Evaluating football tactics- Pulling a defender

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Abstract

This paper studies whether pulling a defender is an effective tactic in a game of football. Data has been analysed from the last full Premier League season, leading to several discussion points and overall conclusions. This work concludes that the tactic is effective and that implementing it in the 61st -70th minute is the most advantageous.

Introduction

Football is the most popular sport in England [3], but how many people actually understand how the game works? A game of football has many tactics, but how effective are they? In this paper, I will be evaluating the tactic of pulling a defender. Pulling a defender is the act whereby a defensive player is substituted for a player in a more forward position. The aim of this is to encourage a team to attack and therefore increase their chances of scoring. But does it work?

My interest in this work stems from reading scientific papers on the act of pulling a goalie in ice hockey. These scientific papers have concluded that the tactic of pulling a goalie is effective and there are several papers that model the optimal time in which to make that substitution [1][5]. I wanted to see whether the equivalent tactic in football is also effective.

Data- Goals Scored

For this paper, data was collected from the 2017/2018 Premier League season [6]. This league was chosen as it is the highest level league in the English football system; and also the sporting league in the UK with the highest average attendance [3]. Also, it is expected that the increased professionalism of the league will result in more tactful play which is necessary for the data.

Firstly, the average scoring rate is calculated for every ten-second interval irrespective of formation and when a defender had been pulled. This is shown in Figure 1. Then, the average conceding rate is calculated for the same time frame. This is shown in Figure 2. For clarity, the equations used to calculate the average rates have been provided.

Average scoring rate formula $= \dfrac{Goals\ scored}{Minutes\ played \times 6}$

Average conceding rate formula $= \dfrac{Goals\ conceded}{Minutes\ played \times 6}$

Figure 1

	Goals Scored	Minutes Played	Average Scoring Rate (10-second interval)
In general	1018	34200	0.00496
Pulled Defender	64	2967	0.00360

Figure 2

	Goals conceded	Minutes Played	Average Conceding Rate (10-second interval)
In general	1018	34200	0.00496
Pulled Defender	57	2967	0.00320

Looking at Figure 1, we can see that the average rate of scoring in each ten-second interval is significantly higher in general, compared to when the tactic is implemented. This is not what we were expecting. From this, it would suggest that pulling a defender is a bad tactic that decreases the chances of a team scoring. In comparison with Figure 2, we can see that there is also a decreased probability of conceding a goal. Despite this, when looking at the average scoring and conceding rates, we can see that when a team has a pulled defender, they are more likely to score than concede. This implies that pulling a defender does switch the game in that team's favour and therefore, tactically, pulling a defender could work. It is likely that the general average rates are higher due to the sample size. The amount of time being played with a pulled defender is considerably lower. This, therefore, could suggest that using this initial analysis in isolation does not lead to any clear conclusions.

In football, the most important factor in a game is how many points you take away from it, not the number of goals scored. Further analysis has been undertaken to evaluate the changes in points, due to the pulling of a defender, to determine how effective the tactic really is.

Data- Points Gained

Figure 3

Minutes	Games played with a pulled defender	Points Gained	Points Lost	Difference	Average Points Change
0-10	0	0	0	0	0
11-20	3	6	0	6	2
21-30	1	0	0	0	0
31-40	3	1	0	1	0.33333
41-50	9	6	4	2	0.22222
51-60	19	12	1	11	0.57894
61-70	21	23	2	21	1
71-80	40	9	5	4	0.1
81+	21	4	4	0	0

Figure 4

Minutes	Games played with a pulled defender	Games with positive change	Games with no change	Games with negative change
0-10	0	0	0	0
11-20	3	2	1	0
21-30	1	0	1	0
31-40	3	1	2	0
41-50	9	3	4	2
51-60	19	6	12	1
61-70	21	9	11	1
71-80	40	7	29	4
81+	21	4	15	2

From Figure 3, we see that there is, on average, never a negative point change. This shows that after any amount of time, it is effective to pull a defender and push forward. Unexpectedly, the highest average points gain is when a substitution is made between 11-20 minutes. Although this is the case, this can be seen as unrepresentative as there are only three samples in that time frame. Moving forward in time, we can see that the next highest points change is between 61-70 minutes.

Figure 4 is even more telling. Similarly, it shows 61-70 minutes as the time frame with the most positive impact. Even with time-frames with more substitutions, 61-70 is the section with the highest number of games with a positive change. Also, it is clear that in every section, there is a higher amount of games where the substitution was positive rather than negative. This would indicate that pulling the defender is a beneficial tactic.

