

League Position, Wage Expenditure and Goal Percentage Based on Set-Pieces Analysis of English Premier League Clubs

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Abstract This study aimed to understand the relationship between an English Premier League club's league position, average annual player wage bill and their dependence on set-pieces for goals. The relationships between these variables were studied in this research paper using Spearman's rank correlation. The data was collected from the 2018-19 and 2019-20 English Premier League seasons from the official Premier League website, for the 20 clubs playing in the league for each corresponding season. A total of 760 matches were watched and analysed over the two seasons. The results showed that (1) there exists a significant moderate negative correlation ($\rho = -0.542$ for 2018-19 and $\rho = -0.516$ for 2019-20) between a team's final league position and their percentage of set-piece goals, and (2) a moderate negative correlation ($\rho = -0.493$ for 2018-19 and $\rho = -0.475$ for 2019-20) between a team's average weekly player wages and their percentage of set-piece goals. A high positive correlation ($\rho = 0.866$ for 2018-19 and $\rho = 0.733$ for 2019-20) was also found between a club's league position and its player wage expenditure which reinforces previous findings. This implies that teams lower in the league table tend to be more reliant on set-pieces to score goals. Similarly, teams with a lower average weekly player wage tend to be more dependent on set-pieces to score goals. Teams higher in the league table or with a greater wage bill do not necessarily score fewer goals via set-pieces but tend to score more goals from open play than lower opposition, which is why their percentage of goals scored via set-pieces is less. These results could impact managers' tactics before games, a club's recruitment strategies as well as the football betting industry.

Keywords Football, English Premier League, Set-piece Goals, Correlation, Club Wages

1. Introduction

Football is one of the most popularly played and watched sports in the world. It is unparalleled in terms of global reach, viewership and participation. But this ever-growing popularity implies that professional footballers and teams are increasingly put under the scanner. While Yiannako studied the goal-scoring patterns of the Euro 2004 which took place in Portugal [1], Kubayi studied goal-scoring patterns at the 2018 FIFA World Cup held in Russia [2]. This is an indicator of the excruciating detail with which football matches are now viewed.

Global football can be broadly classified under two categories based on the competitions played: international football and club football. The English Premier League is one of the most popular sporting leagues in the world. The La Liga, Serie A, Bundesliga, English Premier League and Ligue 1 together make up the major European leagues and are amongst the most popular football leagues in the world. The Spanish La Liga, Italian Serie A, German Bundesliga and the English Premier League which make up the top four

national European football leagues, all have similar but distinguished tactical styles and events that lead to goal-scoring opportunities [3]. In our study, we have looked solely at teams from the English Premier League.

Set-pieces, also known as dead-ball situations, play an important role in a game of football. They refer to any situation where a ball is returned to open play and include events such as free kicks, corner kicks and penalties, to name a few. In our study, every goal which was directly or indirectly, but essentially, caused by a set-piece is considered a set-piece goal. They can range from a magical David Beckham free-kick to a crude but effective Rory Delap throw-in. Nevertheless, they play an integral role in any football game. The proportion of total goals scored due to set-pieces in the 2018 FIFA World Cup was 39.1% [2]. The percentage of goals scored due to set-pieces in Euro 2004 was 35.6% [1]. Wright [4] even went so far as to predict that approximately 30% of all goals scored in professional football are via set-pieces and supported this prediction. Looking at these numbers, we understand the

importance of set-pieces and the reliance that teams have on them to provide goals. Therefore, managers employ specific tactics to both defend and attack from set-pieces. Pulling [5] studied the strategies employed by English Premier League teams in 2015-16 to defend corners, showing the varying strategies employed by coaches for the same.

