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Does a new football coach lead to better results?

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Abstract

In this paper we study whether the change of a manager and/or the line-up lead to better performance. We use data from the Dutch football competition. In order to model the various data we use an ordered probit and two binary probit models. Overall we have not found a uniform strategy in terms of overlap in line-up that leads to improved performance. In some cases a strategy in terms of overlap in line-up leads to improved performance, while the same strategy could lead to bad performance for another team. However there is some evidence that changing line-up affect performance.

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1. Introduction

It is generally assumed that management turnover is negatively related to firm performance, see for example Coughlan & Schmidt (1988) and Weisbach (1988). A manager is usually replaced if he does not fulfill the expectations that the company has associated with his function. To justify the decision of the firm to replace the manager, we should measure and compare the performance of the firm before and after the decision has made. A problem that arises with measuring firm performance is that there are many possible indicators to measure firm performance and therefore it is difficult to assign a specific measure for firm performance. Not to mention the fact that usually managerial change is not observable for standard firm level data, as the news of a managerial change will not spread openly outside the company. A solution to this phenomenon is to look at comparable organizations where managerial change is public news. For example in sports in general, contrary to business, a managerial change is public news and besides that there exist in sports a clear measure for performance. The role of managers in sports is comparable to that of companies, both managers lead their subordinates and both carry the responsibility for the overall results. So it seems plausible that results found in sports also apply to business in general. That is exactly what we want to do in this paper, to focus on sports and to translate the results found to companies.

In this research we have chosen football as a field of research. Besides the question whether replacement of managers is justified, we will look at why results differ between managers and if we can attribute this difference to specific factors. Again, this is difficult to measure for companies, since there is a large organization and the replacement of a manager is not directly associated with immediate changes in that firm. In football it is much more clearly to see the effect of replacing managers and it is also measurable. Think about line-ups for games and the number of points won. This way we can observe the differences between managers. We see that moving research from companies to professional team sports, where detailed records of match results are available, is nowadays a common thing to do for researchers.

In the available literature we find in general that firing a manager does not improve team performance (in the long term), Audas et al. (1997), Bruinshoofd and ter Weel (2003) and Koning (2003). Nevertheless there are cases where team performance improved or deteriorated significantly between managers. We are especially interested in these teams

because we want to examine why the differences in performance between the managers of these teams changed so significantly. Managers, players, crowd support and other factors can form an explanation for the difference in performance.

In practice there is always an interaction between the manager and his players, so that a change in performance never can be attributed to only the manager or on the other hand only the players. Although this is true, we do believe that a manager besides his technical knowledge can have a psychological effect on his players by which they can perform better or worse. If this is true, replacing only the manager in some cases will be enough to improve performance. But in cases when a manager is not capable of making his players perform better, it means appointing a manager is not enough to improve performance. To improve the performance other measures must be taken, such as attracting new players. For football clubs and companies these are common issues.

To answer to what extent managers affect performance, we will examine football clubs where a managerial change took place during the season and compare the performances between the managers. Obviously the team performance of a manager remains the same, increases or deteriorates compared to his predecessor. If after a managerial change all variables are held constant (ceteris paribus), such as the line-ups for games, we could hypothesize that the change in performance is to be attributed for a great part to the new manager. In most of the cases where variables, such as line-ups, have changed it is more difficult to attribute the change in performance to a manager.

If some variables changed, we will look if these changes are correlated with performance and therefore could be an explanation for the difference in performance. For example if the line-ups between the fired (old) manager and his successor (new manager) are very different, this could explain the difference in performance. Managers follow different strategies, some will hold to a certain line-up, while other managers change their line-up regularly and so on. We will try to capture these different strategies and examine which effect these strategies have on performance.

In this paper, next to teams with a managerial change, we will also look at teams without a managerial change during a season and performed very well or bad in a season. These teams will act as a control group. This way we hope to find unique characteristics that especially will hold for teams with a managerial change during the season.

We have football club records available from 1993-1994 till 2010-2011 and we retrieved this data from Infostrada Sports. The data contains detailed match results, like the points won, the overlap in line-ups based on the line-up of the openings match of the season, the overlap in line-ups between two consecutive matches. To model if the line-ups during the season have an effect at points won, we use an ordered probit model. This model is appropriate here because points won is ranked into three categories, that is zero, one and three points.

The structure of the paper is set up as follows. In section 2 we discuss articles that are related to our study. The data and the descriptive statistics of the data are presented in section 3. In the section 4 we discuss the methodology of the different models. Section 5 contains the results. The paper ends with a conclusion and suggestions for further research.

2. Background

Many articles available in this field look at the main factors that lead to management turnover. For example Murphy & Zimmerman (2002) find that turnover of managers is mostly due to poor performance. Also, Groves et al. (1995) examines the managerial labor market in China, he finds that poor performance is the most important cause for a managerial change. There are many articles that confirm this hypothesis, such as Warner, Watts & Wruck (1988), Weisbach (1988) and Warzynski (2000). While these articles look at the main factors for management change, they do not study if the firm performance under the new manager increases.

In Hudson et al. (2004) they do address this issue, and they find that after a managerial change the firm performance on average increases. In their paper they make a distinction between successor managers hired from outside the firm and from inside the firm, they conclude that firm performance is greater when the new manager is hired from outside the firm than when an insider is appointed as the new manager. Khurana & Nohria (2000) find roughly the same conclusions. They state that after firing a manager, an ‘insider’ as successor

has little effect on firm performance, while an outsider as successor improves firm performance significantly.

By examining forced resignations of top managers, Denis & Denis (1995), find that 'forced resignations are preceded by large and significant declines in operating performance and followed by large improvements in performance.' They conclude that following the management change, firms significantly downsize their operations and are subject to a high rate of corporate control activity. So they state that valuable operating improvements are associated with forced resignations.

Cools & van Praag (2003) examine stock market reactions associated with the announcement of forced management departures. They conclude that removal of a badly performing executive affects firm value positively.

2.1 Football related studies

There are also a number of articles analyzing the management change on performance for football teams. Koning (2003) use as dependent variable the difference in goals the two teams scored in a particular match. In the model he takes into account the difference in quality of the opponents faced by the old and new coach. They conclude that firing the coach occurs too often, because the results on the field do not improve clearly.

Another contribution to this field is from Audas et al. (1997), they sum up some causes why a coach is fired in the English premier league and some lower divisions. For example, a manager with "long" service gets more time to recover from bad results than new managers. They also comment that the team performance deteriorates immediately after a resignation of the coach. Another important remark in their conclusion is that the results will improve after firing a coach, simply because no team is losing forever. In another article, Audas et al. (2002), they use an ordered probit model where the dependent variable consist of three ranked outcomes; home win, draw or away win. Whether a team fired their coach is an explanatory variable in their model. They draw the same conclusion as in their earlier paper, Audas et al. (1997): teams tend to recover after a poor run on results, whether they fire their manager or not.

Tena & Forrest (2007), find some improvements in team performance for the short term after a managerial change in the Spanish Football league, but only in home matches. They use a probit model where the dependent variable is a zero-one variable where one means that the manager is dismissed and zero when the manager is not dismissed. Some explanatory variables are the time of the season by including match round number, if the team lost his previous match and if a managerial change already has taken place during the season. They find that the results in home matches improved but away performance was little altered. They conclude from this evidence that a new coach does not typically bring technical solutions to the weaknesses of the team since away performance is little altered. That home results nevertheless improve suggests a role for crowd support in the determination of match outcomes.

By examining the forced resignation of managers of Dutch football teams on team performance, Bruinshoofd & ter Weel (2003) compare a four game period before and after resignation of the coach. They conclude that firing a coach does improve team performance on average. But important to mention is that in Bruinshoofd & ter Weel (2003), they also take a control group, this group contains teams in similar situations as teams where a manager is fired, the difference is that these clubs still have confidence in the manager and continue with the manager. It turns out that the control group in general performs better and from this they conclude that improved team performance is not likely caused by a managerial change.

In the articles discussed above, they focus on the firm/team performance of the managers to answer if a managerial change is beneficial. Our paper contributes to this literature to look whether a managerial change is beneficial and why this change is beneficial or not. For this reason we examine football clubs with a managerial change and the team performance improved or declined significantly after the managerial change. We try to determine if the team performance depends especially on the manager or not. The role of a manager can also be very modest. Obviously, players will also have an effect on performance. We must have in mind that team performance is dependent on both the manager and players, it is an interaction between them and it is interesting to examine how great their effect is on performance. In the remainder of this paper we will discuss the data, the methodology, the results and finally the conclusions.

3. Data

In this section we discuss the structure of our data and the construction of our variables to analyze whether replacing a manager alone is sufficient to improve team performance. We begin with discussing the structure of the Eredivisie, the highest Dutch Football league, to grasp what a team can win or lose at the end of the season. In our study team performance takes on an important role. This is why it is also important to know how teams earn their points and get to their team performance. Further we will look at the data available and some descriptive characteristics of the data.

3.1 The Eredivisie and the measure of performance

The highest Dutch Football league contains 18 teams in each season. Teams try to gain points in order to avoid degradation to the second division. The team that ranks last, the 18th place, at the end of the season will play the upcoming season in the second division. While the team that ranked 1st in the second division will promote to the Eredivisie. The clubs ranking the 17th and 16th place in the Eredivisie will play degradation play-off games. This is why the composition of the Eredivisie changes each season, because teams degrade and other teams promote. Teams do not win points only to avoid degradation, but also in order to achieve a ranking that gives right to participate in the Europe or Champions league. This is very interesting for clubs because of the financial compensation, dependent of the success, to participate in this kind of tournaments. Every team play twice against the same opponent, home and away. Therefore a team in the Eredivisie plays 34 matches during a season. By winning from an opponent the team earns 3 points, while a draw means one point and losing zero points.

During a season a team gathers points together, by winning or to play a draw against its opponents. The ranking of the team at the end of the season is dependent of the total number of points it has won during the season. If we divide the total number of points gathered in a season by the number of games, that is 34 games in a whole season, we get the performance of a team. For example a team ended the season with 68 points that is 20 wins and 8 draws. This total number of points must be divided by 34 games, the total number of games. The performance is then equal to 2 points per game on average. When a team wins all games, their performance is obviously 3 points per game. A team cannot do worse than a performance of zero points per game, it lost every game.

