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The effects of a mid-season coach changes on team performance in the Eredivisie from 2000 till 2023

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Abstract

The objective of this study is to examine the impact of mid-season coach dismissals on team performance in professional football. In the case of 23 successive seasons (almost fourteen thousand matches) of the Eredivisie, the results obtained lead to the conclusion that the dismissal of a coach mid-season does not lead to better results. The better results observed after such a change are attributable to regression-to-the-mean. However, when looking at so-called "wise" dismissals, there is an indication of a causal effect on the performance measures. Implying that if a board can accurately make a distinction between an unlucky streak and a coach underperforming, there is value in dismissing said coach. The results were obtained after a naive approach which consisted of linear regression, followed by an approach with a control group added to the data. The control group was determined using the cumulative surprise based on bookmaker odds.

1 Introduction

Football is, in essence, the biggest sport in the world. Both in a social and economical way. Hence, it has been a subject of interest for many researchers. One particular link that has been extensively explored is that between sports economics and labour economics. Kahn (2000) states that the sport labour market is an excellent setting for testing economic hypotheses. Dobson, Goddard and Dobson (2001) talk about the economics of football. The research discusses early developments in the field and talks about the potential that is present for other fields.

One interesting avenue present in football is the market for head coaches. Coaches or head trainers of professional sports teams, especially in football, are under significant pressure. Olusoga, Butt, Hays and Maynard (2009) conducted research regarding the main stressors elite coaches encounter in their careers. Likewise, Nissen (2016) talks about the 'hire and fire' mentality that is present in football. It seems that despite the meticulous planning, strategic thinking, and rigorous training, coaches in professional football are constantly at risk of dismissal or sacking.

Pieper, Nüesch and Franck (2014) discuss notable similarities between top managers and head coaches in football. Both have to perform under pressure, are media trained and often middle-aged. With the field of professional football being a controlled environment with performance measures widely available at frequent intervals, it is the perfect situation to test economic hypotheses on managerial performance and change.

The decision to dismiss a coach mid-season is often driven by a perceived lack of success, declining performance, or clashes with management. Such an action carries significant implications not only for the coach but also for the team, players, and the overall dynamics of the football club. As shown by de Dios Tena and Forrest (2007) and later on by Van Ours and Van Tuijl (2016).

This research aims to investigate the effects of coach changes in the middle of football seasons within the context of the Eredivisie, the top professional football league in the Netherlands. Similar to aforementioned Van Ours and Van Tuijl (2016). This research will extend that data set to include 2000-2023. This results in a more extensive data set. The analysis will in essence be similar. Using a naive approach to start, before implementing control groups to create a more controlled analysis. This study also takes a broader approach. For example, it uses the findings

Flepp and Franck (2021) they noticed that there is a significant difference between so-called "wise" and "unwise" dismissals. They based their findings on the expected goals instead of points or any other frequently used metric available. This research incorporates these findings into the analysis of Van Ours and Van Tuijl (2016).

Understanding the effects of coach dismissals in the middle of football seasons is crucial for football clubs, as it can inform future decision-making processes and contribute to the development of more effective strategies for managing coaching changes. It is also important for the board to know whether it is wise to dismiss the coach at any point. Or whether they are attributing the bad luck a football team might experience to the performance of the coach. Research has shown that a mid-season coach change often results in a positive shock in the short-run but almost no change in the long-run (Lago-Peñas, 2011). In the end, sacking a head coach is an (often) expensive ordeal. For example, Antonio Conte got dismissed by Chelsea in the 2017-2018 season. This resulted in a £26.6 million pay-off. Therefore, clubs might want to avoid sacking their trainer without completely understanding the resulting effects.

This study uses data obtained from secondary sources. As stated, the complete data set consists of 23 seasons of the highest level league in Dutch professional football, the Eredivisie. This period includes 32 coaches leaving the club voluntarily, and 68 coaches being dismissed by the club. For the total of 100 coach changes.

There is a unique gap in the literature on the distinction between wise and unwise dismissals and their impact on team performance, even though earlier study has examined the effects of coach terminations in football. To the best of my knowledge, this distinction is only addressed by Flepp and Franck (2021). Prior research has frequently concentrated on changes in overall performance following coach terminations, without taking into account the underlying causes of those changes. The concept of wise dismissals, which are based on fairly evaluating coach performance rather than only depending on team results or points, is used in this study to fill this gap. This study attempts to provide a deeper understanding of the causal impacts of coach dismissals on team performance in the Eredivisie by adding the concept of sensible dismissals and taking into account performance measurements like predicted goals.

The results show that the positive effect after coach dismissals in attributable to the regression-to-the-mean phenomenon. For coach quits, no significant effect is found. For all the coach changes together, however, there seems to be a causal effect at play with improved performance. It is also concluded that the ability of the board to correctly assesses the performance of a coach is crucial. So-called wise dismissals showed a significant positive effect on the performance measures.

Section 2 discusses the literature that is already present. Following that, Section 3 will more elaborately talk about the data. Then Section 4 consists of the methodology. Section 5 showcases the results and findings. Lastly, Section 6 will contain concluding remarks and potential future improvements to this study.

2 Literature Review

Coach changes, and mid-season coach changes especially, have been widely study throughout the years. Recently, a lot of research has been done in more obscured leagues. For example,

Hermansson (2020) focused on the Swedish football leagues. Ending his analysis by stating a mid-season coach change does not substantially improve the performance. In fact, most academic research concludes that mid-season coach changes have no effect. Martins et al. (2023) studied the Portuguese league. Using a very different approach. Namely, the experience of three head coaches that were dismissed, and 36 professional players affected by the coach changes. Again, they conclude that the positive effect experienced after a coach change is short-lived. Making the choice to dismiss a coach mid-season questionable at best. Heuer, Müller, Rubner, Hagemann and Strauss (2011) go as far to conclude coach changes have no effect at all. Neither between seasons nor mid-season. Basing their conclusion off the German first league. Liikonen et al.(2021) conducted his research on the top five European leagues. Finding a positive effect after coach change in the short term, but no significant difference in the long term. Resulting in the conclusion that a coach change is unimportant for improving performance. Scelles and Llorca (2020) looked at the French football league from 2000 to 2016. Using a control group in his analysis, he concludes that coach changes do, in fact, have a positive effect on the team performance. Making dismissal of a coach a viable option to improve performance mid-season.

Another avenue of coach dismissals that has been widely researched are the driving factors of the dismissal. Semmelroth (2022) studied the MLS (top American football league) and found that team performance, and expectations regarding play-off qualification impacted the choice for a coach change. But other factors were age, increasing the chance of the coach quitting, and reputation, decreasing the chance of the coach getting sacked. Attié, Pacheco and Oliveira (2023) set out to look at social media pressure affecting coach changes. Showing that the pressure exerted by fans on Twitter effects the probability of a coach change. Rocaboy and Pavlik (2020) shows that coach dismissal actually lead to better results, but only if the team was under-performing before the dismissal. Also concluding that team performance and expected performance play an important part in the coach change.