Another important aspect of modern-day elite football leagues is the wages offered to players at the elite level and the standard of football played by these clubs. The total wage bill for Liverpool FC for the year 2018-19 was GBP 310 million, the fifth-highest in the world for a football club [6]. They also ended the 2018-19 English Premier League season in second place. But is there a link between a club's player wage bill and the standard of football played at the club? Carmichael showed that not only is the on-field success of a club directly related to the player's skills but also expenditure on a player's wages reflects the player's skill and performance level [7]. Clubs with higher wage bills tend to perform better on-field as they can afford more skilled players as per the studies of Hall [8]. On the flip side, clubs languishing at the bottom of the league tables tend to have lower wage bills.

There have been several studies related to set-pieces in football and goal-scoring opportunities in the English Premier League and other major tournaments. Casal [9] analysed the corner kick success in the 2010 FIFA World Cup, 2010 UEFA Champions League and EURO 2012 and found that just 2.2% of corners ended up in goals for the attacking side. During the 2015-16 English Premier League, higher-ranked teams were seen to be more dominant at set-pieces and moments of established offence, than lower-ranked teams [10]. Strategies used by teams in the English Premier League to score from corner kicks, a major component of set-pieces, also vary from team to team [11]. Casal [12] also studied the effectiveness of indirect free kicks in the 2010-11 UEFA Champions League and Europa Cup and found that it took almost 36 indirect free kicks for a goal to be scored from one. Mitrotasios studied the technical, tactical and spatial variables leading to an opportunity to score in the 2016/17 UEFA Champions League and found that 24.1% were scored from set-pieces [13]. Redwood-Brown [14] studied the effects of different standards of opposition on a player's performance in the English Premier League. The study of finding statistics or indicators which best define or differentiate a top team from a bottom team has been an area of interest for researchers. Discriminant analysis of matches from 2004, 2006 and 2010 FIFA World Cup showed that total shots, ball

possession, shots on target, total shots received and shots on target received seemed to be the discriminators [15]. Set-pieces are an excellent way to register shots and shots on target which is the primary focus. Another major component of set-pieces is freekicks, which occur from fouls and aggressive play. Videos of matches played in the Turkish Super League were analysed by observational foul analysis and it was shown that most fouls were made by mid-zone players and the average fouls per game were 24.2, 87.0 and 41.7 in won, lost and drawn matches, respectively [16]. As we see from some of the studies done above, there has been extensive research on set-pieces as well as indicators or differentiation between higher and lower-placed teams in a league but there has been no study on the relationship between an English Premier League club's final league position (an indicator of their performance) and their reliance on set-pieces for goals.

On the other hand, there has been extensive research on factors affecting a player or team's performance. It has been proved that a club's wage bill is a good indicator of its overall performance [8]. Gasparetto [17] also studied the relationship between team performance in the Brazilian Championship and the team's corresponding wage expenditure.

But there has been limited research on the relationship between an English Premier League club's average annual wage bill (a measure of their total wage expenditure) and their dependence on set-pieces for goals. To sum it up, there is a gap of knowledge when it comes to understanding the relationship between an English Premier League club's final league position and the percentage of total goals scored by them in the league via set-pieces, and an English Premier League club's average weekly player wage expenditure and the percentage of total goals scored by them in the league via set-pieces.

The study's aim can be classified into two categories. First, to investigate the correlation between a club's final league standing in the English Premier League and the proportion of league goals they scored through set-pieces during that particular season. Second, to investigate the association between a club's percentage of goals scored throughout a season from set-pieces and the average player wage for that club in the English Premier League.

Understanding these relationships would not only help a football team's technical or coaching staff but also the higher-level management. It would help the coaching staff to organize their teams tactically and for set-pieces given the players that they have. It would

also help coaches better prepare against opposition teams knowing how much they rely on set-pieces according to their league position and wage bills. Understanding these key features on a broader scale can help higher-level management and club scouts with more efficient and need-based recruitment. Finally, being aware of these factors may help bettors make more informed predictions about how goals will be scored and the final league standings at the end of the season.

2. Materials and Methods

2.1. Selection of the Subjects

For the purpose of this study, we looked at all the football clubs that were a part of the English Premier League in the 2018-19 and 2019-20 seasons, individually. A total of 760 matches were watched over the two seasons.

