

Coach dismissal during the season and its impact on team performance in European top 5 leagues

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Kasper Liikonen
Aalto University School of Business
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Author Kasper Liikonen

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Abstract

This paper studies how the change of head coach in the middle of the season affects a team's success. Data have been collected from the top 5 leagues in Europe between the seasons 2015/2016 and 2019/2020. In measuring the success of the head coach changes in the middle of the season, I used the actual results, i.e., points, and used the expected points (xP) to measure the development of the team's game performances between head coaches. In comparing the head coaches, I used a short time frame and a longer time frame. After the change of head coach during the short time frame, the teams did better in terms of both points and expected points (xP) than before the change of head coach. In the longer term, teams are able to collect more points and game performances are better under the new head coach. However, the results showed that the team is not able to collect points or expected points as well as in short time frame. Despite of this, I conclude that replacement of head coaches does improve team performance.

Keywords Football, Managerial Turnover, Expected Points, Team Performance

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1 Introduction

A change of management is a standard operation in the corporate world. Generally, management changes when the CEO contract ends or the CEO retires voluntarily. The company moves forward with the strategy chosen by the CEO, and the company is allowed to operate in a stable state. After the end of the CEO's contract, a new CEO may be selected who may continue along the same lines as his predecessor or bring his strategy to the company that his subordinates should adopt. If the new approach brings results, the shareholders will be satisfied. Such a model works in the ideal world, but sometimes the CEO cannot do a good enough result in the opinion of the owners, in which case the CEO may be fired (Warner et al., 1988 and Weisbach, 1995). In such a case, usually the pressure to fire the CEO comes from outside the company, such as shareholders, the media, or in football, from the fans, which makes the CEO a scapegoat for poor performance (Khanna & Poulsen, 1995).

Today, many studies look at management change. For example, studies have been conducted that have examined that poor performance is the reason for the dismissal of people in management positions and its impact on the company. Studies have been conducted where it has been investigated that poor results are to blame for dismissal and what effects it has on the company. Management separation has clear links to a company's poor success, and this has been studied by Groves, Hong, McMillan, and Naughton (1995). However, it may be that the economy or the industry in question is doing poorly, in which case the CEO's responsibility would be less for poor results.

For this reason, owners should be able to compare their own company's performance with the performance of other companies in the same industry (Bertrand & Mullainathan 2001). After all, it would not be fair to blame the CEO for the global recession. This begs the question: how much responsibility does the CEO have for the success of the company? A company's success, such as share prices, is affected by countless things that the CEO cannot control. Rosen (1990) says that the cause-and-effect relationship between the CEO's actions and the company's success is difficult to prove.

Is termination good or bad for the company? There have been studies of this for and against. According to Warzynski's (2004) research, the change of management of poorly successful companies brings positive results. However, there are also those whose research shows that the change of management fails in most cases (see, for example,

Burnes & Jackson 2011). Without better real-time metrics, the change in stock prices has been used as a measure of success, and from this perspective, it has not been observed that a change in management brings better success (Cools & van Praag, 2003). In comparison, Huson et al. (2004) said that: "... that turnover announcement abnormal stock Returns are significantly positively related to subsequent changes in operating performance measured using accounting numbers. This suggests that investors view turnover announcements as good news because they expect that turnover will prompt performance Improvements, on average".

Although the world of football is slightly different from the world of business, the two have many similarities. Like the stock market, football is monitored really closely on a daily basis and each social class is in its own way tied to the sport on a daily basis, unlike the stock market. In football, a team's success is relentlessly monitored, big money is at stake, and the team's success is rewarded, or failure is penalized; in this case, usually the head coach is the one who suffers. This is understandable as the coaches decide the line-ups for the games, what tactics the team will use, what kind of background team he will bring, what kind of players he will bring to the team, etc. So, it is not too wrong to assume that team success expectations pile up on the head coach. Here, too, research has been done into how much the team's results are the head coach's responsibility. Van Ours et al. (2016) are skeptical in their research of how much a head coach can affect a team's success on the field, while van Ours and van Tuijl (2015) cite Anderson & Sally (2013) in their study, which argued that the head coach's effect is not negligible.

Like CEOs in a corporate world, head coaches often end up as scapegoats for a team's poor success. They are considered to have put their club in a bad position where the possibility is, for example, relegation from the league. In a situation like this, fans, sponsors, and the media often put increasing pressure on club owners to make tough decisions. Even when the coach had been in the role for a long time, relegation out of the league would be a massive shock to the club financially. A good example is the top 5 leagues in Europe and especially in England, where the revenue generated by TV money is enormous. In the 2017/18 season, Aston Villa received £ 7.44 million in basic award, solidarity payment and TV money (not including possible remaining TV Picks or possible play-offs) while playing in the EFL Championship (England's second-highest league level). For comparison, West Bromwich Albion, which played in the Premier League and finished last, earned £ 12.8 million in TV money alone. In addition to that, West Bromwich Albion received £ 80.4 million pot that is distributed to each team in the Premier League (Dicken, 2019). Speaking of such large sums of money, it can be said that

staying in the highest league is important for the future of the teams when speaking financially. The strategy and profitability of the entire club as a business may change completely. Financial losses affect player transfers because playing on a lower budget and at a lower league level makes it difficult for a club to get good purchases. That is why clubs try to get the best players to keep themselves at the main league level. However, in the middle of the season transfer window is limited to August-September and January, so a vital player transfer may not be available to reverse the team's course. As a result, club management usually ends up replacing the head coach of their poorly performing team. Especially the demands of the fans to change the head coach put a lot of pressure on the owners of the club. Pieper, Nüesch, and Franck (2014) found in their study that the pressure exerted by fans on a change of head coach is more significant than, respectively, in a business world, a change of CEO when a team/company is doing poorly.

The club owners of a poorly performing team often have no radical alternative but to fire the head coach. A considerable amount of research has been done in this area, whether why the head coach has been dismissed or whether the change of head coach has yielded positive results. Bryson et al. (2021) concluded in their study that a team's poor performance relative to expectations increases the likelihood of dismissing a head coach. A team that performs well against expectations does not usually change head coach in the middle of the season. The performance of a football team is measured much more often than that of corporations. Games come weekly or even semi-weekly, while companies' operations are often looked over a more extended period. This is one reason why a change of head coach in the middle of the season happens more often than a change of CEO (van Ours, van Taijil 2015). Although football teams and listed companies are judged on results, there are differences. The results companies are affected by many things that are within the reach of the company's management, which means that poor results can be more easily forgiven. In football, on the other hand, many clubs and club management make quick decisions if the team's results are not good, and the decision is often the dismissal of the head coach. For this reason, this bachelor's thesis looks at the performance of teams in the light of points, which measures actual success, and the expected points (xP), which tells how well a team is actually performs on the field.

