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Figure 1 – Areas of the opponent's half of the pitch where possession regains for the subject team were recorded.

# Table 1 – Results obtained from Regression 1 (OLS standard errors)

Independent Variables	Coefficient	t	$\mathbf{p} > (\mathbf{z})$
Possession Regains	.1927	2.81	0.006***
Total Chances Created	.1448	4.30	0.000***
Quality of Opponent	.2973	1.66	0.100+
Venue	.1721	0.64	0.523+
Short Passes	.0358	0.91	0.365+
Corner Success Rate	.0273	1.59	0.115+
Successful Open Play Crosses	2740	-3.21	0.002***
cons	-2.4426	-1.05	0.297+

\*\*\* = Significant at 99% CI \*\* = Significant at 95% CI \* = Significant at 90% CI + = Insignificant

Independent Variables	Coefficient	t	$\mathbf{p} > (\mathbf{z})$
Area 1	.5521	2.23	0.028**
Area 2	.2232	1.21	0.231+
Area 3	2343	-1.03	0.306+
Area 4	1032	-0.47	0.642+
Area 5	.1991	0.91	0.368+
Area 6	.1029	0.49	0.623+
Area 7	1.0545	1.97	0.052*
Area 8	1.0635	1.36	0.178+
Area 9	-1.0085	-1.68	0.097*
cons	-1.5720	4.76	0.000

# Table 2 – Results obtained from Regression 2 (OLS standard errors)

\*\*\* = Significant at 99% CI \*\* = Significant at 95% CI \* = Significant at 90% CI + = Insignificant

Independent Variables	Coefficient	Z	$\mathbf{p} > (\mathbf{z})$
Venue	.4932	1.31	0.190+
Opponent Goal Difference	.0399	2.24	0.025**
Opponent Goals Conceded	.02181	1.56	0.120+
Changes in Match Status	1217	-0.90	0.366+
Days Since Last Match	0812	-0.87	0.382+
Matches in Last 7 Days	4176	-1.13	0.183+
Cons	3.9610	4.09	0.000+

# Table 3 – Results obtained from Regression 3 (Robust bootstrapped errors)

\*\*\* = Significant at 99% CI \*\* = Significant at 95% CI \* = Significant at 90% CI + = Insignificant

# A Case Study Assessing Possession Regain Patterns in English Premier League Football

# Mikael Jamil

Department of Science and Technology, University of Suffolk, Ipswich, United Kingdom

m.jamil2@uos.ac.uk

Mikael Jamil is the Course Leader of BSc Sport Performance Analysis at the University of Suffolk

# A Case Study Assessing Possession Regain Patterns in English Premier League Football

### Abstract

Recent years have seen significant attention awarded to possession regains in football. This case study examines possession regain patterns of an elite English Premier League team across 3 seasons from the 2015-16 season to the 2017-18 season (n=106). A series of regression are conducted in order to determine: what impact possession regains had on attacking performance, which players were most productive with possession post regains and which other factors influenced the number of successful possession regains by the subject team. Results revealed that possession regains in the opponent's half were highly significant and had a positive impact upon attacking performance (p = 0.006). Possession regains that occurred on the left-hand side of the playing field led to more productivity in front of goal (p = 0.028). The quality of the opponent was also revealed to have a significant impact upon the number of possession regains (p = 0.025). It is concluded that possession regains high up the playing field are crucial to the subject team's attacking success. Furthermore, players performing on the left side of the playing field were more productive with possession regains than those playing centrally or on the right.

Keywords: Attacking Transitions; Possession Turnovers; Possession Regains; Soccer; Premier League

# Introduction

In recent years, an English Premier League team appointed a manager well known for his high pressing style of play. Since this manager's appointment, his team's performances have appeared to gradually improve (in terms of league positions and performance in cup competitions). This study will focus specifically on how this manager has implemented his high-pressing style of play in the EPL and the role his players have performed in making it successful. The counter-press style of play is focussed around the turnover of possession in key areas, which many in the industry now refer to as attacking or defensive transitions, depending on whether the ball was won or lost (Vogelbein Nopp and Hökelmann 2014; Hughes and Lovell 2019). Possession of the ball has been revealed in many studies as being a key determinant of team success and various aspects of the passing attribute have been extensively reviewed such as, passing accuracy, passing range, longevity of passing sequences and recovery of possession (Carmichael, Thomas and Ward, 2000; Hughes and Churchill 2005; Jones, James and Mellalieu, 2017; Lago-Penas, Lago-Ballesteros, Dellal and Gomez, 2010; Vogelbein et al., 2014, Almeida, Ferreira and Volossovitch, 2014; Barreira, Garganta, Guimarães, MacHado and Anguera, 2014; Hughes and Lovell 2019).

Many further studies have highlighted key performance indicators that relate to general build up play, prior to a goal being scored as being the most important performance variables (Hook and Hughes 2001; Hughes and Franks 2005; Lago- Penas et al. 2010). Other studies focussing on possession have suggested possession in the right areas of the field (particularly attacking areas) are of most importance (Bate 1998; Lago-Penas et al. 2010; Collet 2013). Collet (2013) in a study across European leagues revealed that unproductive or superfluous passing contributes to negative match outcomes.

Some studies have focussed more specifically on transitions to attack and defence caused by the turnover of possession and these studies have revealed contrasting results. Reep, Pollard and Benjamin (1971) studied possession regains and revealed that 25% of all goals scored came about due to regains that occurred in the attacking quarter of the football pitch. Reep, Pollard and Benjamin also revealed that 30% of all possession regains led to a shot on the opponent's goal. More recent research has also supported the notion that regaining possession of the ball as close to the opponent's goal as possible leads to an increase in scoring opportunities (Garganta Maia and Basto 1997; Grant,

 Williams, Lee and Reilly, 1998; Larson 2001). Grant et al. (1998) concluded that possession regains that occurred closest to the opponent's goal, led to more scoring opportunities (shots) but fewer goals. The authors suggested therefore that possession regains that occurred further away from the opponent's goal resulted in greater quality of chances as these regains allowed teams more space in which to operate and thus exploit.

Hughes and Lovell (2019) examined the influence of turnover zones, turnover type and 'on the ball' player actions upon goals scored and scoring opportunities for 3,077 transitions from 29 Champions League knockout games in the 2014-2015 season. Hughes and Lovell (2019) revealed that nearly half of all possession turnovers occurred in the offensive zone (49.45%) and 7.69% led to goals being scored. In conclusion, Hughes and Lovell (2019) state that teams should press high up the field in order to turn over possession as close as possible to the opponent's goal and thus support the findings of Reep et al. (1971). Furthermore, the authors concluded that immediate player actions after a turnover is critical to the outcome of an attacking transition.

In a study on Champions League knockout football, Almeida et al. (2014) revealed that of the 28 matches analysed and 5,457 possession regains recorded, only 2.8% of possession regains occurred in the offensive quarter. Contrary to many of the studies aforementioned, Almeida et al. (2014) discovered that 81% of possession regains actually occurred in the defensive half of the pitch, with 48.2% of these regains occurring in the defensive quarter.

Gomez, Gomez-Lopez, Lago and Sampaio (2012) investigated 1,900 matches in the Spanish Professional Football League spanning across 5 seasons between the 2003-04 season and 2007-08 season. Gomez et al. (2012) examined the occurrences of certain play actions across 19 pitch zones and discovered that winning teams were more adept at recovering the ball than losing or drawing teams in zone 2 (a zone in the defensive half between the 18-yard box semi-circle and centre circle).

Barreira et al. (2014) investigated 1,619 attacks carried out by semi-finalists of the 2010 FIFA World cup in order to assess ball recovery patterns in 12 pitch zones. Barreira et al. (2014) concluded that possession regains occurred most frequently in central locations in the defensive quarters of the pitch. The authors also discovered that possession regains were much less frequent in the offensive quarters of the pitch, occurring rarely in the third quarter and not at all in the final quarter.

Liu, Gomez, Lago-Penas and Sampaio (2015) also investigated possession regains in a FIFA World cup tournament and analysed 64 matches played at the FIFA World cup 2014. Liu et al. (2015) revealed that turnovers in the defensive half, that resulted in shooting opportunities on the counter attack had a positive effect on the probability of winning matches.

As can be seen from the literature above, possession regains are crucial with regards to attacking performance, however authors appear to be split with regards to which areas of the field is the most productive area to recover possession in. Much of the existing literature therefore seems to provide inconclusive results with regard to which area is "best" for regaining possession of the ball.

The author of this study offers two potential reasons for this divide in the findings of previous research. Firstly, many of the studies above have incorporated several teams, with different managers and thus different styles of play in their studies. A manager's instructions on how, when and where to press their opponents could differ between teams as each manager will attempt to make the most of the unique resources (11-14 players) they preside over during a regular 90-minute match. Furthermore, the varying skill level of each team and squad is likely to impact their ability to press and thus recover possession. Consequently, the results obtained in studies mentioned above have provided us a general overview of possession regain patterns rather than team specific ones.

Finally, many previous studies have focussed on possession regains that have occurred in fixtures played in cup competitions. As argued by Downward, Dawson and Dejonghe (2009), league fixtures are repeated trials that are more likely to reveal genuine team and player efforts, as opposed to the traditional knock out competition where the element of chance has a significant bearing upon success.

The impact of a manager's influence on their own team's performance has been proven to be a crucial factor in previous research (Audas, Dobson and Goddard, 1999; Salomo and Teichmann, 2000; Dawson and Dobson, 2002; Frick Barros and Prinz, 2010, Tenga, Ronglan and Bahr, 2010). In this case study, the subject team had the same manager throughout the sample period, therefore any possession regain patterns discovered are likely to be a reflection of the manager's instructions and coaching philosophy.

Furthermore, as argued above, possession regain patterns are likely to change between teams due to varying quality and skill levels, thus incorporating several teams into one study offers a general overview rather than team specific results. This case study addresses this concern by focussing on the possession regain patterns of a sole EPL team.

Finally, cup competitions such as the European cup consist of knockout fixtures which enforce the 'away goals rule' that could heavily influence the style of play adopted (and thus possession regain patterns) as in some cases away goals count double (www.UEFA.com). Furthermore, knockout matches carry a greater element of chance which can influence performances and thus match outcomes, as opposed to league fixtures that are more representative of genuine performance (Downward et al. 2009). This case study focusses on only league matches played by the one subject team over the

course of a three season period and thus limits the impact of chance on team and player performances.