Clearly, the results across studies differ substantially. From coach changes not mattering at all, not even in-between seasons, to coach changes having a significant effect on performance measures. The effects of coach changes are thus still up for debate. This paper contributes to the existing literature by researching the mid-season coach changes present in the Eredivisie for a period of 23 successive seasons. Using a methodology that has been tried and tested before.

This study extends the second part of the research of Van Ours and Van Tuijl (2016). In the sense that it also uses a naive approach first. followed by a more controlled analysis using control groups. This study uses a more extensive data set, almost doubling the number of coach changes (100). It incorporates the subdivision of dismissals into two categories: wise and unwise, based on the expected goals per match (Flepp & Franck, 2021). Which to the best of my knowledge has not been done before when concerned with the Eredivisie. The choice for the Dutch football league (Eredivisie) is not a popular one. But the Eredivisie has been gaining in popularity slowly over the years, with recent European successes of some top teams.

3 Data

The data used for this research was collected in a variety of ways, making a distinction between voluntary leaves of coaches (quits) and involuntary leaves (dismissals). For the period of 2000-

2014, the data set of Van Ours and Van Tuijl (2016) was used. This data set then got extended using various internet sources[1] . This includes the match history and results from 2014/2015 till 2022/2023[2] , the position a club ended the previous season (denoting -1 for a promoted club), and the expected goals (xG) per team per match from 2018/2019 till 2022/2023 [3] . To apply a similar analysis as Van Ours and Van Tuijl (2016) the betting odds were a necessity as well. These were obtained from a different website. It concerns the betting odds from Bet365[4] .

Table 1: Coach dismissals and quits per season and club 2000/2001-2022/2023

Season	Q	D	T	Clubs
00/01	1	3	4	AZ, De Graafschap, Fortuna Sittard, Sparta
01/02	1	3	4	Ajax, Fortuna Sittard, Roda JC, Vitesse
02/03	1	3	4	AZ, FC Groningen, RBC Roosendaal, Vitesse
03/04	2	2	4	ADO Den Haag, FC Volendam, PEC Zwolle, Willem II
04/05	1	3	4	Ajax, FC Den Bosch, NEC, RBC Roosendaal
05/06	2	3	5	FC Twente, NAC Breda, NEC, RBC Roosendaal, Willem II
06/07	2	1	3	ADO Den Haag, RKC Waalwijk, Roda JC
07/08	2	3	5	Ajax, Heracles Almelo, PSV, Sparta, Willem II
08/09	1	6	7	De Graafschap, FC Utrecht, Feyenoord, PSV, Roda JC, Vitesse, Willem II
09/10	1	4	5	ADO Den Haag, AZ, NEC, SC Heerenveen, Willem II
10/11	1	2	3	Ajax, Vitesse, VVV-Venlo
11/12	2	3	5	De Graafschap, FC Twente, FC Utrecht, PSV, VVV-Venlo
12/13	0	2	2	NAC Breda, FC Twente
13/14	0	4	4	ADO Den Haag, AZ, Cambuur, Roda JC
14/15	0	5	5	AZ, FC Dordrecht, Go Ahead Eagles, Heracles Almelo, NAC Breda
15/16	3	1	4	Cambuur, FC Twente, SC Heerenveen, Vitesse
16/17	0	2	2	ADO Den Haag, Go Ahead Eagles
17/18	2	3	5	Ajax, FC Twente, FC Utrecht, Sparta, Willem II
18/19	3	2	5	Excelsior, FC Utrecht, NAC Breda, PEC Zwolle, SC Heerenveen
19/20	3	2	5	ADO Den Haag, Feyenoord, PSV, Vitesse, VVV-Venlo
20/21	0	4	4	ADO Den Haag, AZ, PEC Zwolle, Willem II
21/22	2	3	5	Cambuur, FC Utrecht, PEC Zwolle, SC Heerenveen, Willem II
22/23	2	4	6	Ajax, Cambuur, FC Utrecht, FC Groningen, Fortuna Sittard, Vitesse
Total	32	68	100	

Table 1 shows the coach changes per season [5]. Over the sample period, Vitesse and Willem II have had the most coach changes (eight times). The number of coach changes mid-season do not change significantly when comparing the later seasons with the earlier seasons. One might have expected this with the added stress of social media (Attié et al., 2023).

This paper uses the cumulative surprise (CS) as a performance metric suggested by Van Ours and Van Tuijl (2016). This means that the expected points are calculated based on the bookmaker odds. Then the actual points obtained is distracted, resulting in a surprise factor. Simply summing this factor gives us the cumulative surprise. As one can imagine, coach changes tend to go hand in hand with (large) negative surprises. This can be explained by the under-performance of a team, putting stress on the relation between a club and the head coach.

Another distinction this paper makes is between wise and unwise dismissals. Flepp and

[1] www.transfermarkt.com/eredivisie/trainerwechselprosaison/wettbewerb/NL1

[2] *nl.wikipedia.org/wiki/Eredivisie_(mannenvoetbal)*

[3] fbref.com/en/comps/23/schedule/Eredivisie-Scores-and-Fixtures

[4] www.football-data.co.uk/netherlandsm.php

[5] Ignoring coach changes before match 5 and after match 30

Franck (2021) have suggested this idea and procedure. They used the expected goals (xG) of a team in a particular match. If the difference in xG between the two teams playing each other is greater than 0.5, the home team scores a win. If the difference in xG is between 0.5 and -0.5 the match ends in a draw. Lastly, if the difference is smaller than -0.5 the home team earns no points. This method is implemented for every match from the season 2018/2019 onward. Using this scoring, a rank is set up based on the expected points. Taking the difference with the rank of the official league table (OLT) gives a metric to base our decision off of. If the OLT rank is higher than the expected rank at the point of dismissal, it is labelled wise. Because the actual play of the team was worse than what the OLT suggests (the team got lucky). If the OLT rank is lower than the expected rank at the moment of dismissal, it is labelled as unwise. In this case, the play on the field was better than what the OLT suggests, implying the team got unlucky so to speak. From 2018/2019 onward, there is a total of fifteen dismissals. Ten of these dismissals are labelled as "wise", five of them as unwise.

