UNIVERSIDAD POLITÉCNICA DE MADRID

Facultad de Ciencias de la Actividad Física y del Deporte (INEF)

**Analyses on the Technical and Tactical Match Performances of
Elite Football Teams and Players Considering Situational
Efficiency**

Tesis Doctoral

D. Qing Yi

易 清

Máster en Educación

Madrid, 2019

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Declaration

I, Qing Yi, declare that the Doctor of Philosophy thesis titled “Analyses on the Technical and Tactical Match Performances of Elite Football Teams and Players Considering Situational” is no more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Signature:

Date:

Dedication

To my dear departed father.

To my mother and all family members.

To my future wife and children.

Dedicatoria

A mi querido padre fallecido.

A mi madre y los miembros de la familia.

A mi futura mujer e hijos.

谨献给

在天堂的父亲

亲爱的母亲和所有家人

未来的妻子和孩子

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Abstract

The analysis of technical and tactical performance is one of the main purposes of performance analysis in football. Researchers have paid much attention to this area during the last decades to reveal the mechanisms of the game and provide important information for practitioners regarding how to play the match to succeed. However, the existing studies cannot fulfil the needs of elite football, and some crucial issues need further consideration such as the simplistic methodologies for identifying key performance indicators, the inconsistencies in the categories and associated performance indicators of playing styles, operational definitions of technical variables, classification of playing positions, and the lack of consideration of the interactive effects between playing positions and situational variables, or the failure to address the repeated-measured data obtained from multiple matches. Therefore, the overall aim of this PhD thesis was to evaluate the effects of situational factors when analysing technical and tactical match performances of teams and players in elite football matches. *Six independent studies* were included in this thesis as *six chapters* (chapter two to seven), aiming to address the mentioned issues above from team level and player level respectively.

Chapter two assessed the technical match-to-match variation of teams and identified the relationships between variation of match variables and team's match performance in the group stage of UEFA Champions League from season 2009/2010 to 2016/2017. The differences of technical variation between teams were identified by the non-clinical

magnitude-based inferences (MBI). Results showed that qualified teams displayed lower variation on variables related to goal scoring, attacking and passing, non-qualified teams achieved higher variation on variables related to defending. Moreover, the autocorrelation function, correlation analysis and generalised linear model were undertaken to quantify the relationships between the variation of technical variables and teams' match performance. Results showed that the variation of variables related to goal scoring, attacking and passing had negative relationships with teams' match performance, while the positive relationships were observed between the variation of variables related to defending and teams' match performance.

Chapter three used K-means cluster analysis to classify all match observations from the 2018 FIFA World Cup (Russia) into two clusters of tactical approaches (direct play and possession play) in order to identify the playing style of each team. Then, generalised mixed linear modelling was undertaken to examine the differences of technical and physical performances between direct-play characterised teams and possession-play teams and the interaction of playing styles of the teams with their opponents. The findings indicate that possession-play characterised teams performed better in variables related to goal scoring, passing and organising and worse in variables related to defending compared with direct-play teams. The differences for both these two types of teams when against different teams that characterised by different playing styles were all mainly observed in variables related to passing and organising.

Chapters four and five aimed to establish performance profiles of technical match

performance and technical variation for players from five playing positions under five match contexts. match data of players in the UEFA Champions League from season 2009/2010 to 2016/2017 were analysed. The differences between players were identified by the non-clinical magnitude-based inferences (MBI). The interactive effects between playing positions and situational variables were identified. All competing contexts had substantial impact on players' performances, except for competition stage. The performances of players from five playing positions were also varied in different competing contexts.

Chapters six and seven identified the differences of technical demands of players from different playing positions and different leagues respectively. Technical performance-related match data of out-field players in the UEFA Champions League from season 2009/2010 to 2016/2017 were analysed. Generalised mixed linear modelling was employed to assess the differences between players controlling the effects of situational variables. Results showed that the differences of technical performance were substantial among players from five playing positions and five leagues. Central defenders and forwards presented the largest differences while the smallest differences were observed between central defenders and full backs. The differences between players from five leagues were mainly observed in variables related to goal scoring, passing and organising, while limited differences could be found in variables related to attacking and defending. No clear differences could be detected between players from La Liga, Premier League and Ligue 1.

Findings from chapter two and three could add novel insights into the development of specific training interventions to optimise team's performance in key indicators, as well as the match preparation by scouting the upcoming opponents that characterised by different playing styles and technical characteristics. The insights gained from chapter four to seven may be of assistance to extend our understanding of the effects of situational variables on players' technical performance. Therefore, the current PhD thesis allows providing a useful tool for practitioners in the post-match evaluation, player recruitment and talent identification.

Key words: football, soccer, match analysis, performance analysis, notational analysis, team sport, performance indicator, situational variable, performance profile, performance variation, match statistics, statistical modelling

Resumen

Uno de los objetivos principales del análisis del rendimiento en el fútbol es el análisis del rendimiento técnico y táctico. Muchos investigadores han prestado mucha atención a esta área durante las últimas décadas con el objetivo de revelar los mecanismos del juego y de proporcionar información importante para los profesionales sobre cómo jugar un partido de modo exitoso. Sin embargo, los estudios existentes hasta ahora no son capaces de satisfacer las necesidades del fútbol de élite, además de que ciertas cuestiones cruciales del juego necesitan una mayor consideración y análisis, como son: las metodologías estadísticas para identificar indicadores clave de rendimiento, las inconsistencias en las categorías y los indicadores de rendimiento asociados de los estilos de juego, definiciones operacionales de las variables técnicas, clasificación de las posiciones de juego, la falta de consideración de los efectos interactivos las posiciones de juego y las variables situacionales, o la incapacidad de abordar los datos de medidas repetidas obtenidas de múltiples partidos. Por lo tanto, el objetivo en general de esta tesis doctoral es evaluar los efectos de los factores situacionales en el momento de analizar los rendimientos técnicos y tácticos de los equipos y jugadores en los partidos de fútbol de élite. Se han incluido *seis estudios independientes* en esta tesis a modo de *seis capítulos* (capítulo dos a siete), con el propósito de abordar las cuestiones anteriormente mencionadas a nivel de equipo y a nivel de jugador respectivamente.

En el *capítulo dos* se han evaluado las variaciones técnicas de partido a partido de los

equipos y se ha identificado las relaciones entre la variación de los variables en los partidos y el rendimiento de partido del equipo durante la fase de grupos en la Liga de Campeones de la UEFA (UCL) desde la temporada de 2009-2010 a la de 2016-2017. El análisis de la magnitud de la inferencia no-clínica (*non-clinical magnitude-based inferences*, MBI) ha permitido identificar diferencias entre la variación técnica entre los equipos. Los resultados demuestran que los equipos clasificados muestran una menor variación en cuanto a variables relacionados con el marcaje, ataque y pase de gol; los equipos no clasificados alcanzaron una mayor variación en las variables relacionadas con la defensa. Además, se ha utilizado la función de autocorrelación, el análisis de correlación y el modelo lineal generalizado para cuantificar las relaciones entre la variación de variables técnicas y el rendimiento de partido de los equipos. Los resultados muestran que la variación de las variables relacionadas con el marcaje, ataque y pase de gol tiene una relación negativa con el rendimiento de partido de los equipos, mientras que se observaron relaciones positivas entre la variación de variables relacionados con la defensa y el rendimiento de partido de los equipos.

En el *capítulo tres* se ha utilizado el método de conglomerados de k -medias para clasificar todas las observaciones de los partidos de la Copa Mundial de la FIFA Rusia 2018 en dos grupos de tácticas de juego (juego directo y juego de posesión) con el fin de identificar el estilo de juego de cada equipo. Luego, se utilizó un modelo lineal mixto generalizado (GMLM) para examinar las diferencias de rendimiento técnico y físico entre los equipos caracterizados por el juego directo y los equipos de juego de posesión, así como la interacción de los estilos de juego de los equipos con sus oponentes. Los

resultados indican que los equipos caracterizados por el juego de posesión han podido actuar mejor en las variables relacionados con el marcaje, pase y organización de goles y peor en las variables relacionadas con la defensa en comparación con los equipos de juego directo. Principalmente, se han observado las diferencias para estos dos tipos de equipos frente a equipos diferentes que se caracterizan por un estilo de juego diferente en las variables relacionados con el pase y organización.

En los *capítulos cuatro y cinco* se pretendió establecer perfiles de rendimiento del rendimiento técnico de los partidos y la variación técnica para jugadores de cinco posiciones de juego en cinco contextos de partidos. Se analizaron los datos de los partidos de UCL de la temporada de 2009-2010 a la de 2016-2017. Se identificaron diferencias entre los jugadores por MBI. Se identificaron los efectos interactivos entre las posiciones de juego y las variables situacionales. Todos los contextos de competición tuvieron un impacto considerable en el rendimiento de los jugadores, excepto en la fase de competición. El rendimiento de los jugadores de cinco posiciones de juego también varió en diferentes contextos de competición.

En los *capítulos seis y siete* se han identificado las diferencias en las exigencias técnicas entre los jugadores de distintas posiciones de juego y diferentes ligas respectivamente. Se analizaron los datos técnicos de los partidos relacionados con el rendimiento de los jugadores de UCL de la temporada 2009-2010 a la de 2016-2017. Se ha empleado el GMLM para evaluar las diferencias entre los jugadores que controlan los efectos de las variables situacionales. Los resultados mostraron que las diferencias de rendimiento

técnico eran entre los jugadores de cinco posiciones de juego y cinco ligas. Las defensas centrales y los delanteros presentaron las mayores diferencias mientras que se observaron las diferencias más pequeñas entre las defensas centrales y los laterales. Se observaron diferencias entre los jugadores de las cinco ligas principalmente en las variables relacionadas con el marcaje, el pase y organización de gol, mientras que se pueden encontrar diferencias más pequeñas en las variables relacionados con el ataque y la defensa. No se pudieron detectar diferencias claras entre los jugadores de La Liga, Premier League y Ligue 1.

Los resultados de los capítulos dos y tres pudieron aportar nuevos conocimientos sobre el desarrollo de intervenciones de capacitación específicas para optimizar el rendimiento del equipo en indicadores clave, así como la preparación de partidos mediante la búsqueda de los próximos adversarios caracterizado por un estilo de juego y características técnicas diferentes. Los conocimientos adquiridos desde el capítulo cuatro al siete pueden ser útiles para ampliar nuestra comprensión de los efectos de las variables situacionales en el rendimiento técnico de los jugadores. Por lo tanto, la presente tesis doctoral permite proporcionar una herramienta útil para los profesionales en torno a la evaluación posterior a los partidos, el reclutamiento de jugadores y la identificación de talentos.

Palabras clave: fútbol, análisis de partido, análisis de rendimiento, análisis notacional, deporte en equipo, indicadores de rendimiento, variables situacionales, perfil de rendimiento, variación de rendimiento, estadísticas de partido, modelos estadísticos.

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Chapter One —General Introduction

1.1 Research Background

1.1.1 Performance Analysis in Football

The success in football across all levels and age groups can be a result of the interaction among technique, tactics, physiological and psychological factors (Carling, Reilly, & Williams, 2008; Memmert & Raabe, 2018). However, football is a team sport characterized by its nature of high dynamics and complexity (Garganta, 2009; Liu, Yi, Giménez, Gómez, & Lago-Peñas, 2015). It is difficult for coaches to interpret the match and to get an insight into how these factors affect the match performance at both team and player level (O'Donoghue & Mayes, 2013). Therefore, a specific field of sport science has developed: sport performance analysis, which has been considered an indispensable part of the coaching process (Mackenzie & Cushion, 2013). Performance analysis in football could reduce the complexity of match performance and interpret football match in a descriptive, systematic and unproblematic way (Cushion, 2007). Coaches can obtain an objective and unbiased understanding of actual match performance (McGarry, O'Donoghue, Sampaio, & de Eira Sampaio, 2013) and to diagnose the played matches and maximise the probability of success (O'Donoghue, 2014).

Already in 1912, the first work of sport performance analysis has been conducted by Hugh Fullerton in baseball (Fullerton, 1912; Pollard, 2002). However, the first

performance analyst in football appeared until 1950, a British named Charles Reep developed a notation system to provide match reports for professional football teams. (Memmert & Raabe, 2018; Reep & Benjamin, 1968). Since then, the scientific research in this field was burgeoning rapidly during the following decades.

Memmert et al. (2018) reported that the evolution of match analysis in football can be divided into four phases (see Figure 1.1). ***Phase 1.0 was dated back from 1950.*** Hand notational system has been created since then to record the frequencies of occurrence of match actions and events during match play, sports analysts started to conduct preliminary descriptive analysis to quantify the match performance of teams and players. ***During phase 2.0 (from 1988),*** many others hand notational systems emerged and more detailed match data could be captured, which provided opportunities for researchers to conduct more complex analysis, such as the identification of playing style (Hughes, 1988; Pollard, Reep, & Hartley, 1988). Moreover, players' match behaviours were analysed under different competing and training situations rather than been investigated in isolation (Mackenzie & Cushion, 2013). When it came to ***phase 3.0 (from 1996),*** match analysis was evolved at various levels and became almost completely digitalised (Reilly & Williams, 2003). Technical, physical and tactical parameters were available due to the advancement of tracking system. Thus, different aspects of match play could be examined and relationships between performance variables were identified in an attempt to predict the match outcome (Mackenzie & Cushion, 2013). We are currently in ***phase 4.0 (from 2011).*** In this phase, the analysis of positional data has gained increased attention due to the developments in sensor

technology. Players' spatial-temporal information can be generated automatically in seconds based on positional data (Memmert, Lemmink, & Sampaio, 2017). Collective performance indicators were developed to describe the dynamics and complexity of football matches (Memmert & Rein, 2018). It could be expected that the research in positional data will be increased at accelerating pace in the following years. If a wide range of data from various aspects could be integrated, we would be driven to *phase 5.0* (Garganta, 2009; Glazier, 2017).

Figure 1.1. Evolution of match analysis (obtained from (Memmert & Raabe, 2018, P.6)).

1.1.2 Technical and Tactical Performance Analysis in Football

Technique and tactic have been a very important element in football throughout its evolution and coaches and analysts were always concerned about how to optimize the team's play in order to succeed (Memmert & Raabe, 2018). During the last decades,

players' technical skill has evolved, the strategies and tactics experienced a multitude of innovations as well (Garganta, 2009; Yi, Jia, Liu, & Gómez, 2018). We are able to understand the mechanisms of the playing systems with a previously unknown depth due to the development of technology, accumulation of experiences and professionalisation of the game (Memmert & Raabe, 2018). Nevertheless, there are some crucial aspects that we should get a holistic understanding on when talking about technical and tactical performance in football: situational variables, match-to-match variation, key performance indicators and playing style.

1.1.2.1 Situational Variables

The analysis of situational variables is the fundamental aspect of technical and tactical analysis in football (Gómez, Lago, & Pollard, 2013). Situational variables (e.g. team and opponent strength, match location, match status, match period, competition type, etc.) have been identified to affect the match performance at a behavioural level (Gómez et al., 2013; Lago-Peñas & Lago-Ballesteros, 2011; Liu, Yi, Giménez, et al., 2015). Therefore, the situational effects should be addressed properly when assessing the technical and tactical performance of players and teams. Otherwise, the applicability of findings might be constrained and the gap between theory and practice was produced (Mackenzie & Cushion, 2013).

One of the most important criteria for evaluating the value of a research finding is whether it can provide practical insight for practitioners (Cushion, 2007). Therefore, the evaluation and diagnosis of match performance of players and teams should be

conducted under specific competing contexts (Liu, Yi, Giménez, et al., 2015). Previously, the effects of situational variables were examined by researchers in isolation (Castellano, Casamichana, & Lago, 2012; Lago-Peñas, Lago-Ballesteros, & Rey, 2011; Pollard & Gómez, 2009). Nevertheless, recent studies not only considered multiple competing contexts (Lago, 2009; Liu, Gómez, Gonçalves, & Sampaio, 2016; Liu, Yi, Giménez, et al., 2015), but also attempted to explore the interactive effects between situational variables (Lago, 2009; Taylor, Mellalieu, James, & Shearer, 2008) and the interaction with playing positions (Liu, Gómez, et al., 2016) and physical variables (Lago, Casais, Dominguez, & Sampaio, 2010) based on larger sample sizes. The insights gained from these studies may be of assistance to the match preparation by developing specific training drills considering situational variables and their interactive effects (Gómez et al., 2013) and to the post-match assessment by establishing integrated and objective technical performance profiles based on the knowledge of such effects (Liu, Yi, Giménez, et al., 2015). Conversely, in the case of comparative analysis, such as the comparisons between playing positions, competitive levels and leagues, the effects of situational variables should be controlled (Yi et al., 2018). As the match contexts are varied across matches, players have to change physiologically and psychologically to adapt to different match scenarios (Eccles, Ward, & Woodman, 2009), which could mask the real differences of match performances between players or teams when comparing the match performances based on the data from multiple matches (Liu, Hopkins, & Gómez, 2016).

1.1.2.2 Match-to-match Variation

The investigation of match-to-match variation of performance variables can also provide useful insights into football match performance (Liu, Gómez, et al., 2016). It is an important tool to interpret meaningful changes of players' behaviours during match play (Gregson, Drust, Atkinson, & Salvo, 2010). Players' match performances are characterized by high variability in complex and dynamic competing environments over successive matches (Bush, Archer, Hogg, & Bradley, 2015). Especially the variability in technical performance has been identified to be more variable from match-to-match than physical variables (Bush, Archer, et al., 2015; Gregson et al., 2010). The sources of variability may be related to internal factors, such as physiological and psychological status, and external factors, such as playing style, tactics and competing contexts (Kempton, Sullivan, Bilsborough, Cordy, & Coutts, 2015). Human motor system possesses the ability of self-organisation to adapt to dynamic environments in order to produce a successful movement (Kamm, Thelen, & Jensen, 1990). Therefore, performance variability could be functional and advantageous as it reflects fine-tuned adjustments of repeated match behaviours to the complex, adaptive and dynamic competing environments and thereby to evaluate the effectiveness of interventions during the training session (Kudo & Ohtsuki, 2008; Stergiou, Yu, & Kyvelidou, 2013).

The coefficient of variation (CV) is considered as the best measure to quantify the match-to-match variation (Hopkins, 2000). The Lower variability means a more predictable match performance and more adequate adaption to environmental demands (Newell & Vaillancourt, 2001). As such, situational variables (e.g. match location,

quality of opponent and match status) may be expected to play a role in the variability of technical match performance as it has been identified previously. However, an inconsistent finding from Bush et al. (2015) suggested that match contexts had limited impact on the variability of technical performance parameters. Besides situational effects, the variability of technical performance also showed differences between different playing positions. Specifically, defenders displayed higher variability in technical variables related to attacking, while relative higher variability was observed for attacking players in technical variables related to defending (Bush, Archer, et al., 2015; Liu, Gómez, et al., 2016). Consequently, due to the controversy between previous studies, there is a need to conduct a deeper research to verify the effects of situational factors on the variability of match performance. Additionally, performance profiles of technical variation could be established incorporating positional and situational effects, which may contribute to a holistic understanding of the high dynamic and complex nature of football match and the interactions between playing positions and situational variables (Liu, Yi, Giménez, et al., 2015; Rampinini, Coutts, Castagna, Sassi, & Impellizzeri, 2007).

1.1.2.3 Key Performance Indicator

Players' performance during match play are represented by a selection of match actions and events. These match actions and events are fundamental components for performance analysis in football and needed to be transformed to performance indicators (Hughes & Bartlett, 2002). Performance indicators are single or combined actions and events, which could be valid measures of various aspects of match

performance to explain the match results and to provide meaningful understandings of match behaviours by establishing activity profiles (McGarry, O'Donoghue, Sampaio, et al., 2013; O'Donoghue, 2009). Nevertheless, the identification of key performance indicators is one of most important tasks in sport performance analysis (Lago-Ballesteros & Lago-Peñas, 2010). Key performance indicators refer to the determinants of the successful match performance and can predict future behaviours during match play (O'Donoghue, 2005). The existing literature had identified that some key performance indicators, such as shot, shot on target and possession, can describe important aspects of dynamic, complex and non-linear properties of match performance and predict successful performance (Lago-Ballesteros & Lago-Peñas, 2010; Liu, Gomez, Lago-Peñas, & Sampaio, 2015; Liu, Hopkins, et al., 2016). Match performance in modern football is considered as complex, multifaceted and unpredictable (Sarmiento, Clemente, Araújo, Davids, McRobert, & Figueiredo, 2017). Thus, there is a need to develop more complex key performance indicators using novel measurement techniques. Dynamics and complexity in performance during match play need to be exposed by an integrated approach taking multiple aspects into account (Memmert et al., 2017; Sarmiento et al., 2017). Complex key performance indicators, such as space control, outplayed opponents and pressing index, were developed in recent studies based on positional data (Memmert & Rein, 2018).

1.1.2.4 Playing Style

Playing style refers to the dominant and recurrent pattern of play adopted by a team in specific competing situation (Fernandez-Navarro, Fradua, Zubillaga, Ford, &

McRobert, 2016), which is presented by a selection of performance indicators that remained relatively stable to understand how players interact and how the match unfolds (Hewitt, Greenham, & Norton, 2016; Hughes & Bartlett, 2002). Different playing styles are characterized by different technical and physical characteristics (Lago-Peñas, Gómez-Ruano, & Yang, 2017), as players have to organize both technical and physical activities during match play according to strategies and tactics prepared before a match (Memmert et al., 2017). Besides, the playing styles that teams employed across matches may be varied considering the standard of opponents, players' fitness and recruitment of new coaches or players (Lago-Peñas et al., 2017; Memmert et al., 2017). In contrast, some teams are maintained a relatively constant playing style due to their playing philosophy over time, such as FC Barcelona (Chassy, 2013; Hewitt et al., 2016).

Playing styles are formed based on an integration of attacking and defending players' behaviours (Pollard et al., 1988). Attacking and defending playing styles have been identified by existing literature. Defending playing styles can be defined as high pressure and low pressure according to the location where teams apply defensive pressure on the opponent aiming to regain the ball possession (Bangsbo & Peitersen, 2000; Wright, Atkins, Polman, Jones, & Sargeson, 2011). Direct play and possession play are considered as the most commonly attacking playing styles used in modern football (Hughes & Franks, 2005; Kempe, Vogelbein, Memmert, & Nopp, 2014). Playing styles are often associated with teams' match results (Tenga, Holme, Ronglan, & Bahr, 2010b). Hence, which one of these two attacking playing styles is more

advantageous has been under continuous debate, whereas there is no conclusive result so far (Collet, 2013; Lago-Peñas & Dellal, 2010; Yue, Broich, & Mester, 2014). Previous researchers have attempted to define and quantify the playing styles. Hewitt et al. (2016) proposed a framework based on metrics within key moments of the match to describe and measure the playing styles. Lago- Peñas et al. (2017), Fernandez-Navarro et al. (2016) and Pollard et al. (1988) defined and classified different playing styles and identified associated performance indicators. Findings from these studies may allow to create playing styles profiles for related performance indicators. Indeed, teams can objectively identify their dominant playing styles and recruiting players who are suitable for their playing style. Moreover, opponents' playing styles could also be detected and specific training drills are developed during the coaching process.

1.2 Limitations and Issues of Current Research

According to the rationale presented, some limitations need to be taken into consideration when analysing technical and tactical match performance of teams and players.

- (1) The identification of key performance indicators and the relationships between key performance indicators and match result are well documented (Lago-Ballesteros & Lago-Peñas, 2010; Liu & Gómez, 2014; Liu, Gomez, et al., 2015). However, some limitations in the methodology can be observed. The success in football is multifactorial. It is problematic to use simplistic approaches to interpret the dynamic and complex characteristics of the whole system by measuring isolated

aspect (Brustad & Ritter-Taylor, 1997). The advancement of new technologies and analytical approaches provide opportunities for developing complex key performance indicators and quantifying their relationships with match result (Memmert & Raabe, 2018). It allows to predict the future match performance better and deepen the understanding of the mechanism of team success.

(2) Some inconsistencies exist in the categories and associated performance indicators of playing styles between existing studies. In addition, the definitions of playing styles have not been fully interpreted and a limited number of indicators are used to characterise a playing style. Thus, the applicability of findings is limited. Furthermore, to the best of my knowledge, no studies have examined the technical and physical demands of playing styles and the effects of playing styles on match outcome.

(3) Previous studies have established performance profiles to evaluate the technical performance of players and teams (Bradley, Lago-Peñas, Rey, & Gomez Diaz, 2013; Liu, Gómez, et al., 2016; Liu, Yi, Giménez, et al., 2015). However, some limitations should also be noted. Firstly, the operational definitions of technical variables are inconsistent between studies due to the data collected by different tracking systems. In addition, the classification of playing positions are also different between studies that considered positional effects. These issues may restrict the reliability, comparability and reproducibility of studies (Mackenzie & Cushion, 2013). Secondly, previous technical performance profiles are created based on relatively

small datasets, which may provide a limited chance to conduct more detailed research assessing the interactive effects between playing positions and situational variables. Thirdly, little attention has been paid to the match-to-match variation of technical performance to establish the performance profiles of technical variation. The investigation of the variability of technical performance may add insight into the dynamics of match play (Rampinini et al., 2007). Lastly, the available literature has sparked a controversy on the effects of situational variables on technical performance. Even though previous studies have agreed that contextual factors can significantly affect players' technical match performance (Liu, Gómez, et al., 2016; Liu, Yi, Giménez, et al., 2015; Taylor, Mellalieu, James, & Barter, 2010), Bush et al. (2015) reported that the competing contexts had limited impact on the variability of technical parameters. Therefore, considering the inconsistency in previous results, more detailed research is needed to further the understanding of the influence of situational variables on technical match performance.

- (4) Comparative analysis is an important aspect of performance analysis (Mackenzie & Cushion, 2013). Researchers have attempted to compare the differences of match performance between groups (e.g. playing positions, competitive levels, different leagues and match results). However, there is limited research identified the differences of technical demands between players from different playing positions. Besides, there is an issue that previous studies failed to account for during the process of data analysis. The repeated-measured data obtained from multiple matches should be addressed appropriately and the effects of situational variables

should also be controlled for. Otherwise, the real differences in match performance would be masked.

1.3 Objectives of the Thesis

Concerning the above-mentioned limitations, the general objective of the current thesis is to evaluate the technical and tactical performances at both elite team and player level from a long-term perspective. Specifically, this objective can be disassembled into the following four specific objectives to address concrete practical issues.

- (1) To identify the match-to-match variation of teams' technical performance and the relationships between the variation of technical variables of teams and match performance in the group stage of UEFA Champions League during the last eight seasons (season 2009/2010-2016/2017). The analysis of technical variability based on a combined approach may provide a novel insight into the identification of key performance indicators.
- (2) To identify the differences of technical and physical demands between two main attacking playing styles (counter attacking and possession) that were mostly used by teams in the 2018 FIFA World Cup. The findings from this study may reveal the latest tactical trend of modern football.
- (3) To analyse the effects of positional and situational variables on players' technical performance by establishing technical performance profiles and technical variation profiles of players in the UEFA Champions League from season 2009/2010 to 2016/2017. The analysis based on a large sample size enabling a holistic

understanding of the complex interaction between playing positions and match contexts.

- (4) To identify the differences of technical performances between players from different playing positions (central defender, full back, central midfielder, wide midfielder and forward) and different leagues (Spanish La Liga, English Premier League, Italian Serie A, German Bundesliga and French Ligue 1) in the UEFA Champions League from season 2009/2010 to 2017/2018. The generalised mixed linear modelling is introduced to address the effects of situational variables and the repeated-measured data from multiple matches across seasons.

1.4 Structure of the Thesis

This thesis consists of eight chapters (see Figure 1.2). *Chapter one* is the general introduction that provides information about research background, limitations of existing literature, objectives and structure of the thesis. *Chapter two to seven* are the key parts of the thesis and have been divided into two sections to evaluate the technical and tactical performance of teams (chapter two-three) and players (chapter five-seven) respectively. *Chapter eight* contains the general discussion and conclusions to illustrate the main findings, limitations, future research lines and practical applications.

The candidate finished six individual manuscripts during the course of this thesis. These publications/submitted manuscripts are included in this thesis as six independent chapters (chapter two-seven) corresponding to the five proposed objectives above (see Table 1.1). Chapter two is undertaken to achieve the aim one. Chapter three is done to

complete the aim two, chapter four and five are in response to aim three while chapter six and seven are to fulfil the aim four. Additionally, the formats of these chapters are different due to the different formatting requirements of the scientific journals to which they were submitted. The detailed information of the publications is listed at the end of this chapter. All of the citations and references from each chapter are placed together at the end of this thesis.

Table 1.1. Studies for corresponding chapters.

Chapter	Title	Journal	Impact Factor	Status
2	Variation of Match Statistics and Football Team's Match Performance in the Group Stage of UEFA Champions League from 2010 to 2017	Kinesiology	0.767	Accepted
3	Technical and Physical Match Performance of Teams in the 2018 FIFA World Cup: Effects of Two Different Tactical Approaches	Journal of Sports Sciences	2.733	Major revision
4	Evaluation of the Technical Performance of Football Players in the UEFA Champions League	International Journal of Sports Science & Coaching	0.856	Under review
5	Positional and situational effects on the technical variation of players in the UEFA Champions League	Research Quarterly for Exercise and Sport	2.268	Under review
6	Technical demands of different playing positions in the UEFA Champions League	International Journal of Performance Analysis in Sport	1.144	Published
7	Differences of technical performance of players from major five European football leagues in the UEFA Champions League	European Journal of Sport Science	2.576	Under review

Analyses on the Technical and Tactical Match Performances of Elite Football Teams and Players Considering Situational Efficiency

Figure 1.2. Structure of the thesis.

Chapter Two—Variation of Match Statistics and Football Team’s Match Performance in the Group Stage of UEFA Champions League from 2010 to 2017

2.1 Introduction

Football is a complex and dynamic team sport (Garganta, 2009; Liu, Yi, Giménez, et al., 2015) where teams’ performances combine interactions of technical, tactical, physical and mental factors (Carling et al., 2008; Drust, Atkinson, & Reilly, 2007; Liu, Yi, Giménez, et al., 2015). Under this unpredictable context, it is difficult for coaches and researchers to identify which factors contribute mostly to a team’s success and how these factors interact (Higham, Hopkins, Pyne, & Anson, 2014). Nevertheless, over the past years, a large amount of match statistics could be obtained due to the progress of video analysis systems (e.g., AMISCO, OPTA and ProZone), which could help us to objectively interpret the played matches (Liu, Hopkins, et al., 2016). One of the main tasks of performance analysis is to identify the key indicators that are related to match outcome within this extensive database and to examine the relationships between key indicators and teams’ match performance (Castellano et al., 2012; Garganta, Maia, & Basto, 1997; Higham et al., 2014).