1.1 Research objectives and research questions

First, I want to tell you why I came up with this topic. In my own football career, I have faced two coach changes in the middle of the season. In addition to this, whenever I have encountered a team that has recently changed coach in the middle of the season, it is said that the opposing team is now at its most dangerous. These things sparked interest in the topic of coach dismissal and whether it was true that “the new broom effect” (Sliwka et al., 2015) was true, how the team would succeed after the first games for the rest of the season and whether the new head coach will help get better results for the team.

The study first examines how the change of head coach affects teams in the short term, and in this study, the short term is limited to the first five games. These first five games are also compared to the last five games of the old head coach, which aims to look at the differences that arise from a change of head coach. The study also examines how certain parameters predict points in the first five games.

Another research question is how the team will perform under the new head coach after the first five games, and whether there will be any productive changes in teams form from the first games in these subsequent games.

However, the most important research question is whether a change of head coach middle of the season is actually a good thing for teams. For this reason, the study will look at the differences in both, the points and the team's performance, before and after the change of coach during season.

1.2 Scope of research and methodology

In this research, focus is on the impact of the dismissal of the head coach on team performance. Data was collected on coach changes in the middle of the season in the top 5 leagues in Europe, namely English Premier League, German Bundesliga, Italian Serie A, Spanish La Liga and French Ligue 1 from seasons 2015-2016 to 2019-2020. Data included cases where both head coaches had had time to coach the team for at least 8 games during that season. This is because we would get to see if a “new broom effect” exists under the new head coach, of which Sliwka et al. (2015) spoke in their own study. If a team changed head coach twice during the season, I only considered the games of all

the coaches if each of them was in the job for at least 8 games. There were 149 coach changes during all seasons that fit my data filters.

Studies like this have been done in two different ways: in a naive way, which only examine situations where the head coach changes have taken place, and in a way where control groups have been included, which also look at teams that have performed poorly but did not change head coach. I set out to do the research in a naive way because I use the expected points (xP) in my study and this variable has not been used before in studies like this examining the impact of a change of head coach on team performance. Purpose and explanation of expected points (xP) will be explained in more detail in chapter 3.1.

The following methods were used to do this thesis. First, relevant studies related to the topic were used. Studies in both football and the financial world and academic literature were used to discuss management change and the success of new management. In order to ensure a high level of quality and relevance, the aim was to use publications with a high number of citations and the publisher is well known.

Data was collected from transfermarkt.com, a prestigious site in the football industry that was able to ascertain exactly when a coach change had taken place. Another page from which data was collected was understat.com which allowed a closer look at the league situations used in the study and which also showed the accumulation of teams expected points (xP). All research, calculations and figures were performed manually using Excel.

Collecting data manually is, of course, error prone. However, the amount of data was not so large as to cause inconvenience. Gathered by hand, I was also able to exclude periods of temporary head coaches as well as periods by head coaches who did not last 8 games in position. Exclusions like this make the data better when short head coach periods are left out of the data.

1.3 Structure of the research

The rest of the thesis is structured as follows. Chapter 2 presents previous research and literature on the subject. Chapter 3 introduces what the expected points mean and the findings from the data, which is continued in Chapter 4 where the data is used to compare

the team's results under the new and old head coach. Chapter 5 presents the conclusions and discussion of the results

2 Literature review

Team sports give researchers many opportunities to look at different phenomena. Especially a lot of data has been obtained from football, especially about the change of head coach, which can be compared to the dismissal of CEO. The change of coach and its effects on the team have long been of interest to researchers, and in recent years more and more detailed research has been done from many different perspectives. One research angle is that the likelihood of the head coach getting fired. A common addition to those studies is odds from bookmakers. Pieper et al. (2014) examine how expectations affect the position of the head coach. They used bookmakers' odds to analyze their effect on the probability of involuntary turnover of team coaches in the highest German soccer league, the Bundesliga. They used the odds because they show the expectations of others for team performance versus owners' exuberant expectations. They found that higher expectations for the team would increase the dismissal chance.

d'Addona & Kind (2014) explored in their study what things drove head coach dismissals at England's top four league levels in six decades. They investigated both long- and short-term impacts using discrete-choice logs and proportional hazard models. They concluded that the likelihood that the link between head coach fired and long-term team performance has remained stable over the decades. However, the impact of short-term success has increased significantly over the years. They suspected that the growing importance of the economy had been the reason for this.

De Paola & Scoppa (2011) investigate how in Serie A (Italy's highest league level) a change of coach affects team performance. They measured success with points, goals scored, and goals conceded. They found that it emerges that coach replacement does not produce statistically significant effects on team performance. They suspected the change of coach was due to reasons other than the team's expected improvement of team's performance.

Bas ter Weel (2011) also studied how the change of head coach affects the team's performance in the Dutch league, and he also concluded that no significant improvements occur. He also used the quality of the head coach as one of the variables.

One new practice in research has been the addition of a control group. In this way, it was possible to see whether or not the old coach should have stayed in a job.

Among others, Baldock et al. (2010), van Ours & van Tuijl (2015), Bruinshoofd & ter Weel (2003), Audas et al. (2002) have used this method in their research. With the control group, they strive to define coaching effectiveness and efficiency separately. According to them, the idea of a control group is simple. They, therefore, compare teams that differentiate the head coach due to the performance dip versus those who, despite the performance dip, stick to the same head coach. The result of each of the three studies was that the team whose head coach was fired performed as well or worse than the teams in the control group. Baldock et al. (2010) also found that control teams recover faster than teams that fired the head coach. van Ours & van Tuijl (2015) believed that similar studies could be conducted in the business world.

Forrest & de Dios Tena (2007) approached the effects of the change of head coach on the team's home and away games. They calculated that almost all the positivity, which was modest, for teams with a new head coach comes from the home games. However, they pointed out that these positive changes diminish after the first home games.

Muehlheusser, Schneemann, Sliwka (2015) examine the effect of team composition (homogeneous or heterogeneous) on how well a team succeeds after a change of head coach. They also approached the issue through player psychology. The assumption they have in their research is that when a new head coach joins in the middle of the season, all players have a bigger desire to show their skills to the new coach. However, so that homogeneous teams survive these difficult stages better than heterogeneous teams. Unlike Forrest & de Dios Tena (2007), according to Sliwka et al. (2015), the overall average effect of dismissal into home and away performance reveals that performance increases more in away games. Sliwka et al. found in their study the "new broom effect", which means that the positive effect of the new head coach in scents diminishes over time, which is in line with other similar studies.