Figure 1: Left: Cumulative Surprise, Right: Cumulative Points

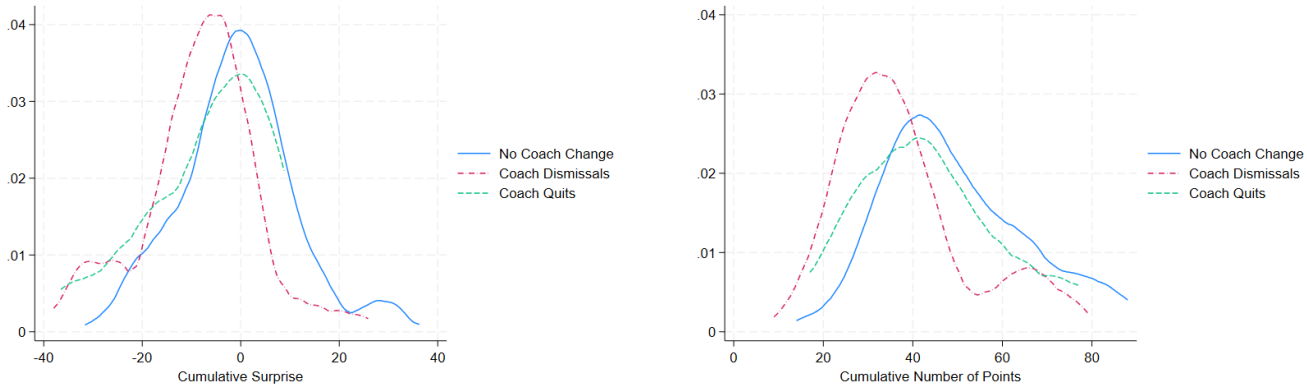


Figure 1 shows the kernel density of the cumulative surprise (left) and the number of points (right) at the end of the season. In both cases for seasons without a change, seasons with a dismissal and seasons with a coach quit. The seasons with a coach dismissal have a more negative cumulative surprise at the end of the season. The plot for seasons with a coach quit is more alike with the seasons without change. It is however flatter. This implies that there are more cases with a negative surprise present at the end of the season. When it comes to the cumulative points, the seasons with dismissals score even worse. The difference is more clearly visible. The seasons with quit and without change get closer together. An explanation for the seasons with dismissal scoring so poorly is in the fact that dismissals tend to happen when a club is under-performing. When such a dismissal happens near the end of a season, there is little time to compensate this negative cumulative surprise.

Table 2 displays the descriptive statistics of the variable used for the analysis. It is divided into two parts. The left-hand side shows the statistics for the entire sample, while the right-hand side shows the statistics from the 2018/2019 season onward. By definition, half the matches get played at home, and half away. However, due to the inclusion of the 2019/2020 season, this is not entirely true for the seasons with dismissal. The 2019/2020 season was ended after the 26^{th}

Table 2: Descriptive summary of variables used in the analysis.

	2000-2023			2018-2023		
	Mean	**Min**	**Max**	**Mean**	**Min**	**Max**
All Coach changes						
Home	.5	0	1	.5	0	1
Rank Opponent	9.56	1	18	9.70	1	18
Points	1.16	0	3	1.18	0	3
Victory	.31	0	1	.31	0	1
Goal Difference	-.36	-9	8	-.35	-9	6
Cumulative Surprise	-4.71	-37.95	25.87	-6.62	-37.95	18.79
N		3368			818	
n		100			25	
Dismissals						
Home	.5	0	1	.5	0	1
Rank Opponent	9.52	1	18	9.67	1	18
Points	1.12	0	3	1.24	0	3
Victory	.30	0	1	.34	0	1
Goal Difference	-.44	-9	8	-.24	-6	6
Cumulative Surprise	-4.89	-37.95	25.87	-5.07	-37.95	18.79
N		2296			494	
n		68			15	

match day. This results in the Home variable being, in fact, slightly below half.

As for the rank of the opponent, which denotes the rank of the opponent last season (1-18), one would expect it to be equal to 9.5. In the analysis any promoted club gets labelled as 18^{th} this is due to the fact that the number of promoted clubs varies between one and three every season.

The number of points per match is equal to 1.16 over the entire sample and 1.18 over the 2018-2023 period. When only looking at teams where a dismissal took place, the number of points per match drops for the entire sample (1.12). However, in the 2018-2023 period an increase is observed (1.24) meaning the teams with a dismissal in the season performed better than the teams that had a coach quit. This also implies that in the recent past, clubs have become better at evaluating a coach in his performance. Resulting in more productive coach dismissals. Overall, the teams involved with coach changes did not perform great. The probability of them winning the game is equal to about 30 per cent. Both the goal difference and cumulative surprise are negative. Note again how in the more recent past (right panel) the negative impact in the goal difference and cumulative surprise is less negative. And the probability of a team with a coach dismissal present is higher by 4%.

4 Methodology

Firstly, a naive approach is used. This means that the performance prior to a coach dismissal is compared to the performance after the dismissal. This is done to create a point of reference for the later analysis. This later analysis consists of matching dismissals with a control group, that is, seasons of the same team with equally bad performance that did not lead to dismissal. The comparison between these two methods leads to very different results.

4.1 Naive Approach

The naive approach consists of a linear model:

$$y_{ijk} = \eta_{ik} + h'_{ijk}\beta + \delta d_{ijk} + \epsilon_{ijk} \tag{1}$$

The performance variables denoted by y_{ijk} are regressed on several explanatory variables. This study uses three performance measures, similar to other research in this field, namely the amount of points won, the chance of victory and the goal difference. η_{ik} represents the fixed club-season effects. This is important as the within-season effects of a coach change is of interest here. Fixed club-season effects are needed to combat the (unobserved) difference in quality between teams, or even between different seasons of the same team. That would otherwise cause heterogeneity. Not including the fixed club-season effects would result in biased estimates. h'_{ijk} represents potential determinants of performance. Based on research from Van Ours and Van Tuijl (2016), the determinants included are the rank of the opposing team the previous season and whether a match is played at home. And lastly, a dummy is added for whether there is a coach change present that season. Here d_{ijk} is the dummy for whether a coach change is present. Thus, δ is the main focus of this paper as it represents the effect of such a coach change. β is a vector of parameter estimates for the determinants, ϵ_{ijk} is the error term. The naive approached is fine to examine the effect of coach changes that is present. However, it would be unclear whether it is a causal-effect or should be looked at as a regression-to-the-mean effect. To make this distinction, further analysis is needed.

The naive approach also takes into account wise and unwise dismissals. To achieve this, eq.1 is adjusted. δd_{ijk} is replaced by $\mu m_{ijk} + \nu n_{ijk}$. Where μ is a dummy variable for a wise dismissal, and ν is a dummy variable for an unwise dismissal as defined in the previous section. Hence, the variables m_{ijk} and n_{ijk} are of interest because they reflect the impact of the wise and unwise dismissals, respectively, on the performance measures.

$$y_{ijk} = \eta_{ik} + h'_{ijk}\beta + \mu m_{ijk} + \nu n_{ijk} + \epsilon_{ijk} \tag{2}$$