At the time of writing this paper the subject team of this case study still have the same manager as when the sample period started. It is assumed that player turnover throughout the sample period is by design and thus intended by the manager in order to recruit players more adept to fulfilling the manager's style of play.

This case study aims to examine the following:

- (1) To examine possession regain patterns of the subject team and determine the extent of the impact of these possession regains upon the subject team's attacking performance.
- (2) To determine which of 9 pitch zones of the opponent's half of the football pitch is the one where the subject team enjoys the most success, in terms of productive possession turnover and thus which players contribute most to this success.
- (3) To examine which other factors influence the subject team's ability to effectively regain possession.

### Methods

### **Experimental Design**

Hughes and Lovell's (2019) definition of a possession turnover was adapted for this study: A possession regain was observed when a player (or players in unison) regained possession of the ball from their opponent(s) in open play via a deliberate action (tackle, block, interception etc) and recorded only if the team regaining possession subsequently had at least one controlled touch.

Possession regains as a result of set pieces were excluded from this study in order to control for instances such as referee bias (Nevill, Balmer and Williams, 2002; Sutter and Kocher 2004; Dawson, Dobson, Goddard and Wilson, 2007; Pollard 2008; Page and Page 2010) sportsmanship, where a player kicked the ball out of play in order for another to acquire treatment to an injury and to avoid any regains that may have been missed due to the playback of action replays during the match footage (Hughes and Lovell, 2019).

A manual notation scatter diagram system (O'Donoghue, 2014) was designed in order to note all possession regains/turnovers that occurred in open play in the opponent's half of the playing field (as well as coding matches on Sportscode). The opponent's half was broken up into 9 equal sized zones as in figure 1 below. Many previous studies examining possession have broken up the playing field in several zones to suit the needs of their studies (Tenga et al. 2010; Lago-Ballesteros, Lago-Peñas and Rey 2012; Gomez et al. 2014; Barreira et al. 2014; Almeida et al. 2014; Gonzalez-Rodenas, Lopez-Bondia, Calabuig, Pérez-Turpin and Aranda 2017; Hughes and Lovell 2019). By separating the opponent's half in to 9 equal zones in this study, I was able to determine specifically where the most productive possession regains occurred and thus which players were most adept at utilising this recovery of possession.

### **Insert Figure 1 here**

# Sample

The sample consisted of 106 English Premier League matches played by the subject of this case study (n=106). Matches spanned over three seasons ranging from part way through the 15/16 season through to the end of the 17/18 season. During the sample period, the subject of this case study did not replace their manager. All matches were downloaded from www.wyscout.com.

Data

The number of possession regains were collated via a scatter diagram manual notation system (O'Donoghue 2014), as well as digitally coded on Sportscode v10 software (also used to view matches). Additional data utilised in this study was provided by OPTA sports, renowned for having a high degree of accuracy (Liu, Hopkins, Gómez and Molinuevo 2013; Beato, Jamil and Devereux 2018).

### Reliability

Reliability testing consisted of two phases:

Phase 1 – All matches were viewed on Sportscode v10 and coded for a first time (C1). Intra-observer reliability tests were then conducted by recoding 20% of randomly selected matches (21 matches) 3 months later (C2).

Phase 2 – Inter-observer reliability was then conducted a further 4 weeks after phase 1 reliability was complete (thus 4 months after C1). For this phase, 5 matches were randomly selected out of the 21 matches observed for C2 and a further 10 matches were randomly selected of the remaining 85 matches from C1.

Reliability was determined via the calculation of weighted kappa statistic as suggested by O'Donoghue (2010) and Liu et al. (2013). The interpretation of kappa values obtained was as follows: <0 less than chance agreement; 0.01-0.20 poor agreement; 0.21-0.40 fair agreement; 0.41-0.60 moderate agreement; 0.61-0.80 good agreement; 0.81-0.99 very good agreement (Viera and Garrett, 2005; Liu et al. 2013).

The Kappa value for phase 1 (intra-observer) reliability was 0.97 revealing a very high degree of agreement between an observer's first coding attempt (C1) and second coding attempt (C2). Out of a total of 77 possession regains recorded, in a random sample of 21 fixtures, in C1, there were 75 agreements in C2.

The Kappa value for the phase 2 (inter-operator) reliability was 0.95 revealing a very high degree of agreement between independent operators. Out of a total of 62 possession regains recorded by operator 1, in a sample of 15 fixtures, there were 59 agreements recorded by operator 2. The reliability results reveal consistency and accuracy in the recording of the number of possession regains by the subject team, by both operator 1 and between operator 1 and operator 2.

### Statistical Analysis

A series of regressions were run in order to investigate; how possession regains impacted the attacking performance of the subject team (Regression 1, equation 1), which players were most productive with possession regains with regards to the attacking performance of the subject team (Regression 2, equation 2); which other factors influenced the number of possession regains by the subject team (Regression 3, equation 3). As there were n=106 match observations in the sample for each regression, the number of regressors was limited to no more than 10, as optimal conditions for regression models consist of around 10 observations per regressor (Wooldridge 2009; Field 2014).

### Regression 1

### $Y_{1jt} = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + u_i$

### (Equation 1)

In equation 1 above, the dependent variable  $(Y_1)$  is the number of goals scored, in match *j* at time *t*. The explanatory (Z) variables consist of the number of possession regains in the opponent's half, total chances created, quality of the opponent, venue (dummy), short pass completion (%), corner success rate (%) and successful open play crosses.

Goals scored are also deemed to be a key performance indicator for attacking play in much previous research on player and team performance (Lucifora and Simmons 2003; Hughes and Franks, 2005; Lago and Martín 2007; Carmichael and Thomas 2008; Lago-Penas et al. 2010; McHale, Scarf and Folker, 2012). Possession regains were included as an explanatory variable as these were the focus of this study. Other factors that affect match performance, prevalent in previous research includes, venue and measures for the quality of the opponent.

Some previous literature has suggested that venue impacts player and team performances, most of which suggests that home sides hold an advantage over their opposition (Nevill, Newell and Gale 1996; Tucker, Mellalieu, James and Taylor 2005; Pollard 2008). This home advantage has been due to a number of factors such as referee bias (Sutter and Kocher 2004; Dawson et al. 2007; Pollard 2008) and higher effort levels from home players (Leard and Doyle 2011). Other factors such as the support received from the crowd and familiarity effects have also been recognised as being the source of home advantages (Nevill et al. 1996; Carmichael and Thomas 2005; Pollard 2008). Staufenbiel, Lobinger and Strauss (2015) also discovered that regardless of expertise, coaches for the home team had higher expectations to win, set more challenging goals and decided for more offensive and courageous playing tactics. Consequently, a venue dummy variable was incorporated in the regression model in order to investigate whether playing home or away had any impact on the subject team's attacking performance.

Many previous studies have also revealed that the quality of the opponent significantly impacts performances and should therefore be accounted for (Gerisch and Reichelt, 1993; Carmichael et al. 2000; Carmichael, Thomas and Ward 2001; Yamanaka, Liang and Hughes 2002; Lago and Martin 2007; Taylor, Mellalieu, James and Shearer 2008; Lago 2009; Redwood-Brown, Bussell and Bharaj 2012; Bradley, Lago-Penas, Rey

and Sampaio 2014). Consequently, measures of opponent quality utilised in some of the studies above such as, final league positions and opponent goal differences, were incorporated into this analysis to investigate whether the quality of the opponent had any impact on the attacking performance of the subject team.

The variable, chance creation represented the total of shots on target and shots off target. In theory, the more shooting opportunities a team creates the more goals they will score, thus enhancing their chances of winning (Carmichael et al. 2001; Torgler 2004; Hughes and Franks 2005; Lago and Martin 2007; Lago-Penas et al. 2010; McHale et al. 2012). Short pass completion was included due to the general importance of possession in football which has been discussed above. Corner success rate was included in order to account for some of the goals that may have been scored direct from pre-planned set plays (Reep et al. 1971; Larson 2001). Finally, the number of successful open play crosses was also included in order to account for goals scored from intentional deliveries from wide areas into team mates within close proximity of the opponent's goal (Mara, Wheeler and Lyons 2012).

### Regression 2

 $Y_{2jt} = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + \beta_7 Z_7 + \beta_8 Z_8 + \beta_9 Z_9 + u_i$ 

### (Equation 2)

In equation 2 above, the dependent variable  $(Y_1)$ , is the number goals scored in match *j* at time *t*. The explanatory (*Z*) variables consist of 9 variables, each representing possession regains that occurred in that zone of the playing field (as displayed in figure 1 above).

# Regression 3

## (Equation 3)

In equation 3 above, the dependent variable  $(Y_2)$ , is the number of possession regains in the opponent's half in match *j* at time *t*. The explanatory (*Z*) variables consisted of measures for the quality of the opponent, venue (dummy), match status and fatigue. To assess the relative quality of the opponent, two measures, the opponent's goal difference and the number of goals they conceded were included in the regression model. The number of changes in match status were also recorded as some recent research suggests this could also impact a team's urgency with regard to regaining the ball (Lago 2009; Bradley et al. 2014; Vogelbein et al. 2014).

Finally, two measures of fatigue were included in the model, firstly the number of days of recovery between matches (non-match days were considered recovery days) and secondly, the number of games played in the last 7 days. Fatigue has been revealed to impact performance (Brownstein et al. 2017; Thorpe, Atkinson, Drust and Gregson 2017) and therefore could impact the number of possession regains, particularly as the high pressing style of play adopted by the subject team places a greater demand on players to perform frequent high speed runs.

# Results

### Regression 1

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity was conducted to test for assumptions and the results confirmed constant variances,  $\chi^2(1) = 0.31$ , prob >  $\chi^2$ = 0.5784. Variance Inflation Factors reveal no multi-collinearity (VIF, 1/VIF), Possession regains (1.07, 0.934911), Total Chances Created (1.35, 0.738848), Quality of Opposition (1.27, 0.786105), Venue (1.11, 0.898698), Short Pass (1.29, 0.773004), Corner Success Rate (1.53, 0.653719), Successful Open Play Crosses (1.53, 0.652892). A Jarque-Bera test was conducted to test for the normality of residual errors and the results confirmed normality ( $\chi^2 = 0.0883$ ).

Results from OLS regression 1 are reported in table 1 below: F (7,98) = 6.55, prob > F = 0.0000, R-squared = 0.3187, Adjusted R-squared = 0.2700, Root MSE = 1.3098, Cohen's  $f^2 = 0.37$  (representing a large effect size).