The existing research normally uses the count values of actions or events to identify the key performance indicators that are related to teams’ match performance (Castellano et

al., 2012; Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez, 2010b; Lago-Peñas, Lago-Ballesteros, et al., 2011; Yang, Leicht, Lago, & Gomez, 2018; Yue et al., 2014). A wide range of statistical methods were employed such as discriminant analysis, principal component analysis and correlation analysis. In addition, there were also predictive analysis conducted to examine the linear relationships between match statistics and match outcome using generalised linear modelling (Liu, Gomez, et al., 2015) and generalised mixed linear modelling (Liu, Hopkins, et al., 2016). Besides, repeated-measure match data of players or teams derived from multiple matches can be addressed properly in these models (Yi et al., 2018). Aforementioned studies were unanimous that technical indicators can be better predictors of match outcome than physical indicators. However, the key indicators identified within previous studies have shown relatively inconsistent findings. Thus, there is an obvious opening for further research to conduct a mixed approach analysing the key indicators and their relationships with match performance, which may increase the practical applications and the full understanding of the outcomes (Rein & Memmert, 2016).

Furthermore, match actions and events of teams are characterized by high variability in dynamic competing environments over a certain period of competition (e.g. one season) (Kempton et al., 2015; Liu, Gómez, et al., 2016), these within-team variations are the result of internal (fitness status, motivation) and external factors (competing contexts, strategies and tactics) (Rampinini et al., 2007). Therefore, the interpretation of match-to-match variation may provide a novel insight for us to identify the relationships between match statistics and match performance. The coefficient of variation (CV) was

considered the best to present the inconsistency of performance indicators during a period (Hopkins, 2000). To the best of our knowledge, recent studies on the variability of performance in football are mainly based on players' match data (Bush, Archer, et al., 2015; Carling, Bradley, McCall, & Dupont, 2016; Gregson et al., 2010; Liu, Gómez, et al., 2016; Rampinini et al., 2007) and failed to account for the variability of teams' performance indicators. Moreover, there are some limitations raised from these studies, which may affect us to gain a more holistic understanding of the variability in football match. They focused more on the variation of physical performance and little attention been paid on the variation of technical performance. Even though technical indicators have been identified by Bush et al. (2015) that vary more from match-to-match than physical indicators. However, limited technical variables were analysed in this study. A study from Liu et al. (2016) used more numbers of technical variables and the situational variables were considered as well, but it is a comparative analysis to compare the differences of variation between players. There is a lack of predictive analysis to predict the relationships between the variation of technical variables and match performance.

One might question the reliability and practical utility of those analysis that are based on a limited sample size. Thus, large datasets are needed to examine the inherent variability in match play (Hopkins, 2000) and the findings could be more rational than those of single-season-based analysis. Nevertheless, there are very few longitudinal studies in this aspect, and although pattern of match play has evolved over the last decades (Kuhn, 2005). Previous studies only examined the match to match variation of

variables under a short or mid-term effect (i.e., during one or two consecutive seasons).

Identifying performance indicators related to match outcome and exploring the variation of match variables are not two isolated aspects and should be considered as a necessary combination. Hence, this study aims to identify the technical variation of teams and the relationships between variation of technical variables and teams' match performance in the group stage of UEFA Champions League from a long-term perspective (eight seasons).

2.2 Methods

2.2.1 Data and Reliability

Technical performance-related match data of all the 768 matches ($n=1,536$ observations) for teams playing at the group stage of UEFA Champions League from season 2009/10 to 2016/17 were collected from a public-accessed football statistic website named "whoscored.com" (<https://www.whoscored.com>) and the authorization of data use was obtained as well. The original data of the website was provided by the company of OPTA Sports data. The reliability of the technical data from the tracking system (OPTA Client System) has been verified earlier (intra-class correlation coefficients: 0.88-1.00; standardised typical error: 0.00-0.37) (Liu, Hopkins, Gómez, & Molinuevo, 2013). This study was conducted in accordance with the Declaration of Helsinki and the local institutional review board approved the current study.

2.2.2 Sample and Variables

Table 2.1. Selected technical performance-related match actions and events.

Groups	Action or event: operational definition
Variables related to goal scoring	<p>Shot: an attempt to score a goal, made with any (legal) part of the body, either on or off target.</p> <p>Shot on target: an attempt to goal which required intervention to stop it going in or resulted in a goal/shot which would go in without being diverted.</p> <p>Shot blocked: a goal attempt heading roughly on target toward goal which is blocked by a defender, where there are other defenders or a goal-keeper behind the blocker.</p> <p>Shot from open play: a goal attempt not stemmed directly from a dead ball situation.</p> <p>Shot from set piece: a goal attempt via a dead ball situation (corner kick, free-kick or throw in).</p> <p>Shot from counter attack: a goal attempt generated from a counter-attack situation. A counter-attack situation is logged when (a) the ball must be turned over in the defensive half; (b) the ball must be quickly manoeuvred (6 s, 3 passes) into the attacking third (the ball must be under control); (c) the defence must have four or less defenders in a position to defend the attack and attacking players must match or outnumber the defensive teams players and (d) the ball must be fully under control in the oppositions defensive third.</p>
Variables related to attacking and passing	<p>Dribble: a dribble is an attempt by a player to beat an opponent in possession of the ball. OPTA also log attempted dribbles where the player overruns the ball.</p> <p>Corner: ball goes out of play for a corner kick.</p> <p>Offside: being caught in an offside position resulting in a free kick to the opposing team.</p> <p>Pass: an intentional played ball from one player to another.</p> <p>Cross: any ball sent into the opposition team's area from a wide position.</p> <p>Through ball: a pass that split the last line of defense and plays the teammate through on goal.</p> <p>Long ball: an attempted pass of 25 yards or more.</p> <p>Short ball: an attempted pass of less than 25 yards.</p> <p>Pass success (%): successful passes as a proportion of total passes.</p> <p>Possession: the duration when a team takes over the ball from the opposing team with- out any clear interruption as a proportion of total duration when the ball was in play.</p> <p>Aerial won: two players competing for a ball in the air, for it to be an aerial duel both players must jump and challenge each other in the air and have both feet off the ground. The player who wins the duel gets the <i>Aerial won</i>, and the player who does not gets an <i>Aerial lost</i>.</p>
Variables related to defending	<p>Tackle: the action of gaining possession from an opposition player who is in possession of the ball.</p> <p>Foul: any infringement that is penalised as foul play by a referee.</p> <p>Yellow card: where a player was shown a yellow card by the referee for reasons of foul, persistent infringement, hand ball, dangerous play, etc.</p>

According to previous studies (Castellano et al., 2012; Lago-Peñas et al., 2010b; Liu, Gomez, et al., 2015; Liu, Yi, Giménez, et al., 2015), the data of twenty technical match actions or events of teams from 768 matches (n=1,536 observations) in the group stage of UEFA Champions League from season 2009/10 to 2016/17 were chosen as the sample in the study. Technical actions or events were classified into three groups: (1)

goal scoring; (2) attacking and passing; (3) defending. The grouping and operational definitions can be seen in Table 2.1 (Liu, Gómez, et al., 2016; Liu, Gomez, et al., 2015; Liu et al., 2013).

2.2.3 Procedure and Statistical Analysis

2.2.3.1 Data Normalization

Variables in percentage units (pass success, possession and aerial success) were analysed with the raw data. Original value of each variable that related to goal scoring and attacking and passing were transformed into adjusted values of 50% of ball possession of the own team gained from one match (Liu, Gomez, et al., 2015). The formula is as follows:

$$V_{\text{adjusted}} = (V_{\text{original}} / BP_{\text{own}}) * 50\%$$

V_{adjusted} is the adjusted value, V_{original} is the original value and the BP_{own} is the ball possession of the own team for one match.

Original data of variables related to defending were transformed into adjusted values of 50% of ball possession of the opponent (Liu, Gomez, et al., 2015). The formula is as follows:

$$V_{\text{adjusted}} = (V_{\text{original}} / BP_{\text{opponent}}) * 50\%$$

V_{adjusted} is the adjusted value, V_{original} is the original value and the BP_{opponent} is the ball possession of the opponent for one match.

2.2.3.2 Descriptive Analysis

The coefficient of variation (CV, expressed as percentages) of the adjusted value of

each variable for each team at group stage of each season was calculated to quantify the within-team match-to-match variability of each team in each season (Atkinson & Nevill, 1998; Bush, Archer, et al., 2015; Liu, Gómez, et al., 2016). If the count value of an action or event was 0 in all the 6 matches at the group stage of one season, the CV was treated as a missing value. Differences of the mean of CVs between qualified and non-qualified teams were compared using non-clinical magnitude-based inference. Magnitude of clear differences is considered as: trivial, 0-0.2; small, 0.2-0.6; moderate, 0.6-1.2; large, 1.2-2.0; and very large, >2.0 (Batterham & Hopkins, 2006). The possibilities for the effect to be true were: 25%-75%, possibly; 75%-95%, likely; 95%-99.5%, very likely; and >99.5%, most likely (Batterham & Hopkins, 2006).

2.2.3.3 Correlation Analysis and Autocorrelation Function

Pearson correlations between CVs and points of the group stage were calculated by the bivariate correlation analysis in the data package IBM SPSS Statistics version 22 (IBM Corp., Armonk, NY). The correlations of CVs and points of the group stage for all teams, qualified teams and non-qualified teams in the past eight seasons were calculated respectively to identify the associated key performance indicators. Moreover, the temporal relationships of variation of variables were examined both for qualified teams and non-qualified teams. Autocorrelation function (ACF) was employed to calculate the correlations of variation of variables between their own past and future values over these 8 seasons (Brockwell & Davis, 2013). The ACF was calculated in each of year (1 season) interval of the time series and 6 lags were chosen according to the time series length, there is no time-offset if lag=0. The magnitude of the correlation coefficient is

as follows: $r < 0.1$ trivial, $0.1 < r < 0.3$ small, $0.3 < r < 0.5$ moderate, $0.5 < r < 0.7$ large, $0.7 < r < 0.9$ very large, $r > 0.9$ nearly perfect (Hopkins, 2002).

2.2.3.4 Generalised Linear Model

The generalised linear model was employed to identify the linear relationships between CV of each action or event and the probability of qualifying to the knockout stage. A binomial logistic regression was run in the model taking the variable of “qualified or not” as the dependent variable and CVs of actions or events as independent variables to predict the logarithm of the odds of qualifying to the knockout stage. The linear relationships were identified as effects of a two-standard-deviation increase in the value of CV of each action or event on the change (%) in the probability of team qualifying to the knockout stage (Liu, Gomez, et al., 2015). Inferences were made using the non-clinical magnitude-based inferences and were evaluated by the smallest worthwhile change, which was set to 10% change in the probability of qualification (Higham et al., 2014; Hopkins, Marshall, Batterham, & Hanin, 2009b).

2.3 Results

2.3.1 Variation of Match Variables

Table 2.2 shows the descriptive statistics of CVs for qualified teams and non-qualified teams from season 2009/10 to 2016/17. Figure 2.1 demonstrated that mean values of CVs of shot (ES; $\pm 90\%$ confidence limit: $0.51; \pm 0.21$), shot on target ($0.63; \pm 0.21$), shot from open play ($0.58; \pm 0.21$), shot from set piece ($0.31; \pm 0.21$), shot from counter attack ($0.40; \pm 0.22$), corner ($0.30; \pm 0.21$), pass ($0.22; \pm 0.21$), through ball ($0.66; \pm 0.21$), pass

success (0.31; ± 0.21), possession (0.32; ± 0.21), and aerial success (0.50; ± 0.21) for non-qualified teams were higher than those for teams that qualified to the knockout stage, while the variation of yellow card (-0.22; ± 0.21) was lower than their counterparts from qualified teams. However, differences of variation in shot blocked, dribble won, offside, cross, long ball, short ball, tackle and foul between qualified and non-qualified teams were trivial. Shot on target (0.63; ± 0.21), shot from open play (0.58; ± 0.21) and through ball (0.66; ± 0.21) from non-qualified teams were the three most unstable variables in the past eight seasons compared with the qualified teams. CVs of shot (0.51; ± 0.21) and aerial success (0.50; ± 0.21) also showed clear differences between non-qualified and qualified teams.

Table 2.2. Descriptive statistics of variation (CV) of match variables for teams (percentage units: mean $\pm$ SD(n)).

Variables	Qualified M $\pm$ SD(n)	Non-qualified M $\pm$ SD(n)
Shot	31.02 $\pm$ 10.49(128)	37.51 $\pm$ 12.79(128)
Shot on target	46.31 $\pm$ 16.72(128)	58.87 $\pm$ 21.64(128)
Shot blocked	63.40 $\pm$ 21.47(128)	68.30 $\pm$ 23.19(128)
Shot from open play	36.59 $\pm$ 12.51(128)	45.40 $\pm$ 15.62(128)
Shot from set piece	59.60 $\pm$ 20.51(128)	66.96 $\pm$ 23.66(128)
Shot from counter attack	156.41 $\pm$ 58.79(109)	183.98 $\pm$ 63.29(110)
Dribble won	40.65 $\pm$ 13.00(128)	41.53 $\pm$ 13.52(128)
Corner	47.67 $\pm$ 15.77(128)	53.28 $\pm$ 18.85(128)
Offside	75.22 $\pm$ 27.25(128)	79.03 $\pm$ 32.55(127)
Pass	8.47 $\pm$ 3.05(128)	9.42 $\pm$ 3.80(128)
Cross	33.27 $\pm$ 15.39(128)	34.32 $\pm$ 12.53(128)
Through ball	73.03 $\pm$ 34.68(125)	99.97 $\pm$ 44.09(125)
Long ball	22.11 $\pm$ 8.50(128)	22.38 $\pm$ 8.37(128)
Short pass	10.68 $\pm$ 3.35(128)	11.66 $\pm$ 5.17(128)
Pass success	5.64 $\pm$ 2.46(128)	7.95 $\pm$ 15.92(128)
Possession	16.42 $\pm$ 7.03(128)	18.76 $\pm$ 7.81(128)
Aerial success	22.55 $\pm$ 8.79(128)	28.45 $\pm$ 12.50(128)
Tackle	29.72 $\pm$ 9.39(128)	29.30 $\pm$ 13.67(128)
Foul	31.63 $\pm$ 11.35(128)	32.11 $\pm$ 11.63(128)
Yellow card	73.07 $\pm$ 29.10(128)	66.46 $\pm$ 25.15(128)

Figure 2.1. Effect sizes of differences in mean of CV of each match variable of teams from non-qualified and qualified teams.

Asterisks indicate the likelihood for the magnitude of the true differences in mean as follows: *possible; **likely; ***very likely; ****most likely.

2.3.2 Temporal Relationship of Variables

Table 2.3 shows the mean values of ACF of each variable both for qualified and non-qualified teams. The ACF result of all variables from qualified and non-qualified teams did not show statistical significance except for dribble won (mean; sig.; -0.085; 0.041) and through ball (-0.071; 0.028) from non-qualified teams. These two variables showed trivial negative autocorrelation in all the results.

Table 2.3. Values of autocorrelation function (ACF) of 20 variables for qualified teams and non-qualified teams.

Variables	Qualified		Non-qualified	
	ACF	Sig.	ACF	Sig.
Shot	-0.054	0.442	-0.125	0.356
Shot on target	-0.029	0.567	-0.076	0.114
Shot blocked	-0.059	0.217	-0.091	0.705
Shot from open play	-0.081	0.268	-0.078	0.522
Shot from set piece	-0.080	0.089	-0.111	0.811
Shot from counter attack	-0.057	0.456	-0.086	0.547
Dribble won	-0.106	0.562	-0.085	0.041*
Corner	-0.084	0.896	-0.010	0.974
Offside	-0.107	0.637	-0.047	0.323
Pass	-0.077	0.471	-0.084	0.863
Cross	-0.076	0.563	-0.078	0.223
Through ball	-0.036	0.114	-0.071	0.028*
Long ball	-0.055	0.087	-0.041	0.197
Short pass	-0.057	0.143	-0.097	0.622
Pass success	-0.103	0.770	-0.095	0.773
Possession	-0.093	0.303	-0.062	0.327
Aerial success	-0.066	0.255	-0.076	0.207
Tackle	-0.106	0.548	-0.063	0.778
Foul	-0.096	0.099	-0.048	0.117
Yellow card	-0.084	0.312	-0.047	0.450

Note. Values of ACF and Sig. are presented as mean value of 6 lags.

2.3.3 Correlations between CVs of Match Variables and Points of the Group Stage

The correlation coefficient between CVs of variables and points of the group stage were presented in Figure 2.2. For qualified teams, clearly negative correlations were observed in the past eight years between CVs of variables related to goal scoring: shot from set piece (r ; $\pm 90\%$ confidence limit: -0.21 ; ± 0.14), shot from counter attack (-0.20 ; ± 0.15) and points gain during the group stage. Considering the variables related to attacking and passing, offside (-0.11 ; ± 0.14), through ball (-0.28 ; ± 0.14), short pass (-0.11 ; ± 0.14), pass success (-0.27 ; ± 0.14) and possession (-0.27 ; ± 0.14) had clearly negative correlations with points of the group stage as well. The correlations between CVs of shot, corner, long ball, aerial success and points of the group stage were unclear.

Figure 2.2. Effect sizes of correlation coefficient between CV of each match variable and points of group stage from qualified and non-qualified teams.

Asterisks indicate the likelihood for the magnitude of the correlations as follows: *possible; **likely; ***very likely; ****most likely. Confidence intervals for some actions or events that don't marked asterisks mean the likelihood for the magnitude of the correlations < 25%.

While for non-qualified teams, the CVs of variables related to goal scoring: shot from set piece (-0.24; $\pm 0.14\%$), CVs of variables related to attacking and passing: dribble won (-0.13; $\pm 0.14\%$), corner (-0.28; $\pm 0.14\%$), cross (-0.12; $\pm 0.14\%$), pass success (-0.11; $\pm 0.14\%$), possession (-0.21; $\pm 0.14\%$), aerial success (-0.23; $\pm 0.14\%$), and CVs of variables related to defending: tackle (-0.22; $\pm 0.14\%$), foul (-0.13; $\pm 0.14\%$) showed clearly negative correlations with points gained during the group stage. The correlations between CVs of shot, shot on target, shot blocked, shot from open play, shot from

counter attack, pass, through ball, long ball, short pass, yellow card and points of the group stage were unclear. It is notable that there were clearly positive correlations between CVs of cross (0.16; $\pm 0.14\%$), foul (0.14; $\pm 0.14\%$), yellow card (0.20; ± 0.14) and points of group stage for the teams that qualified to the knockout stage, but for those that were eliminated in the group stage, there were no such relationships. The CVs of shot from set piece and possession from qualified teams and non-qualified teams all had relatively higher negative correlation coefficients with points of group stage.

2.3.4 Linear Relationships between CVs of Match Variables and the Probability of Qualifying the Knockout Stage

Figure 2.3 shows that, for match variables that related to goal scoring, increasing 2-SD in the CVs of shot, shot on target, shot blocked, shot from open play, shot from set piece, shot from counter attack would bring 28.7% (90% confidence limit: $\pm 10.8\%$), 33.5% ($\pm 10.8\%$), 11.1% ($\pm 10.4\%$), 32.0% ($\pm 10.7\%$), 17.1% ($\pm 10.6\%$), 22.5% ($\pm 11.1\%$) lower probability of qualifying the knockout stage. While for variables related to attacking and passing, a 2-SD increase in the CVs of corner, pass, through ball, short pass, pass success, possession, aerial success would decrease the probability of qualifying the knockout stage by 16.4% ($\pm 10.5\%$), 14.1% ($\pm 10.5\%$), 35.3% ($\pm 11.0\%$), 12.0% ($\pm 11.1\%$), 58.6% ($\pm 29.3\%$), 16.0% ($\pm 10.4\%$), 28.6% ($\pm 11.0\%$). The CV of pass success displayed strongest effects on the probability of qualifying to the knockout stage. While for variables related to defending, a 2-SD increase in the CV of yellow card would bring a 12.3% ($\pm 10.4\%$) higher probability of qualification.

Figure 2.3. Relationships between CV of each match variable and the probability of qualifying to knockout stage.

Relationships were identified as the effect of a two-standard-deviation increase in the value of CV of each performance related action or event on the change in probability (%) of qualifying to knockout stage. 10% and -10% represent the positive and negative smallest worthwhile change threshold, respectively. When bars of one variable crossed the negative and positive smallest worthwhile change threshold in the meantime, the effect was unclear. Asterisks indicate the likelihood for the magnitude of the true effect as follows: * possible; ** likely; *** very likely; **** most likely. Confidence intervals for some actions or events that do not marked asterisks mean likelihood of trivial effect.

2.4 Discussion

The present study employed a collection of approaches to identify teams' technical variation and the relationships between these technical variation and match performance in the group stage of the UEFA Champions League on a large time-span basis (eight seasons). Main results include that: qualified teams showed more stable match performance in variables related to goal scoring, attacking and passing, while non-qualified teams displayed more stable match performance on variables related to defending. The CVs of variables related to goal scoring, attacking and passing had negative relationships with match performance, while variables related to defending displayed positive relationships.

Results showed that shot from counter attack was the most unstable variable both for qualified and non-qualified teams during the past eight seasons. This is a new finding that did not appear in the previous research. It was showed that there are 37 teams (14.5%; n=256) that achieved none shot from counter attack in all six matches played during the group stage. This finding may indicates that the counter attack situation has less frequency of occurrence and could represent an unstable performance (Bush, Archer, et al., 2015). Another reason that could explain the high variability in shot from counter attack is the playing styles and tactics of teams and their opponents. Each team has its own playing style and not all teams are suitable for playing counter attack. Teams that are good using the counter attack also need to adopt different playing styles when playing against different opponents (Bush, Archer, et al., 2015). Match performance of teams is closely related with match performance of players (Shafizadeh, Taylor, &

Peñas, 2013). A previous study (Liu, Gómez, et al., 2016) identified that shot, shot on target and assist were the three technical performance parameters of players that holds highest variability, while our study indicated that match variables of teams: shot from counter attack, shot blocked, shot from set piece, offside, through ball and yellow card were the six most unstable actions or events during the past eight seasons. High variation does not always mean unsuccessful performance, but more attention should be paid on these sensitive actions or events during the coaching process and interventions.

Variations in variables related to goal scoring, attacking and passing for non-qualified teams were higher than their counterparts from qualified teams, but of three variables related to defending, variation of yellow card of qualified teams were higher than those of non-qualified teams, while variation of foul and tackle showed trivial differences. A similar finding was reported on the variation of technical match actions or events of players from La Liga (Liu, Gómez, et al., 2016). Stronger teams tend to obtain higher ball possession percentage in a football match (Jones, James, & Mellalieu, 2004), weaker teams have to concentrate more on defensive aspects when they encounter stronger teams, which explained why weaker teams showed more stable performance on variables related to defending. Furthermore, in variables related to goal scoring and attacking and passing, shot on target, shot from open play and through ball were three variables that showed biggest differences between qualified teams and non-qualified teams. A similar study reported that the variations of shot on target and through ball of players when losing a match were higher than when winning the match (Liu, Gómez,

et al., 2016), which means that these variables from winning teams also showed more stable performances. Previous studies (Castellano et al., 2012; Lago-Peñas et al., 2010b; Lago-Peñas, Lago-Ballesteros, et al., 2011; Liu, Gomez, et al., 2015) have identified that shot on target and ball possession were the key variables to succeed in football. But in the current study, ball possession only showed likely small difference between qualified teams and non-qualified teams. Based on the results, it is suggested that qualified teams have the ability to better retain possession and the variation of possession for both qualified and non-qualified teams maintained at a relatively stable level on a long-term basis. One interesting finding of this study was that there was a clear difference between qualified and non-qualified teams concerning the variability of through ball. Taking positional factors into account, players of full back, wide midfielder, central midfielder and forward of stronger teams made more through balls than weaker teams except for central defender position (Liu, Gómez, et al., 2016). This fact indicated that variation difference of through ball between qualified and non-qualified teams is likely to be related to the differences in the skill level of players. Most players from top teams were always able to achieve more stable number of through ball than those from bottom teams (Liu et al., 2016).

Autocorrelation function (ACF) was used to make a dynamic comparison across the seasons by identifying the correlation among season's variations of a variable. Those variables that did not show statistical significance indicating that there was no relationship between previous and next match performance variation of these variables within these 8 seasons. However, negative autocorrelations in dribble won and through

ball of non-qualified teams were found. Although their effects were trivial, this would mean that there was certain negative relationship in match performance stability within these two variables from non-qualified teams over the past 8 seasons. The higher the ACF value, the greater the correlation (Prieto, García, & Ibáñez, 2017). The more unstable performance of a variable that non-qualified teams in one season have, the more stable performance of this variable would be in another season. Therefore, dribble won and through ball showed low performance persistence across the seasons, which led to the unsuccessful performance of non-qualified teams in the group stage.

Correlation analysis quantified the relationships between variations of match variables and match outcome (points of group stage). We can see in the Figure 2, CVs of through ball, pass success and possession from teams that qualified to the knockout stage showed the highest negative correlations with points of group stage in the past eight seasons. It was suggested that the lower the variation of through ball, pass success and possession from qualified teams, the higher the points gained. The consistency of these actions or events for qualified teams contributed to their successful match outcome. This finding was in line with the previous study (Bush, Archer, et al., 2015) which concluded that the stronger teams tend to adopt a more possession-based strategies retaining the ball possession and seeking scoring opportunities. As for teams that did not qualify into the knockout stage, only the CV of corner displayed a very likely negative correlation with points of group stage. The CV of corner from non-qualified teams negatively correlated to their points, demonstrating that the stability of this action was responsible for the unsuccessful performance of non-qualified teams. Additionally,

this finding may indicate that increasing the frequency of occurrences of corner and improving its stability in match can bring better match outcome for non-qualified teams.

In addition, we should also notice that CVs of yellow card and foul from qualified teams showed clearly positive correlations with the points obtained during the group stage. Teams were likely to obtain a better performance in matches when they had higher variability in yellow card and foul. This may reveal that the numbers of yellow cards and fouls that qualified teams obtained in a game can never always maintain neither at a relatively high level nor at a relatively low level. This depends on the situation of the game and the opponent's tactics. Interestingly, the CV of foul from non-qualified teams showed clear positive correlation with their points gained in the group stage, which can be easily explained by their relatively worse strength in attacking, thus more fouls were committed to prevent opponents from scoring a goal. We also found that CVs of shot from set piece and possession from qualified and non-qualified teams all showed clear negative correlations with their corresponding points during the group stage. It is important for both top and bottom teams to reduce the variations in these two actions or events, which is an effective way to enhance their match performance.

Generalised linear model also allows to identify the relationships between variations of match variables and match performance (qualified or non-qualified to the knockout stage) (Liu, Gomez, et al., 2015). Probably due to the large sample of the current study, the results not only showed differences with league competitions (Lago-Peñas et al., 2010b; Oberstone, 2009) but were also slightly different from those previously

identified in other competitions (Castellano et al., 2012; Lago-Peñas, Lago-Ballesteros, et al., 2011; Liu, Gomez, et al., 2015). The results of prior studies showed that the performance parameters that were the key to succeed and to discriminate top from bottom teams mainly were total shot, shot on target and ball possession. In the current study, The CVs of all variables that related to goal scoring showed clear negative relationships with the probability of qualifying to the knockout stage, especially for shot, shot on target and shot from open play (most likely negative effect). This result indicated that stability, quality and diversity of shot are important factors for teams' success in the group stage of the UEFA Champions League. The variables related to attacking and passing also showed negative relationships with the probability of qualifying to the knockout stage. Especially for the CV of pass success, which had the strongest negative relationship with the probability of qualifying to the knockout phase: a two-standard-deviation increase in the CV of pass success could bring a 58.6% decrease in the probability of qualifying to the knockout stage. Although the CV of pass also showed a clear negative relationship (-14.1%) with the probability of qualifying to the knockout stage, this value was lower than those for CV of pass success. This result may reflect that the quality of pass is more important than the quantity for teams to succeed in football. The occurrence of aerial duel is usually a result from long balls and crosses (Liu, Gomez, et al., 2015). The CV of aerial success in this study showed most likely negative effect, CVs for long ball and cross showed trivial effect. But the CV of corner displayed a clearly negative relationship with the probability of qualifying to the knockout stage. The high frequency of occurrence of corner means that more saves

were made by the goalkeeper or more clearances were committed by defenders. It may indicate that putting more pressure in opponent's defensive area (attacking third) allows gaining more corners and improving the stability of match performance in aerial success is an effective way for teams to succeed. For the variables related to defending, only the CV of yellow card showed a clearly positive relationship with the probability of qualifying to the knockout stage. The unstable match performance of teams on yellow card produces higher successful performance. The low frequency of occurrence of yellow card in matches may result in high variation. Hence, players should learn to reduce unnecessary fouls and to commit fouls at the right time to prevent the offensive threats from the opponent.

2.5 Conclusions

In summary, qualified teams showed more stable match performance on variables related to goal scoring and variables related to attacking and passing such as shot on target, shot from open play and through ball, while non-qualified teams displayed more stable match performance on variables related to defending such as yellow card. Stronger teams preferred to adopt possession-based attacking playing style. CVs of variables related to pass and organization from qualified teams (through ball, pass success and possession) were negatively correlated with points of group stage, while CVs of variables that related to set piece (shot from set piece and corner) from non-qualified teams showed negative correlations with points of group stage. Results of generalised linear modelling showed that CVs of variables related to goal scoring and variables related to attacking and passing all showed clearly negative relationships with

the probability of qualifying to the knockout stage, especially for the pass success. For variables related to defending, only the CV of yellow card showed clearly positive relationship with the probability of qualifying to the knockout stage.

The current study conducted both the comparative analysis and the predictive analysis based on a large data set, aiming to identify teams' technical variation and the relationships between variables' technical variation and match performance from a long-term perspective. Coaches and performance analysts can get a holistic insight into the variability of teams' indicators and a novel perspective to identify the key performance indicators for teams' match performance. Teams could develop specific training interventions to monitor and enhance their match performance in those identified key performance indicators. Specifically, stronger teams can improve the stability of match performance in passing, organising and goal scoring to maintain their initiative during match play. Weaker teams can improve their ability of set-piece, which is an effective way for them to increase the probability of winning a game. However, some limitations of the study should be addressed in further research. Firstly, only the quality of team was considered in the comparisons of team's variation. more situational variables, such as match location, qualify of opponent and match outcome, should be accounted for to establish technical performance profiles, that would be a powerful tool for the match preparation and post-match evaluation. Secondly, only technical performance related actions or events were analysed. Nevertheless, the tactical and physical performance should be further incorporated in the analysis to enhance the practical applications.