As discussed above, previous studies examined the determinants of coach dismissal and the effects of coach dismissals on team performance. Studies on the determinants of coach dismissals often use duration analysis, that is, a hazard rate approach in which the probability to be dismissed after a particular match conditional on not having been dismissed up to that match is assumed to be dependent on past performance, coach characteristics, and sometimes the time in the season. Studies that focus on the coach's dismissal impact on team performance are a little more complex. The options are a naive way or a way where the control group is also involved. The research done in a naive way ignores the fact that the team could have improved its results even without a change of coach. The downside of the control group approach is that it does not fully tell about the

team's and coach's ability to turn the course. This is because it is impossible to measure the different chances of one team at the same time. In other words, it is never possible to know with absolute certainty whether or not the old coach would have had the course turned in the future, as psychological factors have a significant influence on the matter. In addition, almost all research focuses on top European leagues, which should also be taken into account.

3 Data and methodology

This section starts with explaining methodological approach. In addition, the expected points (xP) and the expected goals (xG) are also explained.

3.1 Methodology

As already discussed in Section 1.2, the research question for this bachelor's thesis were whether a change of head coach in the middle of the season is it a good solution for a team or not, in short and longer time frame. In short time frame, the comparison is the last five games of the old head coach and the first five games of the new head coach. In this way, it will be seen whether the new head coach will be able to turn the team's course for the better as soon as he starts his job. In the longer term, in the review will have all the head coaches games of the season. In this way, the impact of a change of head coach on team performance can be examined in the longer term. Another research question is how the team's performance level will change after the first five games under the new head coach. In this comparison comes the first five games of the new coach and the games after the first five games.

The study has used quantitative data collected from two different sites: transfermarkt.com and understat.com. From these sites, I collected head coach changes in Europe's top 5 leagues during the 2015-2020 seasons, as well as team points and xP. From transfermarkt.com I got information about the changes of head coaches and from understat.com I was able to collect the performances of the teams under both the old and the new head coach. Initially, I removed from each season and league head coach exchanges that did not meet my criteria. My criterion was, that both, the new and old head coach, had to be in charge at least eight league games. Then when a head coach exchange with matching criteria was found, I limited the games for a particular team to the time the old head coach was in charge before he was fired. In addition to this, I also limited the results under the old head coach to the last five games, because I needed this information for a short time frame comparison. I collected teams points and xP from whole season when old head coach was in charge and his last five games as well, that I transferred to an Excel spreadsheet. I also collected the same information about the new head coach, that is, for the entire period during that season, first five games and the games after the first five games of the new head coach and then transferred them to an Excel spreadsheet. In some cases, the team had changed head coach more than once

during the season. In such a case, I added the results during the head coach to the data if the eight-game criterion was met by at least two head coaches.

Eventually, I included 149 head coaches changes in my data. I divided the data into five different categories: all games of the old head coach, the last five games of the old head coach, the first five games of the new head coach, the games after the first five games of the new head coach and all the games of the new head coach. In addition to total points and xP, I added a point and xP per game to the data. This makes the comparison more meaningful because the teams played different numbers of games. Because the data was collected manually, I checked the data for errors before analysing. Once this was done, I started the analysis for which I mostly used means in points and xP. In addition to the means, I used paired t-test, simple linear regression, and multiple regression analysis. In addition, I used the tools in Excel to make histograms and scatter plots to describe the results of different teams.

I used a naive approach to the study. This is because xP has not been used to measure team success in similar studies. For this reason, I wanted to ensure that this measure is suitable for such a study, and therefore, if, xP brings new dimensions to this field of research, it can be used in more complex studies in the future. xP is certainly a new acquaintance for many and that is why I have used one paragraph to explain it. I then present the results obtained from the data in Table 1.

3.2 What is xP?

In order to understand what xPoints (xP) means, the first thing is to understand the biggest factor of xP, which is the expected goals (xG). xG is a performance metric used to evaluate football team and player performance. It can be used to represent the probability of a scoring opportunity that may result in a goal. Example: "...Using data from thousands of hours of video, a number is calculated that reflects the likelihood of an opportunity resulting in a goal. In the case of an open goal from a yard out, this number might be 0.99 (99% chance of a goal), while a piledriver from 30 yards on a

striker's weaker foot might be 0.05...." (Page, 2020). The origin of xG is disputed, but in the 1990s the name was first used by Barnet and Hilditch.

So how does xG relate to xP? That is the core of the whole xP. Football analysts use the expected goals (xG) by both teams from the game and take advantage of these in the Monte Carlo simulation. The simulation calculates 10,000 times the expected points for both teams from a given match using xG probabilities and then tells how many points the team was expected to get out of that game (0-3 points). Image 1 shows how points would be divided if team A shots twice at places where the total xG would be, let us say, 1.01 (0.5 + 0.51) and team B shots five times with xG also being 1.01. However, in this case xPoints are bigger for Team A even though they got fewer shots Because the Monte Carlo simulation calculates probabilities, usually in situations like these, where teams as a whole have an equal xG, the simulation emphasis more on high-quality scoring areas, because these scoring locations have a statistically better chance of success in scoring goals.

Match Expected Goals Simulator

Team Shots by Probability

Team A Shots

Team B Shots

Calculate

Summary Results

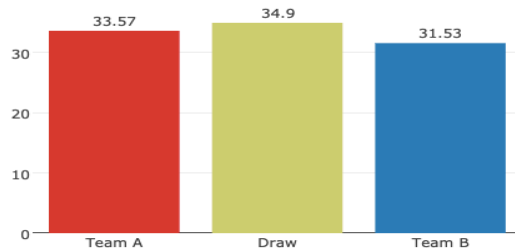
	Goals	M A Dev	Shots	Win%	PPG
A:	1.01	±0.51	2	34%	1.36
B:	1.01	±0.56	5	32%	1.29

Share these results!

Right Click -> Copy Link Address

Match Graphs

Result Percentage



Points Per Game

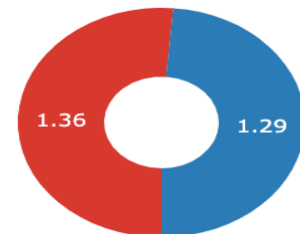


Figure 1. Example of how xG is used to estimate xP. Note! (M|A|Dev) means standard deviation.