### **Insert Table 1 here**

# Regression 2

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity was conducted to test for assumptions and the results confirmed constant variances,  $\chi^2$  (1) = 1.06, prob >  $\chi^2 = 0.3030$ . Variance Inflation Factors revealed no multi-collinearity (VIF, 1/VIF), Area 1 (1.09, 0.921641), Area 2 (1.13, 0.881129), Area 3 (1.09, 0.913607), Area 4 (1.14, 0.877457), Area 5 (1.05, 0.951102), Area 6 (1.10, 0.907126), Area 7 (1.14, 0.879661), Area 8 (1.10, 0.911136), Area 9 (1.10, 0.913027). A Jarque-Bera test was conducted to test for the normality of residual errors and the results confirmed normality ( $\chi^2 = 0.0542$ )

Results from OLS regression 2 are reported in table 2 below. F (9, 96) = 2.04, prob > F = 0.0428, R-squared = 0.1606, Adj R-squared = 0.0819, Cohen's  $f^2 = 0.09$ (representing a small to medium effect size).

### **Insert Table 2 here**

### Regression 3

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity was conducted to test for assumptions and the results suggested heteroskedasticity was present,  $\chi^2$  (1) =

8.56, prob >  $\chi^2$  = 0.0034. Variance Inflation Factors however revealed no multicollinearity (VIF, 1/VIF), Venue (1.05, 0.954508), Opponent Goal Difference (1.47, 0.427461), Opponent Goal Conceded (1.44, 0.693072), Change in Match Status (1.06, 0.940727), Days of Rest In-between Games (2.34, 0.427461), Number of Games in Previous 7 Days (2.26, 0.442004). A Jarque-Bera test was conducted to test for the normality of residual errors and the results confirmed normality ( $\chi^2$  = 0.2138). Due to the presence of heteroskedasticity, a robust bootstrap regression was conducted in order to cover for the violation of this assumption (Field 2014). 2000 repetitions were selected and rather than the standard 95% confidence interval, bias corrected and accelerated confidence intervals (BCa) were selected as these are more accurate (Efron and Tibshirani 1993; Field 2014). The results obtained from regression 3 are reported in table 3 below. Wald  $\chi^2$  (6) = 12.51, prob >  $\chi^2$  = 0.0515, R-squared = 0.1143, Adj R-squared = 0.0606, Cohen's f<sup>2</sup> = 0.06 (representing a small to medium effect size).

### **Insert Table 3 here**

#### Discussion

The results reveal three main findings. Firstly, possession regains in the opponent's half of the playing field had a significant and positive impact on the subject team's attacking performance. This result is therefore in line with previous research that suggests regaining the ball high up the playing field is of great importance with regards to attacking performance (Reep et al. 1971; Garganta et al. 1997; Grant et al. 1998; Larson 2001; Hughes and Lovell 2019). The Cohen's  $f^2$  of 0.37 suggests the independent variables utilised in this part of the analysis had a large effect on the dependent variable (goals scored).

Secondly, possession regains that occurred on the left side of the opponent's half of the field had a significant and positive impact on the subject team's attacking performance. Specifically, possession regains that occurred just beyond the half way line (AREA 1) and closest to the opponent's goal (AREA 7, although at a 90% CI) were revealed to be of significance. These results therefore indicate that players that perform on left sided playing positions for the subject team are not only capable of regaining possession but also utilising possession of the ball productively post regains.

Alternatively, this secondary analysis also revealed that possession regains that occurred deep in the opponent's half on the right side of the playing field (AREA 9) had a negative impact upon the attacking performance of the subject team (although only at a 90% CI). This result suggests that possession regains that occur on the right side of the opponent's half are not used as productively as those that occur on the left side. The fact that the only significant results were discovered in wide areas, provides an insight in to how the subject team deploys their pressing strategy. Based on the results obtained for this analysis it seems the subject team employs a strategy focussed upon regaining the ball high up the playing field in wide areas rather than central areas.

Finally, the tertiary analysis conducted in this study revealed that the quality of the opponent did have a significant and positive impact on the number of possession regains completed by the subject team. This result therefore reinforces the claims of Mackenzie and Cushion (2013) that the impact of the opponent should not be overlooked when assessing performances in team sports. At first glance, this result may appear surprising, however previous research has revealed that the higher quality teams are more capable of retaining the ball, explaining why lower league teams cover greater distances and more high speed runs than the elite teams (Rampinini, Impellizzeri, Castagna, Coutts and Wisloff 2009; Di Salvo, Gregson, Atkinson, Tordoff and Drust 2009). A possession regain thus is more likely to occur in the opponent's half of the field when encountering teams that are more comfortable/capable of passing the ball around in defensive zones. The Cohen's  $f^2$  of 0.06 indicated that the independent variables utilised in this analysis had a small to medium effect size on the dependent variable (number of possession regains by the subject team).

Other results of interest are summarised below:

### <u>Regression 1</u>

The variable Total Chances Created, had a positive impact on the number of goals scored by the subject team, which is to be expected as goals are a product of goal scoring opportunities. The variable Successful Open Play Crosses was revealed to have a highly significant but negative impact upon the number of goals scored by the subject team. This could perhaps be explained by the subject team's forward players not making the most of successful crosses during open play.

## Regression 3

Several variables that have previously been revealed to impact general team performances, such as venue, match status and fatigue (Pollard 2008; Leard and Doyle 2011; Lago and Martin 2007; Lago 2009; Brownstein et al. 2017; Thorpe et al. 2017) were all revealed to have no impact specifically on the number of possession regains completed by the subject team.

# Conclusion

The author of this case study argues that possession regain patterns are likely to vary between teams and leagues around the world due to factors such as the manager's philosophy and coaching ability, strategies and tactics employed by each team and the skill and quality level of each team, which all appear to have been overlooked in previous research. This study addresses these issues by focussing on the possession regain patterns of only one Premier League team across 106 league fixtures both home and away, whilst managed by the same person.

The results obtained from this case study revealed that the number of successful possession regains in the opponent's half had a significant and positive impact upon the attacking performance of the subject team. From a tactical point of view, the EPL subject team has justified its high-pressing style of play with particular focus on regaining the ball in wide areas of the playing field in order to create scoring opportunities.

Furthermore, this study revealed that the subject team is particularly strong at regaining the ball on the left side of the field (AREA 1) and then converting these possession regains in to goals (highly significant positive impact). These results therefore reflect well on the left full back, left sided midfielders and left sided forward players with regards to their productivity with the ball in possession particularly after it has been regained on their side of the field. In contrast, players that performed on the right side of the field were not as productive with the ball, post possession regains. From a practical perspective, these results indicate to the manager which players are implementing his desired strategy and which are not, therefore potentially influencing his coaching methods and informing his recruitment policy.

Finally, the quality of the opponent was revealed to have an impact on the number of possession regains successfully completed by the subject team of this case study. The subject appeared to be more successful at regaining possession of the ball when they played against opponents of higher quality. This result could be explained by higher quality teams being confident in their ability on the ball and also by the lower quality

teams adopting long ball tactics in order to counter the high pressing style of the subject team.

Future studies could investigate the possession regain patterns of several teams across several different leagues managed by specific managers in order to provide a comparison of playing styles around the world. From a practical point of view, this could further inform potential employers of what to expect with certain managerial appointments.

### References

Almeida, C. H., Ferreira, A. P., & Volossovitch, A. (2014). Effects of Match Location, Match Status and Quality of Opposition on Regaining Possession in UEFA Champions League. *Journal of Human Kinetics*, *41*(June), 203–214. <u>https://doi.org/10.2478/hukin-2014-0048</u>

Audas, R., Dobson, S., & Goddard, J. (1999). Organizational performance and managerial turnover. Managerial and Decision Economics (Vol. 20). https://doi.org/10.1002/(SICI)1099-1468(199909)20:63.0.CO;2-O

Barreira, D., Garganta, J., Guimarães, P., MacHado, J., & Anguera, M. T. (2014). Ball recovery patterns as a performance indicator in elite soccer. *Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology*, 228(1), 61–72. <u>https://doi.org/10.1177/1754337113493083</u>

Bate, R. (1998). Football Chance: Tactics and Strategy. In T. Reilly, A. Lees, K. Davids,
& W. Murphy (Eds.) *Science and Football* (pp. 293-301). London: E & FN Spon.

Beato, M., Jamil, M., & Devereux, G. (2018). The Reliability of Technical and Tactical Tagging Analysis Conducted by a Semi-Automatic VTS in Soccer. *Journal of Human Kinetics*, *62*(1), 103–110. <u>https://doi</u>.org/10.1515/hukin-2017-0162

Bradley, P. S., Lago-Peñas, C., Rey, E., & Sampaio, J. (2014). The influence of situational variables on ball possession in the English Premier League. *Journal of Sports Sciences*, *32*(20), 1867–1873. <u>https://doi.org/10.1080/02640414.2014.887850</u>

Brownstein, C. G., Dent, J. P., Parker, P., Hicks, K. M., Howatson, G., Goodall, S., & Thomas, K. (2017). Etiology and recovery of neuromuscular fatigue following competitive soccer match-play. *Frontiers in Physiology*, *8*(OCT). <u>https://doi.org/10.3389/fphys.2017.00831</u>

Carmichael, F., Thomas, D., & Ward, R. (2000). Team Performance: The Case of English Premiership Football. *Managerial and Decision Economics*, *21*(1), 31-45. Retrieved from <u>http://www.jstor.org/stable/3108117</u>

Carmichael, F., Thomas, D., & Ward, R. (2001). Production and Efficiency in Association Football. *Journal of Sports Economics*, 2(3), 228–243. https://doi.org/10.1177/152700250100200303

Carmichael, F., & Thomas, D. (2005). Home-Field Effect and Team Performance. *Journal of Sports Economics*, 6(3), 264–281. https://doi.org/10.1177/1527002504266154

Carmichael, F., & Thomas, D. (2008). Efficiency in Knock-out Tournaments: Evidence from EURO 2004. *European Sport Management Quarterly*, 8(3), 211–228. https://doi.org/10.1080/16184740802224092

Collet, C. (2013). The possession game? A comparative analysis of ball retention and team success in European and international football, 2007-2010. *Journal of Sports Sciences*, *31*(2), 123–136. <u>https://doi.org/10.1080/02640414.2012.727455</u>

Dawson, P., & Dobson, S. (2002). Managerial efficiency and human capital: an application to English association football. *Managerial and Decision Economics*, *23*(8), 471–486. <u>https://doi.org/10.1002/mde.1098</u>

Dawson, P., Dobson, S., Goddard, J., & Wilson, J. (2007). Are football referees really biased and inconsistent?: evidence on the incidence of disciplinary sanction in the English Premier League. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *170*(1), 231–250. <u>https://doi.org/10.1111/j.1467-985X.2006.00451.x</u>

Di Salvo, V., Gregson, W., Atkinson, G., Tordoff, P., & Drust, B. (2009). Analysis of High Intensity Activity in Premier League Soccer. *International Journal of Sports Medicine*, *30*(03), 205–212. https://doi.org/10.1055/s-0028-1105950

Downward, P., Dawson, A. & Dejonghe, T. (2009). *Sports economics theory, evidence and policy*. UK: Butterworth - Heinemann.