4.2 Treatment and Control Groups

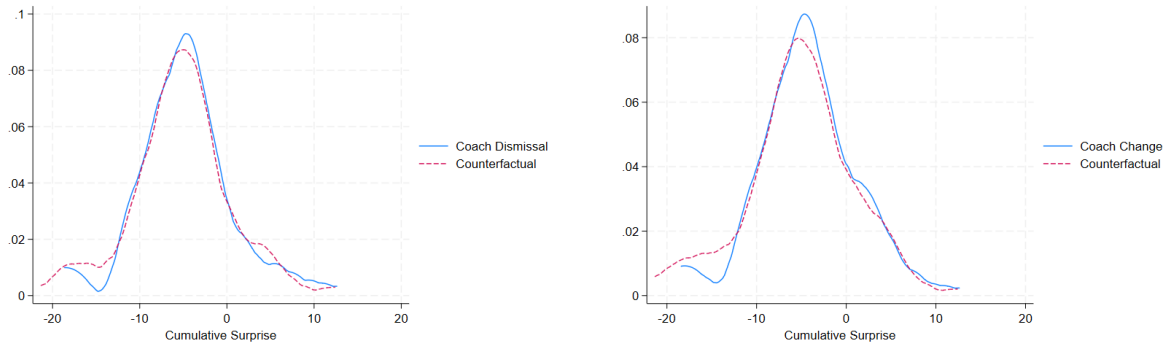
First, the control groups need to be found. In order to do this, the cumulative surprise (CS) is used. Let, for the base observations, the cumulative surprise right before dismissal be denoted by CS_b. Now the nearest neighbour approach is implemented. That is, look for the same particular club in a different season for a match with a similar cumulative surprise. The cumulative surprise for this observation is denoted with CS_c. The matching looks for the same club in a different season to account for unobserved club heterogeneity. Different clubs handle head coach dismissals very differently. This results in some observations being discarded as there is no CS_c that is close enough to CS_p. Here, the allowed difference in CS used is 0.5. Larger difference were tested. But this did not affect the analysis significantly. By matching, this research uses a balance between treated and control groups so to limit any unobserved heterogeneity affecting

coach dismissals present.

Figure 2 shows the fit of this matching. The cumulative surprise present in the last match before the coach change is closely related to the cumulative surprise present in the last match before a coach change did not occur. So the observations and the control groups are closely related in that sense. And, as the right-hand side of Figure 2 shows, this same relation is true for the dismissals.

In a sensitivity analysis, this study looked at heterogeneity present in the treatment and control groups. Two situations were investigated, firstly, differentiating between the effects of the top five teams from the lower ranked teams. Secondly, differentiating between coach changes earlier in the season versus later on. The baseline estimates did not change.

Figure 2: Kernel Densities CS Last Match of the Coach; Actual Coach Changes and Counterfactuals



Note: Left: Coach dismissals, Right: All coach changes

4.3 Equality of Parameters

In order to evaluate the results obtained from the control group approach, a standard F-test is applied. The null hypothesis of this test is that of the control group parameter estimates being equal to the parameter estimates of the treatment group. If this null hypothesis stands, it means that the coach changes in question do not have a significant impact on performance. This is because the control group consists of similar observations where a coach change did not happen. Hence, if the parameters are not significantly different in the treatment group from the control group, the fake coach changes have the same impact as the real changes. Implying there is no causal effect between coach changes and improved performance. But rather a regression-to-the-mean effect. This study opted to use the F-test due to it being easy to interpret and work with. Significance levels of 5% and 10% are used. This, due to these levels being used most often in research. In replications, any other test to test the equality of parameters would suffice.

5 Results

5.1 Naive Approach

Table 3 displays the parameter estimates of the naive approach where the control group is ignored. It contains the results of linear regression for all coach changes, coach dismissals, coach

quits, unwise coach dismissals and wise coach dismissals.

5.1.1 All Coach Changes

In the case of a coach change the position of the opposing team is significantly important. For every position lower on the league table last season, the team wins 0.06 points, their chance of winning increases with 2% and the goal difference increases with 0.12 goals. This makes sense as in general, worse teams tend to end lower on the ranking at the end of the season than stronger teams. Hence, if the opponent did poorly last season, it is likely that they are not a top team. If a team plays at home it is expected to earn 0.52 points more, they have a 17% increment in their chance of winning and the goal difference increases with 0.88. Home advantage is a well documented phenomenon in professional football. So these results, again, make perfect sense. After coach change the points won increases with 0.23, the probability of winning increases with 8% and the goal difference rises with 0.30. A significant improvement in performance is revealed when the club changed coach mid-season. At this point it can not be determined if this is a causal effect, or a regression-to-the-mean effect.

5.1.2 Coach Quits

Regarding the coach quits, the results show no significant impact from a coach quitting on the performance measures. With 1072 observations, the sample size is no concern. There is no indication that coach quits impact performance. This could be explained by the fact that most coaches quit when they have another job offer at a new club. Potentially because of good results or performance at their current club. This results in a transfer from one club to another. Intuitively, there is no reason for such a change to cause improved performance.

5.1.3 Coach Dismissals

The estimates for the coach dismissals are largely similar to those of all the coach changes. This makes sense, as almost two-thirds of all coach changes are dismissals. Hence, the estimates are clearly linked to one another. There is a small increase in the points won, chance of victory and goal difference. But these increases do not make the estimates significantly different from the estimates of all coach changes.

5.1.4 Wise and Unwise Coach Dismissals

Note that for unwise coach dismissals, the variable for coach change is not significant. This means no real conclusions can be drawn from this result. The insignificance is likely due to the small sample size. From the 2018/2019 season onward, there are only five unwise dismissals. There is some indication that the nature of a dismissal plays an important role, as the impact of an unwise coach dismissal seems to be negative on both the amount of points and the chance to win. However, to make any claims further research should be conducted with more data on unwise dismissals (expected goals per match).

Only looking at the wise coach dismissals, again, some improvements are noticeable in the

points and winning chance. Comparing to all coach changes, the number of points scored increases from 0.23 to 0.32 and the winning chance increases from 8% to 13%. The goal difference slightly worsens from 0.30 to 0.26. There is an indication that the wise label is determined appropriately, as the two most important performance measures increase, which one would expect in a so-called wise coach dismissal.

Table 3: Results of the naive approach.

	Points	**Win**	**Goal Diff.**
All Coach changes 2000-2023			
Position_{k-1}	0.06(17.98)**	0.02(14.36)**	0.12(20.90)**
Home Match	0.52(13.17)**	0.17(12.29)**	0.88(14.28)**
Coach Change	0.23(5.19)**	0.08(4.70)**	0.30(4.26)**
number of matches		3368	
number of seasons		100	
Coach Quits 2000-2023			
Position_{k-1}	0.06(8.81)**	0.02(7.44)**	0.11(10.04)**
Home Match	0.45(6.31)**	0.14(5.86)**	0.76(6.60)**
Coach Change	0.12(1.42)	0.04(1.07)	0.14(1.13)
number of matches		1072	
number of seasons		32	
Coach Dismissals 2000-2023			
Position_{k-1}	0.06(15.93)**	0.02(12.37)**	0.12(18.65)**
Home Match	0.54(11.63)**	0.18(10.86)**	0.93(12.89)**
Coach Change	0.27(5.63)**	0.10(5.40)**	0.38(4.44)**
number of matches		2296	
number of seasons		68	
Unwise Coach Dismissal 2018-2023			
Position_{k-1}	0.07(5.89)**	0.02(3.70)**	0.14(24.88)**
Home Match	0.29(1.68)	0.08(1.35)	0.62(1.93)
Coach Change	-0.03(0.15)	-0.04(0.77)	0.14(0.36)
number of matches		154	
number of seasons		5	
Wise Coach Dismissal 2018-2023			
Position_{k-1}	0.06(5.04)**	0.02(4.17)**	0.11(6.39)**
Home Match	0.35(3.13)**	0.11(2.71)**	0.68(6.00)**
Coach Change	0.32(2.59)**	0.13(2.24)*	0.26(1.95)*
number of matches		340	
number of seasons		10	