Photo from: https://danny.page/expected_goals.html

Shortly, xP evaluates how good opportunities the team has been able to create itself and what opportunities the opponent has had in the game. Higher quality xG partly indicates

that a team that has been able to create a lot of high quality xG chances while preventing an opponent from getting similar chances, has usually played better in the game. This leads to overperformance and underperformance. If a team is consistently able to generate a higher xG than its opponent but is unable to collect points as expected, the team is considered to be underperforming relative to its game performance. Underperformance generally means poor results and as described by Bryson et al. (2021) found in their own research that the head coaches of poorly performing teams are under threat of dismissal. For this reason, xP has been taken as one measure in this study.

4 Results from data

In this section, the results of new and old head coaches are collected from the data. The table includes the mean of the points, the mean of xP, and the standard deviation. The means for points and xP have been introduced as not all teams have played the same number of matches. Table 1 shows the results of all the games of the old head coaches and the last five games and the results of the new head coaches of the first five games, the games after the first five games, and the games of the whole season.

	Mean points per game	STDEV. (Points)	Mean xPoints per game	STDEV. (xP)
All the games of the <u>old</u> coaches n=149	0.936	0.392	1.165	0.3
The last five games of the <u>old</u> head coaches n=149	0.706	0.489	1.051	0.378
The first five games of the <u>new</u> head coaches n=149	1.366	0.693	1.314	0.446
After the first five games of the <u>new</u> head coaches n=149	1.195	0.551	1.254	0.356
All the games of the <u>new</u> head coaches n=149	1.253	0.482	1.281	0.333

Table 1. Mean points per game, mean xP per game and standard deviations of all head coaches at different time frame.

Next, a brief review of the team's performance under the old head coach. After this, research looks at the performance of the teams under the new head coaches and answer one of the research questions on how teams are doing when comparing new head coaches results on the first five games and the results after the first five games.

4.1 Team statistics under the old coach

This section looks briefly at all the games of the old head coach from the season and his team's points per game and xP per game, after followed by a review of the head coach's last five games, taking into account that team's points per game and xPoints per game.

As Table 1 shows, both the mean points per game and the mean xP per game are worse in the last five games. The mean points per game for the whole season is 32% higher than in the last five games, and mean xP per game is also bigger for more than 10% for the whole season than in the last five games. It is conceivable that the team has failed to take advantage of its opportunities in the games, but also the level of play has dropped in the last games. Out of 149 cases, 34 team's mean points per game was better in the last five games when compared to the team's whole season mean. In addition, out of 149 cases, 114 teams did not perform as expected by xP, i.e., underperformed. This may be the reason why coaches have been fired. This thesis does not delve deeper into the performance of the old head coaches and their teams but continued to study more from the perspective of the new head coaches.

4.2 Team performance under the new coach

This section looks at the performance of the new head coach and his team in the first five games, as well as performance after five games, and compares whether there are any changes in team performance between these time frames.

4.2.1 Impact of the change of head coach, in the short term

When a new head coach joins a team, usually the team suffers from a bad phase (De Paola & Scoppa, 2011). Unlike before the start of the season, the new head coach does not have much time to change the team's game performances in the middle of the season because the next game may only be a few days away. So, one important thing for a new head coach

is to make the team perform better again and, above all, to collect points. In addition, xP was used to measure team performance to actual points because it better tells how the team's actual game performances have evolved. Table 2 presents a simple linear regression estimation of how a team's performance (xPoints) affects a team's actual points in the first five games under the new head coach. A significant regression equation was found with an R^2 of 0.439. Predicted points is equal to $0.068+1.03(xP)$. Team's points increase 1.03 every xPoints they get, so a team that has played statistically well can expect to get more points than a team that has not been able to perform as well statistically.

Table 2. Estimates results for explained variable first five games points per game from regression.

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.068	0.666	0.103	0.918
xP, First 5 Games	1.030***	0.096	10.727	$p < 0.0001$

***Indicates significance at 1%. $n=149$. $R^2=0.439$. $F=115.06$

Next step is to look at how the new head coaches succeeded during their first five games. The first five games were chosen because the goal was to see how the team would react to the new head coach in the short-term timeline. During this time, the head coach does not have time to make too radical changes to the team and in which case we can assume that the new head coach has the same tools at his disposal as the old head coach.

As Table 1 shows, the change of head coach had a positive impact on the teams. Overall, the teams slightly outperformed in the first five games against xP, though not radically. Figure 2 shows how the performances of the teams were distributed. In the Figure 2, xP per game is subtracted from the actual points per game. The mean difference when looking at PPG-xP for all observations is 0.052.

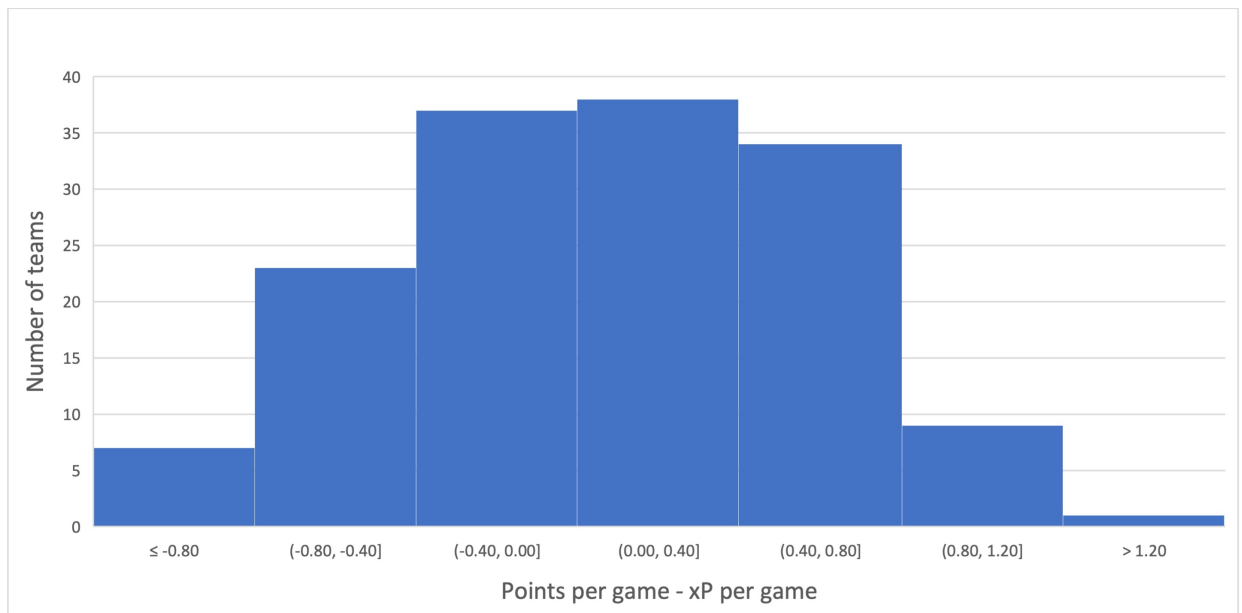


Figure 2. Results of how many teams overperformed or underperformed in the first five games.