2.2. Selection of Variables

In a game of football, set-pieces are usually referred to as dead-ball situations. They include occurrences like penalties, corner kicks, direct freekicks, throw-ins and freekicks, where a ball is put back into play.

The three variables that were studied include

- Final league position for the 2018-19 and the 2019-20 seasons for each club
- Percentage of total league goals scored via set-pieces in each of those seasons by each club
- Average annual player wage expenditure in each of those seasons for each club.

2.3. Data Collection

Primary and secondary data were collected using various methods. The primary data which is the number of goals scored by an English Premier League

club via set-pieces in the league was collected using video observation by watching match recordings for each of the clubs. Each of these Premier League Clubs has an official YouTube channel and website where highlights from each of their matches in the season have been recorded and displayed. Watching these videos allowed counting the number of league goals that were scored via set-pieces. Data for the total number of goals scored by each club and final league position was collected from the official English Premier League website which has a record of several statistics from the league over the past few seasons [18]. From this, we can easily calculate the percentage of goals scored via set-pieces in the league as:

$$\text{percentage of goals scored via set-pieces} = \frac{\text{Goals scored via set-pieces}}{\text{Total goals scored}} \times 100$$

The average annual player wage expenditure has been sourced from the Statista and Sportskeeda official websites [19].

2.4. Statistical Technique

Spearman's rank correlation coefficient has been used to study the relationship between the three variables. Since the final league position is an ordinal type of data and in itself a ranking system, this method would be the most convenient method to be used. Spearman's rank correlation coefficient was used with a significance level of 0.05. IBM SPSS Statistics 21 was used for statistical analysis. Microsoft Excel 2019 has been used for data collection and analysis.

3. Results

The following tables show the final league position, goals scored, goals scored via set-pieces, percentage of set-piece goals and average annual player wage of an English Premier League club in the 2018-19 and 2019-20 seasons.

Table 1. Final league position, percentage of set-piece goals and average annual wage bill for each club in the English Premier League 2018-19

Club	Final League Position	Total Goals Scored	Goals Scored via Set-pieces	Percentage of Goals Scored via Set-pieces	Average Annual Player Wage (£ million) ²¹
Man City	1	95	11	11.58	5.9
Liverpool	2	89	21	23.60	4.86
Chelsea	3	63	17	26.98	5
Tottenham Hotspurs	4	67	18	26.87	3.51

Arsenal	5	73	15	20.55	4.85
Man United	6	65	17	26.15	6.5
Wolverhampton Wanderers	7	47	14	29.79	1.75
Everton	8	54	16	27.27	3.25
Leicester City	9	51	14	27.45	2.71
West Ham United	10	52	14	26.92	3.18
Watford	11	52	11	21.15	1.77
Crystal Palace	12	51	17	33.33	2.75
Newcastle	13	42	10	23.81	1.65
Bournemouth	14	56	17	30.36	1.98
Burnley	15	45	14	31.11	1.6
Southampton	16	45	14	31.11	2.66
Brighton	17	35	20	57.14	1.69
Cardiff	18	34	10	29.41	0.96
Fulham	19	34	6	17.65	1.72
Huddersfield	20	22	9	40.91	1.23

Table 1 shows the final league position, total goals scored, goals scored via set-pieces, percentage of goals scored via set-pieces and annual average player wage expenditure for each club in the English Premier League for the 2018-19 season. As we can see, Manchester City is on top of the league and have the highest annual average player wage bill but the lowest percentage of goals scored via set-pieces which

implies that their player wage expenditure is comparatively high while their reliance on set-pieces to score goals is comparatively low. It is the exact opposite for the bottom-placed club Huddersfield Town. To check for statistical significance, Spearman's rank correlation has been used and the results are shown in the following table.

Table 2. Final league position, percentage of set-piece goals and average annual wage bill for each club in the English Premier League 2018-19.