Efron, B. & Tibshirani, R.J. (1993). *An Introduction to the Bootstrap*. USA: Chapman and Hall CRC.

Field, A. (2014). Discovering Statistics Using IBM SPSS Statistics (4th ed.). London: Sage.

Frick, B., Barros, C. P., & Prinz, J. (2010). Analysing head coach dismissals in the German "Bundesliga" with a mixed logit approach. *European Journal of Operational Research*, 200(1), 151–159. <u>https://doi.org/10.1016/j.ejor.2008.11.048</u>

Garganta, J., Maia, J., & Basto, F. (1997). Analysis of goal-scoring patterns in European top level soccer teams. In J. Bangsbo, M. Hughes, & T. Reilly (Eds.), *Science and football III. Proceedings of the Third World Congress of Science and Football, Cardiff, Wales,* 9–13 April, 1995 (pp. 246–250). London: E & FN Spon

Gerisch, G & Reichelt, M (1993). Computer and Video Aided Analysis of Football Games. In: T.Reilly, J.Clarys and A. Stibbe (Eds.) *Science and Football II* (pp.167-173). London: Taylor and Francis.

Gómez, M. A., Gómez-Lopez, M., Lago, C., & Sampaio, J. (2012). Effects of game location and final outcome on game-related statistics in each zone of the pitch in professional football. *European Journal of Sport Science*, *12*(5), 393–398. https://doi.org/10.1080/17461391.2011.566373

Gonzalez-Rodenas, J., Lopez-Bondia, I., Calabuig, F., Pérez-Turpin, J. A., & Aranda, R. (2017). Association between playing tactics and creating scoring opportunities in counterattacks from United States Major League Soccer games. *International Journal of* 

# Performance Analysis in Sport, 16(2), 737–752. https://doi.org/10.1080/24748668.2016.11868920

Grant, A., Williams, A.M., Lee, D. & and Reilly, J. (1998). Match Analysis of Previous World Cups (1986-1994). Insight 4, pp.20-21.

Hook, C. & Hughes, M. D. (2001). Patterns of play leading to shots in Euro 2000. In: *Pass.com*. CPA (Centre for Performance Analysis). Cardiff: UWIC, 295-302.

Hughes, M. D & Churchill, S. (2005). Attacking profiles of successful and unsuccessful team in Copa America 2001. In: T Reilly, J Cabri, D Araújo. Eds. *Science and Football V.* London and New York: Routledge, pp. 219-224

Hughes, M., & Franks, I. (2005). Analysis of passing sequences, shots and goals in soccer.JournalofSportsSciences,23(5),509–514.https://doi.org/10.1080/02640410410001716779

Hughes, M., & Lovell, T. (2019). Transition to attack in elite soccer. *Journal of Human Sport and Exercise*, *14*(1), 236–253. <u>https://doi.org/10.14198/jhse.2019.141.20</u>

Jones, P. D., James, N., & Mellalieu, S. D. (2017). Possession as a performance indicator in soccer. *International Journal of Performance Analysis in Sport*, *4*(1), 98–102. https://doi.org/10.1080/24748668.2004.11868295 Lago, C., & Martín, R. (2007). Determinants of possession of the ball in soccer. *Journal* of Sports Sciences, 25(9), 969–974. https://doi.org/10.1080/02640410600944626

Lago, C. (2009). The influence of match location, quality of opposition, and match status on possession strategies in professional association football. *Journal of Sports Sciences*, 27(13), 1463–1469. <u>https://doi.org/10.1080/02640410903131681</u>

Lago-Ballesteros, J., Lago-Peñas, C., & Rey, E. (2012). The effect of playing tactics and situational variables on achieving score-box possessions in a professional soccer team. *Journal of Sports Sciences*, *30*(14), 1455–1461. https://doi.org/10.1080/02640414.2012.712715

Lago-Peñas, C., Lago-Ballesteros, J., Dellal, A., & Gómez, M. (2010). Game-related statistics that discriminated winning, drawing and losing teams from the Spanish soccer league. *Journal of Sports Science and Medicine*, *9*(2), 288–293.

Larson, O. (2001). Charles Reep: A Major Influence on British and Norwegian Football. Soccer & Society, 2(3), 58–78. <u>https://doi.org/10.1080/714004854</u>

Leard, B., & Doyle, J. M. (2011). The effect of home advantage, momentum, and fighting on winning in the national hockey league. *Journal of Sports Economics*, *12*(5), 538–560. <u>https://doi.org/10.1177/1527002510389869</u>

Liu, H., Hopkins, W., Gómez, M. A., & Molinuevo, J. S. (2013). Inter-operator reliability of live football match statistics from OPTA Sportsdata. *International Journal of* 

 Performance
 Analysis
 in
 Sport,
 13(3),
 803–821.

 https://doi.org/10.1080/24748668.2013.11868690

Liu, H., Gomez, M. Á., Lago-Peñas, C., & Sampaio, J. (2015). Match statistics related to winning in the group stage of 2014 Brazil FIFA World Cup. *Journal of Sports Sciences*, *33*(12), 1205–1213. <u>https://doi.org/10.1080/02640414.2015.1022578</u>

Lucifora, C., & Simmons, R. (2003). Superstar Effects in Sport: Evidence From Italian Soccer. *Journal of Sports Economics*, 4(1), 35–55. https://doi.org/10.1177/1527002502239657

Mackenzie, R., & Cushion, C. (2013). Performance analysis in football: A critical review and implications for future research. *Journal of Sports Sciences*, *32*(1), 2–7. https://doi.org/10.1080/02640414.2013.807352

Mara, J. K., Wheeler, K. W., & Lyons, K. (2012). Attacking Strategies That Lead to Goal Scoring Opportunities in High Level Women's Football. *International Journal of Sports Science & Coaching*, 7(3), 565–577. https://doi.org/10.1260/1747-9541.7.3.565

McHale, I. G., Scarf, P. A., & Folker, D. E. (2012). On the development of a soccer player performance rating system for the english Premier League. *Interfaces*, *42*(4), 339–351. https://doi.org/10.1287/inte.1110.0589

Nevill, A. M., Newell, S. M., & Gale, S. (1996). Factors associated with home advantage in English and Scottish soccer matches. *Journal of Sports Sciences*, *14*(2), 181–186. <u>https://doi.org/10.1080/02640419608727700</u>

Nevill, A. M., Balmer, N. J., & Mark Williams, A. (2002). The influence of crowd noise and experience upon refereeing decisions in football. *Psychology of Sport and Exercise*, *3*(4), 261–272. https://doi.org/10.1016/S1469-0292(01)00033-4

O'Donoghue, P. (2010). Research Methods for Sports Performance Analysis. UK: Routledge.

O'Donoghue, P. (2014). An Introduction to Performance Analysis of Sport. Abingdon: Routledge.

Page, K., & Page, L. (2010). Alone against the crowd: Individual differences in referees' ability to cope under pressure. *Journal of Economic Psychology*, *31*(2), 192–199. https://doi.org/10.1016/j.joep.2009.08.007

Pollard, R. (2008). Home Advantage in Football: A Current Review of an Unsolved Puzzle. *The Open Sports Sciences Journal*, *1*(1), 12–14. https://doi.org/10.2174/1875399x00801010012

Rampinini, E., Impellizzeri, F. M., Castagna, C., Coutts, A. J., & Wisloff, U. (2009). Technical performance during soccer matches of the Italian Serie A league: effect of fatigue and competitive level. *Journal of Science and Medicine in Sport*, *12*(1), 227–233. <u>https://doi.org/10.1016/j.jsams.2007.10.002</u>

Redwood-Brown, A., Bussell, C., & Bharaj, H. S. (2012). The impact of different standards of opponents on observed player performance in the English Premier League.

Journal of Human Sport and Exercise, 7(SPECIALISSUE.2), 341–355. https://doi.org/10.4100/jhse.2012.72.01

Reep, C., Pollard, R., & Benjamin, B. (1971). Skill and Chance in Ball Games. *Journal* of the Royal Statistical Society. Series A (General), 134(4), 623-629. doi:10.2307/2343657

Salomo, S., & Teichmann, K. (2000). The relationship of performance and managerial succession in the German premier football league. *European Journal for Sport Management (EJSM)*, 7, 99-199.

Staufenbiel, K., Lobinger, B., & Strauss, B. (2015). Home advantage in soccer – A matter of expectations, goal setting and tactical decisions of coaches? *Journal of Sports Sciences*, *33*(18), 1932–1941. <u>https://doi.org/10.1080/02640414.2015.1018929</u>

Sutter, M., & Kocher, M. G. (2004). Favoritism of agents - The case of referees' home bias. *Journal of Economic Psychology*, 25(4), 461–469. <u>https://doi.org/10.1016/S0167-4870(03)00013-8</u>

Taylor, J., Mellalieu, S., James, N., & Shearer, D. (2008). The influence of match location, quality of opposition, and match status on technical performance in professional association football. *Journal of Sports Sciences*, 26(9), 885–895. https://doi.org/10.1080/02640410701836887 Tenga, A., Ronglan, L. T., & Bahr, R. (2010). Measuring the effectiveness of offensive match-play in professional soccer. *European Journal of Sport Science*, *10*(4), 269–277. https://doi.org/10.1080/17461390903515170

Thorpe, R. T., Atkinson, G., Drust, B. and Gregson, W. (2017). Fatigue status in elite team sport athletes : Implications for practice. *International Journal of Sports Physiology and Performance*, *12*(S2), 27–34. <u>https://doi.org/10.1123/ijspp.2016-0434</u>

Torgler, B. (2004). The economics of the FIFA football worldcup. *Kyklos*, *57*(2), 287–300. https://doi.org/10.1111/j.0023-5962.2004.00255.x

Tucker, W., Mellalieu, D. S., James, N., & Taylor, B. J. (2005). Game Location Effects in Professional Soccer: A Case Study. *International Journal of Performance Analysis in Sport*, *5*(2), 23–35. <u>https://doi.org/10.1080/24748668.2005.11868325</u>

https://www.uefa.com/MultimediaFiles/Download/Regulations/uefaorg/Regulations/02/ 55/82/79/2558279 DOWNLOAD.pdf

Viera, A.J. & Garrett, J.M. (2005). Understanding interobserver agreement: the kappa statistic. *Family Medicine*, *37* (5), 360-363.