y axis = number of teams. x axis = result when teams points per game is subtracted xP per game

If the difference between points and xP is positive, the team has collected more points than what the game's expectations would have suggested, i.e., overperformed. While a negative would mean that the team has underperformed. As Figure 2 shows, a large proportion of the teams did not over / underperform very much in the first matches. As the figure shows, the distribution of teams is concentrated close to zero, meaning the teams are not very much over- or under-performing. The figure also shows that a larger number of teams have been able to collect more points than xP would suggest. On closer inspection, the data shows that 82 teams from 149 teams (55,03%) collected more points than what was expected from the team's performance. However, it is good to note that 37 teams collected a maximum of 0.40 points less than xP assumes. This means that these teams have lost a maximum of two points in the first five games which is not a bad result as coincidence is always present in football. Such teams can be counted on playing as expected rather than underperforming.

However, what things and variables contribute to the team playing better under the new head coach in the first games? There are innumerable possible variables, and coincidence also plays a big part in football games. It should also be remembered that every team does not have the same opponents against them, in addition to which other teams can play in the first games more at home than at away, so the benefits of home advantage will help the new head coach start. Such variables are beyond the influence of the head coach. The selected variables are the average ranking of the opponent teams in the league table

in the first five games (the current ranking determined the ranking of the opposing teams on game day), number of home matches in the first five games, and teams last season's league position. These three variables tell how easy/challenging the match program is, how much the team will benefit from home games, and the previous season's position gives some clues about the team's true quality of which Balduck et al. (2010) mentioned that it is team quality that is a big factor in team success. It should be noted that there are 18 teams in the German Bundesliga instead of 20 teams, so in the data, the rankings of Bundesliga teams have been changed to match the rankings of teams from other leagues. Another thing to note is that the teams promoted to the league the previous season marked that team's previous year's ranking as 21.

Table 3 shows how the regression parameters predict the accumulation of points for teams from the first five games. A significant regression equation was found ($F(3;145)=11.084$, $p<0.0001$), with an R^2 of 0.187. Teams predicted points is equal to $3.88+0.89(\# \text{ of home games}) + 0.29(\text{Opponents ranking AVG}) - 0.2$ (Teams last season's place in league). It turned out that the "value" of one home game in points for a team is 0.89 points. Teams are more likely to win a match from a team that held a low position in the league table. For every position lower on the league table, the club wins 0.29 points. The team's last season's league position shows that every lower position predicts the accumulation of -0.20 points in the first five games. That is, if a team plays more of the first five games at home against the teams that have a lower position in the league currently while the team's league position has been high in the previous season, it can be assumed through regression modeling that the team will gain more points.

Table 3. Regression estimation on actual points.

Independent variable	Coefficients	SE	t Stat	P-value
Intercept	3.88	2.138	1.814	0.072
Number of home games*	0.89	0.096	1.828	0.07
Opponents ranking AVG**	0.29	0.134	2.179	0.031
Team last season's place in league***	-0.20	0.045	-4.515	$p<0.0001$

* indicates significance at 10%, ** indicates significance at 5% and *** indicates significance at 1%. $n=149$ $R^2=0.187$.

$F=11.084$

Based on the results presented above, it can be said that most of the teams come to life after the new head coach takes responsibility for the team. Statistically well-played (high xP) teams get more points from the first five games than might be expected. As

can be seen from Figure 2, only 30 teams (20%) used in the data play well below expectations, in this case, difference being under -0.40. This underperformance can be due to many factors. The regression model used in this study took into account the numbers of home games, the opponents' ranking in the league, and the team's previous season's ranking in the league. The most significant of the parameters is the team's ranking last season, which is sig. $p < 0.01$. The level of opponents also matters. In this case, the parameter is significant $p < 0.05$, which is valid. The least significant of the parameters is the number of home matches, which has a significance of $p < 0.10$. It can be said that the number of home matches does not matter as much as the level of the opponents or the level of own team

4.2.2 Team's performance after the first five games

In the first five games, it is not easy to assess the coaching skills of the new head coach as the team takes time to learn new tactics. The first matches are also affected by the fact that players have a strong incentive to exert effort to convince the new manager of their abilities (Sliwka et al., 2015). As research and data show, there is a certain boost in team performance in the short term. More about the success of a change of head coach is indicated by how the team performs after the first games and when the coach has shaped his team's lineup and tactics for longer.

As Table 1 shows, the teams have not been able to keep the results and game performance at the level of the first five games. Figure 3 shows how the teams have performed since the first five games. As in Figure 2, xP has been subtracted from the actual points.