Note: All estimates contain club-season fixed effects; absolute t-statistic in parentheses, based on robust standard errors.
**(*) indicates significance at 5%(10%)

5.2 Treatment and Control Groups

Table 4 shows the parameter estimates when also including a control group. The effect when considering all coach changes is in the top section, followed by the dismissals and quits. Then the bottom half contains the subdivisions of dismissals in the wise and unwise dismissals. The parameter estimates for the rank of the opponent last season and whether the match was a home match were almost identical to those of Table 3. Thus, for readability, those results are disregarded in Table 4. The important variable is the effect of the coach changes and those of the faux coach changes on the performance measures. Panels a, c, e, g, and i include the

relevant estimates from Table3 to make the comparison more convenient. The other panels show the estimates when incorporating the control group into the analysis.

Of the total of 100 coach changes, 88 were matched to a control group. For the dismissals, this is 61 matches out of the total of 68 dismissals. For the quits 29 matches were made. Due to overlapping team seasons, these numbers go down to 75, 61 and 21 respectively. After treatment, which consists of pairing the observations, the estimates are almost identical to those in Table3. This makes sense as the treatment basically drops a few observations. Hence, the estimates do not change much.

5.2.1 All Coach Changes

For all coach changes over the entire sample period, the treatment group shows a significant relation between the coach change and both the amount of points won, the chance of victory and the goal difference. The control groups in this case do not. In none of the performance measures, a significant effect is present. The suspicion that the treatment group differs from the control group is backed up by the F-test. At a 5% confidence level, the null hypothesis of the parameters for coach changes being equal in the two different groups, is rejected for both the points won and goal difference. This implies that there is a causal effect present between coach changes and improved performance.

5.2.2 Dismissals

When only considering dismissals over the entire sample, the effects of coach dismissals are again significant. Albeit, in this case even more significant than in the case of all coach changes. The points earned raises from 0.22 tot 0.28 while the chance of winning a match raises from 7% to 10%. The goal difference also goes from 0.30 to 0.39. Considering the estimates for the control group, even though significant, they are lower. In the case of goal difference, even insignificant. However, from the F-test on equality of the parameters, it is concluded that the parameter estimates in the treatment group are not significantly different from those in the control group. So despite there being an indication of a causal effect, from this particular analysis no such claim can be made at a significant level.

5.2.3 Quits

Looking at only coach quits over the entire sample, no significant effect is found. This is true for both the control and the treatment group, and for all performance measures. Meaning that the coach quits, overall, do not affect performance in any case.

5.2.4 Wise and Unwise Dismissals

Now consider the bottom half of Table 4. It displays the results obtained of the treatment and control analysis on the wise and unwise dismissals. For this part of the analysis, only the 2018-2023 period is used. This is due to the availability of data on expected goals per match in the Eredivisie.

When comparing the estimates for the unwise dismissals, it is found that there is no significant effect present. There seems to be a somewhat negative effect, however, due to the small sample size of 5 club seasons these parameter estimates are not significant. The F-test shows that the treatment group and the control group have similar parameter estimates. This is expected, as the sample size is simply too limited.

For the wise dismissals, significant estimates are found. In all three of the performance measures, the treatment group shows parameter estimates significant at a 5% (10%) level. When including the control group, the estimates reduce to insignificance. This implies that there might be a causal effect present between wise dismissals and improved performance. To get a definitive answer, the F-test is conducted again. It shows no significance at 5% or 10% level. However, it does get close. Meaning, the F-test barely does not reject the null hypothesis of equal parameters between the treatment and control group. Potentially, with a larger sample size, the F-test would be able to reject the null hypothesis.

Table 4: Effects of Coach Changes on Team Performance – Treatment and Control. 2000/2001 - 2022/2023

	Points	**Win**	**Goal Diff.**	**N**	**n**
All Coach Changes 2000-2023					
a. Actual Changes	0.23(5.19)**	0.08(4.70)**	0.30(4.26)**	3368	100
b. Matched-Treatment	0.22(4.71)**	0.07(4.09)**	0.30(4.00)**	5502	88
Matched-Control	0.06(1.06)	0.03(1.51)	0.05(0.54)		75
F-test equality of parameters	4.66**	2.32	4.64**		
Coach Quits 2000-2023					
e. Actual Changes	0.12(1.42)	0.04(1.07)	0.14(1.13)	1072	32
f. Matched-Treatment	0.12(1.32)	0.03(0.97)	0.12(0.88)	1684	29
Matched-Control	-0.07(0.67)	-0.015(-0.36)	-0.08(0.57)		21
F-test equality of parameters	1.85	0.83	1.05		
Coach Dismissals 2000-2023					
c. Actual Changes	0.27(5.63)**	0.10(5.40)**	0.38(4.44)**	2296	68
d. Matched-Treatment	0.28(5.37)**	0.10(5.06)**	0.39(4.52)**	4014	61
Matched-Control	0.17(2.32)**	0.06(2.75)**	0.17(1.53)		58
F-test equality of parameters	2.41	1.49	2.33		
Unwise Dismissals 2018-2023					
g. Actual Changes	-0.03(0.15)	-0.04(0.77)	0.14(0.36)	154	5
h. Matched-Treatment	-0.03(0.16)	-0.04(0.83)	0.15(0.39)	324	5
Matched-Control	-0.07(0.33)	-0.06(0.69)	0.08(0.23)		5
F-test equality of parameters	0.02	0.03	0.02		
Wise Dismissals 2018-2023					
i. Actual Changes	0.32(2.59)**	0.13(2.24)*	0.26(1.95)*	340	10
j. Matched-Treatment	0.32(2.67)**	0.13(2.31)**	0.26(2.00)*	630	10
Matched-Control	0.01(0.05)	-0.01(0.13)	-0.06(0.25)		9
F-test equality of parameters	2.06	2.93	1.28		

Note: All estimates contain club-season fixed effects; N = number of matches; n = number of seasons; the absolute t-statistic in parentheses is based on robust standard errors.
**(*) indicates significance at 5%(10%)

6 Conclusion

This paper finds that teams indeed perform better after a coach change, albeit only marginally. After obtaining that result, a control group was set up to determine whether it was a causal effect or a regression-to-the-mean effect. The control group consisted of seasons with strings of equally bad results where the coach did not get dismissed or quit. It is found that the control group had a very similar effect on the performance measures when only looking at either dismissals or quits. Meaning, the observed effect after a coach quit or dismissal is attributable to the regression-to-the mean phenomenon. However, taking quits and dismissals together, the control group did not show similar results to the treatment group. This implies a causal effect between coach changes and improved performance.