For teams where a managerial change has taken place, we are interested in the performances of the old and new manager. Instead that we take the whole season as a sample for performance, we will now divide the sample for the old and new manager. The performance of the old and new manager is the number of points each won divided by the number of games they coached. For example if the old manager won 20 points in 20 games and the new manager won 28 points in the remainder of the games, that is 14 games. The average performances of the old and new manager are respectively 1 point and 2 points per game. This way we compare the performances between the old and new managers.

3.2 Teams

We have data available that contains details of all teams from the Eredivisie from 1970-1971 till 2010-2011. To test our hypotheses we looked for teams where during a season a managerial change took place. We searched for teams where the differences in performance between the old and new managers are significant. We will research whether managers show different behavior what could explain the difference in performance and if some uniform behavior leads to improved or declined performances. To create a control group, we also looked for teams without a managerial change during the season. We chose for managers that performed remarkably good or bad in a season, based on results in previous seasons and expectations for that season. The data does not present directly if a team fired their manager during a season and if the performance significantly improved or declined compared to previous seasons. So how do we find teams that are suitable for our research? To cope with this problem we brainstormed with a couple of friends that also play football and they follow the Eredivisie closely for quite some years now. We tried to come up with some teams that in our opinion performed much better or worse compared to our expectation and that of the media. We remember especially the teams that performed very well and somewhat less the teams that performed very bad in a season. Besides this we have been granted a limited time to collect data from a database of the company Infrostrada Sports and therefore also a limited time to find appropriate teams for our research. This resulted that our data contains a small number of bad performing teams compared to teams that performed very well. We collected all data while the season 2010-2011 was still going, so teams selected from this season do not provide data for a whole season.

In the remainder of this paper we first will introduce the teams we have selected and their characteristics. To determine the usefulness of the data, we will examine if the differences in

performance between managers are significant. When the performance of the managers are not significant different from each other, we could say that replacing the manager has not the desired effect of improving performance. These teams will be used to analyze why the performances differ significantly. In analyzing the differences between performances we will focus on the line-up and try to find a relationship between performance and the line-ups of a team. In the next sections we will discuss our results and findings and end with a conclusion. We will start with discussing the performances of the teams and next their descriptive characteristics.

Table 1 shows the teams that have improved or declined performance considerably to our belief after a managerial change. The performances of the mangers are also mentioned in Table 1. We notice that five of the six successors have a higher performance compared to their predecessors. In the case of FC Utrecht and FC Volendam the performance even more than doubled after the managerial change. To examine if the difference in performance between managers is significant we use a Chow test. With the Chow test we look whether the performance before the managerial change is significant different from the performance after the managerial change. Because of the big difference in performance we would expect that the difference in performance between managers is significant for FC Utrecht and FC Volendam. We will use a 10% significance level, because of the limited data. It turns out that the difference in performance between the managers is only significant for FC Volendam. We will use all teams for further consideration.

Table 1 Team performances for the old and new managers.
* The difference in performance between the old and new manager is significant.

		Old manager		*New manager*	
Season	***Club***	***Name***	***Performance***	***Name***	***Performance***
93-94’	FC Utrecht	Ab Fafie / interim	0.57	Leon van Veen	1.26
93-94’	FC Volendam*	Korbach / interim	**0.74**	Rijsbergen	**1.93**
02-03’	AZ	Henk van Stee / interim	1.00	Co Adriaanse	1.42
02-03’	FC Groningen	Dwight Lodeweges	0.75	Ron Jans	1.12
08-09’	SC Feyenoord	Gert-Jan Verbeek	1.12	Leon Vlemmings	1.53
09-10’	Sparta	Frans Adelaar	0.83	Aad de Mos	0.25

Table 2 Team performances of teams where the manager coached for a whole season.

		Manager	
Season	***Club***	***Name***	***Performance***
94-95’	Roda JC	Huub Stevens	2.24
01-02’	Sparta	Frank Rijkaard	0.97
06-07’	FC Twente	Fred Rutten	1.94
07-08’	NAC Breda	Ernie Brandts	1.85
09-10’	Heracles	Gert-Jan Verbeek	1.65
10-11’	Ado Den Haag	John van den Brom	1.75*
10-11’	Willem II	Geert Heerkes	0.32*

* Season is still going; performance for Ado Den Haag and Willem II is based on respectively 24 and 22 matches.

Table 2 contains the teams that performed remarkably good or bad to our opinion. These teams had one manager during the whole season and hence a managerial change did not take place. Five of the seven teams performed much better than we would expect in that season. These teams are Roda JC, FC Twente, Nac Breda, Heracles and Ado Den Haag. They all had a performance of 1.65 or higher which indicates that they won on average at least one out of two games. Roda JC performed very well with a performance of 2.24 points per game on average, which means that they won three out of four games that season. The teams that to our opinion performed very badly are Sparta and Willem II, with a performance of respectively 0.97 and 0.32. Two teams in this dataset, Ado Den Haag and Willem II, are taken from season 2010-2011. Since the season 2010-2011 was still going while we collected the

data, their performances are not based on 34 games but respectively on 24 and 22 games. In the next section we will discuss the descriptive statistics of these teams.

To study how performance is affected by the manager and players we will use variables like performance and overlap in line-ups. If significant differences in performance between managers exist, we want to find out what role the managers and players have on performance. We will use line-ups as a measure for the role managers have on performance. If for example the line-ups between the old and new manager are quite similar, we can state that the difference in performance is due to the new manager. If the line-ups differ, the role of the manager on performance is less clear. To model the above we have the following variables:

Dependent variable

Points	**The number of points the team earned in each match. The possibilities are 0, 1 or 3 points per match.**

Independent variables

Overlap opening	**This variable contains the number of players of the line-up of the openings match that overlaps with the line-ups during the season. An example of this variable would be 10, 6, 9, 7, 7, … etc. This indicates that 10 players of the openings line-up also started in the second match of the season, 6 players of the openings line-up also started in the third match, 9 players of the openings line-up started also in the fourth match and so on.**
Overlap first game	**The number of players of the line-up of the first match of the new manager that overlaps with the line-ups during the season. An example of this variable would be 8, 9, 7, 8, 7, … etc. This indicates that 8 players of the line-up of the first match of the new manager also started in the second match of the new manager, 9 players of the**

	first game of the new manager also started in the third match of the new manager, 7 players of the first match of the new manager also started also in the fourth match of the new manager and so on.
Overlap previous	**Overlap of line-ups between two consecutive games.**

3.3 Descriptive statistics of the variables

In this subsection we discuss comprehensively the descriptive statistics of the data. To give a clear insight to the data, we will discuss the descriptive statistics of all teams. In the remainder of this section we will discuss the variables points and line-ups thoroughly.

3.3.1 Dependent variable Points

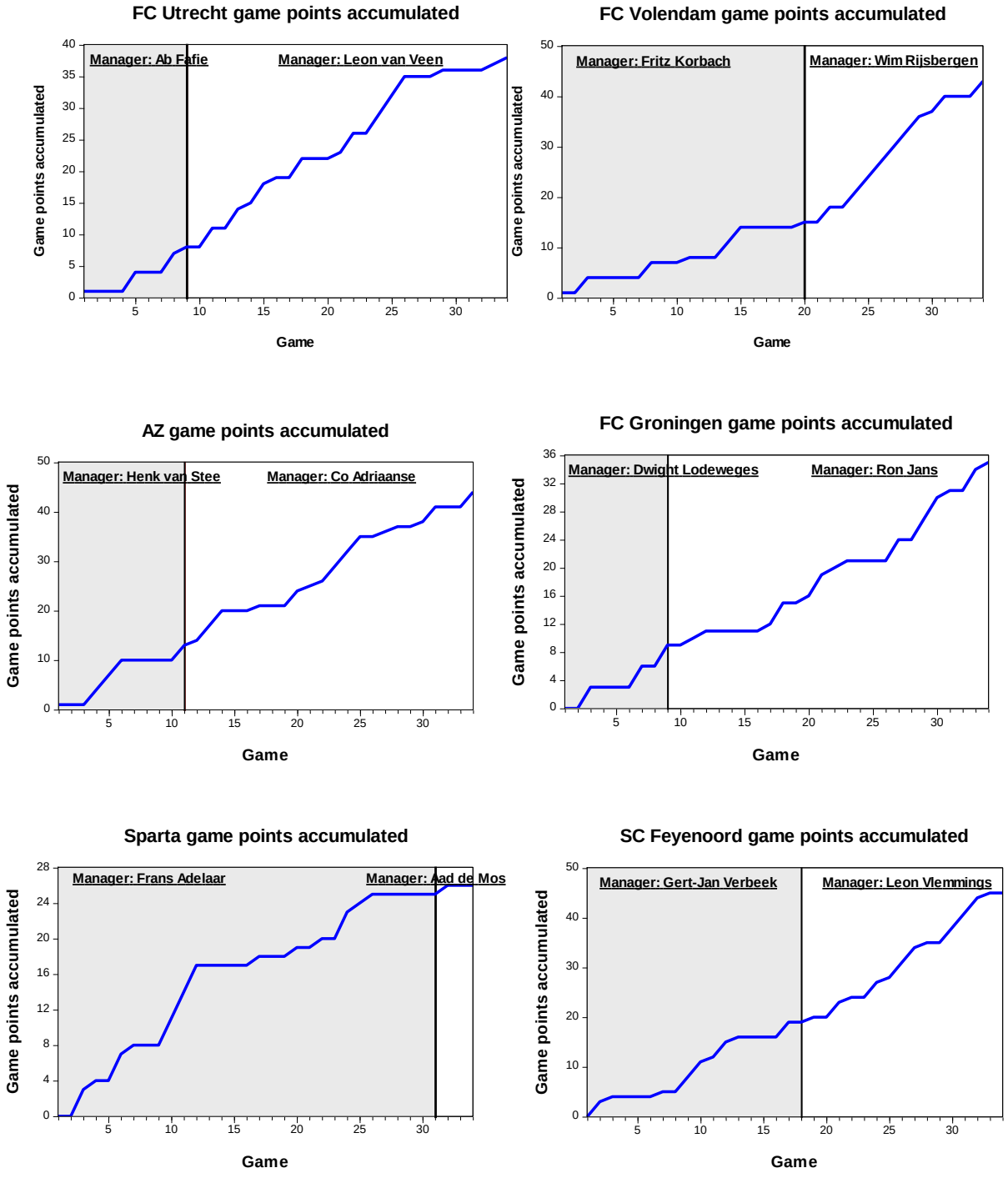
Teams from the Eredivisie win points during the season by winning or playing a draw against their opponent. In Table 3 we see the number of wins, draws and losses of all teams leading to their total number of points in a season. We also show how the number of wins, draws and losses are divided between the managers. If we analyze the results for FC Volendam we see that Wim Rijsbergen compared to Fritz Korbach won more games although Wim Rijsbergen was manager in fewer games, respectively 15 and 19 games. The new manager performed significantly better than the old manager. For FC Utrecht, FC Groningen, AZ and SC Feyenoord the new managers won more games compared to the old managers. However the differences in performance between the new and old managers of these teams are not significant. Frans Adelaar, the new manager of Sparta, is the only manager in this dataset who won fewer games than his predecessor.