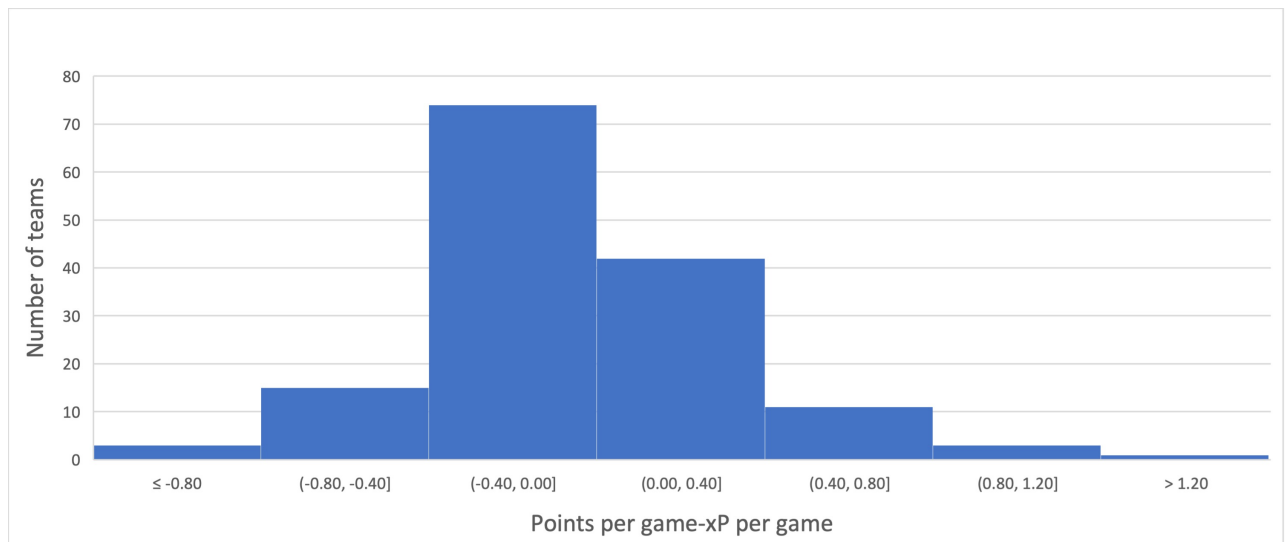


Figure 3. How the difference of points per game and xP per game were divided between the teams after first five games.

y axis = number of teams. x axis = result when teams point per game is subtracted xP per game

When comparing Figure 3 to Figure 2, it seems that more teams have not overperformed expectations after the first five games. Only 57 teams 149 (38.26%) have played better than xP expected, while in the first five games, the equivalent was 82 teams (55.02%). The average difference (PPG-xP per game) for all teams is -0.059, which is less than in the first five games. Figure 3 also shows that there is not as much scatter as in the first five games, but most teams have played as statistically (xP) assumed. There are not many teams that have really clearly outperformed their performances. These results are in line with other studies in the field (e.g., van Ours & van Tuijl (2015), Balduck et al. (2010)) which suggest that a change of head coach brings a positive boost to the team, but only for a short time. However, it is good to note that there are not as many overly underperforming teams as in Figure 2. Such observations also indicate that over a longer period of time, teams tend to play as expected.

But are the differences in points and xP in the first five and after first five games statistically significant? By doing a paired t-test, we see in Table 4, that it is convincing enough to say that the points per game between the first five games and after five games differ significantly at the level of 0.01 (1%). There was a significant drop in gaining points per game after first five games (mean=1,195, SD=0.551) than in first five games (mean=1,366, SD=0.693); (t(148)=2.869, p=0.005). Paired t-test was performed also for the teams xP per game for the first five games and xP per game after the five games. There

was no significant drop in xP per game after first five games (mean=1.254, SD 0.356) than in first five games (mean=1.314, SD=0.446); $t(148)=1.792$, ($p=0.075$).

Table 4. Paired t-test on mean points and xP per game, for first five games and after first five games.

	Mean	SD	SE	t	df	Sig. (2-tailed)
Pair 1; mean points per game						
Points per game, first five games	1.366	0.693	0.057	2.869	148	0.005
Points per game, after first five games	1.195	0.551	0.057			
Pair 2; mean xP per game						
xP per game, first five games	1.314	0.446	0.037	1.792	148	0.075
xP per game, after first five games	1.254	0.356	0.029			

Thus, it can be assumed from the statistics that the game performance itself has not deteriorated significantly from the first five games. However, earning points has decreased significantly. So, it can be assumed that actually the teams are slightly underperforming in terms of game events after five games.

5 Comparison of the results between the teams under old and new head coaches

The final question in changing head coaches is whether the new coach will do better job than the old one. Therefore, this section compares points per game and xP per match of the new and old head coaches for both the first five games and the last five games as well as all the games.

The first focus is on whether the new coach has been able to reverse the team's bad course after the coach change, i.e., comparing the last five games of the old coach and the first five games of the new coach. As Table 1 shows, under the new head coaches, teams have been able to collect more points per match as well as xP per match. Figure 4 shows what differences have arisen in both the points per game and the xP per game when teams changed their head coaches. In Figure 4 the new head coaches point and xP per game is subtracted the old head coaches points and xP per game.

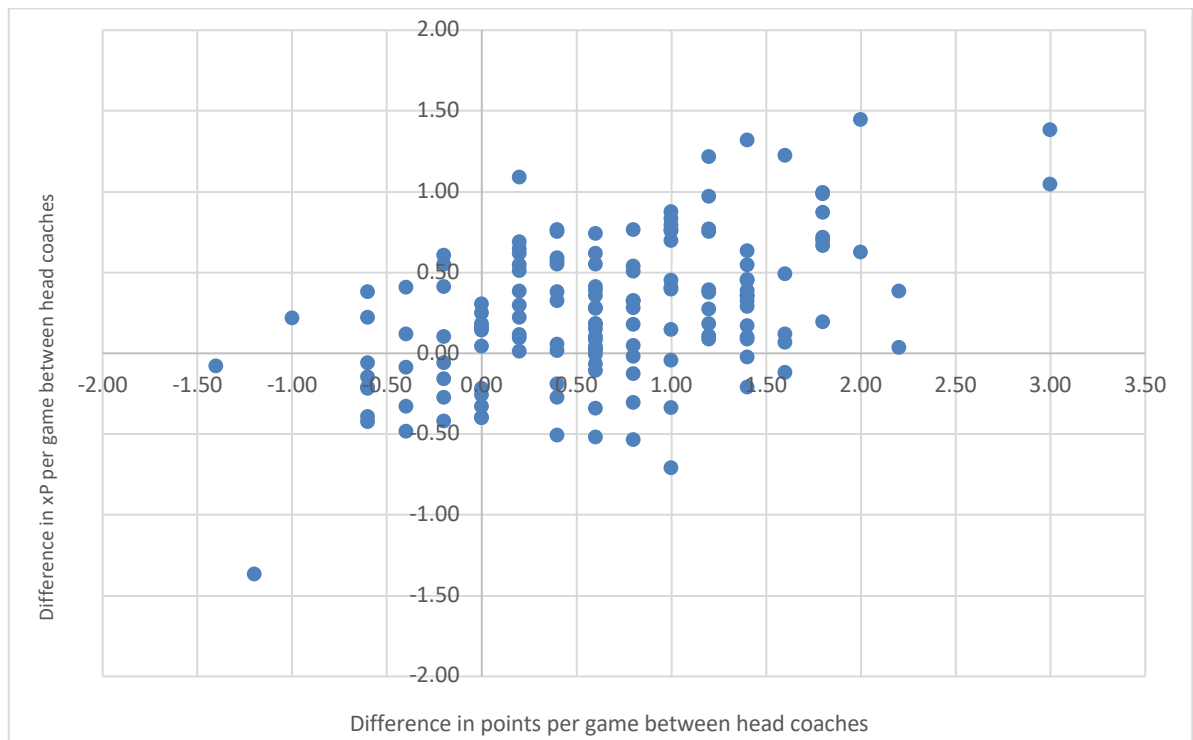


Figure 4 Points and xP per game differences among head coaches in last/first five games.