Chapter Three—Technical and Physical Match Performance of Teams in the 2018 FIFA World Cup: Effects of Two Different Playing Styles

3.1 Introduction

Football performance involves an interaction of technical, physical and tactical activities between players during match play (Moura, Martins, Anido, Ruffino, Barros, & Cunha, 2013). These interactions are a consequence of strategical plans and the match dynamics (Grehaigine, Bouthier, & David, 1997) and can be interpreted by the measurement of attacking and defending behaviors of players from a team and their counterparts (Fernandez-Navarro et al., 2016). Consequently, there are different types of match approaches integrating the mentioned dynamical interactions employed by different teams in each competition scenario (Fernandez-Navarro et al., 2016; Hewitt et al., 2016; Lago-Peñas et al., 2017). Hence, the tactical approach of a team in a specific match can be defined and can depict briefly how the football match unfolds (Lago-Peñas et al., 2017). The term “tactical approach” refers to the dominant and recurrent pattern demonstrated by a team in a specific competing context (Fernandez-Navarro et al., 2016; Hewitt et al., 2016).

In particular, possession play and direct play have been identified as the most common tactical approaches in football (Hughes & Franks, 2005; Kempe et al., 2014). Some teams are using a similar tactical approach over time due to their relatively constant

playing philosophy, which can form an overt specific playing style. For instance, the Spanish *La Liga* teams are usually classified as possession-play characterised teams, while the English Premier League teams are always considered as direct-play characterised teams (Sarmento, Pereira, Matos, Campaniço, Anguera, & Leitão, 2013a). However, in most cases, teams tend to alter their tactical approach according to their players' skill level, coach's coaching style and opponent's playing style (Lago-Peñas et al., 2017; Memmert et al., 2017). Thus, it should be emphasised that although the tactical approach may subject to change, the playing style of a single team is relatively stable within the management of the same coach with the same squad in hand, which usually occurs during the international tournaments between national teams, such as the FIFA World Cup. Moreover, the tactical behaviours may present difference in different competing contexts (match result, match location, quality of team and opponent et al.) (Kempe et al., 2014), these effects should be addressed properly when comparing the differences between playing styles. Therefore, the effects of situational effects were objectively controlled in the current study while previous studies failed to do so.

Both possession and direct playing styles have their strength and weakness, and both call for specific technical and physical requirements (Yue et al., 2014). Accordingly, there are a selection of performance indicators that remain relatively stable that reflects a specific tactical approach and playing style (Hewitt et al., 2016; Hughes & Bartlett, 2002). Teams with possession playing style or employing possession-play tactical approach would have relatively more ball possession than opponents, performing longer ball possession time and more passes (Tenga, Holme, Ronglan, & Bahr, 2010a).

In contrast, teams with direct playing style or using direct-play tactical approach would achieve higher actions of long balls while lower number of passes and time of ball possession. This style is characterised by trying to move the ball into the attacking third as directly as possible in the means of counter attacking (Fernandez-Navarro et al., 2016; Hughes & Franks, 2005). While physical performance indicators were believed to share similar features within players from the two types of teams (Bradley et al., 2013; Da Mota, Thiengo, Gimenes, & Bradley, 2015).

It is not hard to find that, in the prior literature, the tactical approach and playing style were roughly defined by the attacking time achieved by a team which is not objective and solid enough in the methodological regard (Lago-Peñas et al., 2017; Pollard et al., 1988). Furthermore, the match performance indicators were analysed taking into account the tactical approach or playing style of the own team, without an appropriate consideration on the interaction with the opponent team (Fernandez-Navarro et al., 2016).

Therefore, there is a need to classify more accurately the tactical approach and the playing style of football teams, and to quantify the match performance of teams with different playing styles facing different types of opponent. Teams participating in the FIFA World Cup are top national squads from all over the world which are the representatives of the latest tactical trend in football. It provides an ideal sample to achieve the mentioned classification and quantification. We hypothesise that: (1) the possession-play characterised teams would have made more goal-scoring, passing and

organising related match actions, but achieved fewer defending related actions and covered less distance than direct-play characterised teams; and (2) the playing style of opponent teams could have an impact on the technical and physical performances of both direct-play and possession-play characterised teams.

3.2 Methods

3.2.1 Data Resource

Match data of the study originated from two resources. Technical match performance data related to goal scoring were collected from a public-accessed football statistic website named “whoscored.com” (<https://www.whoscored.com>). The original data of this website was provided by the company of OPTA Sportsdata, whose tracking system used for coding football match actions and events has been tested (Liu et al., 2013) to have an acceptable inter-operator reliability (*Kappa* values>0.90). Other technical and physical match performance data were retrieved from FIFA’s official website (FIFA, 2018). The tracking statistics were collected by a real-time optical tracking system operated at 25 frames per second and each frame provided details of players on the field. The accuracy of the tracking system has been recently verified by Linke and colleagues (Linke, Link, & Lames, 2018). For previous applications of the FIFA’s database, see examples of Da Mota et al. (2015) and Nassis et al. (2015). This study was conducted in accordance with the Declaration of Helsinki and meets the ethical standards of the International Journal of Sports Medicine (Harriss & Atkinson, 2009). The study design and procedures were approved by the ethics committee of the local university.

3.2.2 Sample and Variables

Table 3.1. Selected technical and physical performance-related match variables.

Groups	Variable: operational definition
Variables related to goal scoring	<p>Shot: an attempt to score a goal, made with any (legal) part of the body, either on or off target.</p> <p>Shot on target: an attempt to goal which required intervention to stop it going in or resulted in a goal/shot which would go in without being diverted.</p> <p>Shot blocked: a goal attempt heading roughly on target toward goal which is blocked by a defender, where there are other defenders or a goal-keeper behind the blocker.</p> <p>Shot from open play: a goal attempt not stemmed directly from a dead ball situation.</p> <p>Shot from set piece: a goal attempt via a dead ball situation (corner kick, free-kick or throw in).</p> <p>Shot inside box: a goal attempt occurred in the 18-yard line.</p> <p>Shot outside of box: a goal attempt occurred outside the 18-yard line.</p>
Variables related to attacking and passing	<p>Pass: an intentional played ball from one player to another.</p> <p>Pass success (%): successful passes as a proportion of total passes.</p> <p>Delivery into attacking third: player pass the ball from the outside of attacking third into the attacking third with a teammate in control of the ball.</p> <p>Solo run in attacking third: player make an individual possession into the attacking third.</p> <p>Delivery into penalty area: player pass the ball from the outside of penalty area into the penalty area with a teammate in control of the ball.</p> <p>Solo run in penalty area: player make an individual possession into the penalty area.</p>
Variables related to defending	<p>Tackle gaining ball: the successful action of gaining possession from an opposition player who is in possession of the ball.</p> <p>Tackle not gaining ball: the unsuccessful action of gaining possession from an opposition player who is in possession of the ball.</p> <p>Clearance attempted: player under pressure attempt to clear the ball out of the defensive zone or/and out of play.</p> <p>Clearance completed: player under pressure successfully cleared the ball out of the defensive zone or/and out of play.</p> <p>Foul: any infringement that is penalised as foul play by a referee.</p>
Physical variables	<p>Total distance (m): distance covered in a match by all the players of a team.</p> <p>Top speed (km/h): mean value of fastest speed achieved by all players of a team.</p> <p>Sprint (m) : distance covered at the speed over 25km/h in a match by all the players of a team.</p> <p>Distance zone 1 (m): distance covered at the speed of 0-7km/h in a match by all the players of a team.</p> <p>Distance zone 2 (m): distance covered at the speed of 7-15km/h in a match by all the players of a team.</p> <p>Distance zone 3 (m): distance covered at the speed of 15-20km/h in a match by all the players of a team.</p> <p>Distance zone 4 (m): distance covered at the speed of 20-25km/h in a match by all the players of a team.</p> <p>Distance zone 5 (m): distance covered at the speed over 25km/h in a match by all the players of a team.</p>

We selected 59 of 64 matches from the tournament as our sample, excluding the five matches in which extra time was played. Based on the availability of data and the review of previous literature (Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez, 2010a; Liu, Yi, Gimenez, Gomez, & Lago-Penas, 2015; Yi et al., 2018), 18 technical

performance-related variables and 8 physical performance-related variables of outfield players were selected to act as variables quantifying the technical and physical match performance of teams (see Table 1). The variables of ball possession and shot from counter attack were used to quantify the different tactical approaches of teams in the games in order to identify their playing styles.

3.2.3 Procedure and Statistical Analysis

A *k*-means cluster analysis taking the variables of ball possession (in reverse order) and shot from counter attack as predictors was run to quantify all the 118 match observations into two clusters of different tactical approaches: direct play and possession play. Playing styles of teams were identified accordingly: if more than half (>50%) of the number of matches of a team was quantified as direct play, the team was classified as direct-play characterised, if more than half (>50%) of the number of matches of a team was quantified as possession play, the team was classified as possession-play characterised, and if the matches of a team were equally distributed (50% direct play vs 50% possession play), the team was classified as mixed-play characterised.

Generalised mixed linear modelling was then realised with *Proc Glimmix* in the University Edition of Statistical Analysis System (version SAS Studio 3.6). The identified playing styles of teams and the interaction of playing styles of the teams with their opponents were included in the modelling as the fixed effect. A random effect for team and opponent identity was added to account for repeated measurement on the

teams. Separate Poisson regressions were run in the modelling taking the value of each of the 18 technical performance-related and 8 physical performance-related variables as the dependent variable.

Uncertainty in the true effects of the predictors was evaluated using both P value (statistical significant differences) and non-clinical magnitude-based inference as implemented in the spreadsheet accompanying the package of materials for generalised mixed modelling with SAS Studio (Hopkins, 2016b). Estimated magnitudes and their confidence limits were expressed in standardised units, and were assessed qualitatively with the following scale: <0.2 trivial, 0.2-0.6 small, 0.6-1.2 moderate, 1.2-2.0 large, and >2.0 very large (Hopkins, Marshall, Batterham, & Hanin, 2009c). Effects were deemed clear if the 90% confidence interval did not include positive and negative substantial values simultaneously. Clear effects were reported with a qualitative likelihood that the true effect was either substantial or trivial (whichever probability was greater) using the following scale: <0.5% most unlikely, 0.5-5% very unlikely, 5-25% unlikely, 25-75% possibly, 75-95% likely, 95-99.5% very likely, and >99.5% most likely (Hopkins et al., 2009c).

3.3 Results

Table 3.2 shows the descriptive results of the *k*-means cluster analysis. Figure 3.1 shows the proportion of matches employing direct play and possession play tactical approaches of all the 32 teams in the 2018 FIFA World Cup quantified by the *k*-means cluster analysis. As can be seen, most of the teams (especially those who qualified to

the knockout stage) were able to use both direct and possession play tactical approach in the tournament. According to our criterion mentioned in the method, playing styles of teams were classified as following: Costa Rica, Denmark, Egypt, France, Iceland, Iran, Nigeria, Panama, Poland, Russia, Senegal, Serbia, South Korea, Sweden, Tunisia and Uruguay were classified as direct-play characterised teams; Argentina, Australia, Belgium, Brazil, Colombia, Croatia, England, Germany, Japan, Mexico, Morocco, Peru, Saudi Arabia, Spain and Switzerland were classified as possession-play characterised teams; while Portugal was classified as mixed-play characterised team. Due to the limitation in sample size, data of Portugal were excluded for further analysis.

Table 3.2. Result of the k-means cluster analysis.

	Direct Play (n=60 match observations)			Possession Play (n=58 match observations)		
	mean±s	min	max	mean±s	min	max
Ball Possession (%)	41.5±5.6	28	50	58.8±5.4	51	72
Shot from Counter Attack (count)	0.45±0.89	0	4	0.28±0.59	0	3

Figure 3.1. Distribution of tactical approaches employed by teams in the 2018 FIFA World Cup.

Descriptive statistics of the 18 technical performance-related and 8 physical performance-related match variables for teams classified as direct-play and possession-play characterised when playing against different types of opponents are presented in Table 3.3. As can be seen in Figure 3.2, possession-play characterised teams performed a moderate-to-large higher number of shot inside box, pass, pass accuracy and solo run in penalty area ($P \leq 0.0008$; ES: 0.88-1.27), and a small-to-moderate higher numbers in

other goal scoring, attacking and passing related technical variables ($P \leq 0.0485$; ES: 0.32-0.76). On the other hand, direct-play characterised teams achieved more clearance attempted ($P=0.0003$; ES=0.81) and clearance completed ($P=0.0006$; ES=0.80) than possession-play characterised teams, whereas the differences for tackle gaining ball and tackle not gaining ball were unclear. Meanwhile, direct-play characterised teams covered less distance in sprint ($P=0.06$; ES=0.42) and running intensity zone 4 ($P=0.1688$; ES=0.33) and 5 ($P=0.0643$; ES=0.47) than possession-play characterised teams.

Figure 3.3 illustrates the differences of technical and physical performances of direct-play characterised teams and possession-play characterised teams when playing against different types of opponent teams. Direct-play characterised teams achieved higher values in pass ($P=0.0004$; ES=0.91), pass accuracy ($P=0.236$; ES=0.29), delivery into attacking third ($P=0.0005$; ES=0.98), solo run in attacking third ($P=0.0099$; ES=0.68) and distance zone 3 ($P=0.3047$; ES=0.31) when played against direct-play characterised teams than playing against possession-play characterised sides. While possession-play characterised teams achieved higher values in pass ($P=0.0099$; ES=0.56), pass accuracy ($P=0.3625$; ES=0.22), delivery into attacking third ($P=0.06$; ES=0.47), top speed ($P=0.3443$; ES=0.26) and distance zone 1 ($P=0.0204$; ES=0.72) facing direct-play characterised teams than facing possession-play characterised opponents.

Table 3.3. Descriptive statistics of the technical and physical performance of teams classified as direct-play and possession-play characterised when facing different types of opponents.

	Direct-play Teams		Possession-play Teams	
	vs Direct-play	vs Possession-play	vs Direct-play	vs Possession-play
	Teams	Teams	Teams	Teams
	(n=24)	(n=36)	(n=36)	(n=22)
	mean±s	mean±s	mean±s	mean±s
Shot	10.0±4.6	10.6±3.5	14.0±5.7	14.0±6.1
Shot on Target	3.1±1.9	3.5±1.9	4.3±2.4	4.4±2.5
Shot Blocked	2.5±1.9	2.4±2.0	4.0±2.5	4.1±2.6
Shot from Open Play	7.2±3.3	6.9±3.0	9.5±4.8	9.5±5.4
Shot from Set Piece	3.1±2.2	3.2±1.8	4.2±2.8	3.9±2.4
Shot inside Box	4.9±2.5	6.1±2.9	8.2±3.7	8.5±3.7
Shot Outside of Box	5.1±3.0	4.4±2.2	5.7±3.3	5.5±3.2
Pass	433±129	340±88	558±102	486±127
Pass Accuracy (%)	80.3±6.4	78.8±6.1	86.4±3.7	85.4±3.4
Delivery into Attacking Third	39±12	28±10	43±13	37±17
Solo Run in Attacking Third	14.8±8.9	10.2±7.0	16.9±8.4	16.0±7.7
Delivery into Penalty Area	8.7±3.9	8.1±4.0	10.5±4.9	10.5±6.0
Solo Run in Penalty Area	2.5±1.3	2.7±2.2	4.8±3.3	6.0±4.1
Tackle Gaining Ball	2.7±1.8	3.1±1.8	3.3±2.5	3.1±2.0
Tackle not Gaining Ball	7.7±3.6	7.3±3.6	6.9±3.9	7.0±3.9
Clearance Attempted	27.8±9.8	27.6±8.9	19.0±8.7	21.1±10.6
Clearance Completed	22.5±7.7	21.6±6.6	15.4±7.1	16.7±8.7
Foul	13.6±4.8	14.2±4.0	12.3±4.3	12.8±4.5
Total Distance	104,988±4,007	104,241±6,143	103,970±4,791	104,722±4,542
Top Speed	31.8±0.9	31.8±1.0	32.0±1.0	31.8±1.3
Sprint	315±38	320±51	332±41	343±30
Distance Zone1	39,971±1,655	40,097±2,040	40,313±1,784	39,044±1,732
Distance Zone2	43,639±2,572	43,352±3,982	42,254±3,530	43,643±2,896
Distance Zone3	14,043±1,597	13,478±1,727	13,768±1,413	14,099±1,073
Distance Zone4	5,437±735	5,392±836	5,557±655	5,777±610
Distance Zone5	1,887±352	2,005±379	2,079±367	2,160±306

Units for technical variables and sprint are counts (except for pass accuracy), units for distance are *m*, unit for top speed is *km/h*.

Figure 3.2. Standardised effects of playing styles on the technical and physical performance of teams estimated from the generalised mixed linear modelling.

Bars are 90% confidence intervals. Asterisks indicate the likelihood for the magnitude of the true effect as follows: * possible; ** likely; *** very likely; **** most likely. Asterisks located in the area between -0.2 and 0.2 denote for trivial differences. Pound signs indicate that P-value is lower than the significance level of 0.05. Abbreviations: SoT= Shot on Target, SB=Shot Blocked, SfOP=Shot from Open Play, SfSP=Shot from Set Piece, SinB=Shot inside Box, SoutB=Shot outside of Box, PA=Pass Accuracy, DAT=Delivery into Attacking Third, SRAT=Solo Run in Attacking Third, DPA=Delivery into Penalty Area, SRPA=Solo Run in Penalty Area, TGB=Tackle Gaining Ball, TnoGB=Tackle not Gaining Ball, CA=Clearance Attempted, CC=Clearance Completed, TD=Total Distance, TS=Top Speed, DistZ1=Distance Zone1, DistZ2=Distance Zone2, DistZ3=Distance Zone3, DistZ4=Distance Zone4, DistZ5=Distance Zone5.

Figure 3.3. Standardised effects of opponents' playing styles on the technical and physical performance of teams estimated from the generalised mixed linear modelling.

Bars are 90% confidence intervals. Asterisks indicate the likelihood for the magnitude of the true effect as follows: * possible; ** likely; *** very likely; **** most likely. Asterisks located in the area between -0.2 and 0.2 denote for trivial differences. Pound signs indicate that P-value is lower than the significance level of 0.05. Abbreviations: SoT= Shot on Target, SB=Shot Blocked, SfOP=Shot from Open Play, SfSP=Shot from Set Piece, SinB=Shot inside Box, SoutB=Shot outside of Box, PA=Pass Accuracy, DAT=Delivery into Attacking Third, SRAT=Solo Run in Attacking Third, DPA=Delivery into Penalty Area, SRPA=Solo Run in Penalty Area, TGB=Tackle Gaining Ball, TnoGB=Tackle not Gaining Ball, CA=Clearance Attempted, CC=Clearance Completed, TD=Total Distance, TS=Top Speed, DistZ1=Distance Zone 1, DistZ2=Distance Zone 2, DistZ3=Distance Zone 3, DistZ4=Distance Zone 4, DistZ5=Distance Zone 5.

3.4 Discussion

The current study identified two types of tactical approach in the matches of the 2018 FIFA World Cup and classified the playing style of the teams accordingly. Differences in the match performance of teams with different playing styles facing different types of opponent were quantified as well controlling the effects of situational variables.

Generally, teams qualified to the knock-out stage employed more possession play and less direct play tactical approach than non-qualified teams. This is in line with the notion that high ball possession could increase the possibility of success (Lago-Ballesteros & Lago-Peñas, 2010; Lago-Peñas et al., 2010b). However, attention should be paid to the fact that the success of these teams is not a result of the use of possession play tactical approach, but because they prefer to retain the initiative to control the match based on their relatively stronger strength (Lago-Peñas et al., 2017). Moreover, the data from Figure 1 demonstrated that seven teams (France, Croatia, Belgium, England, Sweden, Brazil and Uruguay) that qualified to the quarter-final stage used both possession and direct play tactical approaches in their played matches. In contrast, out of the thirteen teams that employed a single tactical approach, only one team qualified to the quarter-final stage and none qualified to the semi-final stage. This finding reveals that a combined tactical approach could bring better performance in competition, no matter what playing style of the team is. Teams should consider the quality of opponent and other competing contexts to adopt a right tactical approach for each match.

Given the differences in technical variables, a prior study on the 2014 FIFA World Cup (da Mota, Thiengo, Gimenes, & Bradley, 2016) reported that no substantial difference in variables related to goal scoring between high ball possession teams and low ball possession teams. However, the current study found that the variables related to goal scoring, attacking and passing made by the possession-play characterised teams were higher than the direct-play characterised teams, which is in accordance with the results of Bradley et al. (2013) in English Premier League. Possession-play characterised teams place greater emphasis on the ball retention (Collet, 2013) aiming to create a precise, well-constructed and repeatable interactions between individuals (Chassy, 2013; Hewitt et al., 2016), pass frequency and pass accuracy are crucial factors in this process (Hewitt et al., 2016). Furthermore, players are more technically proficient than players from direct-play characterised teams (Bradley et al., 2013; da Mota et al., 2016), thus they possessed the advantage in ball possession and more scoring opportunities obtained accordingly (Lago-Peñas & Dellal, 2010). Conversely, the objective of direct-play characterised teams is to capture the opponent's weakness or mistakes in defence to invade as directly as possible into the attacking third (Lago-Ballesteros, Lago-Peñas, & Rey, 2012; Tenga et al., 2010a). The ball should be passed at a right time to the best positioned teammate within a short period during the attacking process. For this reason, direct-play characterised teams performed short ball possession time and low pass sequences per possession, thus creating relatively fewer scoring chances as well.

As for defensive performance, our data demonstrated that direct-play characterised teams achieved higher frequency in clearance attempted and clearance completed than

possession-play characterised teams, which is inconsistent with the studies on the 2014 FIFA World Cup (da Mota et al., 2016). This disparity between studies may be due to the differences in the methods of classification of teams and the statistical methods. The successful execution of the direct play tactical approach is based primarily on a balanced defensive structure (Wade, 1998). The coordination of defensive actions between players is crucial for enhancing the effectiveness of the defensive structure (Lauder & Piltz, 2013). Players have to commit more defensive actions to delay the opponent's attacking and restricting passing options. Possession-play characterised teams, as identified above, are normally technically superior in attacking and passing, thus, are able to control the ball in most of the time during a match (Lago & Martín, 2007). Hence, time spent and actions made in defending are relatively less.

Bradley et al. (2013) and Da Mata et al. (2016) compared the physical performance of players from teams with high and low ball possession ratio in domestic and international competition respectively, and both concluded that ball possession had limited impact on the physical performance of players. Unexpectedly, result of the current study indicated that players from ball-possession characterised teams covered more high-intensity running (sprint, distance zone 4 and distance zone 5) than players from direct-play characterised teams. High intensity running performance is a crucial factor for teams to succeed (Di Salvo, Gregson, Atkinson, Tordoff, & Drust, 2009; Rampinini et al., 2007), and has been increasing over time (Barnes, Archer, Hogg, Bush, & Bradley, 2014). The increased game speed requires higher physical demands for players from possession-play characterised teams to complete high-intensity running

and repeated sprints during the attacking phase with the aim of breaking the defensive balance and then creating scoring opportunities. Although, there may be a higher demand in high-intensity running activities for players from direct-play characterised teams during attacking period, but they covered relatively less distance in high-intensity running and sprint throughout a match as they focused on defence during most of the game time. Furthermore, difference in the physical demands of players of different field positions may have also contributed to this result. Wide midfielders and forwards from direct-play characterised teams covered greater high-intensity running activities than defenders and central midfielders who sit back and defend at most of the time (Bradley et al., 2013; Di Salvo et al., 2009). While, all players from possession-play characterised teams participated in both attacking and defending phase (Pena & Touchette, 2012), thus performed more high-intensity running activities.

It has been identified that match performance of football teams can be influenced by the playing styles of opponents (Lago-Peñas et al., 2017; Memmert et al., 2017). These effects have been quantified in the current study. We found that both direct-play and possession-play characterised teams achieved higher values in passes, pass accuracy and delivery into attacking third playing against direct-play characterised teams than playing against possession-play characterised sides. The result can be easily explained by the fact that teams are more likely to get the superiority in ball possession when play against direct-play characterised opponents than playing against possession-play characterised sides (Bradley et al., 2013; da Mota et al., 2016). Previous research focused more on the high-intensity running performance while paid limited attention

on the low-intensity activity (Bradley, Sheldon, Wooster, Olsen, Boanas, & Krustup, 2009; Di Mascio & Bradley, 2013; Di Salvo et al., 2009), as the high-intensity activity was considered as an important measure of players' physical capacity (Bradley et al., 2011; Mohr, Krustup, & Bangsbo, 2003). However, we found that ball-possession characterised teams covered more distance in standing and walking when playing with direct-play characterised opponents than when playing against ball-possession characterised sides. It is suggested that higher ball possession may link to a lower playing load, which is in line with the notion that teams that achieved lower ball possession covered more total distance than teams with higher ball possession, especially the high-intensity activity (Bradley et al., 2013). This difference was mainly presented in the process of ball recovery (da Mota et al., 2016). Specifically, when playing against possession-play characterised teams, players from direct-play characterised teams have to move constantly to maintain the balance of defensive structure and put pressure on the opponent. On the contrary, possession-play characterised teams can control the match by passing, and their players can patiently move the ball to seek the defensive weaknesses (Hewitt et al., 2016). Thus, more low-intensity activities (stand and walking) performed, especially in the case that all defenders sit back in the defensive third. Nevertheless, it presented a more balanced match when possession-play characterised teams playing with possession-play characterised teams due to the smaller difference in ball possession.

3.5 Conclusions

Our findings based on the latest data from the 2018 FIFA World Cup presented that teams qualified to the knockout stage were mainly possession-play characterised teams, but most of them were able to adopt both possession and direct play tactical approaches in different match contexts. It reveals a tactical trend that the combined use of direct and possession play would bring a better result in a competition, no matter what playing style the team is characterised. Possession-play characterised teams achieved higher frequencies in match actions related to goal scoring, attacking and passing and covered more distance in sprint and high-intensity running zones, but performed less in defensive variables than direct-play characterised teams. Both possession- and direct-play characterised teams made more passes and delivery into attacking third, as well as achieved higher pass accuracy when played against direct-play characterised teams than playing against possession-play characterised sides. Moreover, possession-play characterised teams covered more distance at low speed when playing against direct-play characterised teams than playing against possession-play characterised teams.

This study provides an insight to a better understanding of the impact of playing styles on teams' match performance. Tactical style profiles could be created for teams to recruit players who are suitable for the team's playing style and for scouting upcoming opponents. Indicators that are associated with a specific playing style can be monitored in the training session or be evaluated in the post-match assessment to develop or optimise a playing style. However, limitations of this study should be noted. The results

of statistical inferences for some comparisons between teams are non-significant (unclear) due to the small sample size confined by the particularity of the FIFA World Cup. This limitation also restricted the further research considering the effects of playing positions to examine the within playing style and between playing style differences in technical and physical performance between positions, which may provide useful information to understand the players' tactical roles and the relationship between tactics and physical performance.

Chapter Four—Evaluation of the Technical Performance of Football Players in the UEFA Champions League

4.1 Introduction

The complexity of football match performance can be reduced by using performance analysis techniques, presenting the results in systematic ways and systematically integrating them to the coaching process (Cushion, 2007). This can be considered as a valuable feedback for coaches, players and sport researchers (Drust, 2010; McGarry, O'Donoghue, & Sampaio, 2013).

Whether performance analysis can be a good feedback or educational tool depends on the type and quality of the methods used (Hughes & Franks, 2007). An accurate, reliable performance profile may improve the efficiency of the analysis procedure (Hughes, Evans, & Wells, 2001) and can provide useful feedback that can be easily understood by sports practitioners (Shafizadeh et al., 2013). Performance profiling is a descriptive analysis that brings a collection of valid and reliable psychological, physical and technical indicators together to characterize the overall performance of players and teams (Doyle & Parfitt, 1996; O'Donoghue, 2005). However, the properties of match performance indicators may vary along the matches played as situational variables have an influence on them. Therefore the data from a single match cannot represent a player's or/a team's typical performance (O'Donoghue, 2005). The individual match effects may generate additional variance in the data of a single match and fail to produce a

significant difference in the comparison between groups (Wells, O'Donoghue, & Hughes, 2004). Accordingly, Hughes et al. (2001) stated that the nature of the data and the performers are the two main factors that should be taken into account when considering the number of matches required. The typical performance of a player/team may only be represented by the data from a large number of matches using the technique of performance profiling. Due to the availability of data, the profiling subject has developed over time from the analysis of single players or teams to more comprehensive analysis including a larger number of players or teams. Previously, median and 95% confidence intervals (James, Mellalieu, & Jones, 2005; O'Donoghue, 2005) were used to present the typical performance of subjects and its spread of performance, while currently profiling techniques are commonly based on mean and 95% confidence intervals (Liu, Yi, Giménez, et al., 2015).

Due to the nature of complexity and highly dynamic behaviour in football matches (Garganta, 2009; Liu, Yi, Giménez, et al., 2015), the match performance of players/teams is not only influenced by technical, tactical, mental (Carling et al., 2008), and physiological factors (Drust et al., 2007), but also by different situational factors (Lago et al., 2010; Taylor et al., 2008). Match performance of players/teams cannot be generalised in all contexts (Butterworth, O'Donoghue, & Cropley, 2013) and introducing the situational variables into performance profile can make it more comprehensive and systematic. Match location, team quality, quality of opposition and match outcome are examples of situational variables that have been investigated so far (Liu, Gómez, et al., 2016; Liu, Yi, Giménez, et al., 2015; Zhang, Lorenzo, Gómez, Liu,

Gonçalves, & Sampaio, 2017). The quality of the opponent is considered the main factor for variation in match performance (McGarry & Franks, 1994). Furthermore, sufficient match observations make it possible to take player positions into account to establish performance profiles according to different playing positions under different competing situations (Liu, Gómez, et al., 2016; Zhang et al., 2017). As players from different playing positions have different tasks in a football game, the joint evaluation of all players' match performance will result in a loss of a lot of valuable information. Therefore, a more useful way is a detailed analysis of the performance of players with proper regard to the particularity of different playing positions and the effect of situational variables.

In contrast to prior studies using data from domestic leagues (Bradley et al., 2011; Lago-Peñas & Lago-Ballesteros, 2011; Liu, Gómez, et al., 2016), the evaluation of data from the UEFA Champions League makes it possible to evaluate differences of performance in different competition stages (group vs. knockout stage). Moreover, the database allows comparison between performances in international matches compared to domestic matches investigated in earlier studies. In order to add these aspects to the current research on performance analysis in football, the current study aims to establish technical performance profiles of players in the UEFA Champions League from season 2009-2010 to 2016-2017 by comparing the between-player differences in match performance from a long-term perspective (8 full seasons) according to players' playing positions and incorporating situational variables: competition stage (group stage/knockout stage), match location, quality of team and opposition, match outcome.

