainder of the game and suspended for the next game. After receiving a red card, the player is also sent off the field and suspended for the next game.[2] Our dependent variable, namely the adjusted number of replacements in the starting line-up between two consecutive games, was then calculated by deducting the number of suspensions from the raw number of replacements in the starting line-up.

In a first step, we start with some basic results. The average number of replacements in the starting line-up is 1.528 (n=1519) if the team won the previous game and 2.226 (n=2513) otherwise. A mean comparison test rejects the null hypothesis of equal means at the one percent significance level (t-values=16.7, $p < 0.001$). Figure 1 illustrates the histograms of the number of replacements in the starting line-up depending on the previous game result.

[2] To be precise, a player can be suspended for up to five games in case of severe misbehaviour. We therefore also tested the results using an alternative specification in which a player who received a red card is suspended for two games. The main findings did not change in any significant way.

Coaches of German soccer teams change fewer players in the starting line-up after wins than after losses. However, simple mean comparison tests may be misleading if third factors affect both the number of changes and the team's winning likelihood. In the following section we estimate a count data model that controls for time-constant team-specific factors that may confound the mean comparison.

3.3 Poisson model of the "never change a winning team" heuristic

As our dependent variable, the number of replacements in the starting line-up adjusted for suspensions, is a non-negative count variable with integer values from 0 to 7, we apply a count data framework. Standard approaches to analysing counting processes are the Poisson regression model and the Negative Binomial regression model. Whereas the Poisson model imposes the assumption that the mean and the variance of the distribution are equal, the Negative Binomial model presumes that the variance of the dependent variable is larger than the mean (Cameron/Trivedi 1998; Winkelmann 2003). We calculate Poisson regression estimates, because the goodness-of-fit statistics (Chi^2= 3579.94, p-value=1.00) do not reject the assumption of equality of mean and variance of the dependent variable.[3]

The main explanatory variable is a dummy variable Win_{it-1} coded 1 if team i won the previous game (0 otherwise). The estimates of a simple model in which the number of replacements is only explained by Win_{it-1} may be spurious, because confounders such as the team's talent disparity are likely to correlate with both Win_{it-1} and the dependent variable. Franck and Nüesch (2010) show that teams with a balanced talent pool perform worse than teams with higher talent heterogeneity, controlling for the average talent level. A balanced talent pool, in turn, is likely to increase the "turnover" in the starting line-up. We therefore include seasonal-team fixed effects as controls to take account of the season-constant heterogeneity between teams. Whereas squad composition changes considerably across seasons, it remains rather stable within each season.[4]

We also experimented with a proxy for game-specific injuries as additional control variable, but it did not change our results in any significant way.[5] As the injury proxy is only available for a subsample of games, we exclude it in the main specification to maximise the size of the data sample.

The coefficients in Table 1 are estimated via (quasi) maximum likelihood. The standard errors in parentheses are White-heteroskedasticity robust and clustered at the coach level to take potential serial correlation of the error term into account. Table 1 shows that coaches decrease the number of replacements by 39.8 % if the team succeeded in the previous game, controlling for unobserved team heterogeneity. The Poisson model confirms that coaches change significantly fewer players of the starting line-up after wins

[3] However, a Negative Binomial regression would lead to virtually the same results.

[4] Between 1995/96 and 2006/07 less than 10 % of all players in the highest German soccer league changed teams within a season (Franck/Nüesch 2010).

[5] We tried to proxy the number of injured players at a given point of time using the information of *Comunio.de*, an online soccer simulation game. Before each game, the operators of *Comunio.de* classify all players under contract to a German club as either fit, rehabilitating, weakened, or injured, based on public information and private club enquires. Using this data source, we find that the number of players of a given team who lost or received the status "injured" does not correlate with the dependent variable (coefficient -0.03, p-value 0.27). The injury proxy is only available for the seasons 2003/04 to 2005/06.