Note: The x-axis indicates the difference in mean points per game. If the point is to the left of the origin, the old coach has had a better points per game. The y-axis multiplies the xP difference accordingly. The scores below origin indicate that under the old head coach, the team has received more xP per game.

As Figure 4 shows, a large proportion of teams have been able to reverse the bad phase in the light of both points and xP. A close look reveals that out of 149 teams, 125 teams (83.89%) were able to collect more points under the new head coach from first five games versus the old head coach and his teams last five games. 11. Thus, it can be stated that the change of head coach is a good decision, at least in the short run, and these results are in line with previous studies (e.g., van Ours & van Tuijl, 2015)

But are the differences statistically significant? In order to ensure that they are statistically significantly different, paired t-test was made for both mean points per game and xPoints game. Table 5 shows results. There was indeed a significant increase in gaining points per game after the new head coaches were promoted (mean=1.366, SD=0.693) than team with old head coaches (mean=0.706, SD=0.489); $t(148)=10.394$, ($p<0.0001$). A similar ending came in xP per game where a significant increase was found after new head coaches took charge (mean=1.314, SD=0.446) than when old coaches were in charge (mean=1.051, SD=0.378); $t(148)=7.205$, ($p<0.0001$). That is, in both cases, the statistical difference is significant at the level of 0.01 (1%).

Table 5. Paired t-test for points and xP from old coaches last five games and new coaches first five games.

	Mean	SD	SE	t	df	Sig. (2-tailed)
Pair 1; New and old coaches mean points per game, first and last five games						
New coaches mean points per game, first five games	1.366	0.693	0.057	10.394	148	$p<0.0001$
Old coaches mean points per game, last five games	0.706	0.489	0.040			
Pair 2; New and old coaches mean xP per game, first and last five games						
New coaches mean xP per game, first five games	1.314	0.446	0.037	7.205	148	$p<0.0001$
Old coaches mean xP per game, last five games	1.051	0.378	0.031			

Thus, it can be statistically assumed that, at least in the short term, teams will be able to collect more points as well as play better under the new head coach.

However, the short timeframe does not yet tell whether the change of head coach was successful or not. As the data in section 3.3.2 showed, under the new head coach, the team will no longer be able to gain points as well as in the first games. For this reason, it is good to compare all the team games under the old head coach and under the new head coach with each other before judging the success of a coach change. The comparison is made in the same way as for the last five games of the old head coach and the first five games of the new head coach. Now, however, all the coaches' games have been taken for comparison. In Figure 5 can be seen what differences have arisen in both the points per game and the xP per game. In Figure 5 the new head coaches point and xP per game is subtracted the old head coaches points and xP per game, same as in Figure 4.

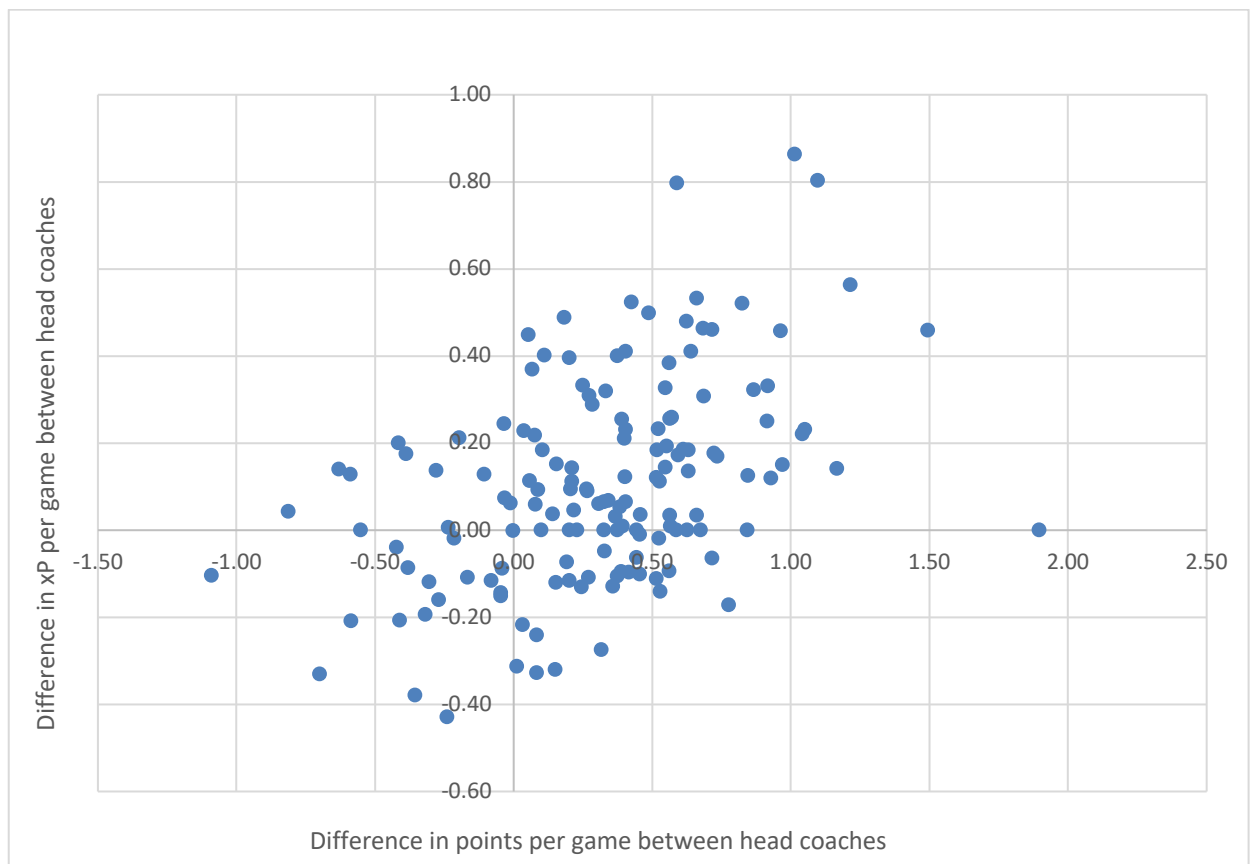


Figure 5. Mean points and mean xP per game differences among head coaches in all games.