As of now, it is not clear why the causal effect is only found for all coach changes together, and not for the quits or dismissals separately. One explanation could be that the matching that happens for all coach changes was done incorrectly. Or the matching for the quits and dismissals is done incorrectly. Another, more likely, option is that there is a variable at play that this study did not consider. A variable that drives this implied causal effect. Future research could include different performance measures to explore this implied causal effect further. Think of social media sentiment as a performance measure.

Another point of interest is the explanatory variables. This study chose to use a limited amount of explanatory variables outside the coach changes. Namely, the rank of the opponent last season, and whether a game was played at home or not. This decision was made as these two variables seemed crucial factors in performance of a team based on Van Ours and Van Tuijl (2016). In future research, more explanatory variables could be added. Potentially altering the results found here.

When subdividing the dismissals into two different categories: wise and unwise, the results change quite dramatically compared to all the dismissals together. For the wise dismissals, there seems to be potential for a causal effect between the dismissal and improved performance. The paper failed to show this at a significant level. However, further research into the topic of wise dismissals in the Eredivisie could prove this causal effect to be present at a significant level. The model struggled with the rather small sample size. Hence, it could be interesting to produce a larger data set. An option that comes to mind is including different football competitions in the analysis.

Overall, this study does not definitively show a causal effect between mid-season coach dismissals and improved performance. It does highlight a causal effect when considering all coach changes that happen mid-season. Likewise, it indicates the importance of the ability for the board to correctly recognise bad luck versus actual underperformance. As the analysis of the wise dismissals indicated the presence of a positive effect between the wise coach change and the performance measures used.