Vogelbein, M., Nopp, S., & Hökelmann, A. (2014). Defensive transition in soccer – are prompt possession regains a measure of success? A quantitative analysis of German Fußball-Bundesliga 2010/2011. *Journal of Sports Sciences*, *32*(11), 1076–1083. https://doi.org/10.1080/02640414.2013.879671 Wooldridge, J. (2009). *Introductory Econometrics: A Modern Approach* (4th ed.). USA: South Western Cengage Learning.

Yamanaka, K., Liang, D, Y. & Hughes, M. (2002). An Analysis of the Playing Patterns of the Japan National Team in the 1998 World Cup for Soccer. In: T. Reilly, J. Bangsbo and M.Hughes (Eds.) *Science and Football III* (pp. 101-105). London and New York: Routledge.

A Case Study Assessing Possession Regain Patterns in English Premier League Football

# A Case Study Assessing Possession Regain Patterns in English Premier League Football

#### Abstract

Recent years have seen significant attention awarded to possession regains in football. This case study examines possession regain patterns of an elite English Premier League team across 3 seasons from the 2015-16 season to the 2017-18 season (n=106). A series of regression are conducted in order to determine: what impact possession regains had on attacking performance, which players were most productive with possession post regains and which other factors influenced the number of successful possession regains by the subject team. Results revealed that possession regains in the opponent's half were highly significant and had a positive impact upon attacking performance (p = 0.006). Possession regains that occurred on the left-hand side of the playing field led to more productivity in front of goal (p = 0.028). The quality of the opponent was also revealed to have a significant impact upon the number of possession regains (p = 0.025). It is concluded that possession regains high up the playing field are crucial to the subject team's attacking success. Furthermore, players performing on the left side of the playing field were more productive with possession regains than those playing centrally or on the right.

Keywords: Attacking Transitions; Possession Turnovers; Possession Regains; Soccer; Premier League

### Introduction

In recent years, an English Premier League team appointed a manager well known for his high pressing style of play. Since this manager's appointment, his team's performances have appeared to gradually improve (in terms of league positions and performance in cup competitions). This study will focus specifically on how this manager has implemented his high-pressing style of play in the EPL and the role his players have performed in making it successful. The counter-press style of play is focussed around the turnover of possession in key areas, which many in the industry now refer to as attacking or defensive transitions, depending on whether the ball was won or lost (Vogelbein Nopp and Hökelmann 2014; Hughes and Lovell 2019). Possession of the ball has been revealed in many studies as being a key determinant of team success and various aspects of the passing attribute have been extensively reviewed such as, passing accuracy, passing range, longevity of passing sequences and recovery of possession (Carmichael, Thomas and Ward, 2000; Hughes and Churchill 2005; Jones, James and Mellalieu, 2017; Lago-Penas, Lago-Ballesteros, Dellal and Gomez, 2010; Vogelbein et al., 2014, Almeida, Ferreira and Volossovitch, 2014; Barreira, Garganta, Guimarães, MacHado and Anguera, 2014; Hughes and Lovell 2019).

Many further studies have highlighted key performance indicators that relate to general build up play, prior to a goal being scored as being the most important performance variables (Hook and Hughes 2001; Hughes and Franks 2005; Lago- Penas et al. 2010). Other studies focussing on possession have suggested possession in the right areas of the field (particularly attacking areas) are of most importance (Bate 1998; Lago-Penas et al. 2010; Collet 2013). Collet (2013) in a study across European leagues revealed that unproductive or superfluous passing contributes to negative match outcomes.

Some studies have focussed more specifically on transitions to attack and defence caused by the turnover of possession and these studies have revealed contrasting results. Reep, Pollard and Benjamin (1971) studied possession regains and revealed that 25% of all goals scored came about due to regains that occurred in the attacking quarter of the football pitch. Reep, Pollard and Benjamin also revealed that 30% of all possession regains led to a shot on the opponent's goal. More recent research has also supported the notion that regaining possession of the ball as close to the opponent's goal as possible leads to an increase in scoring opportunities (Garganta Maia and Basto 1997; Grant, Williams, Lee and Reilly, 1998; Larson 2001). Grant et al. (1998) concluded that possession regains that occurred closest to the opponent's goal, led to more scoring opportunities (shots) but fewer goals. The authors suggested therefore that possession regains that occurred further away from the opponent's goal resulted in greater quality of chances as these regains allowed teams more space in which to operate and thus exploit.

Hughes and Lovell (2019) examined the influence of turnover zones, turnover type and 'on the ball' player actions upon goals scored and scoring opportunities for 3,077 transitions from 29 Champions League knockout games in the 2014-2015 season. Hughes and Lovell (2019) revealed that nearly half of all possession turnovers occurred in the offensive zone (49.45%) and 7.69% led to goals being scored. In conclusion, Hughes and Lovell (2019) state that teams should press high up the field in order to turn over possession as close as possible to the opponent's goal and thus support the findings of Reep et al. (1971). Furthermore, the authors concluded that immediate player actions after a turnover is critical to the outcome of an attacking transition.

In a study on Champions League knockout football, Almeida et al. (2014) revealed that of the 28 matches analysed and 5,457 possession regains recorded, only 2.8% of possession regains occurred in the offensive quarter. Contrary to many of the studies aforementioned, Almeida et al. (2014) discovered that 81% of possession regains actually occurred in the defensive half of the pitch, with 48.2% of these regains occurring in the defensive quarter.

Gomez, Gomez-Lopez, Lago and Sampaio (2012) investigated 1,900 matches in the Spanish Professional Football League spanning across 5 seasons between the 2003-04 season and 2007-08 season. Gomez et al. (2012) examined the occurrences of certain play actions across 19 pitch zones and discovered that winning teams were more adept at recovering the ball than losing or drawing teams in zone 2 (a zone in the defensive half between the 18-yard box semi-circle and centre circle).

Barreira et al. (2014) investigated 1,619 attacks carried out by semi-finalists of the 2010 FIFA World cup in order to assess ball recovery patterns in 12 pitch zones. Barreira et al. (2014) concluded that possession regains occurred most frequently in central locations in the defensive quarters of the pitch. The authors also discovered that possession regains were much less frequent in the offensive quarters of the pitch, occurring rarely in the third quarter and not at all in the final quarter.

Liu, Gomez, Lago-Penas and Sampaio (2015) also investigated possession regains in a FIFA World cup tournament and analysed 64 matches played at the FIFA World cup 2014. Liu et al. (2015) revealed that turnovers in the defensive half, that resulted in shooting opportunities on the counter attack had a positive effect on the probability of winning matches.

As can be seen from the literature above, possession regains are crucial with regards to attacking performance, however authors appear to be split with regards to which areas of the field is the most productive area to recover possession in. Much of the existing literature therefore seems to provide inconclusive results with regard to which area is "best" for regaining possession of the ball.

The author of this study offers two potential reasons for this divide in the findings of previous research. Firstly, many of the studies above have incorporated several teams, with different managers and thus different styles of play in their studies. A manager's instructions on how, when and where to press their opponents could differ between teams as each manager will attempt to make the most of the unique resources (11-14 players) they preside over during a regular 90-minute match. Furthermore, the varying skill level of each team and squad is likely to impact their ability to press and thus recover possession. Consequently, the results obtained in studies mentioned above have provided us a general overview of possession regain patterns rather than team specific ones.

Finally, many previous studies have focussed on possession regains that have occurred in fixtures played in cup competitions. As argued by Downward, Dawson and Dejonghe (2009), league fixtures are repeated trials that are more likely to reveal genuine team and player efforts, as opposed to the traditional knock out competition where the element of chance has a significant bearing upon success.

The impact of a manager's influence on their own team's performance has been proven to be a crucial factor in previous research (Audas, Dobson and Goddard, 1999; Salomo and Teichmann, 2000; Dawson and Dobson, 2002; Frick Barros and Prinz, 2010, Tenga, Ronglan and Bahr, 2010). In this case study, the subject team had the same manager throughout the sample period, therefore any possession regain patterns discovered are likely to be a reflection of the manager's instructions and coaching philosophy.

Furthermore, as argued above, possession regain patterns are likely to change between teams due to varying quality and skill levels, thus incorporating several teams into one study offers a general overview rather than team specific results. This case study addresses this concern by focussing on the possession regain patterns of a sole EPL team.

Finally, cup competitions such as the European cup consist of knockout fixtures which enforce the 'away goals rule' that could heavily influence the style of play adopted (and thus possession regain patterns) as in some cases away goals count double (www.UEFA.com). Furthermore, knockout matches carry a greater element of chance which can influence performances and thus match outcomes, as opposed to league fixtures that are more representative of genuine performance (Downward et al. 2009). This case study focusses on only league matches played by the one subject team over the

course of a three season period and thus limits the impact of chance on team and player performances.

At the time of writing this paper the subject team of this case study still have the same manager as when the sample period started. It is assumed that player turnover throughout the sample period is by design and thus intended by the manager in order to recruit players more adept to fulfilling the manager's style of play.

This case study aims to examine the following:

- (1) To examine possession regain patterns of the subject team and determine the extent of the impact of these possession regains upon the subject team's attacking performance.
- (2) To determine which of 9 pitch zones of the opponent's half of the football pitch is the one where the subject team enjoys the most success, in terms of productive possession turnover and thus which players contribute most to this success.
- (3) To examine which other factors influence the subject team's ability to effectively regain possession.

# Methods

### Experimental Design

Hughes and Lovell's (2019) definition of a possession turnover was adapted for this study: A possession regain was observed when a player (or players in unison) regained possession of the ball from their opponent(s) in open play via a deliberate action (tackle, block, interception etc) and recorded only if the team regaining possession subsequently had at least one controlled touch.

Possession regains as a result of set pieces were excluded from this study in order to control for instances such as referee bias (Nevill, Balmer and Williams, 2002; Sutter and Kocher 2004; Dawson, Dobson, Goddard and Wilson, 2007; Pollard 2008; Page and Page 2010) sportsmanship, where a player kicked the ball out of play in order for another to acquire treatment to an injury and to avoid any regains that may have been missed due to the playback of action replays during the match footage (Hughes and Lovell, 2019).