4.2 Methods

4.2.1 Data and Reliability

Technical performance-related match data of players in the UEFA Champions League from season 2009-2010 to 2016-2017 (1,000 matches, 768 matches from group stage, 232 matches from knockout stage) were collected for analysis. Match data were obtained from a public-accessed football statistics website “whoscored.com” (<https://www.whoscored.com>). Data resource of the website is the sports analytics company OPTA Sportsdata. The reliability of OPTA in coding players’ match actions and events has already been successfully tested as highly reliable (Liu et al., 2013). Because of the specificity of position for goalkeepers and a very limited applicability of technical variables to the performance of goalkeepers, match data for this position was excluded from the sample. Moreover, only the players being part of the starting line-up were included, which finally limited the database to 5,136 players (3,693 players from group stage, 1,443 players from knockout stage) and generated 14,437 full match observations (11,095 from group stage, 3,342 from knockout stage). All players in the sample were divided into 5 groups according to their playing positions (Bush, Barnes, Archer, Hogg, & Bradley, 2015a; Liu, Gómez, et al., 2016): central defender (group stage: $N_1=1,012$ players, $n_1=2811$ full match observations, knockout stage: $N_2=380$ players, $n_2=821$ observations), full back ($N_1=939$, $n_1=2657$, $N_2=337$, $n_2=772$), wide midfielder ($N_1=711$, $n_1=1,214$, $N_2=216$, $n_2=351$), central midfielder ($N_1=1326$, $n_1=3081$, $N_2=511$, $n_2=963$), forward ($N_1=734$, $n_1=1332$, $N_2=237$, $n_2=435$). The current study was conducted in accordance with the Declaration of Helsinki and approved

officially by the Polytechnic University of Madrid's ethics committee.

4.2.2 Technical Variables and Situational Variables

Twenty-five technical performance-related match actions or events were chosen as variables in the present study and were divided into four groups (Table 4.1) based on previous studies (Castellano et al., 2012; Lago-Peñas & Lago-Ballesteros, 2011; Lago-Peñas et al., 2010b; Liu, Gómez, et al., 2016; Liu, Yi, Giménez, et al., 2015). Definitions of these variables can be found in the studies of Liu and colleagues (2013; 2015; 2016).

Table 4.1. The classification of technical variables.

Categories	Variables
Goal scoring	Shot, Shot on target.
Attacking	Dispossessed, Unsuccessful touch, Fouled, Aerial won, Dribble, Offside.
Defending	Yellow card, Total tackle, Interception, Clearance, Blocked shot, Foul.
Passing and organising	Assist, Touch, Key pass, Pass accuracy (%), Pass, Cross, Accurate cross, Long Ball, Accurate long ball, Through ball, Accurate through ball.

The technical data was analysed under following 5 situational variables: (1) competition stage: group stage and knockout stage; (2) match location: home and away; (3) quality of team: teams that qualified into the knockout stage and teams that didn't qualify into the knockout stage; (4) quality of opponent: opponents that qualified into the knockout stage and opponents that didn't qualify into the knockout stage; (5) match outcome: win, draw and lose. Due to the limitation of the sample size from knockout stage, except for the situational variable of competition stage, only the data of players in the group stage were included in the analysis of the other four situational variables.

4.2.3 Statistical Analysis

After the screening of missing values and outliers, count values of 25 technical performance-related actions or events of players were transformed into standardized scores (Z-Score) and were unified into the same scale by the formula “ $T = 10Z + 50$ ” (O'Donoghue, 2013; Zhang et al., 2017). Match performance of players from five positions were compared by means of adjusted values respectively accounting to 5 situational variables and were plotted into radar charts. The standardized scores (Z-Score) were then transformed and unified using the statistical software IBM SPSS Statistics 22 for Windows (Armonk, NY: IBM Corp.) and plotted into radar charts using the Microsoft Excel 2007 program (Redmond, Washington: Microsoft). The non-clinical magnitude-based inference (MBI) was used to identify the differences of match performance of players. Differences were evaluated by using the standardized smallest worthwhile change which was calculated by 0.2 times the between-subject standard deviation. Comparisons between groups were conducted using the spreadsheet developed by Hopkins and the 90% confidence intervals were used to make the inferences (Hopkins, 2007; Hopkins, Marshall, Batterham, & Hanin, 2009a). Magnitude of clear differences was considered as follows: trivial, 0-0.2; small, 0.2-0.6; moderate, 0.6-1.2; large, 1.2-2.0; and very large, >2.0 (Batterham & Hopkins, 2006; Hopkins, 2002). The possibility of the effect to be clear was defined as follows: 25%-75%, possibly; 75%-95%, likely; 95%-99.5%, very likely; and 99.5%-100%, most likely (Batterham & Hopkins, 2006).

4.3 Results

Comparisons in technical variables between players from five positions according to five situational variables are presented in Figure 4.1 and Table 4.2. Figure 4.1 shows a graphical representation of the performance profiles. Table 4.2 gives a summary of all technical variables that showed substantial differences. The full set of descriptive statistics of the players' technical performance can be found in Appendix I.

There is a new finding concerning the influence of competition stage on player performance that did not appear in the previous research due to the investigation of domestic matches (Bradley et al., 2011; Liu, Gómez, et al., 2016) or the lack of knockout matches in international tournaments (Lago-Peñas, Lago-Ballesteros, et al., 2011; Liu, Gomez, et al., 2015). In all variables from five positions between players from group stage and players from knockout stage no clear differences could be identified, except for foul. The comparisons regarding the other four situational variables in the group stage revealed more substantial differences in performance. The number of variables showing substantial differences between home games and away games was very limited across all playing positions. Especially for central midfielders, only shot showed a substantial difference. Central defenders and full backs made more clearances when playing away than when playing at home in the group stage. Their performance in variables related to passing and organizing (pass and cross) in home games was better than in away games. The differences of match performance of wide midfielders and forwards between home and away games were mainly focused on

variables related to goal scoring and variables related to passing and organizing, while the central midfielders only showed clear difference in shot. A similar trend was found by comparing player's match performance when considering the effect of quality of team, quality of opponent and match outcome. Across all position's players from qualified teams, players playing against non-qualified teams and players of a winning team showed better performances in variables related to passing and organizing than their counterparts (players from non-qualified teams, players playing against qualified teams and players playing in games lost/draw). Wide midfielders and forwards showed clear differences in variables related to goal scoring (shot and shot on target) in these three competing contexts. In addition, forwards from qualified teams and from winning teams made more dribbles when compared with their counterparts from non-qualified teams and playing in games lost/draw. Central defenders obtained more aerials won when playing with non-qualified teams than when playing with qualified teams.

Table 4.2 showed that touch and pass are the only two variables that showed clear differences for players of all positions when taking quality of team, quality of opponent and match outcome into account. Touch and pass of wide midfielders showed bigger differences in these three situations compared with those from other four playing positions. Moreover, performance of players from all five positions in touch and pass under the situational variable of team quality showed greater differences than those under the other two situational variables. No clear differences could be detected for yellow card, dispossessed, unsuccessful touch, total tackle, interception, blocked shot, fouled and offside, neither across playing positions, nor under five situational variables.

▲ Group stage ○ Knockout stage

▲ Home ○ Away

Figure 4.1. Comparison of the performance profiles of different position's players under 5 situational variables.

Notes: letters in parentheses denote the magnitude: t = trivial; s = small. Asterisks indicate the likelihood for the magnitude of the true difference in means as follows: *possible; **likely; ***very likely; ****most likely. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 4.2. Substantial differences of players' match performance across five playing positions and five competing situations.

Position	Group - Knockout			Home - Away			Non-qualified - Qualified			Non-qualified Opp. - Qualified Opp.			Draw/Lose - Win		
	Variable	Effect Size	Inference	Variable	Effect Size	Inference	Variable	Effect Size	Inference	Variable	Effect Size	Inference	Variable	Effect Size	Inference
CD				Clearance	0.22±0.06	S*	Touch	0.47±0.06	S****	Touch	-0.39±0.06	S****	Touch	0.31±0.07	S****
				Pass	-0.22±0.06	S*	Pass	0.50±0.06	S****	Pass	-0.39±0.06	S****	Pass	0.33±0.07	S****
							PA	0.29±0.06	S***	AW	-0.26±0.06	S**			
							AccLB	0.21±0.06	S*						
FB				Clearance	0.23±0.07	S*	Touch	0.44±0.07	S****	Touch	-0.35±0.07	S****	Assist	0.39±0.07	S****
				Cross	-0.22±0.07	S*	PA	0.32±0.07	S****	Pass	-0.38±0.07	S****	Touch	0.32±0.07	S****
							Pass	0.50±0.07	S****	AccLB	-0.22±0.07	S*	Pass	0.39±0.07	S****
												PA	0.27±0.07	S***	
WM	Foul	0.21±0.11	S*	Shot	-0.26±0.10	S**	Touch	0.59±0.10	S****	Touch	-0.42±0.10	S****	Assist	0.47±0.12	S****
				KP	-0.28±0.10	S**	Pass	0.56±0.10	S****	Pass	-0.40±0.10	S****	Pass	0.51±0.11	S****
				Cross	-0.21±0.10	S*	ThB	0.35±0.10	S***	Shot	-0.26±0.10	S**	ShotOT	0.38±0.11	S****
				AccCross	-0.21±0.10	S*	PA	0.30±0.10	S***	KP	-0.24±0.10	S**	Touch	0.55±0.11	S****
							AccThB	0.26±0.10	S**	ShotOT	-0.24±0.10	S*	Shot	0.31±0.11	S***
							Shot	0.24±0.10	S**	PA	-0.21±0.10	S*	PA	0.31±0.11	S***
							ShotOT	0.29±0.10	S**				KP	0.29±0.11	S**
							Assist	0.21±0.10	S*				ThB	0.27±0.11	S**
							KP	0.21±0.10	S*				AccThB	0.26±0.11	S**
							AccLB	0.20±0.10	S*				AccLB	0.23±0.11	S*
				Shot	-0.20±0.06	S*	Touch	0.49±0.06	S****	Touch	-0.39±0.06	S****	Assist	0.33±0.07	S****
							PA	0.35±0.06	S****	Pass	-0.37±0.06	S****	Touch	0.39±0.06	S****
CM							Pass	0.49±0.06	S****	LB	-0.23±0.06	S***	Pass	0.38±0.06	S****
							ThB	0.24±0.06	S**				PA	0.21±0.06	S*
							Assist	0.21±0.06	S*						
				Shot	-0.32±0.10	S***	Touch	0.47±0.10	S****	Shot	-0.36±0.10	S****	Assist	0.46±0.11	S****
FW				KP	-0.28±0.10	S**	Pass	0.43±0.10	S****	ShotOT	-0.32±0.10	S***	Shot	0.52±0.10	S****
				ShotOT	-0.22±0.10	S*	Shot	0.32±0.10	S***	KP	-0.35±0.10	S***	ShotOT	0.57±0.10	S****
				AccCross	-0.23±0.10	S*	ShotOT	0.32±0.10	S***	Assist	-0.28±0.10	S**	Touch	0.46±0.10	S****
							Assist	0.28±0.10	S**	Touch	-0.28±0.10	S**	Pass	0.42±0.10	S****
							KP	0.30±0.10	S**	Pass	-0.26±0.10	S**	ThB	0.37±0.11	S****
							PA	0.28±0.10	S**	ThB	-0.28±0.10	S**	KP	0.34±0.10	S***
							Dribble	0.21±0.10	S*	AccThB	-0.27±0.10	S**	AccThB	0.33±0.11	S***
												Dribble	0.28±0.10	S**	

Note: Effect sizes are presented as the magnitude of the true difference in means $\pm$ 90% confidence interval, only the variables that showed clear differences were included. Positive effect size indicates that the mean values of variables from group A bigger than the mean values of variables from group B, negative effect size indicates that the mean values of variables from group B bigger than the mean values of variables from group A, e.g. group B-group A: group stage-knockout stage. Letters in parentheses denote the magnitude: t=trivial; s=small. Asterisks indicate the likelihood for the magnitude of the true difference in means as follows: *possible; **likely; ***very likely; ****most likely. Abbreviations: CD=central defender; FB=full back; WM=wide midfielder; CM=central midfielder; FW=forward; ShotOT=shot on target; AW=aerial won; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

4.4 Discussion

The current study established technical performance profiles of players from the UEFA Champions League based on a large sample (N= 1000 matches from 8 seasons) to identify the differences of technical performance between players across different situational variables and playing positions. Thus, the interaction between situational and positional variables could be investigated.

Generally, all variables showed small or trivial differences across five situational variables and five playing positions. The effects of situational variables on the technical performance of players from different playing positions were lower than in previous studies (Lago, 2009; Lago-Peñas & Lago-Ballesteros, 2011), This finding may be due to the fact that the analysis of long-term data may reduce the impact of situational variables on players' performance due to the higher stability of the performances during 9 seasons under the different contexts. The differences of player's technical

performance could mainly be identified in variables related to passing and organizing, especially touch and pass. In particular, passing and organizing abilities are time-space and task-related variables. The different profiles may reflect that these are key determinants of performance in elite football during the last years (Lago, 2009). Therefore, the present study helps to reveal the interactions between playing positions and situational variables in these two technical variables.

To the best of our knowledge, there is no research that has examined the differences of player's performance between group stage and knockout stage of the UEFA Champions League so far. Our database provided us with the possibility to analyse the performance of players in matches from different competition stages. It could be expected that clear differences can be found comparing matches from group stage and knockout stage due to the special characteristics of knockout matches such as a high importance and presence of high-quality teams. Surprisingly, we found that there was no obvious difference in player's performance between group stage and knockout stage, except for fouls in the group of wide midfielders. This demonstrates a high consistence of player's performance between group stage and knockout stage, although these two competition stages are characterized by different characteristics of matches. Wide midfielders might have more defensive tasks when playing against stronger teams (Almeida, Ferreira, & Volossovitch, 2014), this could explain why wide midfielders from knockout stage committed more fouls than wide midfielders from group stage.

Recent research identified that match location had significant influence on technical

variables (Liu, Gómez, et al., 2016), while had limited impact on physical variables (Bush, Archer, et al., 2015). The effect of match location on players' performance in our database is lower than those of reported in prior studies. Central defenders and full backs made more clearances and less passes and crosses in away games than in home games, which may reveal that home teams tend to employ a more aggressive strategy. In home games, central defenders are involved in the organizing and attacking process and full backs are moving forward frequently into the attacking third to make crosses for teammates. In contrast, away teams will face more defensive pressure, defenders have to make more clearances to block opponent's attack. The fact that wide midfielders, central midfielders and forwards from home teams obtained more shot opportunities than their counterparts from away teams supports the theory that home teams play a more aggressive and offensive strategy. Surprisingly, central midfielders did not show clear differences in variables related to passing and organizing between home games and away games, which may indicate that the performance of central midfielders in passing and organizing related variables is regardless of match location.

Three of the situational variables (quality of team, quality of opponent and match outcome) - although covering different aspects - are in some way connected to teams' strength. Consequently, similar trends in player's technical performance were found in these three contexts. Moreover, they had a relatively greater influence on players' technical performance than competition stage and match location. Technical performance of players from all playing positions in these three competing contexts showed clear differences in variables related to passing and organizing. Similar findings

were reported in a previous study on Spanish La Liga (Liu, Gómez, et al., 2016), which shows that players' performance was consistent between a domestic league and international competition. The important role of variables related to passing and organizing can be explained as follows: Stronger teams have a higher ability to retain ball possession, to control the game and have a higher initiative to score goals instead of prevent goals. Our findings revealed that either, strong teams are more likely to adopt a possession-based playing style, or that improving players' ability in the aspect of passing and organizing can help to achieve a better match performance for football teams in the group stage. Moreover, forwards' performance in shots, shots on target and dribbles showed clear differences within these three contexts, which might be a result of the differences of skill level between forwards and the support they got from midfielders based on the advantage of possession. However, wide midfielders from qualified teams, playing against non-qualified teams and playing in winning games gained more shots and shots on target than wide midfielders from non-qualified teams, playing against qualified teams and playing in draw/losing games. This indicates that wide midfielders from stronger teams had more opportunities to participate in the offensive phase and to invade from wide to inside, hence they are likely to get more scoring chances (Liu, Gómez, et al., 2016).

We also found that touch and pass are the only two variables in which match performance of players from all playing positions showed clear differences when considering the effect of quality of team, quality of opponent and match outcome. This provides us with the opportunity to explore the interaction between five playing

positions and three situational variables. Wide midfielders showed the biggest differences in touch and pass between stronger teams and weaker teams. A possible reason is that wide midfielders from stronger teams played an important role in the organizing and attacking phase, while wide midfielders from weaker teams relatively need to take on more defensive tasks. The magnitude of differences in touch and pass for players from all five playing positions seems to be mostly influenced by the effect of quality of team within these three situational variables. Most variables related to attacking and defending showed unclear differences across different playing positions and different situational variables, which indicates that the differences of players' match performance does not mainly result from attacking and defending abilities, but from the ability of managing the game, keeping hold of the ball, and creating scoring opportunities (Bush, Barnes, et al., 2015a).

4.5 Conclusions

The present study contributes to the current research on performance analysis in top-class football by establishing more comprehensive and detailed technical profiles to examine the interaction of positional and situational variables on players' technical performance. This could be an important step to provide information on players' match performance and their interactions. Generally, the magnitudes of differences for all variables were displayed at a low level (small or trivial) based on a large dataset. Match location, quality of team, quality of opponent and match outcome demonstrated significant effect on players' technical performance while the effect of competition stage on players' technical performance was strongly limited. Strength-related

situational variables showed similar trends and had a relatively greater influence on players' technical performance than match location. The technical performance of each playing position also varies under different competing contexts. Wide midfielders showed the biggest differences in variables related to passing and organizing within strength-related situational variables and the quality of team had a bigger impact on players' match performance in variables related to passing and organizing compared to quality of opponent and match outcome. The differences of players' technical performance could mainly be identified in variables related to goal scoring and variables related to passing and organizing, while there were no clear differences in most attacking and defending related variables. Technical performance of individual player can be evaluated by integrating their match data into the performance profiles, which may provide a valuable tool for player's recruitment and talent identification. Moreover, these technical performance profiles can also be used pre-match preparation considering the conditions of the next match and post-match assessment to develop position-specific interventions in the coaching process.

However, there are still opportunities to expand the level of this research by adding relevant information. Previous studies have identified the influence of match status (e.g. score and time left) on the players' match performance (Lago, 2009). But as all data used within this study is aggregated data reflecting the whole match time, the match status could not be included as an additional situational variable. Another aspect that could be valuable for future research on performance profiles of football players is positional data. A growing availability of positional data has led to innovations in match

analysis in recent years. The investigation of advanced key performance indicators based on positional data can help to gain additional insights to performance of football players (Memmert et al., 2017; Perl & Memmert, 2017). Future research on performance profiles might profit from this work by including variables based on positional data into the performance profiles and thus expanding performance analysis from technical variables to tactical variables.

Chapter Five—Positional and Situational Effects on the Technical Variation of Players in the UEFA Champions League

5.1 Introduction

Performance analysis in sports is a powerful communication and feedback tool to prepare or guide players during practice (Memmert & Rein, 2018; Shafizadeh, Taylor, & Peñas, 2013). The investigation of technical parameters provides an objective understanding of actual match performance and can help to explain the differences between successful and unsuccessful match performances (Hughes & Franks, 2007; McGarry, O'Donoghue, & Sampaio, 2013).

It is well known that match actions or events within individual players are characterized by high variability over successive matches and the variation can be a result of internal and external factors (Kempton, Sullivan, Bilsborough, Cordy, & Coutts, 2015). Variability Analysis of performance indicators is an effective way to measure stability and consistency of a player (Bush, Archer, Hogg, & Bradley, 2015). The smaller the within player variation, the easier to identify the change of his/her match performance (Hopkins, 2000). The within subject variation is best represented using the coefficient of variation (CV) (Hopkins, 2000) as was previously accounted for quantifying the performance variability of players or teams (Atkinson & Nevill, 1998; Bush, Archer, et

al., 2015; Liu, Gómez, Gonçalves, & Sampaio, 2016; Mateus et al., 2015; Rampinini, Coutts, Castagna, Sassi, & Impellizzeri, 2007; Zhang, Lorenzo, Gómez, Liu, Gonçalves, & Sampaio, 2017). This approach allows to create relationships between the variation of performance indicators and the match performance of players or teams.

There are several external factors that may cause within-subject variation in the performance of players/teams such as match location, quality of team and quality of opponent (James, Mellalieu, & Hollely, 2002; Jones, James, & Mellalieu, 2004; Lago & Martín, 2007; Lorenzo Calvo, Gómez Ruano, Ortega Toro, Ibañez Godoy, & Sampaio, 2010). Players need to adapt psychologically and physiologically to these competing scenarios (Eccles, Ward, & Woodman, 2009) and their variation of technical-tactical and physical performance can be influenced by these situational conditions at a behavioural level (Gómez, Lago-Peñas, Pollard, McGarry, O'Donoghue, & Sampaio, 2013; Gómez, Lago, & Pollard, 2013; Lago-Peñas, 2012; Liu, Yi, Giménez, Gómez, & Lago-Peñas, 2015; Taylor, Mellalieu, James, & Barter, 2010). In addition, the differences of players' performance can also be found in different match outcomes, i.e., win, draw and defeat (Castellano, Casamichana, & Lago, 2012; Gómez, Gómez-Lopez, Lago, & Sampaio, 2012; Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez, 2010). Meanwhile, competition stage is another situational variable that has great importance on players' performance (Gómez, Lago-Peñas, et al., 2013). A prior study has identified the difference between match performances during regular season compared to the playoffs in basketball (Sampaio & Janeira, 2003), but little attention has been paid to the differences in variability of the performance of football players in

different competition stages (e.g. group stage/ knockout stage). To the best of our knowledge, no study has yet been analysed differences of players' variability between group stage and knockout stage in the UEFA Champions League or other competitions.

Moreover, besides situational effects, the assessment of the performances of players has to be seen in view of the player's position on the pitch. The team's success is the result of intelligent tactics combined with an appropriate level of physical and technical performance of players from different playing positions playing different roles in a football match (Bush, Barnes, Archer, Hogg, & Bradley, 2015; Yi, Jia, Liu, & Gómez, 2018). Therefore, positional differences should not be disregarded, otherwise a wealth of valuable information will be hidden and restrict the understanding about the players' performance. Previous research has identified the differences and evolutionary trends of physical performance indicators within playing positions (Bush, Barnes, et al., 2015; Di Salvo, Baron, Tschan, Montero, Bachl, & Pigozzi, 2007), several studies have examined the differences of players' performance in different competing situations considering positional variables (Liu et al., 2016; Zhang et al., 2017) and the interactions within situational variables (Lago, 2009; Lago, Casais, Dominguez, & Sampaio, 2010; Taylor, Mellalieu, James, & Shearer, 2008). Nevertheless, previous studies failed when accounting for the interactive effect across playing positions and situational variables in the assessment of the technical performance of players, which would appear to provide limited insights into the high dynamic and complex nature of a football match.

Large datasets covering players' performance parameters can help to determine whether the differences in variation would be due to the external factors or the inherent variability in performance (Hopkins, 2000). Therefore, the use of a large sample size in the current study makes it possible to identify the differences of variation in the technical performance of players in the UEFA Champions League from a long-term perspective (8 seasons) according to the players' specific field positions, as well as five different competing situations: competition stage (group stage/ knockout stage), match location (home and away), quality of team (qualified team/ non-qualified team), quality of opposition (qualified opponent/ non-qualified opponent) and match outcome (win, draw or defeat). This comprehensive analysis can provide a better understanding for coaches about the potential interactive effects between situational variables and playing positions during the assessment of players' technical performance.

In light of previous research and the aspects outlined above, the contribution of the present study to the current research on performance variation of players is diverse: A large and long-term data set including 1,000 matches from 8 seasons and a total of almost 13.000 full match observations is analysed. Both positional and situational variables are investigated, enabling a more detailed understanding for the complex interaction between both types of variables. Moreover, the usage of data from the UEFA Champions League allows it to compare data from different competition stages such as group stage and knockout stage.

5.2 Methods

5.2.1 Data and Reliability

Technical performance data of players from all 1,000 matches (group stage: 768 matches; knockout stage: 232 matches) in the UEFA Champions League from season 2009/10 to 2016/17 were collected. Match data were obtained from a public-accessed football statistics website “*whoscored.com*” (<https://www.whoscored.com>). Match data from this website is provided by *OPTA Sportsdata*, which has been tested to have an acceptable reliability in coding players’ match actions and events (Liu, Hopkins, Gómez, & Molinuevo, 2013). Due to the positional specificities for goalkeepers, the goalkeepers’ data were excluded from the database. Moreover, only the outfield players who played at least 2 full matches in the group stage or knockout stage at each season were included, which finally limited the subjects to 3,276 players ($n=2,389$ players from group stage, $n=887$ players from knockout stage) across 12,908 full match observations ($n=10,122$ from group stage, $n=2,786$ from knockout stage). Playing positions were categorized as central defender (group stage: $N_1=865$ players, $n_1=2,667$ full match observations, knockout stage: $N_2=286$ players, $n_2=727$ observations), full back ($N_1=787$, $n_1=2,505$, $N_2=228$, $n_2=663$), wide midfielder ($N_1=550$, $n_1=1,053$, $N_2=155$, $n_2=291$), central midfielder ($N_1=1,040$, $n_1=2,794$, $N_2=322$, $n_2=774$), and forward ($N_1=504$, $n_1=1,103$, $N_2=133$, $n_2=331$). The categorization of positions was based on the available research (Bush, Barnes, et al., 2015; Liu et al., 2016). Ethical approval for this study was obtained from the ethics committee of the Polytechnic University of Madrid.

5.2.2 Variables

5.2.2.1 Technical Variables

Twenty-five technical performance-related variables were studied and were divided into four groups as presented in Table 5.1. Based on the available related literature (Castellano et al., 2012; Lago-Peñas & Lago-Ballesteros, 2011; Lago-Peñas et al., 2010; Liu et al., 2016; Liu et al., 2015), definitions of these variables can be found in the studies of Liu and colleagues (2013; 2015; 2016).

Table 5.1. The classification of technical variables.

Categories	Variables
Goal scoring	Shot, Shot on target.
Attacking	Dispossessed, Unsuccessful touches, Fouled, Aerial won, Dribble, Offside.
Defending	Yellow card, Total tackle, Interception, Clearance, Blocked shot, Foul.
Passing and organising	Assist, Touch, Key pass, Pass accuracy (%), Pass, Cross, Accurate cross, Long ball, Accurate long ball, Through ball, Accurate through ball.

5.2.2.2 Situational Variable

Five situational variables were included: (1) competition stage (group stage/ knockout stage); (2) match location (home/ away); (3) quality of team (qualified team/ non-qualified team); (4) quality of opponent (qualified opponent/ non-qualified opponent); (5) match outcome (win/ draw/ defeat). Due to the limitation of the sample size from the knockout stage, data of players in knockout matches were only considered for the situational variable competition stage. For the analysis of the other four situational variables, only the match data of players in the group stage were included.

5.2.3 Statistical Analysis

The coefficient of variation (CV) of each variable of each player in the group stage or knockout stage of each season was calculated to present the variation of each variable within a player during the past 8 seasons. (Bush, Archer, et al., 2015; Hopkins, 2000; Kempton et al., 2015; Spencer, Losnegard, Hallén, & Hopkins, 2014). If the mean of a count value of an action or event of a single player was 0 (e.g. 0 shot in 2 matches), the CV of this action or event of this player was expressed as a missing value (Liu et al., 2016). The non-clinical magnitude-based inferences were used to identify the differences of variation in match performance of players from five playing positions under five competing situations. Differences were evaluated by using the standardized smallest worthwhile change which was calculated by 0.2 times the between-subject standard deviation. Comparisons between groups were conducted using the spreadsheet developed by Hopkins and the 90% confidence intervals were used to make the inferences (Hopkins, 2007; Hopkins, Marshall, Batterham, & Hanin, 2009). Magnitude of clear differences was considered as follows: trivial, 0-0.2; small, 0.2-0.6; moderate, 0.6-1.2; large, 1.2-2.0; and very large, >2.0 (Batterham & Hopkins, 2006; Hopkins, 2002). The possibility of the effect to be clear was defined as follows: 25%-75%, possibly; 75%-95%, likely; 95%-99.5%, very likely; and 99.5%-100%, most likely (Hopkins et al., 2009).

5.3 Results

Figure 5.1 shows a graphical representation of the differences of technical performance

variation between players including the results of magnitude-based inferences. Table 5.2 gives a summary of those technical variables that revealed substantial differences under different playing positions and situational variables. The full set of descriptive statistics of the players' technical performance variation can be found in Appendix II.

In a first step, the variation of technical variables of players from all five playing positions was compared with a focus on each situational variable. Players in the knockout stage showed higher variation in most of the variables related to passing and organising, and lower variation in the other three types of technical variables compared to players in the group stage. The variability of match performance of full backs, wide midfielders, central midfielders and forwards was greater when playing away than when playing at home. However, central defenders showed the opposite trend as the variation of most variables with a non-trivial effect (dispossessed, blocked shot, through ball and accurate through ball) were higher in home matches than in away matches. Yellow cards showed clear differences of variation between players from qualified and non-qualified teams in most of the playing positions (central defender, wide midfielder, central midfielder and forward). In general, central defenders and full backs from qualified teams showed a higher stability of match performance than their counterparts from non-qualified teams. The variation of variables related to attacking and variables related to passing and organising for all players was higher when playing against qualified teams than playing against non-qualified teams, while the variability of defending related variables from all players was higher when playing against non-qualified teams than playing against qualified teams. Moreover, the variation of match

performance for wide midfielders, central midfielders and forwards in winning matches was lower than those in draw/defeated matches.