Table 3 Statistics about the number of games won, lost and played a draw and the number of points achieved.
* Significant with a significance level of ten percent.

Club - manager	*# won - points*	*# draw - points*	*# lost - points*	*Total*	*Performance*
FC Utrecht	10 games - 30 points	8 - 8 points	16 games - 0 points	34 – 38 points	1.12 points per game
Ab Fafie / interim	1 - 3 points	1 - 1 point	5 - 0 points	7 - 4 points	0.57 points per game
Leon van Veen	9 - 27 points	7 - 7 points	11 - 0 points	27 - 34 points	1.26 points per game
FC Volendam*	13 - 39 points	4 - 4 points	17 - 0 points	34 – 43 points	1.27 points per game
Fritz Korbach	4 - 12 points	2 - 2 points	13- 0 points	19 - 14 points	0.74 points per game
Wim Rijsbergen	9 - 27 points	2 - 2 points	4 - 0 points	15 - 29 points	1.93 points per game
AZ	12 - 36 points	8 - 8 points	14 - 0 points	34 – 44 points	1.29 points per game
Henk van Stee / interim	3 - 9 points	1 - 1 points	6 - 0 points	10 - 10 points	1.00 points per game
Co Adriaanse	9 - 27 points	7 - 7 points	8 - 0 points	24 - 34 points	1.42 points per game
FC Groningen	9 - 27 points	8 - 8 points	17 - 0 points	34 – 35 points	1.03 points per game
Dwight Lodeweges	2 - 6 points	0 - 0 points	6 - 0 points	8 - 6 points	0.75 points per game
Ron Jans	7 - 21 points	8 - 8 points	11 - 0 points	26 - 29 points	1.12 points per game
Sparta	6 - 18 points	8 - 8 points	20 - 0 points	34 – 26 points	0.76 points per game
Frans Adelaar	6 - 18 points	7 - 7 points	17 - 0 points	30 - 25 points	0.83 points per game
Aad de Mos	0 - 0 points	1 - 1 point	3 - 0 points	4 - 1 point	0.25 points per game
SC Feyenoord	12 - 36 points	9 - 9 points	13 - 0 points	34 – 45 points	1.32 points per game
Gert-Jan Verbeek	5 - 15 points	4 - 4 points	8 - 0 points	17 - 19 points	1.12 points per game
Leon Vlemmings	7 - 21 points	5 - 5 point	5 - 0 points	17 - 26 point	1.53 points per game

Table 3 contains the statistics of each team about the number of games won, lost and played a draw and their associated number of points. Figure 1 shows the course of the number of points achieved during the season by accumulating the number of points. This way we can visually show the differences in slopes between the managers. The slopes in Figure 1 correspond to the performance of the managers that we earlier mentioned in Table 1. So for FC Utrecht this means that the slope equals to 0.57 for Ab Fafie and 1.26 for Leon van Veen. The slope for the new manager is more than two times the slope for the old manager. However we have found earlier that the difference in performance between the managers is not significantly different. For FC Volendam we found that the performances between the old and new managers are significant different. The difference in performance between the managers can be found in the slopes for these teams. We can see in Figure 1 that the performance of the new and old manager of FC Volendam shows clearly different slopes, more obvious than for the other teams.

Figure 1 The accumulated game points during the season



3.3.2 Overlap in line-ups with the openings line-up as base

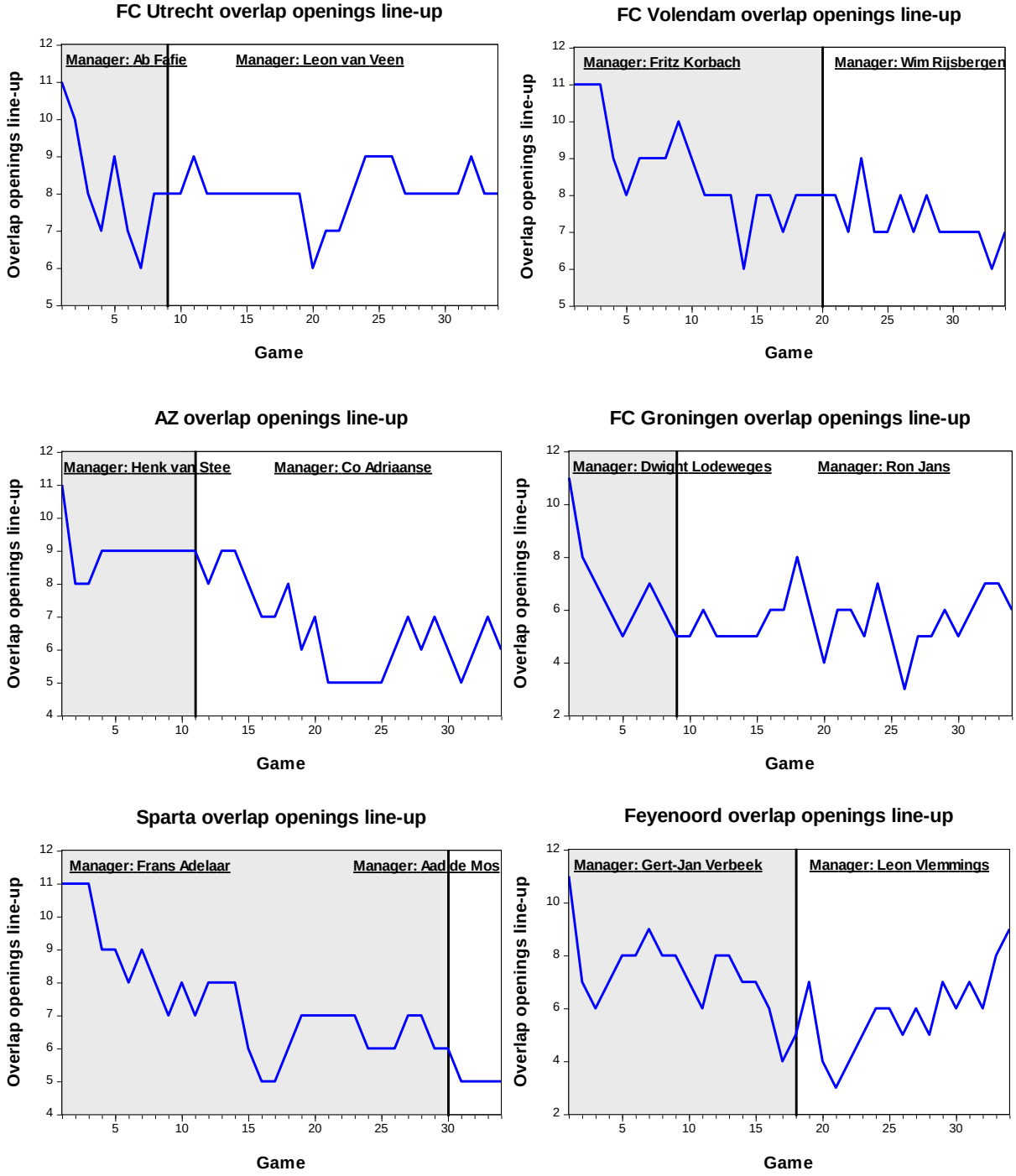
A team of the Eredivisie begins well in advance of the opening match with training sessions and friendly games. This is done by the manager to get the players in shape before the season starts. Another reason to do this is to give the manager the chance to evaluate players and to assemble his best line-up for the opening match of the season. During the season there is a possibility that the manager gains new insights and as a result of these insights he changes the line-up for the next game. This can occur during any moment of the season and as so often the manager intents. We will look if there are clear differences between the old and new managers concerning the overlap in the line-ups during the season. Is there with a managerial change also a behavioral change in the composition of the line-ups during the season? To answer this, the line-up of the opening match of the season is taken as base and we examine how the remainder of the line-ups overlaps with this opening line-up. This is shown in Table 4. For example we notice that the old manager of FC Utrecht started 1 game with 9 players that also started in the opening game. The new manager started 5 games with 9 players that overlap with the opening line-up. It is remarkable to see that every team, except for FC Volendam and Sparta, did not use the same eleven players again in the other games. If we again use a Chow test to test if the difference in average overlap between the managers is significant, we find that the difference is significant for all teams except FC Utrecht. These teams are FC Volendam, AZ, FC Groningen, Sparta and SC Feyenoord. If we look at these teams we notice that all new managers have a lower average overlap compared to the old managers. While in the case of FC Utrecht, which was not significant, it is the other way around. It seems that we can establish a relationship between average overlap with the opening line-up and performance. By decreasing the number of players in the line-up that overlap with the opening line-up, performance improves. However the performance of Sparta declined.

Table 4 Statistics about the number of overlap of players based on the openings line-up.
* Significant with a significance level of ten percent.