Table 1 Test of the "never chance a winning team" heuristic

Win_{it-1}	-0.398***
	(0.032)
Seasonal-team fixed effects	yes
Log pseudolikelihood	-6372.9
Number of observations	4032

Notes: Quasi-Maximum Likelihood estimates of a Poisson model with the number of replacements in the starting line-up between two consecutive games (adjusted for suspensions) as dependent variable. The standard errors (in parentheses) are White-heteroskedasticity robust and adjusted for serial correlation at the coach level. Significance levels: *10%, **5%; ***1%.

than after losses. We do not know so far, however, why coaches behave accordingly. The following two sections are dedicated to this purpose.

3.4 "Never change a winning team" and subsequent performance

If the "never change a winning team" heuristic is based on sporting reasons, following the heuristic should increase subsequent winning. To test this prediction, we estimate three different Logit models with the likelihood of winning (Win_{it}) as dependent variable. The first model includes games if the previous game was won, the second model includes games if the previous game was lost, and the third model includes all games independent of the previous game result. For the first two models the sample size reduces from 4032 to 1519.

Our main explanatory variable is the *Number of replacements*$_{it-1}$. In the third model that contains all games we additionally include a dummy variable Win_{it-1} coded 1 if team *i* won the previous game (0 otherwise) and an interaction term of *Number of replacements*$_{it-1}$ and Win_{it-1}. The sporting explanation of the "never change a winning team" heuristic predicts a negative effect of *Number of replacements*$_{it-1}$ on the likelihood of winning in model 1 (if the previous game was won) but not in model 2 (if the previous game was lost). In model 3 the coefficient of the interaction term is expected to be significantly negative under the sporting explanation.

To control for the influence of relative team quality, we include a dummy variable denoting home teams and a probability measure of winning based on game-specific bookmaker odds. For each possible game outcome (i.e., home win, draw, away win) the official German bookmaker *Oddset* publishes decimal odds (e.g., 2.0) that represent the payout ratios for a winning bet. The higher the odds, the less likely this event is expected to occur. We transformed the decimal odds into "probability odds", defined by the reciprocal of the decimal odds (1/2.0=0.5). The sum of the "probability odds" of all three game outcomes usually exceeds 1 due to the bookmaker's margin. We therefore adjusted the odds by the bookmaker's margin with the result that the adjusted probability odds sum up to one as required for a probability measure. *Oddset* announces the betting odds every Tuesday morning, i.e., four to five days before the game. The odds incorporate information on the general playing quality of both competing teams and other available and game-relevant information such as home game status and injuries of important players. Potential performance-related information based on a team's line-up and the number of replacements should not be incorporated in the odds, however, because the line-up is usually kept secret until 75 minutes before the game.

Table 2 "Never chance a winning team" and subsequent team performance

	If team won the previous game	If team lost the previous game	All games
Number of replacements$_{it-1}$	0.005	-0.009	-0.013
	(0.013)	(0.010)	(0.008)
Win$_{it-1}$			-0.053
			(0.027)
Number of replacements$_{it-1}$*Win$_{it-1}$			0.019
			(0.015)
Home game$_{it}$	-0.033	0.045	0.009
	(0.025)	(0.023)	(0.015)
Probability odds of a win$_{it}$	1.417 ***	1.391 ***	1.373 ***
	(0.115)	(0.138)	(0.066)
Log pseudolikelihood	-895.30	-900.97	-2508.87
Observations	1519	1519	4032

Notes: The table illustrates the marginal effects of a Logit model with Win$_{it}$ (0/1) as dependent variable. The White-heteroskedasticity robust standard errors adjusted for serial correlation at the coach level are reported in parentheses. The results react insensitively to alternative estimation procedures like Probit or the linear probability model (LPM). Significance levels: *10%, **5%; ***1%.

Table 2 illustrates the marginal effects of the Logit models of winning and in parentheses the White-heteroskedasticity robust standard errors adjusted for serial correlation at the coach level. Table 2 shows that neither the number of replacements in the starting line-up in the first column nor the interaction term in the third column affect the likelihood of winning.[6] Thus, our data does not support the sporting justification for not changing a winning team. Teams of coaches who follow the "never change a winning team" heuristic are not more likely to win the next game, ceteris paribus.