Evaluation

Analysis of the data in Figures 3 & 4 suggests that pulling the defender in a football match is a constructive tactic. The data shows that the optimal time to make the substitution is between 61-70 minutes into the match. This could be due to the fact that you want to limit the time that a team is defensively open, whilst also giving the new attacking player enough time to have an influence on the match. Also, it is sensible to ignore any data before the 50th minute because the small sample size makes these numbers unreliable. It is reasonable to assume that, for most cases, a substitution in the first half is often due to injury rather than a tactical decision. This is why the data shows that 61-70 minutes is the optimal time to make a substitution.
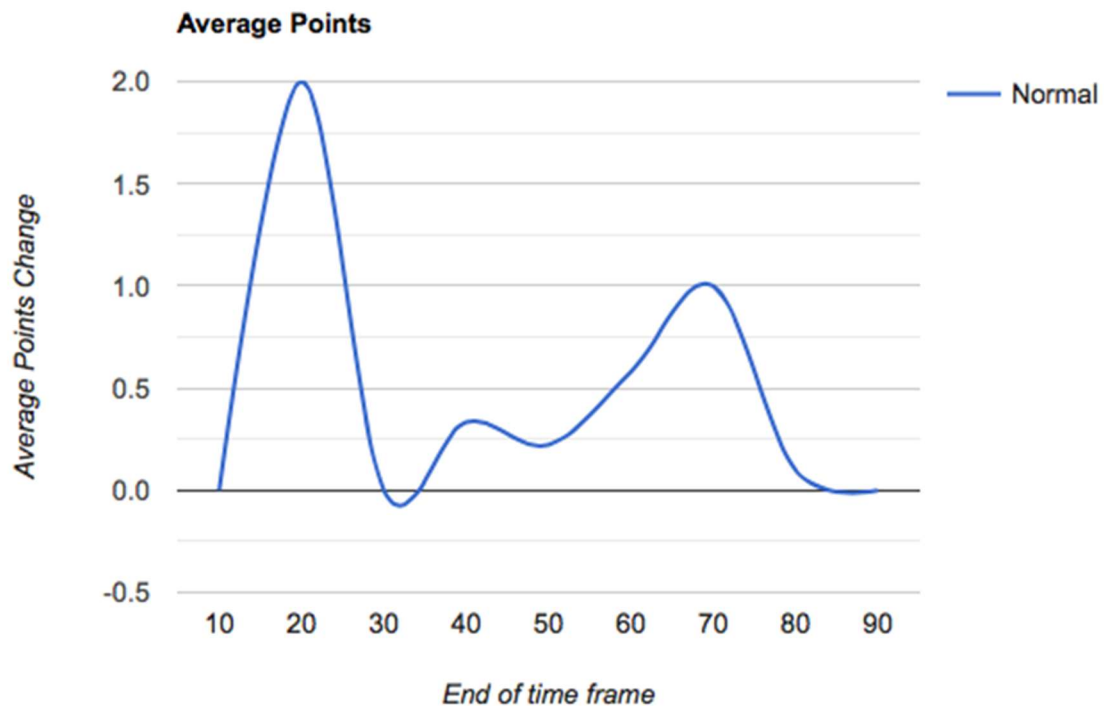
Figure 5

Figure 5 shows interesting analysis when, as suggested, we ignore before the 50th minute and attribute this data to injury. The rest of the data then almost follows an exact bell curve. This would suggest that the graph is a close representation of the actual likelihood of the average points change in any football game, suggesting that the model is a good fit for assessing the question we are asking. As we can see in Figure 5, the curve is not entirely symmetrical and

this would suggest that pulling a defender would be more effective before the 60th-70th minute mark than after.

Evaluating the tactic shows that in 64% of all games, there is no change to the outcome of the match. This is most likely due to the fact that the team pulling a defender is already in a losing position and needs to have one last chance at scoring. Therefore, even if the team were to concede it would not negatively impact them as they are already in a losing position. As previously mentioned, Figure 4 shows that there are always more games with a positive change than with a negative. This further suggests that pulling a defender is advantageous.

Any football fan could tell you that a football match very rarely finishes at exactly 90 minutes, like the graph shows. For simplicity, any data after the 90th minute is within the 81+ category. It may seem that this would skew the data but there were actually no substitutions made after the 90th minute that had any change to the outcome of the match. This means that with or without this data, the average points change would be exactly the same. We can therefore accept that, although this interval is slightly larger than the others, it has not changed the accuracy of the data.

Further Findings

One feature of this data is that it implies that all teams are of equal standard. Although the Premier League can be quite unpredictable, there are definitely teams of a higher standard who are more likely to control and win games. In order to analyse this, all data points from games between the top six teams and bottom six teams have been removed [4]. This data has then been compared to the original.