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A Programming code

Following is the code used for the analysis. It is in essence the code used by Van Ours and Van Tuijl (2016). This variant, however, is extended to include the additional analysis that was needed for producing the results of this paper.

```
clear
use "C:\Users\mickd\OneDrive\Documenten\Universiteit\Bachelor Thesis\EREDIVISIE
    match history 2000-2023.dta"

gen PT= (V>T)*3+(V<T)*0+(V==T)*1
gen VIC=(PT==3)
gen newP=(P>0)*P+(P==-1)*18
gen Saldo= V-T

gen premium_bookmaker= (1/oddh)+(1/oddd)+(1/odda)
gen prh= ((100/oddh))/(premium_bookmaker)
gen prd= ((100/oddd))/(premium_bookmaker)
gen pra= ((100/odda))/(premium_bookmaker)
gen expectation= (prh/100)*3+(prd/100)*1 if H==1
replace expectation= (pra/100)*3+(prd/100)*1 if H==0
gen surp= PT-expectation
sort Club Seizoen WNR
by Club Seizoen: gen CumSurp= sum(surp)
by Club Seizoen: gen CumPoints= sum(PT)

encode Club,gen(club)

sort Club Seizoen WNR

by Club Seizoen: gen quits=1 if NT!=NT[_n-1] & changeT1=="unforced leave" & WNR
    >=5& WNR<=30
by Club Seizoen (WNR): carryforward quits, gen(quit)
by Club Seizoen: gen season_with_quit=1 if quit[34]==1
by Club Seizoen: replace season_with_quit=1 if Seizoen == "2019-2020" & quit
    [26]==1
replace quit=0 if quit==. & season_with_quit==1
replace season_with_quit=0 if quit==.

by Club Seizoen: gen coach_chg=1 if NT!=NT[_n-1] & changeT1~="no change" & WNR
    >=5& WNR<=30
by Club Seizoen (WNR): carryforward coach_chg, gen(coach_chng)
by Club Seizoen: gen season_with_change=1 if coach_chng[34]==1
by Club Seizoen: replace season_with_change=1 if Seizoen == "2019-2020" &
```

```
    coach_chng[26]==1
replace season_with_change=0 if season_with_change==.
replace coach_chng=0 if coach_chng==. & season_with_change==1
xtset ID
* now remove second changes
by Club Seizoen: gen coachx=1 if coach_chng!=coach_chng[_n-1] & WNR>=5 & WNR
    <=30
replace coachx=0 if coachx==.


by Club Seizoen: gen dismissal=1 if NT!=NT[_n-1] & changeT1=="forced leave" &
    WNR>=5 & WNR<=30
by Club Seizoen (WNR): carryforward dismissal, gen(dismiss)
by Club Seizoen: gen season_with_dismissal=1 if dismiss[34]==1
by Club Seizoen: replace season_with_dismissal=1 if Seizoen == "2019-2020" &
    dismiss[26]==1
replace dismiss=0 if dismiss==. & season_with_dismissal==1
replace season_with_dismissal=0 if dismiss==.

sort Seizoen club
by Seizoen club: gen snd_half = 1 if Seizoen >= "2018-2019"

sort Club Seizoen WNR
*two approaches to determine wise/unwise dismissals
gen Diffxg = .
by Club Seizoen: replace Diffxg = xgh - xgo
gen xgP = .
by Club Seizoen: replace xgP = 3 * (Diffxg > 0.5) + (Diffxg >= -0.5) * (Diffxg
    <= 0.5) if xgh!=.
by Club Seizoen: gen CumxgP= sum(xgP)
by Club Seizoen: gen DiffCumP = CumPoints - CumxgP if xgh!=.
gen wise = 1 if DiffCumP > 0 & DiffCumP !=. & coachx ==1 & dismissal == 1
by Club Seizoen: carryforward wise, gen(wiseDismissal)
gen unwise = 1 if DiffCumP < 0 & DiffCumP !=. & coachx ==1 & dismissal ==1
by Club Seizoen: carryforward unwise, gen(unwiseDismissal)


sort Seizoen WNR CumPoints Saldo
by Seizoen WNR: gen RankCumP = _n
replace Rank = 19 - RankCumP

sort Seizoen WNR CumxgP Diffxg
```

```
by Seizoen WNR: gen RankCumxgP = _n if xgh!=.
replace RankCumxgP = 19 - RankCumxgP if xgh!= .

sort Club Seizoen WNR
by Club Seizoen: gen DiffRank = RankCumxgP - RankCumP if RankCumxgP!=.
gen wiseRank = 1 if DiffRank <= 0 & DiffRank !=. & coachx == 1 & dismissal ==1
by Club Seizoen: carryforward wiseRank, gen(wiseRankDismissal)
gen unwiseRank = 1 if DiffRank > 0 & DiffRank !=. & coachx ==1 & dismissal ==1
by Club Seizoen: carryforward unwiseRank, gen(unwiseRankDismissal)
replace unwiseRankDismissal = 0 if unwiseRankDismissal ==. & Diffxg !=.
replace wiseRankDismissal = 0 if wiseRankDismissal ==. & Diffxg !=.

by Club Seizoen: gen season_with_wiseRankDismissal = 1 if wiseRankDismissal
    [34]==1 & season_with_dismissal[34] == 1
by Club Seizoen: replace season_with_wiseRankDismissal=1 if Seizoen ==
    "2019-2020" & wiseRankDismissal[26]==1
by Club Seizoen: gen season_with_unwiseRankDismissal = 1 if unwiseRankDismissal
    [34]==1 & season_with_dismissal[34] == 1
by Club Seizoen: replace season_with_unwiseRankDismissal=1 if Seizoen ==
    "2019-2020" & unwiseRankDismissal[26]==1

* Generates Table 3 - first panel
xtreg PT newP H coach_chng if season_with_change==1, fe robust
xtreg VIC newP H coach_chng if season_with_change==1, fe robust
xtreg Saldo newP H coach_chng if season_with_change==1, fe robust

* Generates Table 3 - second panel
xtreg PT newP H dismiss if season_with_dismissal==1, fe robust
xtreg VIC newP H dismiss if season_with_dismissal==1, fe robust
xtreg Saldo newP H dismiss if season_with_dismissal==1, fe robust

* Generates Table 3 - Third panel
xtreg PT newP H quit if season_with_quit==1, fe robust
xtreg VIC newP H quit if season_with_quit==1, fe robust
xtreg Saldo newP H quit if season_with_quit==1, fe robust


* Generates Table 2
sum H newP PT VIC Saldo CumSurp if season_with_change==1
sum H newP PT VIC Saldo CumSurp if season_with_dismissal==1
sum H newP PT VIC Saldo CumSurp if season_with_change==1 & snd_half ==1
sum H newP PT VIC Saldo CumSurp if season_with_dismissal==1 & snd_half ==1
```

```
sum H newP PT VIC Saldo CumSurp if season_with_dismissal==1 & snd_half ==.
sum H newP PT VIC Saldo CumSurp if season_with_change==1 & snd_half ==.

* Figure 1A
twoway kdensity CumSurp if season_with_change==0 & WNR==34 || /*
       */ kdensity CumSurp if season_with_dismissal==1 & WNR==34, lpattern
           ("-.") || /*
       */ kdensity CumSurp if season_with_quit==1 & WNR==34, lpattern("--") ,
           /*
       */ ytitle(" ") xtitle("Cumulative Surprise") /*
*/ legend(label(1 "No Coach Change") label(2 "Coach Dismissals") label(3 "Coach
    Quits"))
* Figure 1B
twoway kdensity CumPoints if season_with_change==0 & WNR==34 || /*
       */ kdensity CumPoints if season_with_dismissal==1 & WNR==34, lpattern
           ("-.") || /*
       */ kdensity CumPoints if season_with_quit==1 & WNR==34,lpattern("--") ,
            /*
       */ ytitle(" ") xtitle("Cumulative Number of Points") /*
*/ legend(label(1 "No Coach Change") label(2 "Coach Dismissals") label(3 "Coach
    Quits"))



gen oldTC=coachx[_n+1]*season_with_dismissal
gen oldTCAll=coachx[_n+1]*season_with_change
replace oldTC=0 if oldTC==.
replace oldTCAll=0 if oldTCAll==.


* create variable that induces matching outside season * club in which change
   took place
* the variables for All are for all coach changes
gen help=oldTC*(season_with_dismissal)+(1-season_with_dismissal)
gen helpAll=oldTCAll*(season_with_change)+(1-season_with_change)
gen CumSurp2=(CumSurp*help+100*(1-help))
gen CumSurp2All=(CumSurp*helpAll+100*(1-helpAll))

egen id=group(Club Seizoen)

gen treat=oldTC[_n-1]
gsort Club CumSurp2
```

```
gen control=oldTC[_n-1]*(Club==Club[_n-1])*(CumSurp2<100)*(Club~="FC Den Bosch
    ")*(Club~="FC Dordrecht")
gen treat2=oldTC*((CumSurp[_n+1]-CumSurp)<0.5)

gen controlUnwiseRank=oldTC[_n-1]*(Club==Club[_n-1])*(CumSurp2<100)*(Club~="FC
    Den Bosch")*(Club~="FC Dordrecht")*season_with_unwiseRankDismissal[_n-1]
gen controlWiseRank=oldTC[_n-1]*(Club==Club[_n-1])*(CumSurp2<100)*(Club~="FC
    Den Bosch")*(Club~="FC Dordrecht")*snd_half[_n-1]*
    season_with_wiseRankDismissal[_n-1]

gen treatAll=oldTCAll[_n-1]
gsort Club CumSurp2All
gen CumSurpXAll=CumSurp