Note: The x-axis indicates the difference in points per game between the teams. If the point is to the left of the origin, the old coach has had a better points per game. The y-axis multiplies the xP difference accordingly. The scores below origin indicate that under the old head coach, the team has received more xP per game.

As Figure 5 notes, a larger proportion of teams have ended up closer to the origin. A total of 149 cases, in 118 cases the team gained more points per game under the new head coach (79.19%), and comparing xPoints with each other, 100 teams played better under

the new head coach (67.11%). Figure 5 shows how these results were distributed among the teams. It is good to note that although for some teams points per game exceeded the corresponding points per game of the old head coaches team, the team's game performance, i.e., xP, remained lower under the new coach. The same can be observed for xP. Some teams, under the new head coach, outperformed the old head coaches points per game, but same time the mean xP was worse under the new head coach. It's also good to note that quantitatively, the teams weren't able to beat the teams from the old head coach as well when looking at all the games as in the shorter term.

As Table 1 shows, the differences in points and xP from all games are not as big as from the last / first five games of the head coaches. Therefore, possible statistically significant differences are confirmed by paired t-test and Table 6 shows results. There was indeed a significant increase in gaining points per game in all games under the new head coaches (mean=1.256, SD=0.482) than all games under old head coaches (mean=0.936, SD=0.391); $t(148)=8.602$, ($p<0.0001$). A similar ending came also in xP per game where a significant increase was found under all games of new head coach (mean=1.281, SD=0.333) than when old coaches were in charge (mean=1.165, SD=0.300); $t(148)=5.534$, ($p<0.0001$). That is, in both cases, the statistical difference is significant at the level of 0.01 (1%).

Table 6. Paired t-test for new and old coaches total mean points per game and mean xP per game, all games.

	Mean	SD	SE	t	df	Sig. (2-tailed)
Pair 1; new and old coaches mean points per game						
New coaches mean points per game, all games	1.253	0.482	0.040	8.602	148	$p<0.0001$
Old coaches mean points per game, all games	0.936	0.391	0.032			
Pair 2; new and old coaches mean xP per game						
New coaches mean xP per game, all games	1.281	0.333	0.027	5.534	148	$p<0.0001$
Old coaches mean xP per game, all games	1.165	0.300	0.025			

Paired t-test shows that the change of coach has brought a better result to the teams also in the longer run. The next chapter discusses the results in more detailed.

6 Discussion and conclusions

The study examined how the change of head coach during the season affects the team's success and whether the change of coach brings improvement in the time before the change of coach. The study covered 149 head coach changes in the top 5 leagues in Europe between 2015-2016 and 2019-2020.

When a team changes head coach, usually, the team has played the latest games poorly, which has led to a change of head coach (Bryson et al., 2021). In my research, I found that this is also true in this case, when only 34 teams were able to collect more points per game under the old head coach in the last five games. Also, the level of play, in this case xP, was worse in the last five games during the old coaches than before the last five games, with 114 teams playing below game expectations (PPG-xPPG). After the change of head coach, as the results show, most of the new head coaches were able to turn the team's poor results into positive ones in first five games under the new head coach, 83.89% of the teams gained more points, and 74.50% of the teams gained more xP than team under old head coach last five games. Differences were also statistically significant in t-tests at both on actual points and xPoints ($p < 0.0001$).

The study also looked at whether the team was able to outperform xP as expected, i.e., whether the teams outperformed in the first five games or not. Teams were able to collect an average of 0.052 points per game more than xP assumed in the first five games and totally 55,03% of teams gained more points per game than xP. At this point, it is good to note that the t-test (look Table 2) showed that a high xP positively correlated with points per game, one xP was 1.03 points according to the test. After the interesting results, I wanted to know what things affect the results of the first five games with regression model. Since the variables are innumerable, I decided to choose, in my opinion, the relevant parameters which were the number of home games, the average level of opponents and the ranking of the team from the previous season. The home matches were chosen because presumably the new head coach wants to succeed in front of the home crowd. The level of opponents was chosen because we see how demanding the new coach's first games are and the team's ranking last season gives an indication of how good the team really is. One home game adds 0.89 points, when the opponents' league ranking decreases according to the modeling, there should be 0.29 more points and a better ranking in the previous season causes a loss of -0.2 points, for example, the previous season's champion in modeling loses -0.2 points.

As said, there is previous research that a change of head coach will have a positive impact on a team's game in the short term (Balduck et al., 2010). Previous studies (Sliwka et al. 2015) also claim that after the first games, the team will no longer play at the same level as in the first games. The results of this study support previous work. Only 38.26% of the teams were able to collect more points than xPoints, which is less than in the first five games (55.03% of the teams). This study observed that the same outcome for points (first five games versus after five games) differed significantly, $p < 0.001$. However, when the same test was performed on the expected points (xP), they did not differ significantly. For some reason, teams can no longer collect points after the first five games even if there is no significant decline in-game performance. In this context, this should be studied a little more closely; as mentioned at the beginning, xP has not been used in any previous studies.

Another research question was whether the new head coach would bring better results than his predecessor in longer period. The results of this study show that a new head coach can bring better results, in points (79,19% of teams) and xP (67,11% of teams), than the old head coach in the season in which the old head coach was dismissed, and the new head coach began his work, in this case, both coaches all games during the season. By performing the t-test, both points and xP have statistically significant differences in both cases ($p < 0.0001$).

This study done in a naive way, so it is in line with other similar studies. However, the importance of the change of head coach in itself in these positive results remains open in this study. Many previous studies (e.g., Bruinshoofd & ter Weel, 2003) have added a control group to their studies. Studies have shown that in a control group where the head coach has not been replaced, a team that has suffered a bad dip in results will get even better results than in teams where the head coach has been replaced. In addition, a one-season comparison between coaches may be unnecessarily short, and the five-season time window used in the study is too small and may not generalize to lengthier periods (Koning, 2003).

According to the results of this study, a change of head coach is a statistically good option. Teams play better in the first games under the new head coach than under the old head coach, and even after the first games, the results are in favor of a coach change, although the results no longer remain at the level of the first five games. Despite the results, this study does not yet give a complete picture of whether a change of coach is actually a good option. As I often mentioned, the absence of a control group reduces the value of the results, as adding a control group can change the conclusions. Therefore, this study

should be continued in the future with the addition of a control group, especially when in the light of the expected points (xP) there has no similar study performed and to compare the results between the coaches over a more extended period to get better quality results.

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