Overlap openings line-ups	***# of games***									
Club - manager	***11 players***	***10 pl***	***9 pl***	***8 pl***	***7 pl***	***6 pl***	***5 pl***	***4 pl***	***3 pl***	***Average overlap***
FC Utrecht	-	1	6	20	4	2	-	-	-	33 games – 8.00 players
Ab Fafie / interim	-	1	1	1	2	1	-	-	-	6 games – 7.83 players
Leon van Veen	-	-	5	19	2	1	-	-	-	27 games – 8.04 players
FC Volendam*	2 games	1	6	12	10	2	-	-	-	33 games – 8.00 players
Fritz Korbach	2 games	1	5	8	1	1	-	-	-	18 games – 8.56 players
Wim Rijsbergen	-	-	1	4	9	1	-	-	-	15 games – 7.33 players
AZ*	-	-	10	5	6	6	6	-	-	33 games – 7.21 players
Henk van Stee / interim	-	-	7	2	-	-	-	-	-	9 games – 8.78 players
Co Adriaanse	-	-	3	3	6	6	6	-	-	24 games – 6.63 players
FC Groningen*	-	-	-	2	5	12	12	1	1	33 games – 5.76 players
Dwight Lodeweges	-	-	-	1	2	3	1	-	-	7 games – 6.43 players
Ron Jans	-	-	-	1	3	9	11	1	1	26 games – 5.58 players
Sparta*	2 games	-	3	6	9	7	6	-	-	33 games – 7.03 players
Frans Adelaar	2 games	-	3	6	9	7	2	-	-	29 games – 7.31 players
Aad de Mos	-	-	-	-	-	-	4	-	-	4 games – 5.00 players
SC Feyenoord*	-	-	2	7	8	8	4	3	1	33 games – 6.45 players
Gert-Jan Verbeek	-	-	1	6	5	3	-	1	-	16 games – 7.13 players
Leon Vlemmings	-	-	1	1	3	5	4	2	1	17 games – 5.82 players

To see how consistent the managers changed their line-up during the season, we incorporated the overlap of players in line-ups during the season in Figure 2. It is interesting to see that each manager changed his line-up a few games after the opening match on average with three or four new players compared to the opening line-up. This can suggest that the first games of the season the managers are still puzzling on which line-up to start with. We also notice that the new managers in their first matches roughly continue with the line-up where the old managers left off. This is not strange, because usually the new manager hasn't worked with the players. So the first games he leaves everything how it was, he evaluates the players and then adjust where he thinks that it is necessary. In accordance with Table 4, we see that the number of players that overlap with opening line-up is on average lower for most new managers compared to the old managers. We overall see that the average overlap in line-up differ across the managers and the differences in average overlap between managers are significant for FC Volendam, AZ, FC Groningen, Sparta and SC Feyenoord. Except for Sparta, this would indicate new managers should decrease the number of players that overlap with the opening line-up to improve performance.

Figure 2 Overlap of players based on the openings line-up.



Also interesting to see is how some managers tend to fluctuate around a particular number of overlap in line-up and while the other managers were going all directions in terms of overlap in line-up. For example AZ, the old manager is quite steady in the number of overlap, while the new manager almost had no two consecutive line-ups with the same number of players that overlaps with the opening line-up.

Overlap in line-up based on openings match for managers who coached a whole season

Table 5 denotes the average overlap in line-up based on the openings match. The managers in this case were not fired but coached a whole season. It is interesting to compare the behavior of these managers with the old and new managers in the previous section and to find out if there exist a relationship between overlap in line-up and performance. If we look at Table 5 we see that the average overlap quite differs over the teams, remember that Sparta and Willem II performed not so well while the other teams performed very well. There seems to be no clear relationship between performance and overlap in line-up based on openings match. For example Heracles and NAC Breda respectively have an average overlap of 9.47 and 6.44 players, while both teams performed well. These teams serve as a control group for the teams with a managerial change during the season. If we compare the results of both groups, we find a difference in relationship with performance. For the teams with a managerial change, we find that by decreasing the number of overlap with the opening line-up improves performance, except for Sparta. While for the teams without a managerial change it seems to be random and there is no clear relationship between average overlap and performance.

Table 5 Average overlap in line-up based on openings match for managers who coached for a whole season.

Season	*Club*	*Average overlap*
94-95’	Roda JC	8.56
01-02’	Sparta	7.41
06-07’	FC Twente	8.12
07-08’	NAC Breda	6.44
09-10’	Heracles	9.47
10-11’	Ado Den Haag	6.25
10-11’	Willem II	7.05

3.3.3 Overlap in line-up based on the previous game

In the subsection above we spoke about the overlap in line-up based on the openings match. It can be that a manager at the beginning of the season still is figuring out which composition of line-up is the best and because of that a lot of changes in line-ups take place. But it can also be that a manager intentionally changes the line-up regularly. This is usually done if a manager thinks he has a selection of players that are all almost equal in quality to each other. In that case he can choose to rotate with players without weakening the team. The idea behind this system may be that he provides competition between players and this way tries to keep his players mentally focused and another reason may be that he can give players rest if they need it. If this is the best strategy to follow to maximize the results remains to be seen. To examine if this behavior is present, we will look at the overlap in line-up based on the previous match. With other words how many players start in the line-up for a game that also started in the previous game? The results are shown in Table 6.

Table 6 Statistics about the number of overlap of players between two consecutive games.
* Significant with a significance level of ten percent.

Overlap previous line-up	***# of games***							
Club - manager	***11 players***	***10 players***	***9 players***	***8 players***	***7 players***	***6 players***	***5 players***	***Average overlap***
FC Utrecht*	5 games	12 games	8 games	5 games	2 games	1 game	-	33 games – 9.30players
Ab Fafie / interim	-	1 game	1 game	1 game	2 games	1 game	-	6 games – 7.83 players
Leon van Veen	5 games	11 games	7 games	4 games	-	-	-	27 games – 9.63 players
FC Volendam	6 games	9 games	13 games	3 games	1 game	1 game	-	33 games – 9.39 players
Fritz Korbach	3 games	6 games	5 games	2 games	1 game	1 game	-	18 games – 9.28 players
Wim Rijsbergen	3 games	3 games	8 games	1 game	-	-	-	15 games – 9.53 players
AZ*	6 games	10 games	6 games	4 games	6 games	-	1 game	33 games – 9.06 players
Henk van Stee / interim	4 games	3 games	-	2 games	-	-	-	9 games – 10.00 players
Co Adriaanse	2 games	7 games	6 games	2 games	6 games	-	1 game	24 games – 8.71 players
FC Groningen	1 game	7 games	11 games	9 games	3 games	1 game	1 game	33 games – 8.61 players
Dwight Lodeweges	-	4 games	1 game	2 games	-	-	-	7 games – 9.29 players
Ron Jans	1 game	3 games	10 games	7 games	3 games	1 game	1 game	26 games – 8.42 players
Sparta*	7 games	6 games	9 games	3 games	6 games	2 games	-	33 games – 8.97 players
Frans Adelaar	7 games	5 games	9 games	2 games	6 games	-	-	29 games – 9.17 players
Aad de Mos	-	1 game	-	1 game	-	2 games	-	4 games – 7.50 players
SC Feyenoord*	1 game	9 games	7 games	11 games	3 games	2 games	-	33 games – 8.64 players
Gert-Jan Verbeek	1 game	5 games	5 games	4 games	1 game	-	-	16 games – 9.06 players
Leon Vlemmings	-	4 games	2 games	7 games	2 games	2 games	-	17 games – 8.24 players

We direct see that the columns with 4 and 3 players are removed, because it simply did not occur that only 3 or 4 players remained from the previous match. On the other side we also see that a few managers, Ab Fafie, Dwight Lodeweges and Leon Vlemmings, not once started with the same line-up as in the previous match. If we look at the average overlap in line-up based on the previous match, we notice that the managers of FC Volendam show quite similar behavior in terms of overlap in line-up. The other managers differ from each other in average overlap. We again performed a Chow test to test if the differences in average overlap are significantly different. We found that the differences in overlap are significant for FC Utrecht, AZ, Sparta and SC Feyenoord.

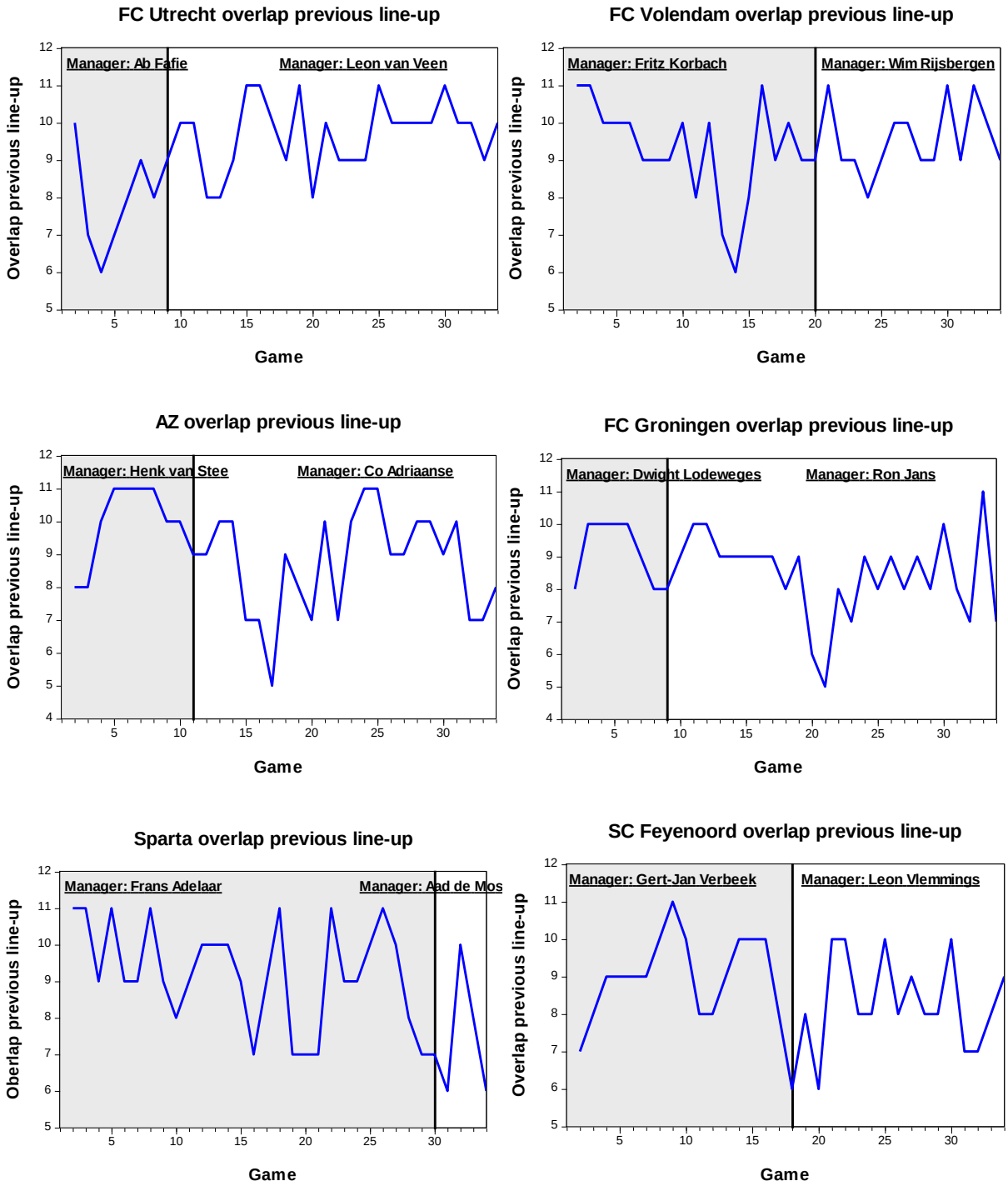
Figure 3 displays the overlap in line-up based on the previous match during the season. The opening game is excluded because there is no previous game available. The overlap in line-up based on previous match seems to fluctuate a lot more than for overlap in line-up based on the opening match. Especially AZ, Sparta and SC Feyenoord fluctuate a lot. The other teams are somewhat more stable in the number of overlap.