gen controlAll=oldTCAll[_n-1]*(Club==Club[_n-1])*(CumSurp2All<100)*(Club~="FC
    Den Bosch")*(Club~="FC Dordrecht")
gen treat2All=oldTCAll*((CumSurp[_n+1]-CumSurp)<0.5)


sort Club Seizoen WNR
tab treat2 treat
drop treat treatAll
gen treat=treat2[_n-1]*(Club~="FC Dordrecht")*(Club~="FC Den Bosch")
tab treat control
gen helpx=treat+2*control
tab Club helpx if helpx>0
*Excluding the teams and season for which no counterfactual was available
gen nocounter=(Club=="Cambuur Leeuwarden")*(Seizoen=="2015-2016")+(Club=="Go
    Ahead Eagles")*
(Seizoen=="2014-2015")+(Club=="Go Ahead Eagles")*(Seizoen=="2016-2017")+(Club
    =="NAC Breda")*
(Seizoen=="2018-2019")+(Club=="NEC")*(Seizoen=="2016-2017")+(Club=="Sparta
    Rotterdam")*
(Seizoen=="2017-2018")+(Club=="Sparta Rotterdam")*(Seizoen=="2021-2022")+(Club
    =="Vitesse")*
(Seizoen=="2002-2003")+(Club=="Willem II")*(Seizoen=="2017-2018")

gen treatAll=treat2All[_n-1]
gen helpxAll=treatAll+2*controlAll
*Figure 2b
twoway kdensity CumSurp if treat==1 || kdensity CumSurp if control==1, ytitle("
     ") xtitle("Cumulative Surprise") lpattern("--") legend(label(1 "Coach
    Dismissal") label(2 "Counterfactual"))
```

```
*Figure 2a
twoway kdensity CumSurp if treatAll==1 || kdensity CumSurp if controlAll==1,
    ytitle(" ") xtitle("Cumulative Surprise") lpattern("--") legend(label(1 "
    Coach Change") label(2 "Counterfactual"))

sort Club Seizoen WNR

* now change into level dummy
replace control=. if control==0
replace treat=. if treat==0
replace controlAll=. if controlAll==0
replace treatAll=. if treatAll==0



by Club Seizoen (WNR): carryforward control, gen(controlx)
by Club Seizoen (WNR): carryforward treat, gen(treatx)
replace controlx=0 if controlx==.
replace treatx=0 if treatx==.
gen som=controlx+treatx
by Club Seizoen (WNR): carryforward controlUnwiseRank, gen(controlURankx)
by Club Seizoen: gen treatURankx = 1 if treatx ==1 &
    season_with_unwiseRankDismissal ==1
by Club Seizoen (WNR): carryforward controlWiseRank, gen(controlWRankx)
by Club Seizoen: gen treatWRankx = 1 if treatx ==1 &
    season_with_wiseRankDismissal ==1

replace controlURankx=0 if controlURankx==.
replace controlWRankx=0 if controlWRankx==.
replace treatWRankx=0 if treatWRankx==.
replace treatURankx=0 if treatURankx==.
gen somWise = treatWRankx + controlWRankx
gen somUnwise = treatURankx + controlURankx
by Club Seizoen: gen season_with_something=1 if som[34]==1
by Club Seizoen: gen season_with_treat=1 if treatx[34]==1
by Club Seizoen: gen season_with_control=1 if controlx[34]==1
by Club Seizoen: replace season_with_something=1 if (som[26] * Seizoen ==
    ("2019-2020"))==1

by Club Seizoen: gen season_with_somethingWise=1 if somWise[34]==1
by Club Seizoen: replace season_with_somethingWise=1 if (somWise[26] * Seizoen
    == ("2019-2020"))==1
by Club Seizoen: gen season_with_somethingUnwise=1 if somUnwise[34]==1
```

```
by Club Seizoen: replace season_with_somethingUnwise=1 if (somUnwise[26] *
    Seizoen == ("2019-2020"))==1

*generates Table 3 - Fourth panel
xtreg PT newP H unwiseRankDismissal if season_with_unwiseRankDismissal==1, fe
    robust
xtreg VIC newP H unwiseRankDismissal if season_with_unwiseRankDismissal==1, fe
    robust
xtreg Saldo newP H unwiseRankDismissal if season_with_unwiseRankDismissal==1,
    fe robust

*generates Table 3 - Fifth panel
xtreg PT newP H wiseRankDismissal if season_with_wiseRankDismissal==1, fe
    robust
xtreg VIC newP H wiseRankDismissal if season_with_wiseRankDismissal==1, fe
    robust
xtreg Saldo newP H wiseRankDismissal if season_with_wiseRankDismissal==1, fe
    robust

**********************************
* For all coach changes
by Club Seizoen (WNR): carryforward controlAll, gen(controlAllx)
by Club Seizoen (WNR): carryforward treatAll, gen(treatAllx)
replace controlAllx=0 if controlAllx==.
replace treatAllx=0 if treatAllx==.
gen somAll=controlAllx+treatAllx

* For Coach Quits
by Club Seizoen (WNR): carryforward controlAll, gen(controlQuit)
replace controlQuit= controlAllx - controlx if controlAllx - controlx >=0
replace controlQuit=0 if controlQuit==.
by Club Seizoen (WNR): carryforward treatAll, gen(treatQuit)
replace treatQuit=0 if season_with_quit ==0
replace treatQuit=0 if treatQuit==.
by Club Seizoen (WNR): gen somQuit= treatQuit + controlQuit

by Club Seizoen: gen season_with_all=1 if somAll[34]==1
by Club Seizoen: replace season_with_all=1 if (somAll[26] * Seizoen ==
    ("2019-2020" ))==1
by Club Seizoen: gen season_with_treatAll=1 if treatAllx[34]==1
by Club Seizoen: gen season_with_controlAll=1 if controlAllx[34]==1
by Club Seizoen: gen season_with_somethingQuit=1 if somQuit[34] ==1
```

```
by Club Seizoen: replace season_with_somethingQuit=1 if (somQuit[26] * Seizoen
    == ("2019-2020"))==1


* Table 4a
xtreg PT newP H coach_chng if season_with_change==1, fe robust
xtreg VIC newP H coach_chng if season_with_change==1, fe robust
xtreg Saldo newP H coach_chng if season_with_change==1, fe robust

* Table 4c
xtreg PT newP H dismiss if season_with_dismissal==1, fe robust
xtreg VIC newP H dismiss if season_with_dismissal==1, fe robust
xtreg Saldo newP H dismiss if season_with_dismissal==1, fe robust

* Table 4d
tab treatx controlx if WNR==34
tab treatx controlx if WNR ==26 & Seizoen == "2019-2020"
xtreg PT newP H treatx controlx if season_with_something==1, fe robust
test treatx=controlx
xtreg VIC newP H treatx controlx if season_with_something==1, fe robust
test treatx=controlx
xtreg Saldo newP H treatx controlx if season_with_something==1, fe robust
test treatx=controlx



* Table 4b
tab treatAllx controlAllx if WNR==34
tab treatAllx controlAllx if WNR ==26 & Seizoen == "2019-2020"
xtreg PT newP H treatAllx controlAllx if season_with_all==1, fe robust
test treatAllx=controlAllx
xtreg VIC newP H treatAllx controlAllx if season_with_all==1, fe robust
test treatAllx=controlAllx
xtreg Saldo newP H treatAllx controlAllx if season_with_all==1, fe robust
test treatAllx=controlAllx


* Table 4f
tab treatQuit controlQuit if WNR==34
tab treatQuit controlQuit if WNR ==26 & Seizoen == "2019-2020"
xtreg PT newP H treatQuit controlQuit if season_with_somethingQuit==1, fe
    robust
```

```
test treatQuit=controlQuit
xtreg VIC newP H treatQuit controlQuit if season_with_somethingQuit==1, fe
    robust
test treatQuit=controlQuit
xtreg Saldo newP H treatQuit controlQuit if season_with_somethingQuit==1, fe
    robust
test treatQuit=controlQuit

* Table 4h
tab treatURankx controlURankx if WNR==34
tab treatURankx controlURankx if WNR ==26 & Seizoen == "2019-2020"
xtreg PT newP H treatURankx controlURankx if season_with_somethingUnwise==1, fe
     robust
test treatURankx=controlURankx
xtreg VIC newP H treatURankx controlURankx if season_with_somethingUnwise==1,
    fe robust
test treatURankx=controlURankx
xtreg Saldo newP H treatURankx controlURankx if season_with_somethingUnwise==1,
     fe robust
test treatURankx=controlURankx

* Table 4j
tab treatWRankx controlWRankx if WNR==34
tab treatWRankx controlWRankx if WNR ==26 & Seizoen == "2019-2020"
xtreg PT newP H treatWRankx controlWRankx if season_with_somethingWise==1, fe
    robust
test treatWRankx=controlWRankx
xtreg VIC newP H treatWRankx controlWRankx if season_with_somethingWise==1, fe
    robust
test treatWRankx=controlWRankx
xtreg Saldo newP H treatWRankx controlWRankx if season_with_somethingWise==1,
    fe robust
test treatWRankx=controlWRankx
```