A manual notation scatter diagram system (O'Donoghue, 2014) was designed in order to note all possession regains/turnovers that occurred in open play in the opponent's half of the playing field (as well as coding matches on Sportscode). The opponent's half was broken up into 9 equal sized zones as in figure 1 below. Many previous studies examining possession have broken up the playing field in several zones to suit the needs of their studies (Tenga et al. 2010; Lago-Ballesteros, Lago-Peñas and Rey 2012; Gomez et al. 2014; Barreira et al. 2014; Almeida et al. 2014; Gonzalez-Rodenas, Lopez-Bondia, Calabuig, Pérez-Turpin and Aranda 2017; Hughes and Lovell 2019). By separating the opponent's half in to 9 equal zones in this study, I was able to determine specifically where the most productive possession regains occurred and thus which players were most adept at utilising this recovery of possession.

### **Insert Figure 1 here**

### Sample

The sample consisted of 106 English Premier League matches played by the subject of this case study (n=106). Matches spanned over three seasons ranging from part way through the 15/16 season through to the end of the 17/18 season. During the sample period, the subject of this case study did not replace their manager. All matches were downloaded from www.wyscout.com.

#### Data

The number of possession regains were collated via a scatter diagram manual notation system (O'Donoghue 2014), as well as digitally coded on Sportscode v10 software (also used to view matches). Additional data utilised in this study was provided by OPTA sports, renowned for having a high degree of accuracy (Liu, Hopkins, Gómez and Molinuevo 2013; Beato, Jamil and Devereux 2018).

### Reliability

Reliability testing consisted of two phases:

Phase 1 – All matches were viewed on Sportscode v10 and coded for a first time (C1). Intra-observer reliability tests were then conducted by recoding 20% of randomly selected matches (21 matches) 3 months later (C2).

Phase 2 – Inter-observer reliability was then conducted a further 4 weeks after phase 1 reliability was complete (thus 4 months after C1). For this phase, 5 matches were randomly selected out of the 21 matches observed for C2 and a further 10 matches were randomly selected of the remaining 85 matches from C1.

Reliability was determined via the calculation of weighted kappa statistic as suggested by O'Donoghue (2010) and Liu et al. (2013). The interpretation of kappa values obtained was as follows: <0 less than chance agreement; 0.01-0.20 poor agreement; 0.21-0.40 fair agreement; 0.41-0.60 moderate agreement; 0.61-0.80 good agreement; 0.81-0.99 very good agreement (Viera and Garrett, 2005; Liu et al. 2013).

The Kappa value for phase 1 (intra-observer) reliability was 0.97 revealing a very high degree of agreement between an observer's first coding attempt (C1) and second coding attempt (C2). Out of a total of 77 possession regains recorded, in a random sample of 21 fixtures, in C1, there were 75 agreements in C2.

The Kappa value for the phase 2 (inter-operator) reliability was 0.95 revealing a very high degree of agreement between independent operators. Out of a total of 62 possession regains recorded by operator 1, in a sample of 15 fixtures, there were 59 agreements recorded by operator 2. The reliability results reveal consistency and accuracy in the recording of the number of possession regains by the subject team, by both operator 1 and between operator 1 and operator 2.

### Statistical Analysis

A series of regressions were run in order to investigate; how possession regains impacted the attacking performance of the subject team (Regression 1, equation 1), which players were most productive with possession regains with regards to the attacking performance of the subject team (Regression 2, equation 2); which other factors influenced the number of possession regains by the subject team (Regression 3, equation 3). As there were n=106 match observations in the sample for each regression, the number of regressors was limited to no more than 10, as optimal conditions for regression models consist of around 10 observations per regressor (Wooldridge 2009; Field 2014).

### <u>Regression 1</u>

## $Y_{1jt} = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + u_i$

### (Equation 1)

In equation 1 above, the dependent variable  $(Y_1)$  is the number of goals scored, in match *j* at time *t*. The explanatory (Z) variables consist of the number of possession regains in the opponent's half, total chances created, quality of the opponent, venue (dummy), short pass completion (%), corner success rate (%) and successful open play crosses.

Goals scored are also deemed to be a key performance indicator for attacking play in much previous research on player and team performance (Lucifora and Simmons 2003; Hughes and Franks, 2005; Lago and Martín 2007; Carmichael and Thomas 2008; Lago-Penas et al. 2010; McHale, Scarf and Folker, 2012). Possession regains were included as an explanatory variable as these were the focus of this study. Other factors that affect match performance, prevalent in previous research includes, venue and measures for the quality of the opponent.

Some previous literature has suggested that venue impacts player and team performances, most of which suggests that home sides hold an advantage over their opposition (Nevill, Newell and Gale 1996; Tucker, Mellalieu, James and Taylor 2005; Pollard 2008). This home advantage has been due to a number of factors such as referee bias (Sutter and Kocher 2004; Dawson et al. 2007; Pollard 2008) and higher effort levels from home players (Leard and Doyle 2011). Other factors such as the support received from the crowd and familiarity effects have also been recognised as being the source of home advantages (Nevill et al. 1996; Carmichael and Thomas 2005; Pollard 2008). Staufenbiel, Lobinger and Strauss (2015) also discovered that regardless of expertise, coaches for the home team had higher expectations to win, set more challenging goals and decided for more offensive and courageous playing tactics. Consequently, a venue dummy variable was incorporated in the regression model in order to investigate whether playing home or away had any impact on the subject team's attacking performance.

Many previous studies have also revealed that the quality of the opponent significantly impacts performances and should therefore be accounted for (Gerisch and Reichelt, 1993; Carmichael et al. 2000; Carmichael, Thomas and Ward 2001; Yamanaka, Liang and Hughes 2002; Lago and Martin 2007; Taylor, Mellalieu, James and Shearer 2008; Lago 2009; Redwood-Brown, Bussell and Bharaj 2012; Bradley, Lago-Penas, Rey

and Sampaio 2014). Consequently, measures of opponent quality utilised in some of the studies above such as, final league positions and opponent goal differences, were incorporated into this analysis to investigate whether the quality of the opponent had any impact on the attacking performance of the subject team.

The variable, chance creation represented the total of shots on target and shots off target. In theory, the more shooting opportunities a team creates the more goals they will score, thus enhancing their chances of winning (Carmichael et al. 2001; Torgler 2004; Hughes and Franks 2005; Lago and Martin 2007; Lago-Penas et al. 2010; McHale et al. 2012). Short pass completion was included due to the general importance of possession in football which has been discussed above. Corner success rate was included in order to account for some of the goals that may have been scored direct from pre-planned set plays (Reep et al. 1971; Larson 2001). Finally, the number of successful open play crosses was also included in order to account for goals scored from intentional deliveries from wide areas into team mates within close proximity of the opponent's goal (Mara, Wheeler and Lyons 2012).

### Regression 2

 $Y_{2jt} = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + \beta_7 Z_7 + \beta_8 Z_8 + \beta_9 Z_9 + u_i$ 

### (Equation 2)

In equation 2 above, the dependent variable  $(Y_1)$ , is the number goals scored in match *j* at time *t*. The explanatory (*Z*) variables consist of 9 variables, each representing possession regains that occurred in that zone of the playing field (as displayed in figure 1 above).

### Regression 3

# (Equation 3)

In equation 3 above, the dependent variable  $(Y_2)$ , is the number of possession regains in the opponent's half in match *j* at time *t*. The explanatory (*Z*) variables consisted of measures for the quality of the opponent, venue (dummy), match status and fatigue. To assess the relative quality of the opponent, two measures, the opponent's goal difference and the number of goals they conceded were included in the regression model. The number of changes in match status were also recorded as some recent research suggests this could also impact a team's urgency with regard to regaining the ball (Lago 2009; Bradley et al. 2014; Vogelbein et al. 2014).

Finally, two measures of fatigue were included in the model, firstly the number of days of recovery between matches (non-match days were considered recovery days) and secondly, the number of games played in the last 7 days. Fatigue has been revealed to impact performance (Brownstein et al. 2017; Thorpe, Atkinson, Drust and Gregson 2017) and therefore could impact the number of possession regains, particularly as the high pressing style of play adopted by the subject team places a greater demand on players to perform frequent high speed runs.

# Results

### Regression 1

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity was conducted to test for assumptions and the results confirmed constant variances,  $\chi^2(1) = 0.31$ , prob >  $\chi^2$  = 0.5784. Variance Inflation Factors reveal no multi-collinearity (VIF, 1/VIF), Possession regains (1.07, 0.934911), Total Chances Created (1.35, 0.738848), Quality of Opposition (1.27, 0.786105), Venue (1.11, 0.898698), Short Pass (1.29, 0.773004), Corner Success Rate (1.53, 0.653719), Successful Open Play Crosses (1.53, 0.652892). A Jarque-Bera

test was conducted to test for the normality of residual errors and the results confirmed normality ( $\chi^2 = 0.0883$ ).

Results from OLS regression 1 are reported in table 1 below: F (7,98) = 6.55, prob > F = 0.0000, R-squared = 0.3187, Adjusted R-squared = 0.2700, Root MSE = 1.3098, Cohen's  $f^2 = 0.37$  (representing a large effect size).

### **Insert Table 1 here**

# Regression 2

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity was conducted to test for assumptions and the results confirmed constant variances,  $\chi^2$  (1) = 1.06, prob >  $\chi^2$  = 0.3030. Variance Inflation Factors revealed no multi-collinearity (VIF, 1/VIF), Area 1 (1.09, 0.921641), Area 2 (1.13, 0.881129), Area 3 (1.09, 0.913607), Area 4 (1.14, 0.877457), Area 5 (1.05, 0.951102), Area 6 (1.10, 0.907126), Area 7 (1.14, 0.879661), Area 8 (1.10, 0.911136), Area 9 (1.10, 0.913027). A Jarque-Bera test was conducted to test for the normality of residual errors and the results confirmed normality ( $\chi^2$  = 0.0542)

Results from OLS regression 2 are reported in table 2 below. F (9, 96) = 2.04, prob > F = 0.0428, R-squared = 0.1606, Adj R-squared = 0.0819, Cohen's  $f^2 = 0.09$ (representing a small to medium effect size).