Variables	Final League Position	Percentage of goals scored via set-pieces	Average annual player wage
Final League Position	1		
percentage of goals scored via set-pieces	-.542*	1	
Average annual player wage	.866**	-.493*	1

* $p < 0.05$, ** $p < 0.01$

The Spearman's rank-order correlation value was found to be relatively strong (-0.542) between the final league position and the percentage of goals scored via set-pieces. Similarly, the percentage of goals scored via set-pieces and average annual player wage correlation value was found to be -0.493. Lastly, for the average annual player wage and final league

position correlation value was found to be very strong (0.866). All values are statistically significant.

The below table (Table 3) shows the final league position, total goals scored, goals scored via set-pieces, percentage of goals scored via set-pieces and annual average player wage expenditure for each club in the English Premier League for the 2019-20 season. It can

be seen that the 18th placed Bournemouth had the greatest percentage of goals scored via set-pieces and the 4th lowest average annual player wage expenditure which implies that they relied heavily on set-pieces to score goals while their player wage expenditure is comparatively low. On the opposite

side of the spectrum, we have Manchester City again which is in 2nd position, has the highest player wage expenditure and comparatively low reliance on set-pieces to score. Correlation analysis has been done to further analyse this data and to see if these trends are statistically significant.

Table 3. Correlation table for Final League Position, Percentage of Set-piece Goals and Average Annual Player Wage for the 2019-20 EPL season.

Club	Final League Position	Total Goals Scored	Goals Scored via Set-pieces	Percentage of Goals Scored via Set-pieces	Average Annual Player Wage (£ million) ²¹
Liverpool	1	85	20	23.5	4.97
Manchester City	2	102	19	18.6	6.27
Manchester United	3	66	15	22.7	5.5
Chelsea	4	69	17	24.6	4.39
Leicester City	5	67	11	16.41	3.01
Tottenham Hotspurs	6	61	9	14.75	3.55
Wolverhampton Wanderers	7	52	15	28.85	1.97
Arsenal	8	56	13	23.2	4.3
Sheffield United	9	39	10	24.64	0.65
Burnley	10	43	17	39.53	1.72
Southampton	11	51	10	19.6	2.06
Everton	12	44	12	27.27	3.68
Newcastle	13	38	10	26.31	1.87
Crystal Palace	14	31	8	25.81	2.59
Brighton	15	39	13	33.3	1.62
West Ham	16	49	16	32.65	2.71
Aston Villa	17	41	15	36.58	1.77
Bournemouth	18	40	18	45	1.72
Watford	19	36	11	30.56	1.82
Norwich	20	26	4	15.38	0.89

The Spearman's rank-order correlation value (Table 4) was found to be relatively strong (i.e. -0.516) between the final league position and the percentage of goals scored via set-pieces. Similarly, for the percentage of goals scored via set-pieces and average

annual player wage the correlation value was found to be -0.475. Lastly, for average annual player wage and final league position the correlation was found to be strong (i.e. 0.733). All values are found to be statistically significant.

Table 4. Final league position, percentage of set-piece goals and average annual wage bill for each club in the English Premier League 2019-20.

Variables	Final League Position	Percentage of goals scored via set-pieces	Average annual player wage
Final League Position	1		
percentage of goals scored via set-pieces	-.516*	1	
Average annual player wage	.733**	-.475*	1

* $p < 0.05$, ** $p < 0.01$

From Table 2 and Table 4 it can be seen that a relatively strong negative correlation was found between an English Premier League team's final league position and the percentage of set-piece goals.