Figure 6

Minutes	Games played with a pulled defender	Points Gained	Points Lost	Difference	Average points change
0-10	0	0	0	0	0
11-20	3	6	0	6	2
21-30	1	0	0	0	0
31-40	3	1	0	1	0.33333
41-50	9	6	4	2	0.22222
51-60	13	8	1	7	0.53846
61-70	16	22	2	20	1.25
71-80	26	7	5	2	0.07692
81+	17	4	3	1	0.05882

Figure 7
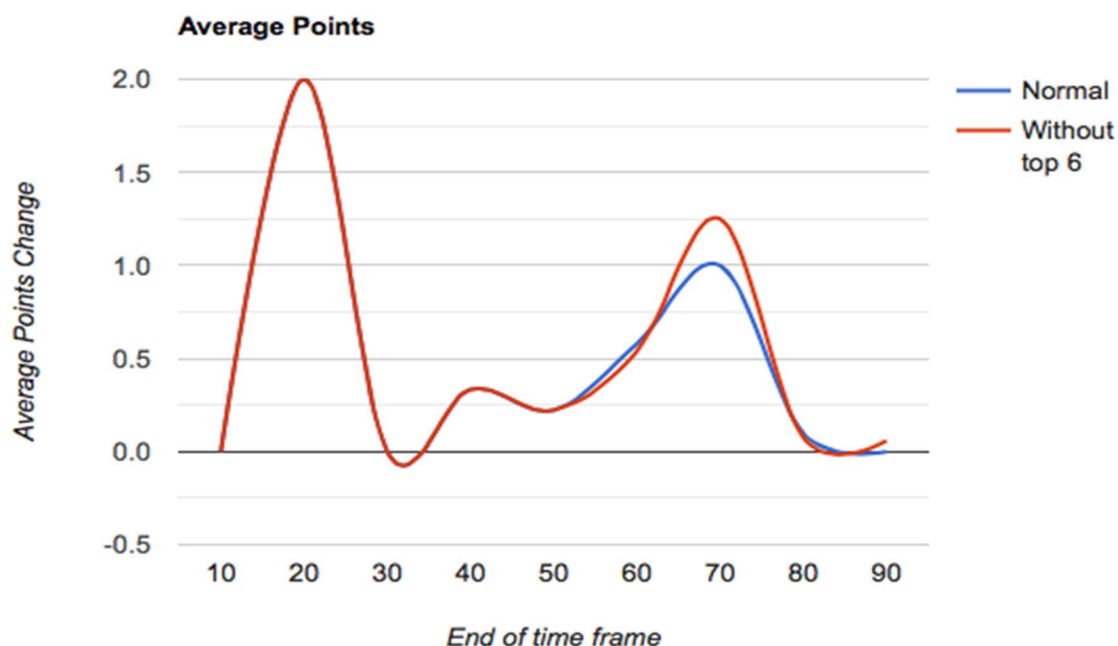
Average Points

Looking at all the data provided, it is interesting to note that the average points change has increased in certain time frames but the peak is in the same place. This reinforces the idea that the optimal time to substitute a defender for an attacking player is between 61-70 minutes. Also, as the peak is higher when the games between the top and bottom six are removed, this suggests that pulling a defender is a sensible tactic and part of the reason that it didn't pay off in these games is due to the sheer standard of the opposing teams.

Conclusion

In conclusion, analysis of the data from the last full Premier League season gives a good indication that pulling a defender is a beneficial tactic. This is due to the fact that the tactic is played when teams are in a losing position and therefore have no risk of dropping points. Furthermore, the data suggests that the optimal time to implement the tactic is between the 61st-70th minute. This is logical, as any earlier, would leave a team defensively open and therefore potentially cause them to concede and reduce any chance of getting back into the game. Any later than the 70th minute gives a player little time to have any influence on the game, and therefore it is unlikely that there will be any change to the final score.

It is also important to comment that it is probable that any substitution within a football match is likely to have a positive impact. During a match, players will tire and suffer from fatigue. Any introduction of a new player should, therefore, be positive as this player should be at full fitness. In order to fully evaluate how effective pulling a defender is, it would be constructive to compare the differences between the tactic and simply substituting a player and replacing them with a player of the same position.

Although there are many factors that influence the outcome of a football match including home advantage, injuries and recovery time etc. [2] The data provided in this paper suggests that pulling a defender is a positive tactic and does increase a team's probability of gaining points. Further research is required to support this theory due to the small sample size of the data.

References

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