### **Insert Table 2 here**

### Regression 3

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity was conducted to test for assumptions and the results suggested heteroskedasticity was present,  $\chi^2$  (1) =

8.56, prob >  $\chi^2$  = 0.0034. Variance Inflation Factors however revealed no multicollinearity (VIF, 1/VIF), Venue (1.05, 0.954508), Opponent Goal Difference (1.47, 0.427461), Opponent Goal Conceded (1.44, 0.693072), Change in Match Status (1.06, 0.940727), Days of Rest In-between Games (2.34, 0.427461), Number of Games in Previous 7 Days (2.26, 0.442004). A Jarque-Bera test was conducted to test for the normality of residual errors and the results confirmed normality ( $\chi^2$  = 0.2138). Due to the presence of heteroskedasticity, a robust bootstrap regression was conducted in order to cover for the violation of this assumption (Field 2014). 2000 repetitions were selected and rather than the standard 95% confidence interval, bias corrected and accelerated confidence intervals (BCa) were selected as these are more accurate (Efron and Tibshirani 1993; Field 2014). The results obtained from regression 3 are reported in table 3 below. Wald  $\chi^2$  (6) = 12.51, prob >  $\chi^2$  = 0.0515, R-squared = 0.1143, Adj R-squared = 0.0606, Cohen's f<sup>2</sup> = 0.06 (representing a small to medium effect size).

#### **Insert Table 3 here**

### Discussion

The results reveal three main findings. Firstly, possession regains in the opponent's half of the playing field had a significant and positive impact on the subject team's attacking performance. This result is therefore in line with previous research that suggests regaining the ball high up the playing field is of great importance with regards to attacking performance (Reep et al. 1971; Garganta et al. 1997; Grant et al. 1998; Larson 2001; Hughes and Lovell 2019). The Cohen's  $f^2$  of 0.37 suggests the independent variables utilised in this part of the analysis had a large effect on the dependent variable (goals scored).

Secondly, possession regains that occurred on the left side of the opponent's half of the field had a significant and positive impact on the subject team's attacking performance. Specifically, possession regains that occurred just beyond the half way line (AREA 1) and closest to the opponent's goal (AREA 7, although at a 90% CI) were revealed to be of significance. These results therefore indicate that players that perform on left sided playing positions for the subject team are not only capable of regaining possession but also utilising possession of the ball productively post regains.

Alternatively, this secondary analysis also revealed that possession regains that occurred deep in the opponent's half on the right side of the playing field (AREA 9) had a negative impact upon the attacking performance of the subject team (although only at a 90% CI). This result suggests that possession regains that occur on the right side of the opponent's half are not used as productively as those that occur on the left side. The fact that the only significant results were discovered in wide areas, provides an insight in to how the subject team deploys their pressing strategy. Based on the results obtained for this analysis it seems the subject team employs a strategy focussed upon regaining the ball high up the playing field in wide areas rather than central areas.

Finally, the tertiary analysis conducted in this study revealed that the quality of the opponent did have a significant and positive impact on the number of possession regains completed by the subject team. This result therefore reinforces the claims of Mackenzie and Cushion (2013) that the impact of the opponent should not be overlooked when assessing performances in team sports. At first glance, this result may appear surprising, however previous research has revealed that the higher quality teams are more capable of retaining the ball, explaining why lower league teams cover greater distances and more high speed runs than the elite teams (Rampinini, Impellizzeri, Castagna, Coutts and Wisloff 2009; Di Salvo, Gregson, Atkinson, Tordoff and Drust 2009). A possession regain thus is more likely to occur in the opponent's half of the field when encountering teams that are more comfortable/capable of passing the ball around in defensive zones. The Cohen's  $f^2$  of 0.06 indicated that the independent variables utilised in this analysis had a small to medium effect size on the dependent variable (number of possession regains by the subject team).

Other results of interest are summarised below:

### <u>Regression 1</u>

The variable Total Chances Created, had a positive impact on the number of goals scored by the subject team, which is to be expected as goals are a product of goal scoring opportunities. The variable Successful Open Play Crosses, was revealed to have a highly significant but negative impact upon the number of goals scored by the subject team. This could perhaps be explained by the subject team's forward players not making the most of successful crosses during open play.

### Regression 3

Several variables that have previously been revealed to impact general team performances, such as venue, match status and fatigue (Pollard 2008; Leard and Doyle 2011; Lago and Martin 2007; Lago 2009; Brownstein et al. 2017; Thorpe et al. 2017) were all revealed to have no impact specifically on the number of possession regains completed by the subject team.

# Conclusion

The author of this case study argues that possession regain patterns are likely to vary between teams and leagues around the world due to factors such as the manager's philosophy and coaching ability, strategies and tactics employed by each team and the skill and quality level of each team, which all appear to have been overlooked in previous research. This study addresses these issues by focussing on the possession regain patterns of only one Premier League team across 106 league fixtures both home and away, whilst managed by the same person.

The results obtained from this case study revealed that the number of successful possession regains in the opponent's half had a significant and positive impact upon the attacking performance of the subject team. From a tactical point of view, the EPL subject team has justified its high-pressing style of play with particular focus on regaining the ball in wide areas of the playing field in order to create scoring opportunities.

Furthermore, this study revealed that the subject team is particularly strong at regaining the ball on the left side of the field (AREA 1) and then converting these possession regains in to goals (highly significant positive impact). These results therefore reflect well on the left full back, left sided midfielders and left sided forward players with regards to their productivity with the ball in possession particularly after it has been regained on their side of the field. In contrast, players that performed on the right side of the field were not as productive with the ball, post possession regains. From a practical perspective, these results indicate to the manager which players are implementing his desired strategy and which are not, therefore potentially influencing his coaching methods and informing his recruitment policy.

Finally, the quality of the opponent was revealed to have an impact on the number of possession regains successfully completed by the subject team of this case study. The subject appeared to be more successful at regaining possession of the ball when they played against opponents of higher quality. This result could be explained by higher quality teams being confident in their ability on the ball and also by the lower quality teams adopting long ball tactics in order to counter the high pressing style of the subject team.

Future studies could investigate the possession regain patterns of several teams across several different leagues managed by specific managers in order to provide a comparison of playing styles around the world. From a practical point of view, this could further inform potential employers of what to expect with certain managerial appointments.

### References

Almeida, C. H., Ferreira, A. P., & Volossovitch, A. (2014). Effects of Match Location, Match Status and Quality of Opposition on Regaining Possession in UEFA Champions League. *Journal of Human Kinetics*, *41*(June), 203–214. <u>https://doi.org/10.2478/hukin-2014-0048</u>

Audas, R., Dobson, S., & Goddard, J. (1999). Organizational performance and managerial turnover. Managerial and Decision Economics (Vol. 20). https://doi.org/10.1002/(SICI)1099-1468(199909)20:63.0.CO;2-O

Barreira, D., Garganta, J., Guimarães, P., MacHado, J., & Anguera, M. T. (2014). Ball recovery patterns as a performance indicator in elite soccer. *Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology*, 228(1), 61–72. <u>https://doi.org/10.1177/1754337113493083</u>

Bate, R. (1998). Football Chance: Tactics and Strategy. In T. Reilly, A. Lees, K. Davids,
& W. Murphy (Eds.) *Science and Football* (pp. 293-301). London: E & FN Spon.

Beato, M., Jamil, M., & Devereux, G. (2018). The Reliability of Technical and Tactical Tagging Analysis Conducted by a Semi-Automatic VTS in Soccer. *Journal of Human Kinetics*, 62(1), 103–110. <u>https://doi</u>.org/10.1515/hukin-2017-0162

Bradley, P. S., Lago-Peñas, C., Rey, E., & Sampaio, J. (2014). The influence of situational variables on ball possession in the English Premier League. *Journal of Sports Sciences*, *32*(20), 1867–1873. <u>https://doi.org/10.1080/02640414.2014.887850</u>

Brownstein, C. G., Dent, J. P., Parker, P., Hicks, K. M., Howatson, G., Goodall, S., & Thomas, K. (2017). Etiology and recovery of neuromuscular fatigue following competitive soccer match-play. *Frontiers in Physiology*, *8*(OCT). https://doi.org/10.3389/fphys.2017.00831

Carmichael, F., Thomas, D., & Ward, R. (2000). Team Performance: The Case of English Premiership Football. *Managerial and Decision Economics*, *21*(1), 31-45. Retrieved from <u>http://www.jstor.org/stable/3108117</u>

Carmichael, F., Thomas, D., & Ward, R. (2001). Production and Efficiency in Association Football. *Journal of Sports Economics*, 2(3), 228–243. https://doi.org/10.1177/152700250100200303

Carmichael, F., & Thomas, D. (2005). Home-Field Effect and Team Performance. *Journal of Sports Economics*, 6(3), 264–281. https://doi.org/10.1177/1527002504266154

Carmichael, F., & Thomas, D. (2008). Efficiency in Knock-out Tournaments: Evidence from EURO 2004. *European Sport Management Quarterly*, 8(3), 211–228. https://doi.org/10.1080/16184740802224092

Collet, C. (2013). The possession game? A comparative analysis of ball retention and team success in European and international football, 2007-2010. *Journal of Sports Sciences*, *31*(2), 123–136. <u>https://doi.org/10.1080/02640414.2012.727455</u>

Dawson, P., & Dobson, S. (2002). Managerial efficiency and human capital: an application to English association football. *Managerial and Decision Economics*, *23*(8), 471–486. <u>https://doi.org/10.1002/mde.1098</u>

Dawson, P., Dobson, S., Goddard, J., & Wilson, J. (2007). Are football referees really biased and inconsistent?: evidence on the incidence of disciplinary sanction in the English Premier League. *Journal of the Royal Statistical Society: Series A (Statistics in Society), 170*(1), 231–250. https://doi.org/10.1111/j.1467-985X.2006.00451.x

Di Salvo, V., Gregson, W., Atkinson, G., Tordoff, P., & Drust, B. (2009). Analysis of High Intensity Activity in Premier League Soccer. *International Journal of Sports Medicine*, *30*(03), 205–212. https://doi.org/10.1055/s-0028-1105950

Downward, P., Dawson, A. & Dejonghe, T. (2009). *Sports economics theory, evidence and policy*. UK: Butterworth - Heinemann.

Efron, B. & Tibshirani, R.J. (1993). *An Introduction to the Bootstrap*. USA: Chapman and Hall CRC.

Field, A. (2014). *Discovering Statistics Using IBM SPSS Statistics* (4th ed.). London: Sage.