The estimation results of the control variables reveal that winning a game is strongly associated with the probability odds that the corresponding team will win, whereas the home game dummy has no additional explanatory power. The latter finding does not prove that the home field advantage is inexistent (the contrary will be shown latter in the paper) but simply that the home field advantage is fully incorporated into the betting odds.

The fact that following the "never change a winning team" heuristic does not affect subsequent team performance provides first suggestive evidence that the coaches may be guided by non-sporting behavioural reasons when selecting the starting line-up. In the next section we aim to readdress the question whether the coaches' adherence to "never change a winning team" may have behavioural reasons by using the home field advantage as a source of performance variations that we argue to be unrelated to the unobserved quality of teamwork.

[6] As the size and the statistical significance of the interaction effect are conditional on the explanatory variables in non-linear Logit models (Ai/Norton 2003), we employed the user-written Stata command *inteff* (Norton et al. 2004) that calculates the marginal effects over the whole range of explanatory variables to test the sensitivity of the results. The coefficient of the interaction effect varies between 0.007 (p=0.82) and 0.021 (p=0.19).

3.5 Exogenous team performance variations and coach behaviour

In the previous section we found that following the "never change a winning team" heuristic does not improve subsequent team performance, ceteris paribus. Thus, the data does not support the sporting explanation. To reexamine the behavioural reasons of the "never change a winning team" heuristic, we need team performance variations that are unrelated to the unobserved quality of teamwork. In professional soccer, the home field advantage serves as a source of performance variations that we argue to be orthogonal to the unobserved quality of teamwork.

The existence of a home advantage is well-established: teams playing in home stadiums win significantly more often than chance would dictate (Courneya/Carron 1992; Nevill et al. 1996; Carmichael/Thomas 2005). There are four explanations why home teams are more likely to win at home than away: Firstly, the large crowd – mostly supporting the home team – stimulates the home team players and intimidates the players from the opposing team (Carmichael/Thomas 2005). Secondly, referees tend to favour the home team when deciding on the amount of stoppage time in close games and in disputable decisions to award goals and penalty kicks (Garicano et al. 2003; Sutter/Kocher 2004; Dohmen 2008). Thirdly, the home team is familiar with the stadium and the playing area. Fourthly, visiting teams experience greater fatigue due to travelling (Carmichael/Thomas 2005).

We regard the first two explanations as major factors and the latter two as minor factors. As all teams play each other in one home and one away game in a random manner, but in such a way that home and away games alternate,[7] the incidence of playing in the home stadium creates team performance variations that we argue to be uncorrelated with the playing strength of the fielded players and the quality of teamwork. The coach's decision on the number of changes in the starting line-up does not affect travelling fatigue and familiarity effects and is very unlikely to influence referee favouritism. We cannot exclude the possibility that psychological crowd effects are related to "never change a winning team". However, this would rather prove social pressure than sporting reasons as behavioural explanation why coaches do not change winning teams.

Table 3 illustrates the results when using the dummy variable $Home\ Game_{it-1}$, equalling 1 if the previous game was a home game and 0 otherwise, as instrument for the previous team success. The first column shows the estimates of the first-stage equation with Win_{it-1} as dependent variable, whereas the second column shows the estimates of the second-stage equation explaining the number of replacements in the starting line-up with the predicted values of Win_{it-1} as explanatory variable. In the second-stage equation, we use a Generalized Method of Moments (GMM) estimator of an instrumental variable Poisson model implemented by Nichols (2007).[8] The standard errors are estimated by the asymptotic approximation, as outlined by Hansen (1982). To take account of the season-constant heterogeneity between teams, we include seasonal-team fixed effects as controls.

The estimates of the first column (first-stage equation) in Table 3 show that playing in the home stadium significantly increases the winning probability by 23.2 %. The partial R^2

[7] Very occasionally, a team plays two games in a row at home or away, for example, if a game is postponed due to unfavourable weather conditions.

[8] Specifically, IV-Poisson is implemented using the "ivpois" command in Stata 11 written by Nichols (Nichols 2007).