If we combine the results of this and the previous section we can make some conclusions. In the previous section we stated that the difference in average overlap based on the openings match was significant for FC Volendam, AZ, FC Groningen, Sparta and SC Feyenoord. This means that the managers showed significant different behavior in terms of overlap in line-up based on openings match. But at the same time we found in this section that the difference in overlap in line-up based on previous match was not significant for FC Volendam and FC Groningen. This tells us that there was a difference in behavior in terms of overlap based on openings match but no significant difference in line-ups between two consecutive games.

It is the other way around for FC Utrecht. There was no significant difference in average overlap based on openings match, but there was a significant difference for overlap in line-up based on previous match.

The managers of AZ, Sparta and SC Feyenoord have a significant difference in overlap in line-up based on openings match and based on previous match. The difference in performance between the managers although was not significant.

Figure 3 Overlap of players based on the line-up of the previous match.



Overlap in line-up based on previous match for managers who coached a whole season

We compare the results of above with the results of the managers who coached a whole season. The results of average overlap in line-up based on previous match for managers who coached a whole season can be found in Table 7. We notice that the average overlap in line-ups between two consecutive games is the lowest for Willem II and Sparta, only Roda JC has a lower average overlap. Sparta and Willem II performed badly. The other teams have a higher average overlap. If we compare this with the old and new managers in Table 6, we find that the new manager of Sparta, who performed less than his predecessor, also has the lowest average overlap compared to the other managers. This could be indicating that if average overlap is relatively low, performance declines. In the next sections we will examine if this is true.

Table 7 Overlap in line-up based on previous match for managers who coached for a whole season.

Season	*Club*	*Average overlap*
94-95’	Roda JC	8.56
01-02’	Sparta	8.91
06-07’	FC Twente	9.91
07-08’	NAC Breda	9.39
09-10’	Heracles	10.27
10-11’	Ado Den Haag	9.70
10-11’	Willem II	9.29

3.3.4 Overlap in line-up based on the first line-up of the new manager

In the previous sections we compared the overlap in line-ups based on openings match and previous match for the old and new managers. Also interesting to look at is the average overlap in line-up for the new manager. This means an overlap in line-ups where the line-up of the first match under the new manager is taken as a base. This way we can say something about the relationship between performance and the average overlap in line-up from the first game of both managers. We compare the average overlap in line-ups based on the first game of the new manager in Table 8 with the average overlap in line-ups based on the first match for the old managers (see Table 4). If we compare these average overlaps with each other we see that the average overlap for the new manager is higher than that of the old manager for FC Volendam, FC Groningen, Sparta and SC Feyenoord. While lower for FC Utrecht and AZ. So we can't detect a clear relationship between performance and average overlap in line-up between the new and old manager in this stage.

Table 8 The number of overlap of players based on the previous line-up.

Overlap first line-up new manager	***# of games***								
Club - manager	***11 players***	***10***	***9***	***8***	***7***	***6***	***5***	***4***	***Average overlap***
FC Utrecht									
Leon van Veen	1 game	-	2	13	9	2	-	-	27 games – 7.70 players
FC Volendam									
Wim Rijsbergen	2 games	3	9	1	-	-	-	-	15 games – 9.40 players
AZ									
Co Adriaanse	1 game	1	2	2	6	10	2	-	24 games – 6.96 players
FC Groningen									
Ron Jans	1 game	-	3	4	9	7	1	1	26 games – 7.08 players
Sparta									
Aad de Mos	1 game	1	1	-	-	1	-	-	4 games – 9.00 players
SC Feyenoord									
Leon Vlemmings	1 game	-	3	7	2	3	1	-	17 games – 7.71 players

4. Methodology

Until now we discussed the descriptive statistics of the data. In this section we will model the data.

A football match has three possible outcomes; by winning from an opponent a team earns 3 points, while a draw means one point and losing means zero points. The dependent variable therefore has three categories and takes on the corresponding discrete values 0, 1 and 3. A linear regression model which correlates the discrete choice of the dependent variable with the explanatory variables does not lead to a satisfactory model. This is because it relates a discrete variable with a continuous variable through a linear relation. Therefore we need a model that can map the explanatory variables onto one of the categories, that is 0, 1 and 3 points. The suitable model in this case is the ordered probit model because of the presence of a presumed ordering of the categories.

Consider the following latent regression:

$$y_i^* = X_i'\beta + \varepsilon_i \tag{3.1}$$

where y_i^* is a latent variable expressed in terms of utility, X_i contains the explanatory variables and ε_i the error term.

The variables X_i contain the line-ups of all the available teams from week to week on the basis line-ups: openings match, first match of the new manager and previous match. The variables contain values varying from 3 to 11, which stands for the number of players in that particular line-up that overlaps with a basis line-up. See also the appendix for all data.

The relationship between the latent variable y_i^* and the observed outcome y_i for team *i* can be summarized as follows:

$$\begin{aligned} &\text{Lost:} && y_i = 0 \quad if \quad y_i^* \le \mu_1 \\ &\text{Draw:} && y_i = 1 \quad if \quad \mu_1 \le y_i^* \le \mu_2 \\ &\text{Win:} && y_i = 3 \quad if \quad y_i^* \ge \mu_2 \end{aligned} \tag{3.2}$$

The cumulative distribution for the ordered probit model looks like

$$F(\mu_j - X_i\beta) = \Phi(\mu_j - X_i\beta) = \int_{-\infty}^{\mu_j - X_i\beta} \frac{1}{\sqrt{2\pi}} \exp(\frac{-z^2}{2})dz \tag{3.3}$$

Where X_i contains the explanatory variables and the intercept is set equal to zero for identification purposes. To estimate the parameters, we apply maximum likelihood. The likelihood is equal to:

$$L(\mu, \beta) = \prod_{i=s1}^{N} \prod_{j=1}^{J} (F(\mu_j - X_i\beta) - F(\mu_{j-1} - X_i\beta))^{I[y_i=1]} \tag{3.4}$$

And the log-likelihood is given by

$$l(\mu, \beta) = \sum_{i=1}^{N} \sum_{j=1}^{J} I[y_i = 1] \log(F(\mu_j - X_i\beta) - F(\mu_{j-1} - X_i\beta)) \tag{3.5}$$

The $\mu's$ and $\beta's$ are estimated by maximizing the log-likelihood by using the statistical package EViews 7.

In the ordered probit models it is possible that there is no significant difference between the thresholds $\mu's$. To check if the presumed ordering is present and hence if the ordered probit model is appropriate we will look at binary probit models, where we have 2 possible outcomes instead of 3. If the parameters in the probit model show the same sign and are roughly similar compared to the ordered probit model we can conclude that the presumed ordering is present and the ordered probit model is indeed appropriate.

The 2 possible outcomes in the probit model are not losing (draw 1 point and win 3 points) versus losing (lose 0 points). We will also look at winning (win 3 points) versus not winning (lose 0 points and draw 1 point). In notation it looks like below:

$$y_i = \begin{cases} 1 \ if \ \ team \ \ wins \ \ or \ \ plays \ \ a \ \ draw \\ 0 \ if \ \ team \ \ loses \end{cases} \tag{3.6}$$

$$y_i = \begin{cases} 1 \ if \ \ team \ \ wins \\ 0 \ if \ \ team \ \ plays \ \ a \ \ draw \ \ or \ \ loses \end{cases} \tag{3.7}$$

The probit model assumes a Bernoulli distribution,

$$y_i \sim BIN(1,\pi) = y_i \sim BIN(1, F(X_i'\beta)) \tag{3.8}$$

There is one draw and π is the cumulative distribution $F(X_i'\gamma)$. The cumulative distribution is the probability of {winning, draw} or winning in the respective models.

The probit model follows a normal distribution function, so the cumulative distribution $F(X_i'\beta)$ looks as follows:

$$F(X_i'\beta) = \Phi(X_i'\beta) = \int_{-\infty}^{X_i'\beta} \frac{1}{\sqrt{2\pi}} \exp(\frac{-z^2}{2})dz \tag{3.9}$$

where X_i represent the explanatory variables and β is the parameter vector.

Again we apply maximum likelihood to estimate the parameters and the likelihood we write as:

$$L(\beta) = \prod_{i=1}^{n} (\Phi(X_i\beta))^{y_i} \cdot (1-\Phi(X_i\beta))^{1-y_i} \tag{3.10}$$

And the corresponding log-likelihood function is

$$l(\beta) = \sum_{i=1}^{n} y_i \log \Phi(X_i\beta) + \sum_{i=1}^{n} (1-y_i) \log(1-\Phi(X_i\beta)) \tag{3.11}$$

We maximize the log-likelihood by using a numerical optimization algorithm. We estimate the parameters using the statistical package EViews 7.

Our binary probit model will look eventually as follows

$$y_i^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon_i \tag{3.12}$$

Dependent variable ordered probit model:

- Number of points won

Dependent variable binary probit models:

First case:

- $y_i = \begin{cases} 1 \ if \ \ team \ \ wins \ \ or \ \ plays \ \ a \ \ draw \\ 0 \ if \ \ team \ \ loses \end{cases}$

Second case:

- $y_i = \begin{cases} 1 \ if \ \ team \ \ wins \\ 0 \ if \ \ team \ \ plays \ \ a \ \ draw \ \ or \ \ loses \end{cases}$

Explanatory variables:

- X_1 = Overlap opening
  - Overlap in line-ups during the season compared to the openings match
- X_2 = Overlap previous
  - Overlap in line-ups between two consecutive games
- X_3 = Overlap first game
  - Overlap in line-up based on the first match of the new manager (only relevant for the new manager)

Interpretation

We are interested in the parameters β_0, β_1, β_2 and β_3 of model (3.12). In general we can say that if a parameter is significant and has a positive sign, an increase in overlap in line-ups will improve performance. And if a parameter is significant and has a negative sign it indicates that if overlap in line-ups increases, performance will decline.