As a second step, the differences of the players' variation were identified with a focus on the different playing positions. The variation of accurate through balls from central defenders showed clear differences in all five competing contexts and the biggest magnitude of difference can be found in the situational variable of match location ($ES \pm 90\% \text{ CI: } -0.63 \pm 0.45$). Similarly, accurate through balls (0.82 ± 0.6) from full backs also showed higher difference of variation in the situational variable of match location than in the other four situational variables. The differences of variation in blocked shots and clearance for full backs were all non-trivial with regard to the situational variables of quality of team, quality of opponent and match outcome. The variation of wide midfielders' performance in blocked shots (0.81 ± 0.39) showed very likely to moderate differences under the situational variable of match location. Wide midfielders' variation in variables related to goal scoring (shot or shot on target) showed significant differences in all five competing contexts. The variation of central midfielders' performance only showed clear difference in key passes (0.21 ± 0.15) between home and away matches while the other twenty-four variables showed trivial differences. Central midfielders moreover showed clear differences in through balls in the situational variables of quality of team, quality of opponent and match outcome. For forwards, the performance variation in accurate through balls (-0.72 ± 0.38) also showed very likely to moderate differences between winning matches and draw/defeated matches. Except for the situational variable of competition stage, forwards showed significant

differences in variables related to goal scoring (shot or shot on target) under the other four situational variables. Performance variation of forwards showed relative larger differences under situational variables of quality of team, quality of opponent and match outcome compared to the other two situational variables.

Figure 5.1. Effect sizes of differences in mean of CV of each variable of different position's players playing in different match contexts.

Notes: Asterisks indicate the likelihood for the magnitude of the true differences in mean as follows: *possible; **likely; ***very likely; ****most likely. Asterisks located in the trivial area denote for trivial differences. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=bad control; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 5.2. Substantial differences of players' match performance variation across five playing positions and five competing situations.

Position	Group - Knockout			Home - Away			Non-qualified - Qualified			Non-qualified Opp. - Qualified Opp.			Draw/Lose - Win		
	Variable	Effect Size	Inference	Variable	Effect Size	Inference	Variable	Effect Size	Inference	Variable	Effect Size	Inference	Variable	Effect Size	Inference
CD	AccThB	0.40±0.49	S**	AccThB	-0.63±0.35	M***	YC	0.34±0.20	S**	LB	0.28±0.14	S**	Offside	0.20±0.38	S*
	AccCross	0.30±0.31	S*	BS	-0.35±0.16	S**	Offside	0.37±0.34	S**	Shot	0.22±0.16	S*	KP	-0.26±0.20	S*
				ShotOT	0.37±0.22	S**	Assist	0.25±0.40	S*	ShotOT	-0.25±0.22	S*	AccLB	-0.24±0.16	S*
				Disp	-0.23±0.18	S*	Clearance	0.25±0.16	S*	Fouled	0.25±0.15	S*	AccThB	0.22±0.42	S*
				ThB	-0.27±0.31	S*	Fouled	0.25±0.16	S*	AccLB	0.21±0.14	S*			
							AccCross	0.27±0.27	S*	AccThB	0.37±0.43	S*			
							AccLB	0.21±0.16	S*						
FB							AccThB	0.24±0.38	S*						
	LB	0.28±0.19	S**	AccThB	0.82±0.61	M***	ShotOT	0.43±0.25	S**	Assist	0.30±0.31	S*	Assist	-0.44±0.34	S**
	Offside	-0.37±0.32	S**	KP	0.33±0.16	S**	ThB	0.42±0.34	S**	BS	-0.21±0.14	S*	BS	0.32±0.19	S**
	TT	-0.21±0.19	S*	Cross	0.34±0.16	S**	AccThB	0.57±0.56	S**	Fouled	0.22±0.15	S*	AccThB	-0.47±0.54	S**
	Fouled	-0.20±0.20	S*	ThB	0.42±0.33	S**	Clearance	0.24±0.16	S*	KP	0.21±0.16	S*	Disp	0.25±0.18	S*
	Touch	0.27±0.18	S*	AccCross	0.25±0.18	S*	BS	0.26±0.18	S*	AccCross	0.21±0.18	S*	Clearance	0.20±0.15	S*
	KP	0.28±0.20	S*				Offside	0.30±0.32	S*	Clearance	-0.26±0.18	S*	Touch	-0.21±0.15	S*
WM	YC	-0.22±0.31	S*	BS	0.81±0.39	M***	YC	0.35±0.35	S**	Offside	0.46±0.33	S**	Assist	-0.57±0.41	S**
	ShotOT	-0.24±0.28	S*	AccCross	0.49±0.27	S***	ThB	-0.34±0.31	S**	Assist	0.27±0.42	S*	KP	-0.42±0.26	S**
	Interception	-0.20±0.24	S*	KP	0.38±0.23	S**	ShotOT	-0.28±0.24	S*	YC	-0.22±0.39	S*	Shot	-0.44±0.24	S**
	BS	-0.30±0.42	S*	Cross	0.31±0.23	S**	AW	-0.26±0.24	S*	ShotOT	0.23±0.26	S*	ShotOT	-0.29±0.28	S*
	Dribble	-0.23±0.25	S*	AccThB	0.45±0.44	S**	Offside	0.30±0.31	S*	Fouled	0.24±0.23	S*	UnsTouch	-0.22±0.25	S*
	PA	0.22±0.22	S*	AW	-0.33±0.25	S**						TT	-0.26±0.25	S*	
	Pass	0.21±0.22	S*	Assist	0.25±0.40	S*						Clearance	-0.22±0.28	S*	
CM	AccThB	-0.22±0.37	S*	Shot	0.21±0.22	S*						Offside	-0.31±0.33	S*	
				Offside	0.31±0.32	S*						ThB	-0.26±0.33	S*	
	AW	-0.28±0.17	S**	KP	0.21±0.15	S*	YC	0.31±0.19	S**	YC	-0.33±0.19	S**	AW	-0.39±0.15	S***
	YC	-0.25±0.20	S*				UnsTouch	0.21±0.16	S*	ShotOT	0.35±0.18	S**	Assist	-0.46±0.29	S**
	Foul	-0.26±0.17	S*				BS	0.21±0.18	S*	AW	0.27±0.15	S**	Shot	-0.21±0.15	S*
							ThB	-0.21±0.20	S*	Shot	0.20±0.14	S*	ShotOT	-0.27±0.18	S*
										Offside	0.20±0.27	S*	TT	-0.22±0.14	S*
FW										ThB	0.23±0.20	S*	ThB	-0.27±0.21	S*
										AccThB	0.29±0.26	S*			
	BS	-0.29±0.48	S*	KP	0.42±0.23	S**	ShotOT	-0.31±0.24	S**	KP	0.45±0.24	S***	AccThB	-0.72±0.38	M***
	Cross	0.27±0.25	S*	Assist	0.28±0.34	S*	Offside	-0.36±0.25	S**	Shot	0.32±0.23	S**	KP	-0.55±0.25	S***
	AccThB	0.21±0.36	S*	Shot	0.29±0.23	S*	KP	-0.43±0.24	S**	AccCross	0.37±0.31	S**	Assist	-0.50±0.36	S**
				ShotOT	0.24±0.23	S*	Pass	0.31±0.22	S**	ThB	0.36±0.31	S**	YC	-0.45±0.37	S**
							ThB	-0.32±0.28	S**	YC	-0.28±0.33	S*	Shot	-0.42±0.24	S**
FW							Assist	-0.25±0.36	S*	Clearance	-0.31±0.28	S*	ShotOT	-0.43±0.25	S**
							YC	0.26±0.31	S*	Dribble	0.28±0.24	S*	ThB	-0.38±0.30	S**
							Shot	-0.22±0.23	S*	Cross	0.27±0.24	S*	Interception	-0.22±0.29	S*
							AW	0.20±0.25	S*	AccLB	0.24±0.25	S*	Offside	-0.26±0.27	S*
							Touch	0.22±0.22	S*	AccThB	0.25±0.38	S*	AccLB	-0.23±0.25	S*
							AccThB	-0.22±0.34	S*						

Note: Effect sizes are presented as the magnitude of the true difference in means $\pm$ 90% confidence interval, only the variables that showed clear differences were included. Positive effect size indicates that the mean values of variables from group A are bigger than the mean values of variables from group B, negative effect size indicates that the mean values of variables from group B are bigger than the mean values of variables from group A, e.g. group B-group A: group stage-knockout stage. Letters in parentheses denote the magnitude: t=trivial; s=small, m=moderate. Asterisks indicate the likelihood for the magnitude of the true difference in means as follows: *possible; **likely; ***very likely; ****most likely. Abbreviations: CD=central defender; FB=full back; WM=wide midfielder; CM=central midfielder; FW=forward; ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

5.4 Discussion

The current study analysed the variability of the technical performance of players based on a large sample (8 seasons) and thus in a more comprehensive and detailed manner than previous research (Bush, Archer, et al., 2015; Liu et al., 2016). As argued, the examination of both positional differences and situational differences of the players' performance variation can provide a better understanding on the interaction effects across playing positions and situational variations from two perspectives.

On the one hand, performance variation from all playing positions were compared under each competing context. To the best of our knowledge, there is no research that has examined the differences of player's performance variation between the group stage and the knockout stage of the UEFA Champions League so far. We found that for all

playing positions, players from the knockout stage showed more variable performance in passing and organising related variables than players from the group stage. In the analysis of this result, it needs to be taken into account that in general, teams' opponents in the knockout stage are stronger than opponents in the group stage. Previous studies have identified that players' performance in variables related to passing and organising were more inconsistent when playing against strong teams than when playing against weak teams (Liu et al., 2016) and that strong teams tend to achieve high ratio of ball possession in a match (Jones et al., 2004); It can be expected that the strategy and tactics that teams use against strong opponents are highly influenced by the playing style and tactics of the opponent while teams will be able to continuously use their usual playing style against weaker opponents in the group stage (Fernandez-Navarro, Fradua, Zubillaga, & McRobert, 2018). We strongly assume this to be the reason why players from the knockout stage showed more variable performances in passing and organising related variables.

A prior study analysing data of the Spanish First Division Professional Football League (*La Liga*) has reported that the effect of team and opposition strength on the variation of technical variables of players is greater than the effect of match location and match outcome (Liu et al., 2016), while in the current study a similar result could not be identified. This difference can be due to the highest level of competitiveness of UEFA Champions League that forces the teams to perform at the highest level during all the matches played in comparison with a national competition with more than 30 matches to play. The match performance of central defenders and full backs from qualified teams

varied more than central defenders and full backs from non-qualified teams. This might be due to the multiple tasks for backs from qualified teams, being in need to accomplish defensive duties while also being involved in attacking. Backs from non-qualified teams in contrast might be mainly concentrated on defending and their match performance is therefore more consistent and predictable. Players from all playing positions showed more consistent performance in variables related to attacking and variables related to passing and organising when playing against non-qualified teams than when playing against qualified teams. While players from weaker teams have a limited capacity in attacking and organization, stronger teams show better tactical discipline and strategical organization (Castellano et al., 2012). This might be the reason why players from all playing positions tend to achieve a more stable and a better offensive performance when playing against non-qualified teams. In the meantime, those teams that played against qualified teams might face greater defensive pressure, which would explain that players from all playing positions showed a more stable performance in variables related to defending when playing against qualified teams.

The performance variation of full backs, wide midfielders, central midfielders and forwards were more stable in home matches than in away matches due to the home advantage. Central defenders showed a more unstable performance in the variables dispossessed, blocked shots, through balls and accurate through balls in home matches. Probably, this can be explained by teams being more likely to adopt offensive tactics when playing at home than away (Liu et al., 2016; Pollard, 2008; Poulter, 2009), which provides some chances for them to participate in the attacking process. Thus, a more

variable performance was shown in these variables in home matches due to the low frequency of occurrence. When taking the effect of match outcome into account, midfielders and forwards showed more consistent performances in winning matches than in draw/defeated matches, which may reveal that the stable performance of midfielders and forwards is very important for the team to succeed in a match (Gelade, 2017).

On the other hand, the current study also compared the variation between each playing position under five competing contexts to identify the effect of situational variables on the variation of each playing position. The clear differences of variation in accurate through balls from central defenders can be found in all five competing contexts, which means that accurate through balls is the most sensitive variable for central defenders and can be easily influenced by competing contexts, especially the match location. We also found that the variation of accurate through balls from central defenders and full backs in home/away matches and from forwards in winning/draw/defeated matches all showed very likely to moderate differences. It shows that the effect of the match location has a significant impact on the stability of the defenders' performance in accurate through balls. This issue could be explained by the positive assertive behaviour displayed by the home players (i.e. better defensive actions due to pressing with reduced contact) compared with the negative assertive behaviour of away players (i.e. poor decision making due to the defensive pressure) (Thomas, Reeves, & Smith, 2006). In addition, increasing the frequency of occurrence of accurate through balls for forwards might contribute to a better match result for teams.

Quality of team, quality of opponent and match outcome are three different situational variables that are all strongly associated with team strength. All three show a significant influence on the full backs' performance variation in the variables related to defending (blocked shots and clearance). Full backs from stronger teams produced higher CV than their counterparts from weaker teams in these two defense-related variables. Moreover, the variation of blocked shots from wide midfielders showed a significant difference between home and away matches. The more unstable performance in away matches might be traced back to the fact that they had to make more attempts than usual to block the opponent's shot in away matches against stronger teams and a small change in the frequency of occurrence caused a large impact on the CV observed (Carling, Bradley, McCall, & Dupont, 2016). The variation of variables related to goal scoring for wide midfielders showed clear differences in all five competing contexts, proving that the match performance of wide midfielders in variables related to goal scoring is highly dependent on competing contexts. This finding can provide a valuable reference for coaches to utilize in the coaching process.

Previous studies have already reported that the technical performance of players was more stable in home matches than in away matches (Almeida, Ferreira, & Volossovitch, 2014; Liu et al., 2016; Poulter, 2009), which could be replicated except for central defenders. Probably, central defenders are responsible of the last line of defense that may generate goals against, the pressure they faced from opponents with different levels and different playing styles may modify their performance and then reduce the stability of this playing position. Another interesting finding of this study was that the effect of

match location had a limited impact on the variability of the central midfielders' match performance. The variation of variables related to passing and organising didn't show a clear difference as it could be expected between home and away matches except for the key pass. Additionally, we observed clear differences of variation of through balls for central midfielders in competing contexts related to team strength (quality of team, quality of opponent and match outcome). For forwards, the variation of variables related to goal scoring and the variable of key pass both showed clear differences in the competing contexts of match location, quality of team, quality of opponent and match outcome. This indicates that those forwards being able to seize goal scoring opportunities and possess qualities in organising the offensive process by proper passes can make a significant contribution for their team (Liu et al., 2016).

5.5 Conclusions

This study established technical profiles considering five playing positions and five situational variables to examine their interactions on players' technical variation from a long-term perspective using one of the largest samples published to date (8 seasons). Large dataset makes it possible for us to conduct a comprehensive analysis, such as the difference between group stage and knockout stage, which is failed to account for by existing studies. our results showed that each situational variable has a significant influence on players from all five playing positions. Situational variables of quality of team, quality of opponent and match outcome showed similar effects on the variation of the player's performance. The technical variation of each playing position also varies in different competing contexts. Variables related to goal scoring and variables

related to passing and organising from all positions show relatively higher variation in all five competing contexts. The established technical variation profiles can be used for pre-match preparation considering the conditions of the next match and for the players' post-match evaluation to develop position-specific interventions in the coaching process. The profiles can also provide an important tool for talent identification and player's recruitment. Performance data of a single player can be integrated into the profiles and be compared with the players from the same position under different competing contexts. Furthermore, coaches and performance analysts should pay more attention to those sensitive indicators, such as shot on target and through ball, that have been identified with high match-to-match variations in the current study.

Chapter Six—Technical Demands of Different Playing Positions in the UEFA Champions League

6.1 Introduction

Match performance of football is the result of the interaction of technical, tactical and physical activities presented by players within a match (Bush, Barnes, Archer, Hogg, & Bradley, 2015b; Carling, 2010; Dellal, Chamari, Pintus, Girard, Cotte, & Keller, 2008). Every player fulfils specific tasks and undertakes associated functions according to his/her playing position in the game, in order to achieve a successful performance, and eventually to win a match (Hughes et al., 2012). Hence, the positional difference should not be disregarded when evaluating players' match performance (Butterworth et al., 2013) and the individualized criterion is needed to identify the characteristics and demands of each playing position, otherwise a wealth of valuable information might be masked which may lead to a restriction on the understanding of players' match performance (Lago-Peñas, Casais, Dellal, Rey, & Domínguez, 2011).

There have been many studies conducted to identify the characteristics and demands of individual roles within a football team framework (Bloomfield, Polman, & O'Donoghue, 2007; Boone, Vaeyens, Steyaert, Bossche, & Bourgois, 2012; Dellal, Wong, Moalla, & Chamari, 2010; Di Salvo, Baron, Tschan, Montero, Bachl, & Pigozzi, 2007; Mohr, Krustup, & Bangsbo, 2005; Reilly, Bangsbo, & Franks, 2000). Most of

the previous research is mainly concerning the physical demands or anthropometric and physiological characteristics of different positional roles based on time-motion analysis. It has been reported that midfielders covered significantly greater total distance compared with players of any other position and even performed more high intensity running than central backs and forwards. Full backs and forwards showed higher sprinting ability and better agility, while central backs covered the shortest total distance and presented the least sprinting time. Moreover, Hughes et al. (2000) reported that fullbacks and midfielders showed the best performance in the intermittent exercise test and have the highest maximal oxygen intakes. On the contrary, midfielders appeared to have the lowest muscle strength.

However, there has been limited research investigating the position-specific technical match demands from an empirical perspective, even though technical indicators have been considered as better predictors of football match success (Lago-Peñas, Lago-Ballesteros, et al., 2011) and technical skills have been counted as a main component in football talent identification and development systems (Vaeyens, Lenoir, Williams, & Philippaerts, 2008). Hughes et al. (2012) and Wiemeyer (2017) reported the technical demands of different playing positions in a qualitative way, the typical technical features and technical requirements of each positional role were identified and compared whereas limited systematic quantitative data were included. Taylor et al. (2004) developed a notational analysis system to construct inter-positional and intra-positional behavioural and performance profiles, but the post-hoc test was not used in the non-parametric analysis hence it failed to identify the differences between any two

playing positions. Vale et al. (2009) conducted a more quantitative research, which concluded that there were no significant differences in passing abilities of young players (17-18 years old) when considering playing positions. However, the data of this study was based on three tests of technical skills rather than the match statistics from official football matches. Dellal et al. (2010) identified the positional demands from both physical and technical aspects in the French First League, main findings include: midfielders showed the greatest total distance covered; forwards covered the greatest distance in sprinting but lost the greatest number of duels, while central backs and full backs won the highest number of duels, and central backs also showed the lowest values of successful passes. Nevertheless, this study failed to address the repeated-measured data of players who played in multiple matches. Furthermore, position-specific technical demands identified in these studies were not controlled for the effects of situational factors (e.g., team and opponent strength, match location, competition phase, etc.) which have already been proved to largely affect the technical performance of football players from a behaviour level (Gómez et al., 2013; Lago-Peñas & Lago-Ballesteros, 2011; Liu, Yi, Giménez, et al., 2015). In addition, the sampling issues have been disregarded in these studies. The small number of players may fail to produce meaningful typical performance of each playing position (Taylor et al., 2004), while the mean values of indicators can yield valuable information about position specific demands based on a large number of players observed in each playing position (Reilly et al., 2000).

Consequently, the current study aims to quantitatively identify the position-specific

technical demands of elite football players in the UEFA Champions League using one of the largest samples published to date. The generalised linear mixed modelling is employed to deal appropriately with repeated-measure data of players from multiple matches in a long-term perspective. Situational variables of competition stage, match location, team and opponent strength were controlled by the modelling in order to define sets of key performance indicators for each position.

6.2 Methods

6.2.1 Data and Reliability

Technical performance-related match data of all the 1,000 games played in the UEFA Champions League from season 2009/10 to 2016/17 were collected for analysis. Data resource is a public-accessed football statistic website named “whoscored.com” (<https://www.whoscored.com>), which uses the original data from OPTA Sportsdata company. The inter-operator reliability of the data-coding system when collecting information of football players’ match actions and events has been tested to be an acceptable level (Liu et al., 2013). This study maintains the anonymity of the players following European data protection law and is officially approved by the ethics committee of the local university.

6.2.2 Sample and Variables

Sample of the current study consisted of all players who started and played at least one entire match in the UEFA Champions League during the eight seasons of 2009/10-2016/17. Substitutes and the players they substituted were excluded. And due to the

specificity of the position of goalkeeper, match data of players from this position were excluded as well. Hence, the sample finally came to 14,437 full match observations.

Players in the sample were divided into 5 groups according to their playing positions at the start of each game (Bush, Barnes, et al., 2015b; Liu, Gómez, et al., 2016): Central Defender (CD, n = 3632 match observations), Full Back (FB, n = 3429 match observations), Central Midfielder (CM, n = 4044 match observations), Wide Midfielder (WM, n = 1565 match observations), and Forward (FW, n = 1767 match observations).

Table 6.1. Selected performance-related match events and actions.

Groups	Event or action: operational definition
Variables related to goal scoring	<p>Shot: an attempt to score a goal, made with any (legal) part of the body, either on or off target</p> <p>Shot on target: an attempt to goal which required intervention to stop it going in or resulted in a goal/shot which would go in without being diverted</p>
Variables related to passing and organising	<p>Touch: a sum of count values of all actions and events where a player touches the ball</p> <p>Pass: an intentional played ball from one player to another</p> <p>Pass accuracy (%): successful passes as a proportion of total passes</p> <p>Key pass: the final pass or cross leading to the recipient of the ball having an attempt at goal without scoring</p> <p>Cross: any ball sent into the opposition team's area from a wide position</p> <p>Long ball: an attempted pass of 25 yards or more</p> <p>Through ball: a pass that split the last line of defense and plays the teammate through on goal</p> <p>Aerial won: two players competing for a ball in the air, for it to be an aerial duel both players must jump and challenge each other in the air and have both feet off the ground. The player who wins the duel gets the <i>Aerial won</i>, and the player who does not gets an <i>Aerial lost</i>.</p> <p>Dribble: a dribble is an attempt by a player to beat an opponent in possession of the ball. OPTA also log attempted dribbles where the player overruns the ball.</p> <p>Fouled: where a player is fouled by an opponent</p> <p>Dispossessed: when a player is tackled without attempting to dribble past his opponent</p>
Variables related to defending	<p>Tackle: the action of gaining possession from an opposition player who is in possession of the ball</p> <p>Interception: a player intercepts a pass with some movement or reading of the play</p> <p>Clearance: attempt made by a player to get the ball out of the danger zone, when there is pressure (from opponents) on him to clear the ball</p> <p>Foul: any infringement that is penalised as foul play by a referee</p> <p>Yellow card: where a player was shown a yellow card by the referee for reasons of foul, persistent infringement, hand ball, dangerous play, etc.</p>

Based on previous literature (Castellano et al., 2012; Lago-Peñas & Lago-Ballesteros, 2011; Lago-Peñas et al., 2010b; Liu, Gómez, et al., 2016; Liu, Hopkins, et al., 2016; Liu, Yi, Giménez, et al., 2015; Mao, Peng, Liu, & Gómez, 2016), count numbers of 18 technical performance-related match events and actions were selected to act as variables identifying the technical match performance of players. The grouping and operational definitions of these variables can be found in Table 6.1 (Liu, Gómez, et al., 2016; Liu et al., 2013; Liu, Hopkins, et al., 2016; Mao et al., 2016).

6.2.3 Procedure and Statistical Analysis

A generalised mixed linear model was realised with *Proc Glimmix* in the University Edition of Statistical Analysis System (version SAS Studio 3.6). A random effect for player identity was used to account for repeated measurement on the players. The fixed effects estimated the effect of the playing position, as well as the effect of game location, competition phase, team and opposition strength. Separate Poisson regressions were run in the model taking the value of each of the 18 technical performance-related variables as the dependent variable.

Playing position, game location and competition phase were all included as nominal predictor variables in the model. Playing position was with five levels (CD, FB, CM, WM and FW), game location was with three levels (home, away and neutral), and competition phase was with two levels (group stage and knock-out stage). The effect of team strength and opponent strength was estimated by including the difference in the

log of the end-of-season UEFA club coefficient as a predictor (Liu, Yi, Giménez, et al., 2015; Phillips & Hopkins, 2017).

Uncertainty in the true effects of the predictors was evaluated using non-clinical magnitude-based inference as implemented in the spreadsheet accompanying the package of materials for generalised mixed modelling with SAS Studio (Hopkins, 2016a). Observed magnitudes and their confidence limits were expressed in standardised units, whereby the difference in means was divided by the observed between-player standard deviation (SD) derived from the mixed model, then evaluated qualitatively with the following scale: <0.2 trivial, 0.2-0.6 small, 0.6-1.2 moderate, 1.2-2.0 large, >2.0 very large (Hopkins et al., 2009b). Effects were deemed clear if the 90% confidence interval (CI) did not include positive and negative substantial values simultaneously. Clear effects were reported with a qualitative likelihood that the true effect was either substantial or trivial (whichever probability was greater) using the following scale: <0.5% most unlikely, 0.5-5% very unlikely, 5-25% unlikely, 25-75% possibly, 75-95% likely, 95-99.5% very likely, >99.5% most likely (Hopkins et al., 2009b).

6.3 Results

Mean and between-player standard deviation of the 18 technical performance-related match actions and events of players from five different playing positions estimated from the generalised mixed linear model controlling the effects of game location, competition phase, team and opposition strength are presented in Table 6.2. The

comparison on the difference in the mean counts of each action or event between players from different playing positions are presented in the Figure 6.1.

Table 6.2. Descriptive statistics of technical match performance players of different playing positions estimated from the generalised mixed linear model. (N denotes the number of payers, n denotes the number of match observations, results are *mean $\pm$ between-player standard deviation*, units are counts, except for pass accuracy).

Variable	CD ($n = 3,632$)	FB ($n = 3,429$)	CM ($n = 4,044$)	WM ($n = 1,565$)	FW ($n = 1,767$)
Shot	0.67 ± 1.20	0.52 ± 1.10	1.41 ± 1.68	1.11 ± 1.49	1.59 ± 1.80
Shot on target	0.19 ± 0.88	0.13 ± 0.93	0.54 ± 1.05	0.37 ± 0.94	0.65 ± 1.12
Touch	58.3 ± 19.3	57.5 ± 19.1	55.5 ± 18.6	59.1 ± 19.5	51.1 ± 17.7
Pass	42.3 ± 18.1	40.3 ± 17.5	38.9 ± 17.1	43.0 ± 18.3	34.9 ± 15.9
Pass accuracy (%)	81.2 ± 10.3	79.2 ± 10.1	78.6 ± 10.1	81.1 ± 10.3	78.3 ± 10.1
Key pass	0.53 ± 1.14	0.63 ± 1.21	0.98 ± 1.46	0.86 ± 1.37	1.07 ± 1.53
Cross	0.90 ± 2.34	1.41 ± 3.06	1.13 ± 2.65	0.99 ± 2.45	1.12 ± 2.64
Long ball	4.36 ± 3.78	4.02 ± 3.59	3.17 ± 3.11	3.94 ± 3.54	2.12 ± 2.50
Through ball	0.09 ± 0.99	0.05 ± 1.53	0.13 ± 0.91	0.13 ± 0.91	0.19 ± 0.90
Dribble	0.51 ± 1.25	0.60 ± 1.33	0.81 ± 1.52	0.70 ± 1.41	0.78 ± 1.49
Aerial won	1.15 ± 1.74	0.97 ± 1.61	0.90 ± 1.56	0.91 ± 1.56	1.03 ± 1.65
Fouled	0.94 ± 1.30	1.01 ± 1.34	1.42 ± 1.57	1.30 ± 1.51	1.51 ± 1.62
Dispossessed	0.58 ± 1.16	0.58 ± 1.16	1.23 ± 1.61	1.04 ± 1.48	1.31 ± 1.67
Tackle	2.15 ± 1.96	2.46 ± 2.10	1.89 ± 1.83	2.26 ± 2.00	1.41 ± 1.60
Interception	2.13 ± 1.96	2.11 ± 1.96	1.52 ± 1.68	1.82 ± 1.82	0.98 ± 1.41
Clearance	2.74 ± 3.22	2.72 ± 3.20	1.31 ± 2.11	1.98 ± 2.63	0.81 ± 1.73
Foul	1.23 ± 1.40	1.31 ± 1.44	1.48 ± 1.53	1.50 ± 1.54	1.52 ± 1.54
Yellow card	0.21 ± 0.70	0.18 ± 0.70	0.18 ± 0.70	0.20 ± 0.70	0.17 ± 0.70

6.3.1 Variables Related to Goal Scoring

Forwards performed more shots and shots on target than central defenders, full backs and wide midfielders, but showed trivial difference when compared to central midfielders. Defenders (central defenders and full backs) made less shots and shots on target than that of midfielders and forwards, while the difference between full backs and central defenders was trivial. The number of shots and shots on target of central midfielders were higher than those of wide midfielders.

Figure 6.1. Effect sizes of differences in mean count of each match action or event between players from 5 playing positions.

Notes: Asterisks indicate the likelihood for the magnitude of the true differences in mean as follows: *possible; **likely; ***very likely; ****most likely. Asterisks located in the area between -0.2 and 0.2 denote for trivial differences. Abbreviations: ShotOT=shot on target; PA=pass accuracy (%); KP=key pass; LB=long ball; ThB=through ball; AW=aerial won; Disp=dispossessed; YC=yellow card.

6.3.2 Variables Related to Passing and Organising

Through ball and cross were the only two variables that showed clear differences between central defenders and full backs, central defenders obtained more through balls and less crosses than that of full backs, while substantial differences between central midfielders and wide midfielders were observed in pass, pass accuracy and long ball, wide midfielders had greater number of these three variables compared with central midfielders. Central midfielders only showed the greatest number of dribbles compared to the rest of playing positions in all variables related to passing and organising, whereas only the comparison with central defenders showed clear difference and the differences in the pairwise comparisons with other playing positions were trivial. Forwards had the lowest value of touches, passes, and through balls. Moreover, only cross and aerial won showed trivial differences between forwards and central defenders when considering variables related to passing and organising.

Midfielders (central midfielders and wide midfielders) gained more key passes, fouled and dispossessed than that of defenders (central defenders and full backs). However, no substantial differences were detected in touch and aerial won between defenders and midfielders. In addition, central defenders had more passes, pass accuracy and long balls than central midfielders, full backs performed more crosses than wide midfielders. As for the differences between midfielders (central midfielders and wide midfielders) and forwards, midfielders presented higher number of touches, passes and long balls compared to those of forwards while there were no substantial differences detected in key pass, cross, through ball, dribble, aerial won and fouled. Additionally, midfielders

and forwards showed a substantially greater number of key passes, fouled and dispossessed than defenders. When considering the differences between defenders (central defenders and full backs) and forwards, defenders obtained more touches, passes and long balls and less key passes, through balls, dispossessed and fouled than that of forwards, while the differences in cross and aerial won were trivial.