4. Discussion

The higher the final league position of a team the less reliant they are on set-pieces for scoring goals. In other words, teams towards the top of the league tend to score a lesser percentage of their total goals via set-pieces like free kicks, corners, etc. One of the possible reasons for this correlation could be the fact that the probability of scoring from a set piece is much higher than scoring from open play [20]. While this fact is yet to be statistically proven across all footballing leagues, there are a few reasons to explain this phenomenon, considering it is true. Firstly, set-pieces allow the attacking team to get more players closer to the opposition's goal than would normally happen through open play. Secondly, starting from a dead ball helps players to put in more accurate crosses and take more accurate shots than from the hustle and bustle of open play. This provides teams with a more direct route to a goal than possession-based open play. On the other hand, research carried out on the 2010 FIFA World Cup, UEFA Champions league 2010-11 and EURO 2012 showed that corners were a rather ineffective way of scoring goals but the goals scored via corners lead to the team winning the match or earning a draw more than 75% of the time [9]. A similar result was found for indirect free kicks at the 2010 FIFA World Cup [12]. This underlines the importance of training for set-pieces and emphasizes the importance of set-pieces on the outcomes of a game of football. In fact, the variance in training and strategies used in set-pieces for higher-placed teams vs lower-placed teams in the Premier League has already been

established. During the 2015-16 season, the top six teams favoured out-swinging deliveries with a dynamic attacking organization during corners while the bottom six teams favoured inswinging deliveries with both dynamic and static attacking organization during corners [11].

But questions can be asked about whether these results would stand the test of time i.e. whether teams towards the bottom of the league table would continue to rely more heavily on them in the future, and whether this was the case in the past. While it has been established that successful and unsuccessful teams adopt different playing styles, a study on the Greek Super League found that better-performing teams had better ball possession statistics than teams with lower performance, and there was no significant difference in set-pieces between the two [21]. But our study focuses on the percentage of goals scored via set-pieces over a league's duration and not the number of set-pieces in a match.

Studies by Barnes have shown that certain physical, technical and tactical performance parameters in the English Premier League such as the number of explosive sprints, number of short passes and pass success rate all increased from 2006 to 2013 but not the number of long passes [22]. The evolving nature of the English game was further analyzed by splitting the teams up into tiers based on their ranking with similar results [23]. The evolution of these physical and technical performance analysis parameters in the English game might suggest that the negative correlation between a team's league position and their reliance on set-piece goals might be an evolving trend and a limitation to our study. 25.4% and 26.6% of all goals scored in the 2018-19 and 2019-20 seasons respectively were following set-pieces as compared to 40.2 percentage for the 2018 FIFA World Cup [24]. This reiterates the importance of training for set-pieces both offensively and defensively given that

more than 1 out of every 4 goals scored comes from a set-piece. A comparison can be done to see whether there is a significant statistical difference in the percentage of set-piece goals scored in leagues and knockout football tournaments.

We see a significantly high positive correlation between an English Premier League team's final league position and their annual average player wage for both seasons from Table 2 and Table 4. This is in accordance with the findings of Carmichael [7], Hall [8] and Gasparetto [17] who also found that teams with higher wage expenditures are placed higher in their respective football leagues. The average annual wage is nothing but a measure of the total wage expenditure of the club, adjusted to the number of players on the first team payroll. This implies that clubs have a vast knowledge of the market of existing talent and make sound financial decisions with respect to player wages, which tends to pay off more often than not. They are usually able to extract from the player, the skill set they require, expect and pay for.

Since we have established that there is a moderate negative correlation between league position and the percentage of goals scored via set-pieces, and there is a high positive correlation between league position and average annual player wage for English Premier League Clubs. Logically we can imply that there exists a moderate negative correlation between the percentage of goals scored via set-pieces and the average annual player wage. These are precisely the results we get from Tables 2 and 4. We can see that the correlation (negative) is relatively strong for the 2019-20 and 2018-19 seasons respectively, between an English Premier League team's average annual player wage and percentage of set-piece goals.