Variables X_1 and X_2 contain information about the old and new manager. Earlier we examined if the difference in performance was significant or not between the old and new manager. When the difference in performance is significant and the coefficients β_1 and/or β_2 are significant, there will exist a relationship between performance and overlap in line-up. The old and new manager has a significant different behaviour in terms of overlap and their different strategy lead to significant different performances. Depending on the signs of these parameters we can say something about the role of the manager in team performance and how players relate to performance.

5. Results

In this section we will first discuss the parameter estimates and the interpretation of the parameters of the models. We will compare the results among managers who replaced a manager during the season and among the managers who last for a whole year. After that we will look at the comparison between managers to study the behavior of the different managers. And how this relates to performance and if there is a (common) pattern present.

5.1 Parameter estimates and interpretation of the parameters

In this subsection we will first discuss the results of the teams where a manager is fired and the performance improved or declined substantially. Next we will look at the results of the teams where the manager coached for a whole season. Finally we will give some findings and compare the results for both models.

5.1.1 Teams where a manager is fired during the season

We have six teams available for research, see also Table 1. But because of the few games the new manager of Sparta coached we will leave Sparta out of further consideration. The result will be not representative. This is unfortunate, because the performance of the new manager declined compared to the old manager and Sparta was the only team where this was the case.

We have three models where we use a ten percent significance level, because of the limited data available. We have simplified the names of the variables for convenience purposes. Table 9a shows the results of the ordered probit model while Table 9b and 9c are binary probit models where the dependent variable is clustered for respectively {draw, losses} and {wins, draw}. So instead of three possible outcomes we have now two possible outcomes. In the first case we have the outcomes wins and {draw, losses} and in the second case losses and {win, draw}. The binary probit models are used to check if the presumed ordering is present in the ordered probit model and hence if the ordered probit model is appropriate. The models show the coefficients of the variables and the corresponding standard errors between brackets. Instead that we discuss the different models separately, we will discuss the results per team.

FC Utrecht

The results are all insignificant with a ten percent significance level, except for the variable "Overlap opening" in Table 9b. The coefficient is positive, which indicates that if the manager leaves the line-up as much as possible intact compared to the openings match it will benefit the performance. Vice versa if the manager chooses to change his line-up regularly the performance will decrease compared to when he does not change the line-up regularly.

Table 9a Parameter estimates of the ordered probit model with dependent variable "points" and corresponding standard errors between brackets.

	FC Utrecht	***FC Volendam***	***AZ***	***FC Groningen***	***SC Feyenoord***
Overlap opening	0.60	-0.07	-0.35	0.32	-0.28
	(0.42)	(0.56)	(0.39)	(0.24)	(0.23)
Overlap previous	-0.21	**-1.21**	0.28	-0.16	0.27
	(0.28)	**(0.60)**	(0.17)	(0.18)	(0.25)
Overlap first game	0.23	**-1.22**	0.35	0.02	**-0.45**
	(0.26)	**(0.66)**	(0.34)	(0.17)	**(0.27)**

Table 9b Parameter estimates of the binary probit model where the dependent variable has two possible outcomes: wins and {draw, losing}. The corresponding standard errors are between brackets.

	FC Utrecht	***FC Volendam***	***AZ***	***FC Groningen***	***SC Feyenoord***
c	-5.91	NA	**-5.32**	-1.89	3.07
	(4.71)		**(3.00)**	(2.48)	(3.90)
Overlap opening	**0.87**	NA	0.13	0.38	-0.17
	(0.53)		(0.48)	(0.29)	(0.29)
Overlap previous	-0.31	NA	**0.48**	-0.06	0.02
	(0.33)		**(0.26)**	(0.21)	(0.28)
Overlap first game	0.19	NA	-0.02	-0.05	-0.34
	(0.30)		(0.40)	(0.18)	(0.28)

Table 9c Parameter estimates of the binary probit model where the dependent variable has two possible outcomes: {wins, draw} and loses. The corresponding standard errors are between brackets.

	FC Utrecht	***FC Volendam***	***AZ***	***FC Groningen***	***SC Feyenoord***
c	-2.98	**16.80**	-0.62	0.50	1.96
	(0.42)	**(9.10)**	(2.38)	(2.40)	(4.67)
Overlap opening	0.34	-0.08	-0.66	0.23	-0.61
	(0.45)	(0.59)	(0.45)	(0.27)	(0.53)
Overlap previous	-0.14	-0.84	0.18	-0.24	0.97
	(0.30)	(0.57)	(0.20)	(0.21)	(0.78)
Overlap first game	0.23	-0.78	0.56	0.06	-0.70
	(0.31)	(0.67)	(0.40)	(0.19)	(0.56)

FC Volendam

Because of too few observations if we cluster {losses, draw}, Table 9b shows no results for FC Volendam. In Table 9a, the variables "Overlap previous" and "Overlap first game" are significant and have a negative sign. This tells us that by decreasing overlap in line-ups between two consecutive games will increase performance. The same holds for the new manager when the overlap in line-ups is based on the first game of the new manager. The more the new manager change his line-up compared to his first game, the more performance will improve. So the best strategy for the manager to follow here is to replace all eleven players each game. Remember that the performance between the old and new manager is significant, see data section. This means that following the strategies above has lead to significant improved performance.

AZ

Of all variables only the constant and the variable "Overlap previous" in Table 9b are significant for AZ. The constant is negative so AZ tends to play a draw or lose a game then to win a game. This does not mean that AZ did not win a lot of games but there were more games that it lost or played a draw. It also does not indicate whether the performance of the team with the new manager improved or declined compared to the old manager.

The variable "Overlap previous" in Table 9b is also significant and has a positive sign. The new manager of AZ obtained the most points when he kept the line-up between two consecutive games as much as possible intact. So the performance will decline if the manager changes the line-up between two consecutive games compared to when the manager does not

change the line-up. This is in contrast with FC Volendam where it was the other way around, but the differences in performance between the two managers for AZ are not significant.

FC Groningen

There are no significant results at all, so it seems that the composition of the line-up has no effect on the performance of FC Groningen.

SC Feyenoord

In Table 9a the variable "Overlap first game" is significant, while all other variables are not significant. This means that for the new manager by decreasing overlap in the line-up with his first game will improve performance. Although "Overlap first game" is significant this has not lead to significant differences in performance.

5.1.2 The teams with one manager that remained during the whole season

We will look in this subsection at teams where one manager coached the team for a whole season. Therefore the variable "Overlap first game" is not applicable here. Table 10a shows the results of the ordered probit model. In Table 10b we clustered for the dependent variable {draw, losses} and in Table 10c we clustered {wins, draw}. We will again discuss the results per team. Remember that all teams performed very well except for Sparta and Willem II who performed badly.

In Table 10b we miss Willem II and in Table 10c we miss Roda JC. Willem II has only won one match according to our data and that is why the probit model predicts perfectly for the dependent variable for which the possible outcomes are wins and {draw, losses}. We do not have results in Table 10c for Roda JC because of too few observations.

NAC, FC Twente, Heracles and Ado den Haag

All results are insignificant; this implies that the composition of the line-up does not have an effect on the performance of the team.

Table 10a Parameter estimates of the ordered probit model with dependent variable "points" and corresponding standard errors between brackets.

	NAC	*Roda JC*	*FC Twente*	*Heracles*	*Ado d H*	*Sparta*	*Willem II*
Overlap opening	-0.02	**-0.67**	0.42	0.01	-0.08	**0.45**	-0.16
	(0.27)	**(0.38)**	(0.28)	(0.23)	(0.22)	**(0.16)**	(0.27)
Overlap previous	-0.22	**0.73**	-0.11	0.15	-0.15	**-0.24**	**-0.41**
	(0.23)	**(0.31)**	(0.24)	(0.24)	(0.23)	**(0.18)**	**(0.23)**

Table 10b Parameter estimates of the binary probit model where the dependent variable has two possible outcomes: wins and {draw, losing}. The corresponding standard errors are between brackets.

	NAC	*Roda JC*	*FC Twente*	*Heracles*	*Ado d H*	*Sparta*	*Willem II*
C	2.68	0.40	-3.94	-2.72 (3.45)	2.30	**-11.26**	NA
	(3.39)	(3.34)	(3.46)		(2.66)	**(5.82)**	
Overlap opening	0.04	**-0.69**	0.49	0.11	-0.01	**1.22**	NA
	(0.29)	**(0.40)**	(0.31)	(0.25)	(0.24)	**(0.65)**	
Overlap previous	-0.29	**0.62**	0.02	0.16	-0.22	**-0.05**	NA
	(0.25)	**(0.31)**	(0.26)	(0.26)	(0.25)	**(0.31)**	

Table 10c Parameter estimates of the binary probit model where the dependent variable has two possible outcomes: {wins, draw} and loses. The corresponding standard errors are between brackets.

	NAC	*Roda JC*	*FC Twente*	*Heracles*	*Ado d H*	*Sparta*	*Willem II*
C	2.88	NA	1.25	-0.16	2.42	-0.65	3.02
	(3.84)		(3.96)	(3.36)	(3.03)	(1.44)	(2.98)
Overlap opening	-0.14	NA	0.39	-0.11	-0.19	**0.39**	-0.16
	(0.32)		(0.41)	(0.25)	(0.25)	**(0.16)**	(0.27)
Overlap previous	-0.14	NA	-0.33	0.15	-0.05	**-0.27**	-0.29
	(0.27)		(0.34)	(0.26)	(0.28)	**(0.18)**	(0.23)

Roda JC

In Table 10a the variables "Overlap opening" and "Overlap previous" are significant, this is also the case for Table 10b. These variables have the same sign and are roughly similar. This suggests that the presumed ordering is present and that the ordered probit model is appropriate. The variable "Overlap opening" has a negative sign in both models, which indicates that the more different the line-up is compared to the line-up of the openings match the more performance will improve. However by changing the line-up between two consecutive games the performance will decline compared to when the manager doesn't change the line-up between two consecutive games. So it seems that Roda JC was successful by tossing the line-up upside down compared to the openings line-up for once in a while but did not change a lot in line-up between two consecutive games.