6.3.3 Variables Related to Defending

There were no substantial differences between central defenders and full backs in all variables related to defending. The number of tackles and clearances of wide midfielders were higher than that of central midfielders and the differences of interception, foul and yellow card were trivial. Forwards had the lowest number of tackles, interceptions and clearances compared with other four playing positions. Additionally, forwards and central midfielders committed more fouls than central defenders.

Only clearance showed substantial differences and yellow card showed trivial differences between defenders (central defenders and full backs) and midfielders (central midfielders and wide midfielders), defenders had more clearances than midfielders. Midfielders (central midfielders and wide midfielders) gained more tackles, interceptions and clearances than that of forwards while no substantial differences were ascertained in foul and yellow card. The comparison between defenders (central defenders and full backs) and forwards showed the similar result that defenders had

more tackles, interceptions and clearances than that of forwards but only yellow card showed trivial difference.

6.4 Discussion

The current study identified the differences of technical demands between playing positions in the UEFA Champions League by controlling the effects of situational variables (competition stage, match location, team and opponent strength) from a long-term perspective (8 seasons). The different positions on the field were characterized by specific technical requirements and position specific key performance indicators were identified in different aspects of match performance (goal scoring, passing and organising, defending).

Our results showed that forwards achieved the greatest number of shots and shots on target, which is similar to the findings reported by Taylor et al. (2004). Moreover, central midfielders showed trivial difference with forwards in the number of shots and shots on target, but showed substantial higher numbers than wide midfielders, which may indicate that central midfielders played a more offensive role in the modern football tactics and made more contributions in the finalization of the attacking process (Liu, Gómez, et al., 2016). It is unsurprising that there was a trivial difference between central defenders and full backs in the performance related to goal scoring, and both were worse than midfielders and forwards, which can be easily explained by the similarities in the tactical duties between central defenders and full backs and the differences of positional roles between defenders, midfielders and forwards.

The differences of technical demands related to passing and organising between central defenders and full backs were mainly in through ball and cross. Even though the number of through balls achieved by central defenders was higher than that of full backs, whereas both of them were at a relative lower level than midfielders and forwards due to the position specific duties. Additionally, full backs were observed having higher frequencies in cross than central defenders and even higher than wide midfielders. This finding demonstrates that crossing is a main technical requirement for full backs (Hughes et al., 2012; Van Lingen, 1998), they were required to enter more into the attacking third and sending the ball from wide area into the opponent's area when in possession, while wide midfielders move into central area attracting opponent's defenders inside and creating space for full backs (Bush, Barnes, et al., 2015b). The mean value of pass, pass accuracy and long ball of central midfielders not only was lower than that of wide midfielders, but also was lower than that of central defenders. Together with the aforementioned results that the relative better performance of central midfielders in variables related to goal scoring, we found that the central midfielders are moving forward more into the opponent's penalty area in the offensive phases thus they can get more scoring opportunities. This finding partly contrast with research by Liu et al. (Liu, Gómez, et al., 2016) who presented evidence that good central midfielders in the Spanish professional football league primarily focus on passing and organising duties rather than invading too much into the opponent's area. Furthermore, teams employed more the wide area to seek offensive opportunities thus more passing and organising related actions or events were performed by wide players in their areas

(Almeida et al., 2014). The position specific duties of players on the pitch may once again account for that the forwards obtained the lowest value of touches, passes and through balls and the substantial differences between forwards and central defenders. Unexpectedly, all playing positions showed the same level of performance in aerial won, which can be supported by a previous study that indicated the heading ability is a common technical requirement for all playing positions (Hughes et al., 2012). This result is in contrast with the general consensus that forwards and central defenders are those who possess good heading ability. In fact, aerial duel occurs at all over the pitch not just in the attacking/defending third.

Regarding the differences of technical demands related to passing and organising between defenders and midfielders, the number of key pass, fouled and dispossessed of midfielders were higher than those for defenders. A possible reason is that midfielders' position is closer to the opponent's area than defenders and they provide support for forwards by sending key passes, they have to face more defensive pressure due to the higher player intensity thus more fouled and dispossessed were obtained. In addition, the number of pass, pass accuracy and long ball of central defenders were higher than those for central midfielders, which may reveal a trend that central defenders are more involved in the attacking process when team in possession (Bush, Barnes, et al., 2015b) and playing the role of launching point to initiate team's offense sending the ball to the forwards in a more direct way (Liu, Gómez, et al., 2016). Another concern is that central defenders showed higher pass accuracy than central midfielders, which may be probably due to the fact that central defenders faced less defensive pressure from

opponent. In the comparison between midfielders and forwards, clear differences were found in touch, pass and long ball and trivial differences were found in dribble, aerial won and fouled, which is consistent with our expectation. However, one noteworthy finding is that trivial differences in the performance between midfielders and forwards were found in key pass, cross and through ball, which may demonstrate that the task of forwards in the attacking area is not only seizing the scoring opportunities provided by teammates, but also creating opportunities for teammates by proper ability of passing and organising. Differences in the performance of passing and organising between defenders and forwards were biggest, especially between central defenders and forwards, which may well be explained by the fact that the biggest differences exist between positional duties of these two field positions.

Concerning the variables related to defending, no substantial differences were found between the performance of central defenders and full backs, which could have been expected. However, wide midfielders had more tackles and clearances than central midfielders, which may suggest that wide midfielders might have more defensive tasks than central midfielders during match play (Almeida et al., 2014), which is consistent with the aforementioned finding that the teams' offense were launched more from the wide area. Generally, defenders demonstrated the highest involvement in defending related actions while forwards presented the lowest and midfielders lay in the middle. Nevertheless, even though forwards achieved the lowest tackles, interceptions and clearances, they committed the most fouls. Combining the fact that the number of fouls committed by wide and central midfielders showed only trivial difference with that of

forwards, it may be induced that the defending of modern football starts in opponent's half by the pressing of forwards (Dellal et al., 2011), inevitable and necessary fouls are more committed by the midfielders and forwards in areas far away from the defending third of own team in order to delay or interfere opponents' attack. This can be partially supported by the finding that yellow card showed trivial differences among all playing positions.

6.5 Conclusions

It could be concluded that the main findings of the present study reveal that technical demands differ significantly across different playing positions when controlling the effects of situational variables of competition stage, match location, team and opponent strength. The biggest difference was found between central defenders and forwards while central defenders and full backs presented the smallest difference. In this study, the basic positional technical demands were identified, which is in line with previous research and in accordance with the specific positional role of each playing position on the pitch. Meanwhile, new trends were also detected. Central defenders involved more in the link-up and attacking process as the launching point of offense. Invading more into the attacking third and sending the ball from wide position to central position (cross) is the main task for full backs during the offensive phase. Central midfielders showed worse performance in passing and organising and better performance in goal scoring than we had expected. Wide midfielders possessed the ability of control the ball and moving more into the opponent's area. Forwards made more contribution in the defense when the possession was lost and they also showed the capacity of creating the scoring

opportunities for teammates in the attacking process. The data presented within the present study identified that different playing positions on the field are characterized by specific technical activities and demands, which might provide valuable insights into the trend of modern football match-play and developing individualized conditional training programs for soccer players.

Chapter Seven—Differences of technical performance of players from major five European football leagues in the UEFA Champions League

7.1 Introduction

Spanish La Liga, English Premier League, Italian Serie A, German Bundesliga and French Ligue 1 are the top five ranked professional football leagues in the Union of European Football Associations (UEFA, www.uefa.com) and have always been considered the most successful football leagues over time (Lago-Peñas, Gómez-Ruano, Megías-Navarro, & Pollard, 2016). These leagues attract top-level players from all over the world (Littlewood, Mullen, & Richardson, 2011; Oberstone, 2011).

However, each of these five leagues is characterised by different particularities of match-play due to the cultural, historical and social differences existing among countries (Sapp, Spangenburg, & Hagberg, 2018; Sarmiento, Pereira, Matos, Campaniço, Anguera, & Leitão, 2013b). Thus, players or teams from the same league are always characterised by a specific stereotype (Crolley, Hand, & Jeutter, 2000). Teams from English Premier League prefer the direct playing style with a special emphasis on its physical aspect; Italian teams are especially characterized by its rigid tactical requirement and defensive organization; Spanish teams prioritize the technical beauty of the game and players have better ability to control the game (Oberstone, 2011;

Sapp et al., 2018; Sarmiento et al., 2013b).

Nevertheless, the playing style has been evolving over years (Sarmiento et al., 2013b), which is the result of the increasing frequency of free flow of players and coaches between leagues in modern football, which may bridge the difference between leagues (Frick, 2007; Littlewood et al., 2011). Even so, differences between the major European football leagues have been identified from various perspectives. A qualitative analysis from Sarmiento et al. (2013b) demonstrated that the differences exist between Spanish La Liga, English Premier League and Italian Serie A in the aspects of culture, preferred strategy and tactic, players' characteristics and coaches' philosophy. Moreover, there have been many comparative studies conducted to examine the differences between major European leagues in aspects of anthropometric data (Bloomfield, Polman, Butterly, & O'Donoghue, 2005), technical and tactical performance (Alberti, Iaia, Arcelli, Cavaggioni, & Rampinini, 2013; Collet, 2013; Dellal et al., 2011; Lago-Peñas et al., 2016; Oberstone, 2011; Sapp et al., 2018), physical performance (Dellal et al., 2011), injury pattern (Waldén, Häggglund, & Ekstrand, 2005), player recruitment (Frick, 2007; Littlewood et al., 2011) and competitive balance (Brandes & Franck, 2007; Pawlowski, Breuer, & Hovemann, 2010). Even though much attention has been paid on the differences of technical and tactical performance of different leagues, either limited performance-related variables or limited number of leagues analysed in the available studies confined the universality of their conclusions. It is well known that there is a wide diversity in the history, culture and geography in European nations (Crolley et al., 2000; Goig, 2008), thus, there is an obvious opening for further research

to conduct a more comprehensive comparison for gaining an insight into the differences of match-play between major European leagues.

Another obstacle that might affect us to conduct an objective and accurate assessment of player's match performance is the comparability of match data across leagues due to the inconsistency in the use of data collection and analysis system (Barros et al., 2007; Di Salvo et al., 2009). Therefore, based on the availability, the match data from the UEFA Champions League is ideal for the comparison. In addition, regarding the data analysis, a methodology is needed to address appropriately the repeated-measured data of players who played in multiple matches (Yi et al., 2018), which was failed to be considered in previous research (Alberti et al., 2013; Dellal et al., 2011; Lago-Peñas et al., 2016; Oberstone, 2011; Sapp et al., 2018).

Consequently, the current study aims to quantify the differences of technical performance of players from five major European leagues (Spanish La Liga, English Premier League, Italian Serie A, German Bundesliga and French Ligue 1) in the UEFA Champions League from season 2009/2010 to 2017/2018. The large sample size allows us to control the effects of situational variables (game location: home, away and neutral, team and opponent strength: end-of-season UEFA club coefficient, match type: group stage and knockout stage and game result: win, draw and lose) and the effect of players' playing position (central defender, full back, central midfielder, wide midfielder and forward) using the generalised mixed linear modelling, which can give us the pure difference between leagues. What is more, an added random effect of player names in

the modelling, could process properly the repeated-measured data of a player participating in various matches.

7.2 Methods

7.2.1 Data Resource and Reliability

Technical performance-related match data of players in all the 1,125 games throughout 9 seasons from 2009-10 to 2017-18 in the UEFA Champions League were collected from a public-accessed football statistic website named “whoscored.com” (<https://www.whoscored.com>). The original data of this website is provided by OPTA Sportsdata company, whose tracking system (OPTA Client System) has been tested by Liu et al. (2013) to have a high level of reliability. The current study maintains the anonymity of the players according to European data protection law and follows the research ethics standard set out by the local university.

7.2.2 Sample and Variables

The dataset consisted of 9,799 full-match observations of 1,291 players from Spanish La Liga (n=2,597 observations), English Premier League (n=2,303), Italian Serie A (n=1,522), German Bundesliga (n=2,021) and French Ligue 1 (n=1,356) played in the UEFA Champions League during the past nine seasons (2009/10-2017/18). Only the outfield players who played at least 1 full match in each season were included. Moreover, due to the differences of technical variables between outfield players and goalkeepers, technical performance-related match data of goalkeepers were excluded from the sample.

After the screening based on the availability of data and the review of previous literature (Castellano et al., 2012; Lago-Peñas et al., 2010b; Liu, Gómez, et al., 2016; Liu, Yi, Giménez, et al., 2015; Yi et al., 2018), 20 technical performance-related match actions and events grouped into four groups were selected as the dependent variables in the analysis (see table 7.1).

Table 7.1. Selected performance-related match events and actions.

Groups	Event or action
Variables related to goal scoring	Shot, Shot on target
Variables related to passing and organising	Touch, Pass, Pass accuracy (%), Key pass, Cross, Long ball, Through ball, Aerial won, Dribble, Offside, Fouled, Dispossessed
Variables related to defending	Tackle, Interception, Clearance, Blocked shot, Foul, Yellow card

7.2.3 Procedure and Statistical Analysis

Generalised mixed linear modelling was achieved by *Proc Glimmix* in the University Edition of Statistical Analysis System (version SAS Studio 3.6). The fixed effects estimated the effects of league, game location, team and opponent strength, match type and game result, as well as playing position. Player identity was used as the random effect to interpret the repeated-measure data of players from multiple matches. Separate Poisson regressions were run in the model taking the value of each of the 20 technical performance-related variables as the dependent variable.

League, game location, match type, game result and playing position were all included as nominal predictor variables in the model. League was with five levels (Spanish La Liga, English Premier League, Italian Serie A, German Bundesliga and French Ligue 1), game location was with three levels (home, away and neutral), match type was with two levels (matches of group stage and knock-out stage), game result was with three

levels (win, draw and loss), and playing position was with five levels (CD, FB, CM, WM and FW). The effect of team and opponent strength was estimated by including the difference in the log of the end-of-season UEFA club coefficient as a predictor (Yi et al., 2018).

Uncertainty in the true effects of the predictors was evaluated using non-clinical magnitude-based inference that referenced *Bayesian* with a dispersed uniform prior which was implemented in the spreadsheet accompanying the package of materials for generalised mixed modelling with SAS Studio (Hopkins, 2016a). Estimated magnitudes of difference in means and their 90% confidence limits were presented in standardised units, and were evaluated qualitatively with the following scale: trivial, 0-0.2; small, 0.2-0.6; moderate, 0.6-1.2; large, 1.2-2.0; and very large, >2.0 (Hopkins et al., 2009b). The likelihood of the effects to be clear was considered qualitatively as follows: 25%-75%, possibly; 75%-95%, likely; 95%-99.5%, very likely; and >99.5%, most likely (Hopkins et al., 2009b).

7.3 Results

Descriptive statistics (mean $\pm$ SD) of the 20 technical performance-related match variables for players from five European football leagues estimated by the generalised mixed linear model controlling the effects of playing position, game location, match type, game result and team and opposition strength are presented in Table 7.2. The estimated true effects (effect size $\pm$ 90% confidence interval) of differences within pairwise comparisons between any two of these five leagues are shown in Figure 7.1.

Table 7.2. Descriptive statistics of technical match performance of players from big five UEFA leagues estimated from the generalised mixed linear model. (n denotes the number of match observations, results are *mean $\pm$ between-player standard deviation*, units are counts, except for pass accuracy).

Variable	Bundesliga ($n = 2,021$)	La Liga ($n = 2,597$)	Ligue 1 ($n = 1,356$)	Premier League ($n = 2,303$)	Serie A ($n = 1,522$)
Shot	1.19 ± 1.56	0.95 ± 1.40	1.03 ± 1.45	0.93 ± 1.38	0.92 ± 1.38
Shot on target	0.38 ± 0.95	0.30 ± 0.91	0.33 ± 0.92	0.31 ± 0.91	0.30 ± 0.90
Touch	62.33 ± 20.96	61.57 ± 20.79	60.57 ± 20.55	61.34 ± 20.73	55.90 ± 19.45
Pass	45.55 ± 19.62	44.86 ± 19.41	42.85 ± 18.82	43.85 ± 19.12	39.25 ± 17.74
Pass accuracy (%)	81.16 ± 9.59	82.09 ± 9.66	81.17 ± 9.59	81.39 ± 9.61	79.06 ± 9.43
Key pass	0.89 ± 1.39	0.84 ± 1.36	0.85 ± 1.37	0.74 ± 1.29	0.83 ± 1.35
Cross	1.16 ± 2.66	1.04 ± 2.50	1.28 ± 2.82	1.02 ± 2.47	1.08 ± 2.54
Long ball	3.60 ± 3.32	3.38 ± 3.19	3.04 ± 3.00	3.34 ± 3.17	3.64 ± 3.34
Through ball	0.12 ± 0.99	0.15 ± 0.95	0.11 ± 1.02	0.13 ± 0.98	0.13 ± 0.97
Dribble	0.67 ± 1.40	0.70 ± 1.42	0.78 ± 1.50	0.87 ± 1.58	0.66 ± 1.39
Offside	0.11 ± 0.89	0.11 ± 0.90	0.12 ± 0.88	0.13 ± 0.87	0.14 ± 0.86
Aerial won	1.06 ± 1.66	1.04 ± 1.65	1.11 ± 1.70	1.13 ± 1.71	0.99 ± 1.61
Fouled	1.14 ± 1.41	1.22 ± 1.45	1.21 ± 1.44	1.05 ± 1.36	1.29 ± 1.48
Dispossessed	0.80 ± 1.30	0.89 ± 1.37	0.97 ± 1.42	0.98 ± 1.43	0.91 ± 1.38
Tackle	2.03 ± 1.89	1.98 ± 1.87	2.02 ± 1.89	1.86 ± 1.81	1.85 ± 1.81
Interception	1.55 ± 1.69	1.53 ± 1.68	1.72 ± 1.77	1.51 ± 1.67	1.58 ± 1.70
Clearance	1.48 ± 2.17	1.54 ± 2.20	1.45 ± 2.14	1.63 ± 2.27	1.69 ± 2.32
Blocked shot	0.20 ± 0.92	0.27 ± 0.93	0.24 ± 0.92	0.30 ± 0.94	0.29 ± 0.94
Foul	1.34 ± 1.47	1.29 ± 1.44	1.29 ± 1.44	1.34 ± 1.47	1.39 ± 1.49
Yellow card	0.17 ± 0.71	0.19 ± 0.70	0.18 ± 0.70	0.16 ± 0.71	0.20 ± 0.70

Figure 7.1. Standardised effects of differences in mean count of each match action or event between five UEFA leagues estimated from the generalised mixed linear modelling.

Bars are 90% confidence intervals. Asterisks indicate the likelihood for the magnitude of the true effect as follows: * possible; ** likely; *** very likely; **** most likely. Asterisks located in the area between -0.2 and 0.2 denote for trivial differences. ShotOT=shot on target; PA=pass accuracy in %; KP=key pass; LB=long ball; ThB=through ball; AW=aerial won; Disp=dispossessed; BS=Blocked shot; YC=yellow card.

Regarding the variables related to goal scoring, the number of shots of players from German Bundesliga was clearly higher than that of Spanish La Liga, English Premier League and Italian Serie A, while no substantial differences were observed among shots attempted by players of other four leagues. There were no clear differences ascertained in shot on target between players from all five leagues. No substantial differences were detected between players from Spanish La Liga, English Premier League and German Bundesliga when considering the variables related to passing and organizing. However, comparing to the players from other four leagues, players of Italian Serie A obtained lower number of touches, passes and achieved lower pass accuracy. Additionally, players from German Bundesliga and Italian Serie A achieved more long balls than players from French Ligue 1. Players from English Premier League had greater number of dribbles compared with those of players from Italian Serie A. Other pairwised comparisons across five leagues regarding variables related to passing and organising were trivial, Nevertheless, trivial differences were also observed between players from all five leagues in all variables related to defending.

7.4 Discussion

The current study quantified players' technical characteristics of the major five European football leagues based on one of the largest samples published to date (nine seasons) from the UEFA Champions League. In general, the differences in player's technical performance between five leagues were smaller than we expected from the stereotypical perspective. Differences were mainly focused on the variables related to

goal scoring, passing and organising, whereas differences in variables related to defending were all trivial.

It is important to emphasise that the findings in the present study are based on the methodology of generalised mixed linear modelling and the effects of situational variables on players' match performance were controlled, thus we found many disparities from prior studies. Our study suggests that players from Spanish La Liga, English Premier League and French Ligue 1 performed similar match performance and no substantial differences were observed in all technical variables, which is in contrast with the stereotypes and the characteristics proved in previous studies about players from Spanish La Liga and English Premier League. It was demonstrated in previous research that players from Spanish La Liga performed a more elaborated and skilled playing style while players from English Premier League prefer the direct playing style, they played in the toughest and fastest games with high demand in their physical ability (Dellal et al., 2011; Oberstone, 2011; Sarmiento et al., 2013b). In addition, a previous research from Oberstone (2011) reported that significant differences existed between Spanish La Liga and English Premier League in variables related to goal scoring and defending. Another research from Dellal et al. (2011) identified that these two leagues showed similar characteristics in passing performance. Nevertheless, French Ligue 1 has received comparatively less attention in existing studies about the comparisons between major European leagues probably due to the less competitiveness and distinct characteristic. While, the technical demands of players from French Ligue 1 were identified in the present study, which shares a similar feature with players from Spanish

La Liga and English Premier League in the UEFA Champions League from a long-term perspective. In a word, this finding may reveal a trend that the differences in technical performance among these three leagues decrease over time. This could potentially be attributed to the fact that an increasing level of migration of players and coaches between leagues (Littlewood et al., 2011; Maguire & Pearton, 2000; Maguire & Stead, 1998; Sarmiento et al., 2013b). Hence, the teams' playing style and players' technical characteristics were evolved and assimilated (Maguire & Pearton, 2000; Maguire & Stead, 1998).

Differences of technical performance between players from German Bundesliga, Spanish La Liga and English Premier League only observed in the number of shots. Players from German Bundesliga obtained most shots while the differences in shot on target were trivial among these three leagues, which partly contrast with research by Oberstone (2011) which showed that Spanish La Liga has higher goal efficiency than English Premier League. This finding demonstrates that players from German Bundesliga have the ability to create more scoring opportunities but achieved relatively lower shot accuracy. Considering the technical differences between players from German Bundesliga and French Ligue 1, we only found substantial difference in long balls. Players from German Bundesliga performed more long balls than players from French Ligue 1. Interestingly, the number of long balls from players from Italian Serie A was also substantially higher than those of French Ligue 1. Long balls are always linked with the direct playing style (Fernandez-Navarro et al., 2016; Lago-Peñas et al.,

2017). This finding may indicate that the direct play is in vogue in German Bundesliga and Italian Serie A using long aerial passes frequently.

Players from Italian Serie A showed comparatively greater technical difference during the comparisons between five leagues, especially in the aspect of passing and organizing. They achieved the lowest ball touches, passes and pass accuracy comparing to their counterparts from the other four leagues, which is in contrast with the prior study from Oberstone (2011) who indicated that Italian Serie A is a league with better passing compared with Spanish La Liga and English Premier League. The notion that teams from Italian Serie A are characterized by the direct playing style has been discussed above and reported by Sarmento et al. (2013b). Italian teams prefer to perform counter-attack and focus more on the tactical-defensive aspect (Oberstone, 2011; Sarmento et al., 2013b), which means that they initiative give up the ball control, thus the low number of touch and pass were obtained. In addition, long pass is a crucial element during the counter-attack process, the high frequencies of occurrence in long balls could influence the accuracy of pass (Liu, Gómez, et al., 2016).

Given the focus on the perspective of attacking. The popular assumption is that Spanish La Liga is primarily attacking and trying to control the match with high ball possession, while Italian Serie A has been characterized by its rigorous defensive tactics and relatively less developed and worse prepared in offensive aspect (Sarmento et al., 2013b). Conversely, the results of the present study showed that limited differences in attacking performances between players from five leagues. The only substantial

difference was detected in dribble between players of English Premier League and Italian Serie A. Dribble is a performance indicator that could reflect the degree of freedom of players during match play (Liu, Gómez, et al., 2016). In English Premier League, tactical and strategic aspects haven't been considered the same importance as in other leagues, while Italian Serie A has a special emphasis on its collective execution in the defensive organization and plays a conservative game (Sarmiento et al., 2013b). Therefore, players from English Premier League are given more freedom to perform technical skills (dribble) during the attacking process.

It was believed that teams in Italian Serie A are better in defending performance than other European teams (Sarmiento et al., 2013b). However, one noteworthy finding in this study is that players from all five leagues showed no substantial differences in defending performance. This may reveal a trend that teams are increasingly aware of the importance of a solid defense for winning a game, trying to keep a good balance between attacking and defending during match play. The introduction of a considerable number of foreign players and coaches may once again account for that why the differences that we expected didn't show in the current study. The foreign players that grown up in different youth academy systems have been instilled different conceptions about attacking and defending (Maguire & Pearton, 2000; Maguire & Stead, 1998), there will be an interplay between players from different countries when they play in the same team. Moreover, the migration of players and coaches between leagues may reduce the differences in players' physical abilities and teams' playing style between different leagues (Bloomfield et al., 2005; Sarmiento et al., 2013b). Therefore, these two

factors may explain that the defending variables are no longer the important indicators to differentiate the five leagues. In addition, the evolution of tactics and strategies may also play a role. The diversity of tactics and strategies in modern football enable teams to find a defensive tactic that suitable for their playing style in defense.

7.5 Conclusion

This study identified both similarities and disparities in various aspects of players' technical performance across major five European football leagues in the UEFA Champion League from a long-term perspective. Players from German Bundesliga were more advantageous than other leagues for creating scoring opportunity. Italian players did not show their advantage in defending performance but showed the worst performance in passing and organising. Players from Spanish La Liga and English Premier League have a balance performance in all aspects. However, the superiority of La Liga players in passing and organising was not detected and Premier League players are no longer playing the “aerial game” as we used to think from the stereotypical perspective. Little attention has been paid on the comparison of players from French Ligue 1 with other leagues, while our data suggested that their technical performance were similar to players from Spanish La Liga and English Premier League, but they prefer shot pass during the attacking process. These technical differences largely driven by the differences in culture, playing style, players' characteristics and coach's philosophy. Nevertheless, the evolution of tactics and strategies, the migration of players and coaches and the different systems in youth academy may also play a role. The technical characteristics for players from each league have been identified, thus the

technical profiles could be created, which can provide a more thorough understanding for stakeholders in talent identification, player recruitment the preparation of matches against with foreign teams. However, the limitation of this study is that the differences of physical performance between players from major five European football leagues were not measured due to the availability of match data.

Chapter Eight—Overall Conclusions

The general aim of this PhD thesis was to evaluate the technical and tactical performances from team and player perspectives based on match-related statistics of elite football competitions (UEFA Champions League and FIFA World Cup), and the efficiency of situational variables (competition stage, match location, quality of team, quality of opponent and match outcome) was taken into deep account. Existing literature has been investigated the match performance of team and player from various aspects trying to extract the key information from the dynamic and complex match, and to interpret and evaluate the playing behaviours during match play. Situational variables have received increasing attention in performance analysis and have improved the applicability of the research findings. However, the effects of situational variables should be addressed properly according to the purpose of the research. In the current PhD thesis, the effects of situational variables have been fully considered in Chapter two, four and five for the identification of key performance indicators (KPI), establishment of performance profiles and evaluation of match-to-match variation. In contrast, these effects were controlled in the comparative analyses from Chapter three, six and seven to compare the pure differences between teams and players (see Figure 8.1).

Figure 8.1 Overview of the effect of situational variable in the thesis.

This section summarised the main findings from Chapters two to seven and presented them from the perspectives of team and player, respectively. Moreover, innovative points, practical applications, limitations and further research lines of the current PhD thesis were also discussed.

8.1 Summary of Main Findings

8.1.1 Team Level

- (1) Teams that qualified to the knockout stage of UEFA Champions League displayed lower match-to-match variation than non-qualified teams on variables related to goal scoring, attacking and passing. Non-qualified teams showed lower variability on variables related to defending. The variability of variables related to goal scoring, attacking and passing showed negative relationships with teams' match performance. Nevertheless, positive relationships were observed between the

variability of variables related to defending displayed and teams' match performance.

- (2) Most of the teams that qualified to the knockout stage of the 2018 FIFA World Cup adopted both direct play and possession tactical approaches in different competing contexts, but they prefer to the possession play. Possession-play characterised teams obtained higher numbers in variables related to goal scoring, attacking and passing, covered more distances in high-intensity running activity. Nevertheless, direct-play characterised teams displayed superiorities in variables related to defending. Furthermore, the differences for both direct-play and possession-play characterised teams when playing against direct-play and possession-play characterised opponents were mainly found in variables related to attacking and passing. Possession-play characterised teams covered more distance in stand and walking when playing with direct-play characterised teams than playing with possession-play characterised teams.

8.1.2 Player Level

- (1) Each of the five situational variables, competition stage, match location, quality of team, quality of opponent, and match result, has a significant influence on players from all five playing positions. The technical performance and technical variation of each playing position were also different in five competing contexts. However, there is an exception that the effect of competition stage on players' technical performance is limited. Situational variables that related to strength of team (quality

of team, quality of opponent and match outcome) showed similar trends and have relatively stronger effects on player's technical performance and technical variability than other situational variables. Besides, variables related to goal scoring and variables related to passing and organising displayed relatively greater differences than variables related to attacking and defending in players' technical performance and technical variation under five competing contexts.

(2) The differences of technical demands between central defenders, full backs, wide midfielders, central midfielders, and forwards are substantial when controlling the effects of situational factors. The greatest difference was observed between central defenders and forwards while the smallest difference can be found between central defenders and full backs. Wide midfielders achieved better performance than central midfielders in passing and organising, but players from these two playing positions are more involved in the attacking process in the opponent's area. The tactics in modern football competition require defenders to be involved more in the link-up and attacking phase as the launching point of the attack, forwards are also given more defensive tasks in the initial defending phase.

(3) The differences of technical demands between players from major five European football leagues are identified based on the match data from the UEFA Champions League. Differences were mainly detected in the variables related to goal scoring, passing and organising while no substantial differences can be found in variables related to defending. Specifically, no substantial differences of technical

performance can be found between players from La Liga, Premier League and Ligue 1. Players from German Bundesliga are more capable of creating scoring opportunity. Italian players displayed the lowest frequencies in variables related to passing and organising and their traditional strength in defending is disappeared. Players from all five leagues showed trivial differences in variables related to defending. Players from English Premier League and Spanish La Liga performed a balanced technical performance.