Frick, B., Barros, C. P., & Prinz, J. (2010). Analysing head coach dismissals in the German "Bundesliga" with a mixed logit approach. *European Journal of Operational Research*, 200(1), 151–159. <u>https://doi.org/10.1016/j.ejor.2008.11.048</u>

Garganta, J., Maia, J., & Basto, F. (1997). Analysis of goal-scoring patterns in European top level soccer teams. In J. Bangsbo, M. Hughes, & T. Reilly (Eds.), *Science and football III. Proceedings of the Third World Congress of Science and Football, Cardiff, Wales,* 9–13 April, 1995 (pp. 246–250). London: E & FN Spon

Gerisch, G & Reichelt, M (1993). Computer and Video Aided Analysis of Football Games. In: T.Reilly, J.Clarys and A. Stibbe (Eds.) *Science and Football II* (pp.167-173). London: Taylor and Francis.

Gómez, M. A., Gómez-Lopez, M., Lago, C., & Sampaio, J. (2012). Effects of game location and final outcome on game-related statistics in each zone of the pitch in professional football. *European Journal of Sport Science*, *12*(5), 393–398. https://doi.org/10.1080/17461391.2011.566373

Gonzalez-Rodenas, J., Lopez-Bondia, I., Calabuig, F., Pérez-Turpin, J. A., & Aranda, R. (2017). Association between playing tactics and creating scoring opportunities in counterattacks from United States Major League Soccer games. *International Journal of* 

 Performance
 Analysis
 in
 Sport,
 16(2),
 737–752.

 https://doi.org/10.1080/24748668.2016.11868920

Grant, A., Williams, A.M., Lee, D. & Dand Reilly, J. (1998). Match Analysis of Previous World Cups (1986-1994). Insight 4, pp.20-21.

Hook, C. & Hughes, M. D. (2001). Patterns of play leading to shots in Euro 2000. In: *Pass.com*. CPA (Centre for Performance Analysis). Cardiff: UWIC, 295-302.

Hughes, M. D & Churchill, S. (2005). Attacking profiles of successful and unsuccessful team in Copa America 2001. In: T Reilly, J Cabri, D Araújo. Eds. *Science and Football V.* London and New York: Routledge, pp. 219-224

Hughes, M., & Franks, I. (2005). Analysis of passing sequences, shots and goals in soccer.JournalofSportsSciences,23(5),509–514.https://doi.org/10.1080/02640410410001716779

Hughes, M., & Lovell, T. (2019). Transition to attack in elite soccer. *Journal of Human Sport and Exercise*, *14*(1), 236–253. <u>https://doi.org/10.14198/jhse.2019.141.20</u>

Jones, P. D., James, N., & Mellalieu, S. D. (2017). Possession as a performance indicator in soccer. *International Journal of Performance Analysis in Sport*, *4*(1), 98–102. https://doi.org/10.1080/24748668.2004.11868295 Lago, C., & Martín, R. (2007). Determinants of possession of the ball in soccer. *Journal* of Sports Sciences, 25(9), 969–974. <u>https://doi.org/10.1080/02640410600944626</u>

Lago, C. (2009). The influence of match location, quality of opposition, and match status on possession strategies in professional association football. *Journal of Sports Sciences*, 27(13), 1463–1469. <u>https://doi.org/10.1080/02640410903131681</u>

Lago-Ballesteros, J., Lago-Peñas, C., & Rey, E. (2012). The effect of playing tactics and situational variables on achieving score-box possessions in a professional soccer team. *Journal of Sports Sciences*, *30*(14), 1455–1461. https://doi.org/10.1080/02640414.2012.712715

Lago-Peñas, C., Lago-Ballesteros, J., Dellal, A., & Gómez, M. (2010). Game-related statistics that discriminated winning, drawing and losing teams from the Spanish soccer league. *Journal of Sports Science and Medicine*, *9*(2), 288–293.

Larson, O. (2001). Charles Reep: A Major Influence on British and Norwegian Football. Soccer & Society, 2(3), 58–78. <u>https://doi.org/10.1080/714004854</u>

Leard, B., & Doyle, J. M. (2011). The effect of home advantage, momentum, and fighting on winning in the national hockey league. *Journal of Sports Economics*, *12*(5), 538–560. <u>https://doi.org/10.1177/1527002510389869</u>

Liu, H., Hopkins, W., Gómez, M. A., & Molinuevo, J. S. (2013). Inter-operator reliability of live football match statistics from OPTA Sportsdata. *International Journal of* 

 Performance
 Analysis
 in
 Sport,
 13(3),
 803–821.

 https://doi.org/10.1080/24748668.2013.11868690

Liu, H., Gomez, M. Á., Lago-Peñas, C., & Sampaio, J. (2015). Match statistics related to winning in the group stage of 2014 Brazil FIFA World Cup. *Journal of Sports Sciences*, *33*(12), 1205–1213. <u>https://doi.org/10.1080/02640414.2015.1022578</u>

Lucifora, C., & Simmons, R. (2003). Superstar Effects in Sport: Evidence From Italian Soccer. *Journal of Sports Economics*, 4(1), 35–55. https://doi.org/10.1177/1527002502239657

Mackenzie, R., & Cushion, C. (2013). Performance analysis in football: A critical review and implications for future research. *Journal of Sports Sciences*, *32*(1), 2–7. https://doi.org/10.1080/02640414.2013.807352

Mara, J. K., Wheeler, K. W., & Lyons, K. (2012). Attacking Strategies That Lead to Goal Scoring Opportunities in High Level Women's Football. *International Journal of Sports Science & Coaching*, 7(3), 565–577. https://doi.org/10.1260/1747-9541.7.3.565

McHale, I. G., Scarf, P. A., & Folker, D. E. (2012). On the development of a soccer player performance rating system for the english Premier League. *Interfaces*, *42*(4), 339–351. https://doi.org/10.1287/inte.1110.0589

Nevill, A. M., Newell, S. M., & Gale, S. (1996). Factors associated with home advantage in English and Scottish soccer matches. *Journal of Sports Sciences*, *14*(2), 181–186. <u>https://doi.org/10.1080/02640419608727700</u>

Nevill, A. M., Balmer, N. J., & Mark Williams, A. (2002). The influence of crowd noise and experience upon refereeing decisions in football. *Psychology of Sport and Exercise*, *3*(4), 261–272. <u>https://doi.org/10.1016/S1469-0292(01)00033-4</u>

O'Donoghue, P. (2010). Research Methods for Sports Performance Analysis. UK: Routledge.

O'Donoghue, P. (2014). An Introduction to Performance Analysis of Sport. Abingdon: Routledge.

Page, K., & Page, L. (2010). Alone against the crowd: Individual differences in referees' ability to cope under pressure. *Journal of Economic Psychology*, *31*(2), 192–199. https://doi.org/10.1016/j.joep.2009.08.007

Pollard, R. (2008). Home Advantage in Football: A Current Review of an Unsolved Puzzle. *The Open Sports Sciences Journal*, *1*(1), 12–14. https://doi.org/10.2174/1875399x00801010012

Rampinini, E., Impellizzeri, F. M., Castagna, C., Coutts, A. J., & Wisloff, U. (2009). Technical performance during soccer matches of the Italian Serie A league: effect of fatigue and competitive level. *Journal of Science and Medicine in Sport*, *12*(1), 227–233. <u>https://doi.org/10.1016/j.jsams.2007.10.002</u>

Redwood-Brown, A., Bussell, C., & Bharaj, H. S. (2012). The impact of different standards of opponents on observed player performance in the English Premier League.

Journal of Human Sport and Exercise, 7(SPECIALISSUE.2), 341–355. https://doi.org/10.4100/jhse.2012.72.01

Reep, C., Pollard, R., & Benjamin, B. (1971). Skill and Chance in Ball Games. *Journal* of the Royal Statistical Society. Series A (General), 134(4), 623-629. doi:10.2307/2343657

Salomo, S., & Teichmann, K. (2000). The relationship of performance and managerial succession in the German premier football league. *European Journal for Sport Management (EJSM)*, 7, 99-199.

Staufenbiel, K., Lobinger, B., & Strauss, B. (2015). Home advantage in soccer – A matter of expectations, goal setting and tactical decisions of coaches? *Journal of Sports Sciences*, *33*(18), 1932–1941. <u>https://doi.org/10.1080/02640414.2015.1018929</u>

Sutter, M., & Kocher, M. G. (2004). Favoritism of agents - The case of referees' home bias. *Journal of Economic Psychology*, 25(4), 461–469. <u>https://doi.org/10.1016/S0167-4870(03)00013-8</u>

Taylor, J., Mellalieu, S., James, N., & Shearer, D. (2008). The influence of match location, quality of opposition, and match status on technical performance in professional association football. *Journal of Sports Sciences*, 26(9), 885–895. https://doi.org/10.1080/02640410701836887 Tenga, A., Ronglan, L. T., & Bahr, R. (2010). Measuring the effectiveness of offensive match-play in professional soccer. *European Journal of Sport Science*, *10*(4), 269–277. https://doi.org/10.1080/17461390903515170

Thorpe, R. T., Atkinson, G., Drust, B. and Gregson, W. (2017). Fatigue status in elite team sport athletes : Implications for practice. *International Journal of Sports Physiology and Performance*, *12*(S2), 27–34. <u>https://doi.org/10.1123/ijspp.2016-0434</u>

Torgler, B. (2004). The economics of the FIFA football worldcup. *Kyklos*, *57*(2), 287–300. https://doi.org/10.1111/j.0023-5962.2004.00255.x

Tucker, W., Mellalieu, D. S., James, N., & Taylor, B. J. (2005). Game Location Effects in Professional Soccer: A Case Study. *International Journal of Performance Analysis in Sport*, *5*(2), 23–35. <u>https://doi.org/10.1080/24748668.2005.11868325</u>

https://www.uefa.com/MultimediaFiles/Download/Regulations/uefaorg/Regulations/02/ 55/82/79/2558279 DOWNLOAD.pdf

Viera, A.J. & Garrett, J.M. (2005). Understanding interobserver agreement: the kappa statistic. *Family Medicine*, *37* (5), 360-363.

Vogelbein, M., Nopp, S., & Hökelmann, A. (2014). Defensive transition in soccer – are prompt possession regains a measure of success? A quantitative analysis of German Fußball-Bundesliga 2010/2011. *Journal of Sports Sciences*, *32*(11), 1076–1083. https://doi.org/10.1080/02640414.2013.879671 Wooldridge, J. (2009). *Introductory Econometrics: A Modern Approach* (4th ed.). USA: South Western Cengage Learning.

Yamanaka, K., Liang, D, Y. & Hughes, M. (2002). An Analysis of the Playing Patterns of the Japan National Team in the 1998 World Cup for Soccer. In: T. Reilly, J. Bangsbo and M.Hughes (Eds.) *Science and Football III* (pp. 101-105). London and New York: Routledge.