While Carmichael factored in a lot of variables including shots, fouls, goals, crosses, points, etc. to arrive at the conclusion that a club's finances are directly linked to its on-field success [7]. The average annual player wage expenditure is a measure of the club's revenue and financial resources. In other words, teams with lower average annual wage expenditure lack the resources to pay for players who warrant larger wages. Clubs pay wages that reflect the individual player's talent, as they are well-informed about available talent [8]. Hence, it can be said that players that are considered less talented or low performers are paid smaller wages and clubs with lesser financial resources are forced to invest in these players. Considering that these clubs' performances and success are restrained by their finances, they rely more heavily on direct routes to a goal like set-pieces,

counter attacks and long balls. Offensive set-pieces provide a more direct route to a goal which leads to teams lower in the league table and with lower player wages being more reliant on them as compared to clubs higher in the league table. This often leads to these lower positioned teams to centre their offensive play around set-pieces as in the case of Burnley who are known for their aerial prowess from set-pieces. This is not to say that better-performing clubs with more finances score fewer goals via set-pieces, which is quite the contrary as can be seen from Tables 1 and 3. Liverpool scored the most goals via set-pieces in 2018-19 and 2019-20 despite finishing 1st and 2nd respectively. These teams tend to score a greater number and proportion of their goals from open play and eventually score more goals in total. Hence, the lack of financial resources leads to a comparatively greater reliance on set-pieces and lesser reliance on open play to score goals.

While our results are significant and can be generalized to all seasons and teams of the English Premier League, it would be interesting to see if these results could be generalized to the other major European Leagues like La Liga, Serie A, Bundesliga and Ligue 1. With our present research and data, the results cannot be generalized to all the aforementioned leagues as they have varying playing styles and the tactics employed to create goal-scoring opportunities are not the same in every league [3]. It would be interesting to research similar parameters for these leagues as well and see how they compare to each other.

5. Conclusion

The purpose of this study was to understand the relationship between an English Premier League club's final league position, their player wage expenditure and their reliance on set-pieces to score goals. The average annual player wage was taken as a measure of the club's player wage expenditure while the percentage of all goals that were scored via set-pieces was taken as a measure of a club's reliance on set-pieces to score goals. Our results showed that there is a significant moderate negative correlation between an EPL club's final league position and the percentage of goals scored via set-pieces. Hence, teams towards the bottom of the league table tend to rely more heavily on set-pieces to score goals and score fewer goals from open play while it is the opposite for teams towards the top of the league table. It was also found that there exists a significant moderate negative correlation between an EPL club's

average annual player wage bill and their percentage of goals scored via set-pieces. Teams with a lower wage bill tend to score a greater percentage of their goals via set-pieces and less from open play, while it is the opposite for teams with higher wage bills. Lastly, there exists a significantly high positive correlation between an EPL club's average annual player wage expenditure and their league position, reaffirming our previous results as well as results found in previous research. From these findings, we get a better understanding of how teams in the EPL employ different tactics based on their financial resources and league position. Teams that lack the resources to employ the best performing players tend to rely on set-pieces to score goals as it provides them with a more direct route to goal. Based on this research, coaches may strategise and set their teams up differently. For example, a team higher up on the league table will be cautious not to give away free kicks in dangerous positions and corners while playing a team lower in the league table. The same can be said of replacing a team's league position with their wage expenditure. Since a considerable number of goals are scored via set-pieces for clubs lower in the league table with smaller wage bills, recruiters will know that investing in set-pieces specialists and aerial threats might be a great avenue to score goals, with their limited wage budget. Burnley is a prime example of this as they continue to punch above their weight even with their limited budget by capitalizing on set-pieces, investing in players who are aerials threats and players with great set-piece delivery. Stepping away from teams, higher management and coaching staff, this research would also help people place more informed bets. It will be quite beneficial for those who bet on English Premier League games to understand a team's tactics and patterns when scoring goals. Understanding a club's goal-scoring trends could be worth millions to those who bet on the English Premier League frequently. Based on this research, bettors may make better predictions about the origin of a team's goals based on league standing and player wage. Based on this knowledge, they might even wager on the precise manner in which a particular team will score on any given day.

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