8.2 Innovative Points

The innovative research conducted in the present PhD thesis can be summarized into following two points:

- (1) This PhD thesis provides a novel insight into the analysis of variability of match performance. Previous studies were mainly focused on the comparison of the differences in match-to-match variation between players under different competing situations (Bush, Archer, et al., 2015; Liu, Gómez, et al., 2016; Rampinini et al., 2007). However, the analysis in the Chapter two employed correlation analysis to identify the relationships between the variation of technical variables and teams' match performance in the group stage of UEFA Champions League. Then, some key performance indicators such as possession, pass success and through ball were identified. Furthermore, a predictive analysis was conducted using generalised linear model to predict the effects of the match variation of teams' technical

variables on the probability of qualifying to the knockout stage, and the key performance indicators could be identified as well.

(2) Chapter three, six and seven employed the generalised mixed linear modelling to identify the differences in technical and tactical performance between players from different playing positions and leagues, and between different playing styles. The effects of situational variables could be controlled to identify the pure differences between teams and players. Moreover, the repeated-measured data of teams and players from multiple matches could be addressed in a more objective way. These methodological issues were not accounted for in previous studies.

8.3 Practical Applications

The findings of the current PhD thesis may provide practical insights for coaches and practitioners in following aspects:

(1) Coaches can get a holistic insight into the variability of technical performance of teams and players from the findings of Chapter two and five. The match-to-match variation of technical variables between teams and players were compared considering the situational effects. Thus, the stability of technical performance of teams and players under different competing contexts could be identified. This could provide important references for coaches when designing training sessions. Special attention should be paid on those key performance indicators identified based on the coefficient of variation to develop specific training interventions, as their variability could significantly affect the match performance of teams and

players. For example, improving the stability in the indicator of pass accuracy is an effective way for both strong and weak teams to increase the probability of winning a match.

(2) The established performance profiles in Chapters three and four may provide a useful tool for pre-match preparation and post-match evaluation. As the playing positions and situational variables were all considered in the performance profiles, this can help coaches to develop the applicable tactics and strategies and to select the right players considering the conditions of the next match. They are also important feedback tools for evaluating the match performance of teams and players after a match, and then the match performance could be improved by developing position-specific interventions in the coaching process. In addition, the player's recruitment and talent identification may also benefit from these performance profiles by integrating and comparing the player's match data with that of a player in the same position in the profiles.

(3) Chapters two, six and seven identified the differences between teams that characterised different playing styles and between players from different playing positions and leagues respectively. The findings from Chapter three can be used for the process of players' recruitment who are suitable for the team's playing style, and for the scouting of upcoming opponent providing inference to the tactical preparation when playing against teams characterised by different playing styles. Chapter six identified the technical demands of different playing positions, which

may contribute to the identification of the roles and responsibilities of different playing positions during match play. Indicators that were associated with a specific playing position can be monitored and evaluated to ease the individualization of training. The technical characteristics of players from different leagues were identified in Chapter seven. These findings could be used for the recruitment of foreign players and match preparation when playing against teams from other leagues and countries during international competitions.

8.4 Limitations and Further Research Lines

- (1) Regarding the research content of this thesis, more attention has been paid on the player level while the match performance of teams needs a deeper investigation. For example, establishing the technical match performance profiles and technical match-to-match variation profiles and identifying the differences of technical performance of teams from different European leagues. Besides, the key performance indicators of players should also be identified.
- (2) The effect of team strength was considered in the investigation of teams' technical match-to-match variation. However, competition stage, match location, opposition strength and match results are also important situational factors, which could be considered in the further analysis to create detailed technical performance profiles and technical variation profiles for teams. Nevertheless, there are some limitations when establishing the detailed performance profiles. In the current thesis, twenty-five technical variables of players from five playing positions were used to establish

the technical match performance profiles and technical variation profiles under five match situations. There are 625 pairwise comparisons conducted, which may probably result in an increase of type I errors. Thus, this problem should be paid more attention to further research.

(3) The study in chapter two used the generalised linear model to identify the relationships between teams' technical variation and their match performance in the group stage of the UEFA Champions League. However, this analysis failed to consider the situational factors, which may restrict the applicability of findings. Therefore, the investigation of key performance indicators should be conducted under different match contexts. This may provide important insights into the training session and contributing to the prediction of future performance. Furthermore, the analysis on positional data could be valuable for future research to develop complex key performance indicators.

(4) The analysis in Chapter three is based on 59 matches from the 2018 FIFA World Cup. The limited sample size caused non-significant (unclear) differences in some indicators between teams. Moreover, this limitation may restrict further investigation to take the effects of playing positions into account.

(5) The current thesis is accomplished based on the match data collected from multiple seasons (eight/nine seasons). However, it failed to identify the evolution of match performance of teams and players. This study could be conducted in the future to explore the long-term trend of match play.

References

- Alberti, G., Iaia, F. M., Arcelli, E., Cavaggioni, L., & Rampinini, E. (2013). Goal scoring patterns in major European soccer leagues. *Sport Sciences for Health*, 9(3), 151-153.
- 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(1), 203-214.
- Atkinson, G., & Nevill, A. M. (1998). Statistical methods for assessing measurement error (reliability) in variables relevant to sports medicine. *Sports Medicine*, 26(4), 217-238.
- Bangsbo, J., & Peitersen, B. (2000). *Soccer systems and strategies*: Human Kinetics.
- Barnes, C., Archer, D., Hogg, B., Bush, M., & Bradley, P. (2014). The evolution of physical and technical performance parameters in the English Premier League. *International Journal of Sports Medicine*, 35(13), 1095-1100.
- Barros, R. M., Misuta, M. S., Menezes, R. P., Figueroa, P. J., Moura, F. A., Cunha, S. A., . . . Leite, N. J. (2007). Analysis of the distances covered by first division Brazilian soccer players obtained with an automatic tracking method. *Journal of Sports Science & Medicine*, 6(2), 233-242.
- Batterham, A. M., & Hopkins, W. G. (2006). Making meaningful inferences about magnitudes. *International Journal of Sports Physiology and Performance*, 1(1), 50-57.

- Bloomfield, J., Polman, R., Butterly, R., & O'Donoghue, P. (2005). Analysis of age, stature, body mass, BMI and quality of elite soccer players from 4 European Leagues. *Journal of Sports Medicine and Physical Fitness*, 45(1),58-67.
- Bloomfield, J., Polman, R., & O'Donoghue, P. (2007). Physical demands of different positions in FA Premier League soccer. *Journal of Sports Science & Medicine*, 6(1),63-70.
- Boone, J., Vaeyens, R., Steyaert, A., Bossche, L. V., & Bourgois, J. (2012). Physical fitness of elite Belgian soccer players by player position. *The Journal of Strength & Conditioning Research*, 26(8), 2051-2057.
- Bradley, P. S., Carling, C., Archer, D., Roberts, J., Dodds, A., Di Mascio, M., . . . Krstrup, P. (2011). The effect of playing formation on high-intensity running and technical profiles in English FA Premier League soccer matches. *Journal of Sports Sciences*, 29(8), 821-830.
- Bradley, P. S., Lago-Peñas, C., Rey, E., & Gomez Diaz, A. (2013). The effect of high and low percentage ball possession on physical and technical profiles in English FA Premier League soccer matches. *Journal of Sports Sciences*, 31(12), 1261-1270.
- Bradley, P. S., Sheldon, W., Wooster, B., Olsen, P., Boanas, P., & Krstrup, P. (2009). High-intensity running in English FA Premier League soccer matches. *Journal of Sports Sciences*, 27(2), 159-168.
- Brandes, L., & Franck, E. (2007). Who made who? An empirical analysis of competitive balance in European soccer leagues. *Eastern Economic Journal*, 33(3), 379-403.

- Brockwell, P. J., & Davis, R. A. (2013). *Time series: theory and methods*: Springer Science & Business Media.
- Brustad, R. J., & Ritter-Taylor, M. (1997). Applying social psychological perspectives to the sport psychology consulting process. *The Sport Psychologist*, 11(1), 107-119.
- Bush, Archer, D. T., Hogg, R., & Bradley, P. S. (2015). Factors influencing physical and technical variability in the English Premier League. *International journal of sports physiology and performance*, 10(7), 865-872.
- Bush, Barnes, C., Archer, D. T., Hogg, B., & Bradley, P. S. (2015). Evolution of match performance parameters for various playing positions in the English Premier League. *Human Movement Science*, 39, 1-11.
- Butterworth, A., O'Donoghue, P., & Cropley, B. (2013). Performance profiling in sports coaching: a review. *International Journal of Performance Analysis in Sport*, 13(3), 572-593.
- Carling, C. (2010). Analysis of physical activity profiles when running with the ball in a professional soccer team. *Journal of Sports Sciences*, 28(3), 319-326.
- Carling, C., Bradley, P., McCall, A., & Dupont, G. (2016). Match-to-match variability in high-speed running activity in a professional soccer team. *Journal of Sports Sciences*, 34(24), 2215-2223.
- Carling, C., Reilly, T., & Williams, A. M. (2008). *Performance assessment for field sports*. London: Routledge.
- Castellano, J., Casamichana, D., & Lago, C. (2012). The use of match statistics that discriminate between successful and unsuccessful soccer teams. *Journal of Human Kinetics*, 31, 137-147.

- Chassy, P. (2013). Team play in football: How science supports FC Barcelona's training strategy. *Psychology*, 4(09), 7-12.
- 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.
- Crolley, L., Hand, D., & Jeutter, R. (2000). Playing the identity card: Stereotypes in European football. *Soccer & Society*, 1(2), 107-128.
- Cushion, C. (2007). Modelling the complexity of the coaching process. *International Journal of Sports Science & Coaching*, 2(4), 395-401.
- Da Mota, G., Thiengo, C. R., Gimenes, S. V., & Bradley, P. S. (2015). The effects of ball possession status on physical and technical indicators during the 2014 FIFA World Cup Finals. *Journal of Sports Sciences*, 34(6), 493-500.
- da Mota, G. R., Thiengo, C. R., Gimenes, S. V., & Bradley, P. S. (2016). The effects of ball possession status on physical and technical indicators during the 2014 FIFA World Cup Finals. *Journal of Sports Sciences*, 34(6), 493-500.
- Dellal, A., Chamari, K., Pintus, A., Girard, O., Cotte, T., & Keller, D. (2008). Heart rate responses during small-sided games and short intermittent running training in elite soccer players: a comparative study. *The Journal of Strength & Conditioning Research*, 22(5), 1449-1457.
- Dellal, A., Chamari, K., Wong, d. P., Ahmaidi, S., Keller, D., Barros, R., . . . Carling, C. (2011). Comparison of physical and technical performance in European soccer match-play: FA Premier League and La Liga. *European Journal of Sport Science*, 11(1), 51-59.

- Dellal, A., Wong, d. P., Moalla, W., & Chamari, K. (2010). Physical and technical activity of soccer players in the French First League-with special reference to their playing position. *International SportMed Journal*, 11(2), 278-290.
- Di Mascio, M., & Bradley, P. S. (2013). Evaluation of the most intense high-intensity running period in English FA premier league soccer matches. *The Journal of Strength & Conditioning Research*, 27(4), 909-915.
- Di Salvo, V., Baron, R., Tschan, H., Montero, F. C., Bachl, N., & Pigozzi, F. (2007). Performance characteristics according to playing position in elite soccer. *International Journal of Sports Medicine*, 28(03), 222-227.
- 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.
- Doyle, J., & Parfitt, G. (1996). Performance profiling and predictive validity. *Journal of Applied Sport Psychology*, 8(2), 160-170.
- Drust, B. (2010). Performance analysis research: Meeting the challenge: Routledge.
- Drust, B., Atkinson, G., & Reilly, T. (2007). Future perspectives in the evaluation of the physiological demands of soccer. *Sports Medicine*, 37(9), 783-805.
- Eccles, D. W., Ward, P., & Woodman, T. (2009). Competition-specific preparation and expert performance. *Psychology of Sport and Exercise*, 10(1), 96-107.
- Fernandez-Navarro, J., Fradua, L., Zubillaga, A., Ford, P. R., & McRobert, A. P. (2016). Attacking and defensive styles of play in soccer: analysis of Spanish and English elite teams. *Journal of Sports Sciences*, 34(24), 2195-2204.
- FIFA. (2018). 2018 FIFA World Cup Russia. Retrieved July 20, 2018, from <https://www.fifa.com/worldcup/index.html>. Retrieved 07.20, 2018

- Frick, B. (2007). THE FOOTBALL PLAYERS'LABOR MARKET: EMPIRICAL EVIDENCE FROM THE MAJOR EUROPEAN LEAGUES. *Scottish Journal of Political Economy*, 54(3), 422-446.
- Fullerton, H. (1912). The inside game: the science of baseball. *The American Magazine*, 70, 2-13.
- Garganta, J. (2009). Trends of tactical performance analysis in team sports: bridging the gap between research, training and competition. *Revista Portuguesa de Ciências do Desporto*, 9(1), 81-89.
- Garganta, J., Maia, J., & Basto, F. (1997). Analysis of goal-scoring patterns in European top level soccer teams. *Science and football III*, 246-250.
- Glazier, P. S. (2017). Towards a grand unified theory of sports performance. *Human Movement Science*, 56, 139-156.
- Goig, R. L. (2008). Identity, nation-state and football in Spain. the evolution of nationalist feelings in Spanish Football. *Soccer & Society*, 9(1), 56-63.
- Gómez, M., Lago, C., & Pollard, R. (2013). Situational variables. In McGarry T, O'Donoghue P, and Sampaio J (Eds.) *Routledge handbook of sports performance analysis* (259-269). London: Routledge.
- Gregson, W., Drust, B., Atkinson, G., & Salvo, V. (2010). Match-to-match variability of high-speed activities in premier league soccer. *International Journal of Sports Medicine*, 31(04), 237-242.
- Grehaigine, J.-F., Bouthier, D., & David, B. (1997). Dynamic-system analysis of opponent relationships in collective actions in soccer. *Journal of Sports Sciences*, 15(2), 137-149.

- Harriss, D. J., & Atkinson, G. (2009). International Journal of Sports Medicine – Ethical Standards in Sport and Exercise Science Research. *International Journal of Sports Medicine*, 30(10), 701-702.
- Hewitt, A., Greenham, G., & Norton, K. (2016). Game style in soccer: what is it and can we quantify it? *International Journal of Performance Analysis in Sport*, 16(1), 355-372.
- Higham, D. G., Hopkins, W. G., Pyne, D. B., & Anson, J. M. (2014). Performance indicators related to points scoring and winning in international rugby sevens. *Journal of Sports Science & Medicine*, 13(2), 358-364.
- Hopkins. (2007). A spreadsheet to compare means of two groups. *Sportscience*, 11, 22-24.
- Hopkins, Marshall, S., Batterham, A., & Hanin, J. (2009a). Progressive statistics for studies in sports medicine and exercise science. *Medicine+ Science in Sports+ Exercise*, 41(1), 3.
- Hopkins, W. (2016a). SAS (and R) for mixed models. Spreadsheet: process Poisson and logistic repeated measures. *Sportscience*, 20, iii.
- Hopkins, W., Marshall, S., Batterham, A., & Hanin, J. (2009b). Progressive statistics for studies in sports medicine and exercise science. *Medicine+ Science in Sports+ Exercise*, 41(1), 3.
- Hopkins, W. G. (2000). Measures of reliability in sports medicine and science. *Sports Medicine*, 30(1), 1-15.
- Hopkins, W. G. (2002). A scale of magnitudes for effect statistics. *A new view of statistics*, 502.
- Hopkins, W. G. (2016b). SAS (and R) for mixed models. *Sportscience*, 20(iii).

- Hopkins, W. G., Marshall, S. W., Batterham, A. M., & Hanin, J. (2009c). Progressive statistics for studies in sports medicine and exercise science. *Medicine and Science in Sports and Exercise*, 41(1), 3-13.
- Hughes, M. (1988). Comparison of patterns of play of successful and unsuccessful teams in the 1986 World Cup for soccer. *Science and football*.
- Hughes, M., Caudrelier, T., James, N., Redwood-Brown, A., Donnelly, I., Kirkbride, A., & Duschesne, C. (2012). Moneyball and soccer-an analysis of the key performance indicators of elite male soccer players by position. *Journal of Human Sport and Exercise*, 7(2).
- Hughes, M., Evans, S., & Wells, J. (2001). Establishing normative profiles in performance analysis. *International Journal of Performance Analysis in Sport*, 1(1), 1-26.
- Hughes, M., & Franks, I. (2005). Analysis of passing sequences, shots and goals in soccer. *Journal of Sports Sciences*, 23(5), 509-514.
- Hughes, M., & Franks, I. (2007). *The essentials of performance analysis: an introduction*: Routledge.
- Hughes, M. D., & Bartlett, R. M. (2002). The use of performance indicators in performance analysis. *Journal of Sports Sciences*, 20(10), 739-754.
- James, N., Mellalieu, S. D., & Jones, N. M. (2005). The development of position-specific performance indicators in professional rugby union. *Journal of Sports Sciences*, 23(1), 63-72.
- Jones, P., James, N., & Mellalieu, S. D. (2004). Possession as a performance indicator in soccer. *International Journal of Performance Analysis in Sport*, 4(1), 98-102.

- Kamm, K., Thelen, E., & Jensen, J. L. (1990). A dynamical systems approach to motor development. *Physical Therapy*, 70(12), 763-775.
- Kempe, M., Vogelbein, M., Memmert, D., & Nopp, S. (2014). Possession vs. direct play: evaluating tactical behavior in elite soccer. *International Journal of Sports Science*, 4(6A), 35-41.
- Kempton, T., Sullivan, C., Bilsborough, J. C., Cordy, J., & Coutts, A. J. (2015). Match-to-match variation in physical activity and technical skill measures in professional Australian Football. *Journal of Science and Medicine in Sport*, 18(1), 109-113.
- Kudo, K., & Ohtsuki, T. (2008). Adaptive variability in skilled human movements. *Transactions of the Japanese Society for Artificial Intelligence*, 23(3), 151-162.
- Kuhn, T. (2005). Changes in professional soccer: a qualitative and quantitative study. *Science and football V*, 184-195.
- 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.
- Lago, C., Casais, L., Dominguez, E., & Sampaio, J. (2010). The effects of situational variables on distance covered at various speeds in elite soccer. *European Journal of Sport Science*, 10(2), 103-109.
- Lago, C., & Martín, R. (2007). Determinants of possession of the ball in soccer. *Journal of Sports Sciences*, 25(9), 969-974.
- Lago-Ballesteros, J., & Lago-Peñas, C. (2010). Performance in team sports: Identifying the keys to success in soccer. *Journal of Human Kinetics*, 25, 85-91.

- 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.
- Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez. (2010a). 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.
- Lago-Peñas, C., Casais, L., Dellal, A., Rey, E., & Domínguez, E. (2011). Anthropometric and physiological characteristics of young soccer players according to their playing positions: relevance for competition success. *The Journal of Strength & Conditioning Research*, 25(12), 3358-3367.
- Lago-Peñas, C., & Dellal, A. (2010). Ball possession strategies in elite soccer according to the evolution of the match-score: the influence of situational variables. *Journal of Human Kinetics*, 25, 93-100.
- Lago-Peñas, C., Gómez-Ruano, M., Megías-Navarro, D., & Pollard, R. (2016). Home advantage in football: Examining the effect of scoring first on match outcome in the five major European leagues. *International Journal of Performance Analysis in Sport*, 16(2), 411-421.
- Lago-Peñas, C., Gómez-Ruano, M., & Yang, G. (2017). Styles of play in professional soccer: an approach of the Chinese Soccer Super League. *International Journal of Performance Analysis in Sport*, 17(6), 1073-1084.
- Lago-Peñas, C., & Lago-Ballesteros, J. (2011). Game location and team quality effects on performance profiles in professional soccer. *Journal of sports science & medicine*, 10(3), 465-471.

- Lago-Peñas, C., Lago-Ballesteros, J., Dellal, A., & Gómez, M. (2010b). Game-related statistics that discriminated winning, drawing and losing teams from the Spanish soccer league. *Journal of Sports Science & Medicine*, 9(2), 288-293.
- Lago-Peñas, C., Lago-Ballesteros, J., & Rey, E. (2011). Differences in performance indicators between winning and losing teams in the UEFA Champions League. *Journal of human kinetics*, 27, 135-146.
- Lauder, A. G., & Piltz, W. (2013). *Play practice: Engaging and developing skilled players from beginner to elite*. Champaign, IL: Human Kinetics.
- Linke, D., Link, D., & Lames, M. (2018). Validation of electronic performance and tracking systems EPTS under field conditions. *PloS one*, 13(7), e0199519.
- Littlewood, M., Mullen, C., & Richardson, D. (2011). Football labour migration: An examination of the player recruitment strategies of the 'big five' European football leagues 2004–5 to 2008–9. *Soccer & Society*, 12(6), 788-805.
- Liu, H., & Gómez, M.-A. (2014). *Relationships between match performance indicators and match outcome in 2014 Brazil FIFA world cup*. Paper presented at the VIII Congreso Intemacional de la Asociacion Espano-la de Ciencias del Deporte.
- Liu, H., Gómez, M.-A., Gonçalves, B., & Sampaio, J. (2016). Technical performance and match-to-match variation in elite football teams. *Journal of Sports Sciences*, 34(6), 509-518.
- 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.

- Liu, H., Hopkins, W., Gómez, A. M., & Molinuevo, S. J. (2013). Inter-operator reliability of live football match statistics from OPTA Sportsdata. *International Journal of Performance Analysis in Sport*, 13(3), 803-821.
- Liu, H., Hopkins, W. G., & Gómez, M.-A. (2016). Modelling relationships between match events and match outcome in elite football. *European Journal of Sport Science*, 16(5), 516-525.
- Liu, H., Yi, Q., Giménez, J.-V., Gómez, M.-A., & Lago-Peñas, C. (2015). Performance profiles of football teams in the UEFA Champions League considering situational efficiency. *International Journal of Performance Analysis in Sport*, 15(1), 371-390.
- Liu, H. Y., Yi, Q., Gimenez, J. V., Gomez, M. A., & Lago-Penas, C. (2015). Performance profiles of football teams in the UEFA Champions League considering situational efficiency. *International Journal of Performance Analysis in Sport*, 15(1), 371-390.
- Mackenzie, R., & Cushion, C. (2013). Performance analysis in football: A critical review and implications for future research. *Journal of Sports Sciences*, 31(6), 639-676.
- Maguire, J., & Pearton, R. (2000). The impact of elite labour migration on the identification, selection and development of European soccer players. *Journal of Sports Sciences*, 18(9), 759-769.
- Maguire, J., & Stead, D. (1998). Border crossings: Soccer labour migration and the European Union. *International Review for the Sociology of Sport*, 33(1), 59-73.

- Mao, L., Peng, Z., Liu, H., & Gómez, M. A. (2016). Identifying keys to win in the Chinese professional soccer league. *International Journal of Performance Analysis in Sport*, 16(3), 935-947.
- McGarry, T., & Franks, I. M. (1994). A stochastic approach to predicting competition squash match-play. *Journal of Sports Sciences*, 12(6), 573-584.
- McGarry, T., O'Donoghue, P., & Sampaio, J. (2013). *Routledge handbook of sports performance analysis*. London: Routledge.
- McGarry, T., O'Donoghue, P., Sampaio, J., & de Eira Sampaio, A. J. (2013). *Routledge handbook of sports performance analysis*. London: Routledge.
- Memmert, D., Lemmink, K. A., & Sampaio, J. (2017). Current approaches to tactical performance analyses in soccer using position data. *Sports Medicine*, 47(1), 1-10.
- Memmert, D., & Raabe, D. (2018). *Data Analytics in Football: Positional Data Collection, Modelling and Analysis*: Routledge.
- Memmert, D., & Rein, R. (2018). Match Analysis, Big Data and Tactics: Current Trends in Elite Soccer. *Deutsche Zeitschrift für Sportmedizin*, 69(3), 65-72.
- Mohr, M., Krstrup, P., & Bangsbo, J. (2003). Match performance of high-standard soccer players with special reference to development of fatigue. *Journal of Sports Sciences*, 21(7), 519-528.
- Mohr, M., Krstrup, P., & Bangsbo, J. (2005). Fatigue in soccer: a brief review. *Journal of Sports Sciences*, 23(6), 593-599.
- Moura, F. A., Martins, L. E. B., Anido, R. O., Ruffino, P. R. C., Barros, R. M., & Cunha, S. A. (2013). A spectral analysis of team dynamics and tactics in Brazilian football. *Journal of Sports Sciences*, 31(14), 1568-1577.

- Nassis, G. P., Brito, J., Dvorak, J., Chalabi, H., & Racinais, S. (2015). The association of environmental heat stress with performance: analysis of the 2014 FIFA World Cup Brazil. *British Journal of Sports Medicine*, 49(9), 609-613.
- Newell, K. M., & Vaillancourt, D. E. (2001). Dimensional change in motor learning. *Human Movement Science*, 20(4-5), 695-715.
- O'Donoghue, P. (2009). *Research methods for sports performance analysis*. London: Routledge.
- O'Donoghue, P. (2013). *Statistics for sport and exercise studies: an introduction*. London: Routledge.
- O'Donoghue, P. (2014). *An introduction to performance analysis of sport*. London: Routledge.
- O'Donoghue, P. (2005). Normative profiles of sports performance. *International Journal of Performance Analysis in Sport*, 5(1), 104-119.
- O'Donoghue, P., & Mayes, A. (2013). Performance analysis, feedback and communication in coaching. In McGarry T, O'Donoghue P, and Sampaio J (Eds.) *Routledge handbook of sports performance analysis* (pp. 173-182). London: Routledge.
- Oberstone, J. (2009). Differentiating the Top English Premier League Football Clubs from the Rest of the Pack: Identifying the Keys to Success. *Journal of Quantitative Analysis in Sports*, 5(3).
- Oberstone, J. (2011). Comparing team performance of the English premier league, Serie A, and La Liga for the 2008-2009 season. *Journal of Quantitative Analysis in Sports*, 7(1).

- Pawlowski, T., Breuer, C., & Hovemann, A. (2010). Top clubs' performance and the competitive situation in European domestic football competitions. *Journal of Sports Economics*, 11(2), 186-202.
- Pena, J. L., & Touchette, H. (2012). A network theory analysis of football strategies. *arXiv preprint arXiv:1206.6904*.
- Perl, J., & Memmert, D. (2017). A Pilot Study on Offensive Success in Soccer Based on Space and Ball Control—Key Performance Indicators and Key to Understand Game Dynamics. *International Journal of Computer Science in Sport*, 16(1), 65-75.
- Phillips, K. E., & Hopkins, W. G. (2017). Performance Relationships in Timed and Mass-Start Events for Elite Omnium Cyclists. *International Journal of Sports Physiology & Performance*, 12(5), 628-633.
- Pollard, R. (2002). Charles Reep (1904-2002): pioneer of notational and performance analysis in football. *Journal of Sports Sciences*, 20(10), 853-855.
- Pollard, R., & Gómez, M. A. (2009). Home advantage in football in South-West Europe: Long-term trends, regional variation, and team differences. *European Journal of Sport Science*, 9(6), 341-352.
- Pollard, R., Reep, C., & Hartley, S. (1988). The quantitative comparison of playing styles in soccer. *Science and football*, 309-315.
- Prieto, J., García, J., & Ibáñez, S. J. (2017). Scoring coordination patterns in basketball international championships of national teams. *Revista de Psicología del Deporte*, 26(1), 27-32.

- Rampinini, E., Coutts, A. J., Castagna, C., Sassi, R., & Impellizzeri, F. M. (2007). Variation in top level soccer match performance. *International Journal of Sports Medicine*, 28(12), 1018-1024.
- Reep, C., & Benjamin, B. (1968). Skill and chance in association football. *Journal of the Royal Statistical Society. Series A (General)*, 131(4), 581-585.
- Reilly, T., Bangsbo, J., & Franks, A. (2000). Anthropometric and physiological predispositions for elite soccer. *Journal of Sports Sciences*, 18(9), 669-683.
- Reilly, T., & Williams, A. M. (2003). *Science and soccer*: Routledge.
- Rein, R., & Memmert, D. (2016). Big data and tactical analysis in elite soccer: future challenges and opportunities for sports science. *SpringerPlus*, 5(1), 1410.
- Sapp, R. M., Spangenburg, E. E., & Hagberg, J. M. (2018). Trends in aggressive play and refereeing among the top five European soccer leagues. *Journal of Sports Sciences*, 36(12), 1346-1354.
- Sarmiento, H., Clemente, F. M., Araújo, D., Davids, K., McRobert, A., & Figueiredo, A. (2017). What Performance Analysts Need to Know About Research Trends in Association Football (2012–2016): A Systematic Review. *Sports Medicine*, 4, 799-836.
- Sarmiento, H., Pereira, A., Matos, N., Campaniço, J., Anguera, T. M., & Leitão, J. (2013a). English Premier League, Spain's La Liga and Italy's Serie A – What's Different? *International Journal of Performance Analysis in Sport*, 13(3), 773-789.
- Sarmiento, H., Pereira, A., Matos, N., Campaniço, J., Anguera, T. M., & Leitão, J. (2013b). English Premier League, Spain's La Liga and Italy's Serie A – What's

- Different? *International Journal of Performance Analysis in Sport*, 13(3), 773-789.
- Shafizadeh, M., Taylor, M., & Peñas, C. L. (2013). Performance consistency of international soccer teams in Euro 2012: A time series analysis. *Journal of Human Kinetics*, 38, 213-226.
- Stergiou, N., Yu, Y., & Kyvelidou, A. (2013). A perspective on human movement variability with applications in infancy motor development. *Kinesiology Review*, 2(1), 93-102.
- Taylor, B. J., Mellalieu, D. S., James, N., & Barter, P. (2010). Situation variable effects and tactical performance in professional association football. *International Journal of Performance Analysis in Sport*, 10(3), 255-269.
- Taylor, J. B., Mellalieu, S. D., & James, N. (2004). Behavioural comparisons of positional demands in professional soccer. *International Journal of Performance Analysis in Sport*, 4(1), 81-97.
- Taylor, J. B., Mellalieu, S. D., James, N., & Shearer, D. A. (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.
- Tenga, A., Holme, I., Ronglan, L. T., & Bahr, R. (2010a). Effect of playing tactics on achieving score-box possessions in a random series of team possessions from Norwegian professional soccer matches. *Journal of Sports Sciences*, 28(3), 245-255.