Sparta

In all models the variable "Overlap opening" is significant and all coefficients have a positive sign which indicate that the presumed ordering is present. The manager of Sparta increased performance when the overlap in line-up increased compared to the openings match.
The constant in Table 10b with a coefficient of -11.26 is also significant. Because of the negative sign, Sparta lost significantly more games or played a draw than that it won games.

Willem II

There is one significant result, which is the variable "Overlap previous" in Table 10a. The coefficient has a negative sign which indicates that the more different the line-up is between two consecutive games the more performance will improve.

We found earlier in the data section that the difference in performance between the managers is significant for FC Volendam. The variables "Overlap previous" and "Overlap first game" for FC Volendam are significant and have a negative sign in the ordered probit model. This tells us that by decreasing overlap in line-ups between two consecutive games will increase performance. Also when the new manager change his line-up compared to his first game, performance will improve. So the best strategy to follow is to replace all eleven players each game. Remarkable for the teams without a managerial change is that the strategy which is successful for Roda JC seems to have the opposite effect for Sparta and Willem II.

6. Conclusion and suggestions for further research

6.1 Summary and conclusion

In this article we researched the role of the manager on the performance of a football team and how overlap in line-ups affects the performance. In order to answer this question we used an ordered probit and two binary probit models. There are some interesting results but there seems not to be a uniform strategy that leads to improved performance. We have to note that the available data of teams that performed badly was limited. Nonetheless there are some interesting results.

Teams with a managerial change

We first will discuss the results for the teams with a managerial change during the season. We found that the variable "Overlap opening" is only significant for FC Utrecht in the first case of the probit model. It indicates that FC Utrecht improved performance if the manager duplicated as much as possible the line-up of the openings match. The performance declines if the manager uses a line-up with less overlap compared to the openings line-up.

The results found for AZ, are contrary to that of FC Volendam. Performance improves if the overlaps in line-ups between two consecutive games are more similar and the other way around. It seems that different strategies can lead to improved performance.

All variables for line-up for FC Groningen were not significant in the ordered probit model.

To improve performance the managers of SC Feyenoord should always change the line-ups compared to the line-ups in their first game.

The teams discussed above have no significant different performance between the managers.

We found that the differences in performance between the old and new manager are significant for FC Volendam.

The new manager of FC Volendam improves performance when the line-ups between two consecutive games differ more from each other. Performance declines if overlaps in line-ups between two consecutive games are more similar. It also holds that the more the new manager

changes his line-up compared to his first game, the more performance will improve. So the best strategy for the manager to follow here is to replace all eleven players each game. The difference in performance between the managers was only significant for FC Volendam. So following the above strategies lead to significant improved performance.

Teams without a managerial change

We also studied teams where one manager coached the team during a whole season as a control group. Because these teams have one manager during the season the variable "Overlap first game" is not applicable here.

Roda JC performed very well with the following strategy; the more different the line-up is compared to the line-up of the openings match the more performance will improve.
Sparta used the same strategy but this turned out not to be successful for them, because they performed badly. Sparta increased performance when the line-up was very similar compared to the line-up of the openings match. When the line-up differs more compared to the openings match, performance will decline.

Roda JC performed very well by leaving the line-up between two consecutive games as much as possible intact, while Willem II with the same strategy performed very badly. Willem II improved performance when it changed the line-up between two consecutive games. So it seems there does not exist a particular strategy to leads to improved performance.

Overall we have not found a uniform strategy in terms of overlap in line-ups that leads to improved performance. In some cases a strategy in terms of overlap in line-ups leads to improved performance, while the same strategy could lead to bad performance for another team. This is not strange because results are dependent of both the manager and players. Although the results for FC Volendam seems to suggest that decreasing the number of overlap with the previous game and the first game of the new manager, will improve performance.

6.2 Remarks and suggestion for further research

One can collect more data, because the data in our research is limited. Especially for teams that performed badly and where the new manager performed worse than his predecessor. Another suggestion could be teams that performed very well or bad over a couple of years and used one or two managers. This way you can get more insight in what role the managers play for a team and how this relates to performance.

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Appendix

A. Data of teams which fired their manager during the season

Explanation of variables:

- Overlap opening
  - Overlap in line-ups during the season compared to the openings match
- Overlap previous
  - Overlap in line-ups between two consecutive games
- Overlap first game
  - Overlap in line-up based on the first match of the new manager (only relevant for the new manager)

FC Utrecht season 1993/1994

Manager	Overlap opening	Overlap first game	Overlap previous	Points won
Ab Fafie	11			1
Ab Fafie	10		10	0
Ab Fafie	8		7	0
Ab Fafie	7		6	0
Ab Fafie	9		7	3
Ab Fafie	7		8	0
Interim	6		9	0
Leon van Veen	8	11	8	3
Leon van Veen	8	9	9	1
Leon van Veen	8	8	10	0
Leon van Veen	9	8	10	3
Leon van Veen	8	8	8	0
Leon van Veen	8	9	8	3
Leon van Veen	8	8	9	1
Leon van Veen	8	8	11	3
Leon van Veen	8	8	11	1
Leon van Veen	8	7	10	0
Leon van Veen	8	7	9	3
Leon van Veen	8	7	11	0
Leon van Veen	6	7	8	0
Leon van Veen	7	8	10	1
Leon van Veen	7	6	9	3
Leon van Veen	8	8	9	0
Leon van Veen	9	8	9	3
Leon van Veen	9	8	11	3
Leon van Veen	9	8	10	3
Leon van Veen	8	8	10	0
Leon van Veen	8	7	10	0
Leon van Veen	8	7	10	1
Leon van Veen	8	7	11	0
Leon van Veen	8	8	10	0
Leon van Veen	9	7	10	0
Leon van Veen	8	7	9	1
Leon van Veen	8	6	10	1

FC Volendam season 1993/1994

Manager	Overlap opening	Overlap first game	Overlap previous	Points won
Korbach	11			1
Korbach	11		11	0
Korbach	11		11	3
Korbach	9		10	0
Korbach	8		10	0
Korbach	9		10	0
Korbach	9		9	0
Korbach	9		9	3
Korbach	10		9	0
Korbach	9		10	0
Korbach	8		8	1
Korbach	8		10	0
Korbach	8		7	0
Korbach	6		6	3
Korbach	8		8	3
Korbach	8		11	0
Korbach	7		9	0
Interim	8		10	0
Interim	8		9	0
Rijsbergen	8	11	9	1
Rijsbergen	8	11	11	0
Rijsbergen	7	9	9	3
Rijsbergen	9	10	9	0
Rijsbergen	7	8	8	3
Rijsbergen	7	9	9	3
Rijsbergen	8	9	10	3
Rijsbergen	7	9	10	3
Rijsbergen	8	9	9	3
Rijsbergen	7	9	9	3
Rijsbergen	7	9	11	1
Rijsbergen	7	10	9	3
Rijsbergen	7	10	11	0
Rijsbergen	6	9	10	0
Rijsbergen	7	9	9	3

AZ season 2002/2003

Manager	Overlap opening	Overlap first game	Overlap previous	Points won
Henk van Stee	11			1
Henk van Stee	8		8	0
Henk van Stee	8		8	0
Henk van Stee	9		10	3
Henk van Stee	9		11	3
Henk van Stee	9		11	3
Henk van Stee	9		11	0
Henk van Stee	9		11	0
Henk van Stee	9		10	0
Interim	9		10	0
Co Adriaanse	9	11	9	3
Co Adriaanse	8	9	9	1
Co Adriaanse	9	9	10	3
Co Adriaanse	9	10	10	3
Co Adriaanse	8	7	7	0
Co Adriaanse	7	6	7	0
Co Adriaanse	7	7	5	1
Co Adriaanse	8	7	9	0
Co Adriaanse	6	6	8	0
Co Adriaanse	7	6	7	3
Co Adriaanse	5	5	10	1
Co Adriaanse	5	6	7	1
Co Adriaanse	5	6	10	3
Co Adriaanse	5	6	11	3
Co Adriaanse	5	6	11	3
Co Adriaanse	6	6	9	0
Co Adriaanse	7	8	9	1
Co Adriaanse	6	7	10	1
Co Adriaanse	7	8	10	0
Co Adriaanse	6	6	9	1
Co Adriaanse	5	5	10	3
Co Adriaanse	6	7	7	0
Co Adriaanse	7	7	7	0
Co Adriaanse	6	6	8	3

FC Groningen season 2002/2003

Manager	Overlap opening	Overlap first game	Overlap previous	Points won
Lodeweges	11			0
Lodeweges	8		8	0
Lodeweges	7		10	3
Lodeweges	6		10	0
Lodeweges	5		10	0
Lodeweges	6		10	0
Lodeweges	7		9	3
Lodeweges	6		8	0
Ron Jans	5	11	8	3
Ron Jans	5	9	9	0
Ron Jans	6	9	10	1
Ron Jans	5	9	10	1
Ron Jans	5	7	9	0
Ron Jans	5	8	9	0
Ron Jans	5	7	9	0
Ron Jans	6	7	9	0
Ron Jans	6	7	9	1
Ron Jans	8	8	8	3
Ron Jans	6	7	9	0
Ron Jans	4	7	6	1
Ron Jans	6	6	5	3
Ron Jans	6	6	8	1
Ron Jans	5	7	7	1
Ron Jans	7	7	9	0
Ron Jans	5	6	8	0
Ron Jans	3	6	9	0
Ron Jans	5	4	8	3
Ron Jans	5	5	9	0
Ron Jans	6	6	8	3
Ron Jans	5	6	10	3
Ron Jans	6	6	8	1
Ron Jans	7	8	7	0
Ron Jans	7	8	11	3
Ron Jans	6	7	7	1