Table 3 IV-Poisson model using the home game advantage as instrument

	Win_{it-1}	**Number of $replacements_{it}$**
Home $game_{it-1}$	-0.232 ***	
	(0.014)	
Predicted Win_{it-1}		-0.213 *
		(0.111)
Seasonal-team fixed effects	yes	yes
Partial R^2 of Home $game_{it-1}$	0.063	
F-statistics of Home $game_{it-1}$	261.08 ***	
Observations	4032	4032

Notes: The first column of this table illustrates the coefficients of a multivariate linear probability model (LPM) with Win_{it-1} as dependent variable (first stage). The second column presents the IV-Poisson estimates (second stage) using the algorithm of Nichols (2007). Win_{it-1} is instrumented by the dummy variable Home $game_{it-1}$. The standard errors (in parentheses) are derived with bootstrap methods in the second column. Significance levels: *10%, **5%; ***1%.

of 6.3 % and the high F-statistics (261.08) of the identifying instrument $Home\ Game_{it-1}$ document the relevance of our instrument when explaining Win_{it-1} (Bound et al. 1995).

The estimates of the second column in Table 3 show that coaches significantly decrease the number of replacements by 21.3 % after wins even though the previous success was caused only by the home field advantage.

4 Conclusions

Using game-level observations of the highest German soccer league over a period of seven seasons, we find clear empirical evidence of the "never change a winning team" heuristic: soccer coaches change significantly fewer players in the starting line-up after wins than after losses, controlling for suspensions and unobserved team heterogeneity.

We show that following the "never change a winning team" heuristic does not improve subsequent team performance and that coaches adapt their player selection for the starting line-up even to performance variations due to exogenous home field factors, such as referee favouritism. These results provide first suggestive evidence that behavioural rather than sporting concerns may influence the coach's adherence to "never change a winning team". Our findings are in line with evidence from psychological scenario studies using stated preferences, which show that behaving according to heuristics decreases regret even when holding the decision outcome constant (Inman/Zeelenberg 2002; Zeelenberg et al. 2002).

An aspect that we have not yet addressed is the strategy of squad rotation. Some coaches use squad rotation as a matter of routing to create internal competition for the line-ups and to rest players. Squad rotation generally increases "turnover" of the competing team, i. e. regardless of whether the team lost or won the previous game. Whether squad rotation benefits or harms team performance is controversial. But even if squad rotation affected team performance, the seasonal-team fixed effects in our model would largely absorb this potential confounding effect. Squad rotation, therefore, does not distort our results.

Our study does not control for the influence of performances in (i) the German Cup, (ii) the Europa League and (iii) the Champions League. Because coaches tend to rest their (star) players in the national club games scheduled shortly before the international competitions, clubs playing in international competitions should have a higher"turnover". In addition, the team selection of coaches may react less sensitively to previous results in the national league if the team also plays in international club competitions. Additional sensitivity tests (see Table A1 in the Appendix) reveal that the negative effect of previous wins on the number of replacements is smaller but still statistically significant for teams playing in international tournaments.

As stated preferences are unavailable, this paper is not able to discriminate between the different behavioural explanations for the heuristic. In addition to revealed preferences approaches using field data, we encourage future survey studies to identify the exact attitudes and emotions that motivate coaches to follow the "never change a winning team" heuristic.

Appendix

Table A1 Moderating influence of international competitions on the "never chance a winning team" heuristic

Win_{it-1}	-0.467 ***
	(0.034)
$International_i$ * Win_{it-1}	0.174 ***
	(0.059)
$International_i$	0.408 ***
	(0.143)
Seasonal-team fixed effects	yes
Log pseudolikelihood	-6367.27
Observations	4032

Notes: Quasi-Maximum Likelihood estimates of a Poisson model with the number of replacements in the starting line-up between two consecutive games in the national league as dependent variable. *$International_i$* is a dummy variable equalling 1 if the team plays in the UEFA Champions League or the Europa League in the given season. The standard errors (in parentheses) are White-heteroskedasticity robust and adjusted for serial correlation at the coach level. Significance levels: *10%, **5%; ***1%.

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