Sparta season 2009/2010

Manager	Overlap opening	Overlap first game	Overlap previous	Points won
Frans Adelaar	11			0
Frans Adelaar	11		11	0
Frans Adelaar	11		11	3
Frans Adelaar	9		9	1
Frans Adelaar	9		11	0
Frans Adelaar	8		9	3
Frans Adelaar	9		9	1
Frans Adelaar	8		11	0
Frans Adelaar	7		9	0
Frans Adelaar	8		8	3
Frans Adelaar	7		9	3
Frans Adelaar	8		10	3
Frans Adelaar	8		10	0
Frans Adelaar	8		10	0
Frans Adelaar	6		9	0
Frans Adelaar	5		7	0
Frans Adelaar	5		9	1
Frans Adelaar	6		11	0
Frans Adelaar	7		7	0
Frans Adelaar	7		7	1
Frans Adelaar	7		7	0
Frans Adelaar	7		11	1
Frans Adelaar	7		9	0
Frans Adelaar	6		9	3
Frans Adelaar	6		10	1
Frans Adelaar	6		11	1
Frans Adelaar	7		10	0
Frans Adelaar	7		8	0
Frans Adelaar	6		7	0
Frans Adelaar	6		7	0
Aad de Mos	5	11	6	0
Aad de Mos	5	10	10	1
Aad de Mos	5	9	8	0
Aad de Mos	5	6	6	0

SC Feyenoord 2008/2009

Manager	Overlap opening	Overlap first game	Overlap previous	Points won
Verbeek	11			0
Verbeek	7		7	3
Verbeek	6		8	1
Verbeek	7		9	0
Verbeek	8		9	0
Verbeek	8		9	0
Verbeek	9		9	1
Verbeek	8		10	0
Verbeek	8		11	3
Verbeek	7		10	3
Verbeek	6		8	1
Verbeek	8		8	3
Verbeek	8		9	1
Verbeek	7		10	0
Verbeek	7		10	0
Verbeek	6		10	0
Verbeek	4		8	3
Leon Vlemmings	5	11	6	0
Leon Vlemmings	7	8	8	1
Leon Vlemmings	4	8	6	0
Leon Vlemmings	3	8	10	3
Leon Vlemmings	4	8	10	1
Leon Vlemmings	5	9	8	0
Leon Vlemmings	6	9	8	3
Leon Vlemmings	6	8	10	1
Leon Vlemmings	5	8	8	3
Leon Vlemmings	6	9	9	3
Leon Vlemmings	5	8	8	1
Leon Vlemmings	7	7	8	0
Leon Vlemmings	6	6	10	3
Leon Vlemmings	7	6	7	3
Leon Vlemmings	6	5	7	3
Leon Vlemmings	8	6	8	1
Leon Vlemmings	9	7	9	0

B. Data of the teams where one manager coached a team for a whole season

Twente season 2006/2007

Manager	Overlap opening	Overlap previous	Points won
Fred Rutten	11		0
Fred Rutten	9	9	3
Fred Rutten	9	11	1
Fred Rutten	9	9	1
Fred Rutten	9	11	3
Fred Rutten	9	11	3
Fred Rutten	9	11	3
Fred Rutten	9	9	3
Fred Rutten	8	10	0
Fred Rutten	8	10	3
Fred Rutten	8	10	1
Fred Rutten	8	10	3
Fred Rutten	8	10	1
Fred Rutten	8	11	3
Fred Rutten	8	11	1
Fred Rutten	8	10	3
Fred Rutten	8	10	3
Fred Rutten	8	11	0
Fred Rutten	8	10	3
Fred Rutten	8	11	0
Fred Rutten	9	9	3
Fred Rutten	8	10	3
Fred Rutten	7	10	3
Fred Rutten	7	11	3
Fred Rutten	7	11	3
Fred Rutten	6	8	1
Fred Rutten	8	8	3
Fred Rutten	8	10	0
Fred Rutten	7	9	1
Fred Rutten	9	9	3
Fred Rutten	8	9	1
Fred Rutten	7	9	0
Fred Rutten	7	10	1
Fred Rutten	8	9	3

Roda JC season 1994/1995

Manager	Overlap opening	Overlap previous	Points won
Huub Stevens	11		1
Huub Stevens	9	9	1
Huub Stevens	9	10	1
Huub Stevens	9	10	1
Huub Stevens	9	11	3
Huub Stevens	9	11	3
Huub Stevens	9	10	3
Huub Stevens	9	10	3
Huub Stevens	9	11	3
Huub Stevens	9	11	3
Huub Stevens	10	10	1
Huub Stevens	9	10	3
Huub Stevens	8	10	3
Huub Stevens	9	9	3
Huub Stevens	9	10	1
Huub Stevens	9	11	3
Huub Stevens	8	10	3
Huub Stevens	9	9	0
Huub Stevens	8	8	3
Huub Stevens	7	9	1
Huub Stevens	8	9	3
Huub Stevens	8	8	3
Huub Stevens	7	9	3
Huub Stevens	8	10	1
Huub Stevens	9	9	3
Huub Stevens	8	9	3
Huub Stevens	8	8	0
Huub Stevens	8	9	3
Huub Stevens	9	9	1
Huub Stevens	8	9	3
Huub Stevens	8	10	3
Huub Stevens	8	10	3
Huub Stevens	8	8	1
Huub Stevens	8	10	3

NAC season 2007/2008

Manager	Overlap opening	Overlap previous	Points won
Ernie Brands	11		0
Ernie Brands	8	8	0
Ernie Brands	8	8	3
Ernie Brands	8	7	3
Ernie Brands	7	9	3
Ernie Brands	6	9	1
Ernie Brands	7	10	3
Ernie Brands	6	9	1
Ernie Brands	6	10	0
Ernie Brands	5	10	3
Ernie Brands	6	11	1
Ernie Brands	6	11	1
Ernie Brands	6	10	3
Ernie Brands	6	11	3
Ernie Brands	6	10	0
Ernie Brands	7	10	0
Ernie Brands	6	10	0
Ernie Brands	7	10	1
Ernie Brands	5	8	3
Ernie Brands	6	10	3
Ernie Brands	7	8	3
Ernie Brands	6	10	3
Ernie Brands	6	9	3
Ernie Brands	8	10	3
Ernie Brands	7	8	3
Ernie Brands	6	10	0
Ernie Brands	6	10	3
Ernie Brands	6	9	0
Ernie Brands	5	9	3
Ernie Brands	5	9	1
Ernie Brands	6	8	3
Ernie Brands	6	10	3
Ernie Brands	6	10	3
Ernie Brands	6	9	0

Heracles season 2009/2010

Manager	Overlap opening	Overlap previous	Points won
Verbeek	11		3
Verbeek	9	9	1
Verbeek	11	9	0
Verbeek	11	11	3
Verbeek	11	11	0
Verbeek	8	8	0
Verbeek	10	9	1
Verbeek	9	10	3
Verbeek	11	10	0
Verbeek	10	10	3
Verbeek	11	10	3
Verbeek	10	10	3
Verbeek	10	11	0
Verbeek	10	11	0
Verbeek	8	9	3
Verbeek	10	9	3
Verbeek	10	11	3
Verbeek	10	11	3
Verbeek	9	9	0
Verbeek	8	11	1
Verbeek	9	10	0
Verbeek	9	11	3
Verbeek	9	11	0
Verbeek	8	10	0
Verbeek	9	10	3
Verbeek	9	11	3
Verbeek	9	11	1
Verbeek	9	11	3
Verbeek	9	11	0
Verbeek	9	11	3
Verbeek	9	11	1
Verbeek	9	11	3
Verbeek	9	11	0
Verbeek	9	10	3

Sparta season 2001/2002

Manager	Overlap opening	Overlap previous	Points won
Frank Rijkaard	11		0
Frank Rijkaard	10	10	3
Frank Rijkaard	10	11	0
Frank Rijkaard	9	9	11
Frank Rijkaard	8	9	0
Frank Rijkaard	7	8	1
Frank Rijkaard	9	8	1
Frank Rijkaard	9	9	3
Frank Rijkaard	9	6	0
Frank Rijkaard	9	10	0
Frank Rijkaard	9	10	3
Frank Rijkaard	9	10	0
Frank Rijkaard	9	10	0
Frank Rijkaard	9	9	3
Frank Rijkaard	8	8	1
Frank Rijkaard	8	9	1
Frank Rijkaard	8	9	1
Frank Rijkaard	8	10	0
Frank Rijkaard	7	8	1
Frank Rijkaard	8	10	1
Frank Rijkaard	8	11	0
Frank Rijkaard	8	9	1
Frank Rijkaard	8	11	0
Frank Rijkaard	7	10	1
Frank Rijkaard	5	6	0
Frank Rijkaard	6	11	0
Frank Rijkaard	6	11	0
Frank Rijkaard	4	7	0
Frank Rijkaard	4	7	0
Frank Rijkaard	4	7	0
Frank Rijkaard	4	8	0
Frank Rijkaard	5	10	0
Frank Rijkaard	4	6	0
Frank Rijkaard	5	7	1

Ado den Haag season 2010/2011

Manager	Overlap opening	Overlap previous	Points won
John van den Brom	11		0
John van den Brom	8	8	0
John van den Brom	7	9	3
John van den Brom	7	11	1
John van den Brom	7	11	1
John van den Brom	6	10	3
John van den Brom	7	10	3
John van den Brom	6	10	1
John van den Brom	7	10	3
John van den Brom	7	11	0
John van den Brom	8	10	0
John van den Brom	5	9	3
John van den Brom	5	9	3
John van den Brom	5	10	1
John van den Brom	5	11	3
John van den Brom	5	11	0
John van den Brom	4	9	0
John van den Brom	4	8	1
John van den Brom	6	9	3
John van den Brom	6	7	3
John van den Brom	6	9	3
John van den Brom	6	11	3
John van den Brom	6	10	3
John van den Brom	6	10	1

***The competition in season 2010/2011was not finished when we collected the data for our research.**

Willem II season 2010/2011

Manager	Overlap opening	Overlap previous	Points won
Geert Heerkes	11		0
Geert Heerkes	10	10	0
Geert Heerkes	10	11	0
Geert Heerkes	8	9	0
Geert Heerkes	8	9	0
Geert Heerkes	8	10	0
Geert Heerkes	6	8	0
Geert Heerkes	7	10	1
Geert Heerkes	5	9	0
Geert Heerkes	5	11	0
Geert Heerkes	6	10	0
Geert Heerkes	6	11	1
Geert Heerkes	6	11	0
Geert Heerkes	7	9	0
Geert Heerkes	6	10	0
Geert Heerkes	5	9	1
Geert Heerkes	8	7	1
Geert Heerkes	7	10	0
Geert Heerkes	7	8	0
Geert Heerkes	7	6	3
Geert Heerkes	6	9	0
Geert Heerkes	6	8	0

***The competition in season 2010/2011was not finished when we collected the data for our research.**