- Tenga, A., Holme, I., Ronglan, L. T., & Bahr, R. (2010b). Effect of playing tactics on goal scoring in Norwegian professional soccer. *Journal of Sports Sciences*, 28(3),237-244.
- Vaeyens, R., Lenoir, M., Williams, A. M., & Philippaerts, R. M. (2008). Talent identification and development programmes in sport. *Sports Medicine*,38(9), 703-714.
- Vale, P., Ramos, A., Salgado, B., Correia, P., Martins, P., Brito, J., . . . Rebelo, A. (2009). *Differences in technical skill performance of Portuguese junior soccer players according to competitive level and playing position*. Paper presented at the International Research in Science and Soccer The Proceedings of the First World Conference on Science and Soccer.
- Van Lingen, B. (1998). *Coaching soccer: The official coaching book of the Dutch Soccer Association*: Reedswain.
- Wade, A. (1998). *Principles of team play*: Reedswain Inc.
- Waldén, M., Häggglund, M., & Ekstrand, J. (2005). UEFA Champions League study: a prospective study of injuries in professional football during the 2001–2002 season. *British Journal of Sports Medicine*, 39(8),542-546.
- Wells, J., O'Donoghue, P., & Hughes, M. (2004). *The need to use representative player data from multiple matches in performance analysis*. Paper presented at the World Congress of Performance Analysis in Sport VI, Belfast, 22nd-25th June.
- Wiemeyer, J. (2017). Who should play in which position in soccer? Empirical evidence and unconventional modelling. *International Journal of Performance Analysis in Sport*, 3(1),1-18.

- Wright, C., Atkins, S., Polman, R., Jones, B., & Sargeson, L. (2011). Factors associated with goals and goal scoring opportunities in professional soccer. *International Journal of Performance Analysis in Sport*, 11(3),438-449.
- Yang, G., Leicht, A. S., Lago, C., & Gomez, M. A. (2018). Key team physical and technical performance indicators indicative of team quality in the soccer Chinese super league. *Research in Sports Medicine*, 26(2),158-167.
- Yi, Q., Jia, H., Liu, H., & Gómez, M. Á. (2018). Technical demands of different playing positions in the UEFA Champions League. *International Journal of Performance Analysis in Sport*,1-12.
- Yue, Z., Broich, H., & Mester, J. (2014). Statistical analysis for the soccer matches of the first Bundesliga. *International Journal of Sports Science & Coaching*, 9(3),553-560.
- Zhang, S., Lorenzo, A., Gómez, M.-A., Liu, H., Gonçalves, B., & Sampaio, J. (2017). Players' technical and physical performance profiles and game-to-game variation in NBA. *International Journal of Performance Analysis in Sport*, 17(4),466-483.

Appendix I

Table 1. Descriptive statistics of match performance profiles of central defenders under five competing situations.

Variable	Central Back									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
	(n=2667)	(n=727)	(n=1328)	(n=1339)	(n=1365)	(n=1302)	(n=1300)	(n=1367)	(n=1655)	(n=1012)
Assist	0.03±0.18	0.04±0.2	0.03±0.19	0.03±0.18	0.02±0.14	0.04±0.21	0.04±0.21	0.02±0.15	0.02±0.13	0.06±0.24
YC	0.19±0.39	0.21±0.41	0.17±0.37	0.21±0.41	0.2±0.4	0.18±0.38	0.18±0.38	0.2±0.4	0.21±0.41	0.16±0.36
Shot	0.58±0.9	0.53±0.93	0.67±0.95	0.49±0.83	0.53±0.86	0.63±0.93	0.63±0.91	0.53±0.89	0.54±0.89	0.64±0.91
ShotOT	0.16±0.42	0.16±0.46	0.2±0.46	0.13±0.37	0.15±0.41	0.17±0.43	0.17±0.43	0.15±0.41	0.14±0.4	0.2±0.46
Disp	0.41±0.82	0.4±0.75	0.38±0.78	0.44±0.86	0.39±0.81	0.43±0.83	0.41±0.81	0.41±0.83	0.42±0.85	0.39±0.78
UnsTouch	0.34±0.7	0.37±0.67	0.34±0.72	0.35±0.67	0.35±0.75	0.34±0.64	0.33±0.63	0.35±0.75	0.36±0.73	0.31±0.63
TT	2.02±1.7	2.23±1.84	2.03±1.73	2.01±1.68	1.96±1.64	2.07±1.77	2.03±1.77	2±1.64	2.03±1.65	2.01±1.79
Interception	2.4±1.79	2.26±1.75	2.4±1.8	2.41±1.78	2.42±1.83	2.39±1.75	2.38±1.82	2.42±1.77	2.43±1.78	2.36±1.81
Clearance	4.7±3.51	4.81±3.74	4.31±3.23	5.1±3.72	4.98±3.58	4.41±3.41	4.63±3.44	4.77±3.57	4.82±3.61	4.51±3.33
BS	0.62±0.87	0.61±0.84	0.54±0.81	0.7±0.92	0.67±0.93	0.56±0.8	0.58±0.83	0.65±0.91	0.64±0.9	0.58±0.82
Foul	1.09±1.12	1.05±1.09	1.09±1.13	1.1±1.11	1.09±1.13	1.1±1.11	1.06±1.11	1.12±1.13	1.14±1.15	1.02±1.07
Fouled	0.81±1.05	0.74±1.02	0.82±1.05	0.8±1.05	0.74±1.01	0.87±1.09	0.85±1.07	0.76±1.04	0.8±1.05	0.81±1.06
AW	1.52±1.65	1.66±1.69	1.58±1.71	1.46±1.59	1.39±1.55	1.65±1.74	1.74±1.78	1.31±1.49	1.46±1.65	1.62±1.66
Dribble	0.42±0.84	0.35±0.68	0.42±0.86	0.41±0.81	0.43±0.86	0.4±0.82	0.44±0.89	0.39±0.78	0.41±0.83	0.43±0.85
Offside	0.06±0.26	0.07±0.3	0.07±0.27	0.05±0.24	0.06±0.25	0.06±0.26	0.05±0.25	0.06±0.26	0.06±0.25	0.06±0.26
Touch	61.38±20.47	60.48±22.99	63.32±21.38	59.46±19.34	56.86±18.6	66.12±21.26	65.39±21.02	57.56±19.18	58.91±19.14	65.41±21.89
KP	0.41±0.83	0.36±0.77	0.46±0.85	0.36±0.81	0.39±0.8	0.43±0.87	0.43±0.86	0.39±0.81	0.39±0.81	0.45±0.88
PA	83.26±9.94	82.15±11.35	83.92±9.66	82.61±10.18	81.72±10.35	84.88±9.23	84.03±9.64	82.53±10.17	82.44±10.03	84.6±9.66
Pass	47.36±20.7	46.48±22.85	49.61±21.54	45.12±19.59	42.56±18.43	52.38±21.74	51.43±21.62	43.48±19	44.69±19.1	51.72±22.42
Cross	0.8±1.91	0.63±1.67	0.9±2.05	0.7±1.76	0.84±2.01	0.76±1.79	0.82±1.94	0.78±1.88	0.84±1.95	0.74±1.84
AccCross	0.17±0.57	0.14±0.51	0.2±0.63	0.14±0.49	0.17±0.59	0.17±0.55	0.19±0.61	0.16±0.53	0.17±0.56	0.18±0.59
LB	6.15±4.14	5.99±4.11	6.37±4.26	5.94±4.01	5.9±4.04	6.42±4.24	6.49±4.27	5.83±3.99	6.03±4.12	6.34±4.18
AccLB	3.69±3.11	3.43±3.11	3.94±3.24	3.45±2.96	3.39±2.97	4.01±3.23	3.96±3.22	3.44±2.98	3.53±3.05	3.96±3.2
ThB	0.11±0.43	0.13±0.5	0.11±0.46	0.1±0.39	0.08±0.32	0.14±0.51	0.13±0.46	0.09±0.39	0.09±0.38	0.14±0.49
AccThB	0.04±0.23	0.04±0.21	0.05±0.24	0.04±0.22	0.03±0.18	0.06±0.27	0.05±0.23	0.04±0.22	0.03±0.19	0.06±0.28

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 2. Descriptive statistics of match performance profiles of full backs under five competing situations.

Variable	Full Back									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
	(n=2505)	(n=663)	(n=1273)	(n=1232)	(n=1279)	(n=1226)	(n=1250)	(n=1255)	(n=1520)	(n=985)
Assist	0.07±0.27	0.08±0.27	0.08±0.29	0.06±0.24	0.05±0.21	0.1±0.31	0.09±0.31	0.05±0.22	0.03±0.16	0.14±0.37
YC	0.17±0.37	0.18±0.39	0.14±0.35	0.19±0.4	0.18±0.38	0.16±0.36	0.15±0.36	0.18±0.38	0.18±0.39	0.14±0.35
Shot	0.52±0.8	0.48±0.79	0.58±0.85	0.46±0.73	0.52±0.81	0.51±0.79	0.53±0.81	0.5±0.78	0.48±0.77	0.57±0.84
ShotOT	0.15±0.4	0.11±0.35	0.16±0.41	0.13±0.38	0.14±0.38	0.15±0.41	0.16±0.42	0.13±0.38	0.11±0.34	0.2±0.47
Disp	0.59±0.85	0.63±0.9	0.56±0.85	0.62±0.86	0.57±0.82	0.61±0.88	0.59±0.89	0.59±0.81	0.6±0.85	0.58±0.86
UnsTouch	0.6±0.87	0.65±0.85	0.6±0.89	0.6±0.85	0.61±0.84	0.59±0.9	0.57±0.84	0.63±0.89	0.61±0.87	0.58±0.87
TT	2.46±1.81	2.53±1.81	2.42±1.79	2.5±1.82	2.44±1.81	2.48±1.81	2.48±1.84	2.44±1.77	2.49±1.8	2.41±1.81
Interception	2.21±1.7	2.27±1.75	2.15±1.66	2.26±1.74	2.19±1.71	2.22±1.69	2.18±1.69	2.23±1.71	2.24±1.69	2.16±1.72
Clearance	3.52±2.83	3.37±2.7	3.22±2.65	3.84±2.97	3.72±2.88	3.32±2.76	3.49±2.92	3.55±2.73	3.63±2.76	3.36±2.93
BS	0.36±0.65	0.39±0.7	0.32±0.6	0.4±0.7	0.4±0.69	0.31±0.61	0.32±0.62	0.4±0.68	0.4±0.68	0.3±0.6
Foul	1.18±1.16	1.11±1.16	1.15±1.1	1.21±1.22	1.25±1.21	1.11±1.1	1.17±1.13	1.2±1.19	1.22±1.2	1.11±1.09
Fouled	0.94±1.07	1.01±1.08	0.96±1.12	0.91±1.02	0.91±1.03	0.96±1.11	0.99±1.1	0.88±1.04	0.9±1.03	0.99±1.13
AW	1.08±1.33	1.13±1.3	1.08±1.28	1.07±1.37	1.02±1.3	1.13±1.35	1.17±1.37	0.98±1.28	1.03±1.28	1.15±1.39
Dribble	0.63±0.99	0.79±1.11	0.65±0.98	0.61±1	0.64±1.04	0.63±0.94	0.65±1.03	0.62±0.95	0.63±0.98	0.64±1
Offside	0.07±0.29	0.08±0.32	0.08±0.31	0.07±0.25	0.07±0.28	0.08±0.29	0.08±0.29	0.07±0.28	0.07±0.28	0.08±0.29
Touch	61.08±18.62	63.09±21	62.48±18.32	59.64±18.81	57.1±16.78	65.24±19.51	64.24±19.14	57.94±17.53	58.7±17.58	64.77±19.55
KP	0.72±0.99	0.75±1.08	0.82±1.05	0.63±0.92	0.64±0.93	0.8±1.05	0.8±1.06	0.64±0.91	0.65±0.94	0.83±1.06
PA	80.38±10.08	80.24±10.79	81.13±9.88	79.61±10.23	78.67±10.22	82.17±9.62	81.38±9.82	79.39±10.24	79.13±9.91	82.33±10.03
Pass	44.07±16.96	45.93±19.59	45.56±16.6	42.53±17.2	40.01±14.74	48.3±18.07	47.2±17.71	40.95±15.58	41.43±15.37	48.14±18.44
Cross	2.56±2.76	2.37±2.49	2.85±2.94	2.25±2.52	2.43±2.74	2.69±2.77	2.65±2.8	2.46±2.72	2.55±2.82	2.56±2.66
AccCross	0.56±0.95	0.51±0.83	0.65±1.03	0.47±0.86	0.5±0.9	0.62±1	0.62±1.03	0.5±0.87	0.52±0.91	0.62±1.01
LB	4.53±3.18	4.26±2.93	4.67±3.16	4.38±3.19	4.47±3.18	4.59±3.17	4.78±3.31	4.28±3.02	4.49±3.23	4.58±3.09
AccLB	2.47±2.35	2.24±2.11	2.66±2.4	2.28±2.27	2.3±2.23	2.65±2.45	2.72±2.48	2.22±2.18	2.34±2.31	2.67±2.39
ThB	0.07±0.28	0.09±0.32	0.08±0.3	0.05±0.25	0.05±0.24	0.08±0.31	0.07±0.27	0.06±0.28	0.05±0.25	0.08±0.31
AccThB	0.02±0.14	0.02±0.17	0.03±0.17	0.01±0.11	0.02±0.12	0.03±0.16	0.03±0.17	0.01±0.11	0.01±0.11	0.03±0.18

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 3. Descriptive statistics of match performance profiles of wide midfielders under five competing situations.

Variable	Wide Midfielder									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
	(n=1053)	(n=291)	(n=519)	(n=534)	(n=578)	(n=475)	(n=504)	(n=549)	(n=700)	(n=353)
Assist	0.12±0.36	0.13±0.36	0.12±0.37	0.12±0.35	0.08±0.3	0.16±0.42	0.14±0.39	0.1±0.33	0.06±0.25	0.24±0.5
YC	0.16±0.36	0.22±0.42	0.13±0.34	0.18±0.39	0.17±0.37	0.15±0.35	0.16±0.37	0.15±0.36	0.17±0.38	0.13±0.33
Shot	1.84±1.7	2.05±2.03	2.04±1.67	1.64±1.7	1.64±1.5	2.07±1.88	2.07±1.86	1.62±1.5	1.66±1.57	2.18±1.88
ShotOT	0.69±0.98	0.8±1.11	0.73±0.95	0.65±1	0.55±0.78	0.86±1.15	0.82±1.11	0.58±0.82	0.56±0.82	0.95±1.19
Disp	1.66±1.51	1.77±1.61	1.68±1.54	1.65±1.48	1.62±1.49	1.71±1.54	1.65±1.57	1.67±1.45	1.7±1.53	1.59±1.46
UnsTouch	1.34±1.42	1.29±1.42	1.35±1.44	1.33±1.4	1.36±1.44	1.33±1.39	1.34±1.43	1.35±1.41	1.42±1.49	1.19±1.26
TT	1.78±1.65	1.88±1.74	1.77±1.6	1.79±1.7	1.74±1.68	1.82±1.61	1.83±1.63	1.73±1.66	1.72±1.65	1.89±1.64
Interception	1.47±1.55	1.59±1.69	1.38±1.52	1.55±1.58	1.47±1.49	1.47±1.62	1.5±1.61	1.44±1.49	1.44±1.5	1.53±1.65
Clearance	1.08±1.62	1.18±1.73	0.99±1.63	1.15±1.6	1.03±1.55	1.13±1.7	1.11±1.66	1.04±1.57	1.02±1.47	1.18±1.87
BS	0.15±0.42	0.19±0.51	0.13±0.39	0.17±0.45	0.13±0.39	0.17±0.45	0.15±0.44	0.15±0.41	0.14±0.39	0.18±0.48
Foul	1.31±1.26	1.65±1.42	1.29±1.22	1.33±1.3	1.36±1.28	1.25±1.24	1.34±1.28	1.29±1.25	1.34±1.29	1.24±1.2
Fouled	1.57±1.43	1.6±1.53	1.62±1.46	1.52±1.4	1.55±1.44	1.58±1.43	1.67±1.46	1.47±1.4	1.57±1.44	1.56±1.42
AW	0.8±1.1	1.03±1.55	0.78±1.03	0.82±1.17	0.74±1.05	0.88±1.16	0.87±1.16	0.74±1.04	0.77±1.08	0.86±1.14
Dribble	1.26±1.65	1.53±1.79	1.32±1.74	1.21±1.56	1.12±1.4	1.44±1.9	1.4±1.8	1.14±1.49	1.18±1.62	1.43±1.71
Offside	0.37±0.79	0.41±0.86	0.4±0.83	0.34±0.75	0.37±0.8	0.38±0.79	0.38±0.75	0.36±0.83	0.36±0.79	0.41±0.8
Touch	57.39±21	59.74±21.62	59.41±22.29	55.42±19.48	52.1±18.21	63.82±22.34	62.27±22.98	52.9±17.87	53.46±17.99	65.17±24.15
KP	1.28±1.4	1.44±1.42	1.48±1.56	1.08±1.2	1.15±1.34	1.44±1.46	1.47±1.55	1.11±1.22	1.13±1.27	1.57±1.59
PA	78.72±10.69	78.16±10.85	79.13±10.52	78.33±10.84	77.13±11.08	80.66±9.85	79.99±10.1	77.56±11.08	77.47±10.71	81.22±10.21
Pass	40.43±19.48	41.23±19.4	41.88±20.74	39.03±18.08	34.74±16.52	46.14±21.23	45.62±21.72	36.6±16.27	36.98±16.24	47.28±23.23
Cross	2.62±2.99	2.66±3.14	2.95±3.24	2.3±2.68	2.43±2.84	2.85±3.15	2.71±3.09	2.53±2.89	2.47±2.86	2.92±3.22
AccCross	0.58±1.03	0.55±1.01	0.69±1.15	0.47±0.89	0.54±1.01	0.63±1.06	0.65±1.11	0.52±0.95	0.51±0.94	0.73±1.18
LB	3.25±3.4	3.25±3.86	3.45±3.65	3.05±3.13	3.06±3.37	3.48±3.43	3.51±3.65	3.01±3.14	3.05±3.24	3.64±3.69
AccLB	2.18±2.78	2.21±3.11	2.35±3.04	2.01±2.51	1.94±2.63	2.46±2.94	2.42±3.03	1.96±2.52	1.96±2.55	2.61±3.15
ThB	0.28±0.61	0.37±0.69	0.31±0.68	0.25±0.54	0.18±0.45	0.4±0.75	0.33±0.69	0.23±0.52	0.22±0.53	0.4±0.73
AccThB	0.11±0.35	0.14±0.35	0.13±0.41	0.09±0.29	0.07±0.29	0.16±0.42	0.14±0.4	0.08±0.3	0.08±0.29	0.18±0.45

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 4. Descriptive statistics of match performance profiles of central midfielders under five competing situations.

Variable	Central Midfielder									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
	(n=2794)	(n=774)	(n=1398)	(n=1396)	(n=1376)	(n=1418)	(n=1398)	(n=1396)	(n=1678)	(n=1116)
Assist	0.09±0.3	0.12±0.35	0.09±0.31	0.08±0.3	0.05±0.23	0.12±0.36	0.12±0.35	0.06±0.24	0.04±0.21	0.15±0.4
YC	0.18±0.39	0.23±0.42	0.15±0.36	0.22±0.41	0.2±0.4	0.17±0.37	0.16±0.37	0.21±0.41	0.21±0.41	0.15±0.35
Shot	1.2±1.44	1.19±1.54	1.35±1.55	1.05±1.3	1.13±1.31	1.27±1.55	1.31±1.53	1.09±1.32	1.15±1.33	1.28±1.58
ShotOT	0.38±0.72	0.41±0.71	0.43±0.78	0.32±0.65	0.34±0.64	0.42±0.79	0.43±0.77	0.33±0.65	0.33±0.65	0.45±0.8
Disp	1.08±1.25	1.11±1.39	1.04±1.22	1.12±1.28	1.09±1.26	1.07±1.24	1.06±1.25	1.1±1.25	1.14±1.28	0.99±1.2
UnsTouch	0.8±1.07	0.85±1.1	0.79±1.03	0.81±1.12	0.83±1.09	0.76±1.06	0.79±1.06	0.8±1.09	0.83±1.11	0.75±1.02
TT	2.37±1.89	2.44±1.93	2.4±1.92	2.34±1.85	2.29±1.85	2.45±1.93	2.36±1.92	2.38±1.86	2.27±1.88	2.52±1.9
Interception	2.04±1.78	2±1.72	2.09±1.81	1.98±1.74	2.01±1.81	2.06±1.74	2.04±1.77	2.03±1.79	1.99±1.78	2.1±1.77
Clearance	2.04±2.79	1.94±2.57	1.86±2.63	2.22±2.93	2.19±2.89	1.89±2.67	2.04±2.88	2.04±2.69	2.07±2.77	2±2.81
BS	0.34±0.66	0.35±0.69	0.28±0.58	0.39±0.71	0.36±0.67	0.31±0.64	0.32±0.65	0.35±0.66	0.35±0.66	0.32±0.65
Foul	1.43±1.3	1.59±1.46	1.39±1.28	1.46±1.32	1.43±1.29	1.42±1.31	1.41±1.26	1.45±1.33	1.43±1.3	1.43±1.29
Fouled	1.29±1.31	1.41±1.3	1.34±1.38	1.24±1.24	1.23±1.33	1.34±1.28	1.28±1.3	1.29±1.32	1.27±1.33	1.32±1.28
AW	0.96±1.3	1.09±1.45	0.97±1.28	0.95±1.32	0.94±1.31	0.98±1.29	1.07±1.39	0.85±1.19	0.91±1.27	1.04±1.33
Dribble	0.78±1.16	0.97±1.4	0.8±1.21	0.76±1.11	0.72±1.09	0.83±1.23	0.83±1.23	0.72±1.09	0.73±1.12	0.85±1.22
Offside	0.11±0.4	0.09±0.35	0.14±0.45	0.09±0.34	0.1±0.4	0.13±0.41	0.13±0.41	0.1±0.39	0.11±0.39	0.12±0.42
Touch	67.45±23.3	70.61±25.33	68.4±23.49	66.5±23.06	61.7±19.55	73.03±25.21	71.91±24.61	62.98±20.98	63.77±20.86	72.99±25.57
KP	1±1.28	1.09±1.33	1.09±1.37	0.9±1.17	0.88±1.18	1.11±1.36	1.1±1.33	0.89±1.22	0.91±1.18	1.12±1.4
PA	83.51±8.77	83.61±9.31	83.56±8.94	83.45±8.6	81.87±9.24	85.09±7.98	84.26±8.66	82.75±8.82	82.58±8.67	84.9±8.74
Pass	52.78±22.92	55.41±25.18	53.54±23.02	52.03±22.79	47.19±18.77	58.21±25.17	56.98±24.47	48.57±20.41	49.18±20	58.19±25.78
Cross	1.48±2.46	1.67±2.64	1.65±2.62	1.31±2.29	1.37±2.45	1.58±2.47	1.62±2.63	1.34±2.27	1.48±2.49	1.47±2.43
AccCross	0.37±0.85	0.43±0.88	0.4±0.89	0.33±0.82	0.32±0.77	0.41±0.92	0.42±0.95	0.31±0.74	0.35±0.81	0.39±0.92
LB	5.36±3.97	5.22±3.96	5.52±4.04	5.19±3.9	5.09±3.79	5.62±4.13	5.72±4.22	4.79±3.68	5.18±3.8	5.63±4.2
AccLB	3.75±3.27	3.71±3.3	3.93±3.3	3.58±3.23	3.43±2.96	4.06±3.52	4.05±3.58	3.45±2.9	3.54±3.04	4.07±3.57
ThB	0.28±0.65	0.37±0.79	0.3±0.71	0.27±0.6	0.21±0.53	0.36±0.75	0.32±0.67	0.25±0.63	0.25±0.63	0.33±0.68
AccThB	0.1±0.33	0.14±0.41	0.1±0.34	0.1±0.32	0.07±0.28	0.13±0.37	0.12±0.36	0.08±0.3	0.08±0.29	0.13±0.39

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow

card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 5. Descriptive statistics of match performance profiles of forwards under five competing situations.

Variable	Forward									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
	(n=1103)	(n=331)	(n=553)	(n=550)	(n=497)	(n=606)	(n=570)	(n=533)	(n=676)	(n=427)
Assist	0.18±0.45	0.18±0.44	0.22±0.51	0.15±0.38	0.11±0.34	0.23±0.52	0.24±0.53	0.12±0.33	0.1±0.3	0.31±0.6
YC	0.15±0.36	0.17±0.38	0.16±0.37	0.15±0.35	0.14±0.35	0.16±0.37	0.14±0.35	0.16±0.37	0.17±0.38	0.12±0.33
Shot	2.82±2.05	3.17±2.18	3.13±2.1	2.51±1.95	2.47±1.85	3.11±2.16	3.17±2.23	2.45±1.76	2.42±1.8	3.45±2.25
ShotOT	1.15±1.21	1.33±1.3	1.27±1.24	1.02±1.17	0.95±1.09	1.31±1.28	1.34±1.36	0.95±0.99	0.89±0.99	1.56±1.41
Disp	2.03±1.71	2.03±1.68	2.01±1.75	2.05±1.66	1.98±1.66	2.07±1.75	2.01±1.74	2.04±1.67	2.01±1.66	2.06±1.78
UnsTouch	1.82±1.71	1.74±1.52	1.86±1.69	1.78±1.73	1.87±1.65	1.78±1.76	1.81±1.8	1.83±1.61	1.88±1.75	1.72±1.65
TT	1.15±1.34	1.01±1.13	1.18±1.35	1.12±1.32	1.2±1.36	1.11±1.32	1.14±1.31	1.17±1.36	1.13±1.37	1.19±1.29
Interception	0.8±1.18	0.78±1.08	0.75±1.09	0.85±1.26	0.86±1.18	0.75±1.17	0.79±1.15	0.81±1.21	0.8±1.18	0.8±1.17
Clearance	0.55±0.89	0.6±1.01	0.51±0.87	0.59±0.92	0.59±0.93	0.51±0.86	0.54±0.92	0.56±0.86	0.54±0.89	0.56±0.9
BS	0.08±0.29	0.1±0.33	0.07±0.27	0.09±0.31	0.09±0.29	0.08±0.29	0.07±0.27	0.1±0.31	0.08±0.29	0.08±0.3
Foul	1.4±1.45	1.41±1.37	1.41±1.39	1.39±1.5	1.48±1.48	1.33±1.41	1.39±1.4	1.41±1.49	1.42±1.48	1.36±1.39
Fouled	1.74±1.54	1.95±1.6	1.67±1.48	1.81±1.6	1.67±1.54	1.8±1.54	1.87±1.61	1.6±1.44	1.71±1.52	1.78±1.57
AW	1.27±1.86	1.1±1.49	1.35±1.94	1.19±1.77	1.41±2.13	1.15±1.6	1.18±1.8	1.36±1.92	1.3±1.94	1.22±1.73
Dribble	1.36±1.7	1.98±2.35	1.38±1.8	1.34±1.61	1.17±1.5	1.51±1.84	1.52±1.9	1.19±1.44	1.16±1.41	1.68±2.05
Offside	0.73±1.04	0.66±1.04	0.81±1.07	0.65±0.99	0.71±1.14	0.75±0.94	0.72±1.05	0.74±1.02	0.7±1.08	0.79±0.97
Touch	51.65±20.35	55.68±22.64	52.14±20.7	51.16±20	46.96±16.48	55.5±22.34	54.29±21.52	48.83±18.63	48±17.65	56.43±22.88
KP	1.55±1.47	1.53±1.57	1.75±1.53	1.35±1.37	1.33±1.38	1.74±1.51	1.79±1.57	1.3±1.31	1.36±1.33	1.86±1.63
PA	77.31±11.1	78.68±11.36	76.96±11.13	77.66±11.07	75.41±11.17	78.86±10.8	77.78±10.87	76.8±11.32	76.88±10.82	77.98±11.5
Pass	34.95±16.82	37.97±19.2	35±16.77	34.91±16.89	31.07±12.94	38.14±18.86	36.94±17.72	32.83±15.55	32.21±14.44	39.09±19.25
Cross	2.28±2.96	2.02±2.58	2.52±3.29	2.04±2.57	2.17±3.04	2.36±2.9	2.4±2.95	2.14±2.98	2.19±2.96	2.41±2.97
AccCross	0.5±0.96	0.42±0.83	0.6±1.08	0.39±0.82	0.47±0.95	0.51±0.98	0.56±1.05	0.42±0.86	0.43±0.86	0.6±1.11
LB	1.85±2.1	1.69±1.92	1.77±2.07	1.92±2.14	1.76±2.11	1.92±2.1	1.99±2.23	1.7±1.94	1.74±2.08	2.02±2.13
AccLB	1.28±1.66	1.18±1.5	1.27±1.69	1.29±1.63	1.2±1.67	1.35±1.66	1.38±1.76	1.18±1.55	1.21±1.62	1.4±1.72
ThB	0.53±1.01	0.76±1.24	0.52±1	0.55±1.03	0.33±0.68	0.7±1.2	0.66±1.11	0.4±0.88	0.39±0.77	0.77±1.28
AccThB	0.21±0.55	0.3±0.65	0.22±0.58	0.21±0.5	0.12±0.37	0.29±0.64	0.28±0.64	0.14±0.41	0.14±0.4	0.33±0.71

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Appendix II

Table 1. Descriptive statistics of the variability of central defenders' performance under five competing situations (arbitrary unit).

Variable	Central Back									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
Shot	1.38±0.66(338)	1.42±0.59(94)	1.23±0.6(226)	1.33±0.57(200)	1.37±0.59(205)	1.39±0.72(178)	1.22±0.59(212)	1.34±0.62(219)	1.38±0.6(247)	1.26±0.58(151)
ShotOT	2.02±0.79(207)	2.01±0.77(57)	1.67±0.64(138)	1.92±0.69(98)	1.92±0.75(115)	1.91±0.64(106)	1.8±0.77(121)	1.73±0.67(114)	1.91±0.73(130)	1.73±0.68(95)
Disp	1.59±0.88(310)	1.58±0.9(92)	1.57±0.68(179)	1.38±0.67(175)	1.54±0.75(188)	1.6±0.93(151)	1.43±0.76(165)	1.49±0.73(193)	1.48±0.74(220)	1.57±0.78(118)
UnsTouch	1.64±0.73(278)	1.62±0.54(91)	1.54±0.67(176)	1.47±0.68(173)	1.6±0.73(165)	1.67±0.73(148)	1.52±0.66(166)	1.53±0.67(181)	1.54±0.7(203)	1.63±0.67(116)
Fouled	1.21±0.6(389)	1.16±0.59(112)	1.21±0.59(256)	1.15±0.6(251)	1.14±0.63(239)	1.27±0.58(195)	1.06±0.6(242)	1.23±0.57(258)	1.21±0.6(305)	1.15±0.61(163)
AW	0.94±0.48(370)	0.96±0.46(121)	0.9±0.46(265)	0.9±0.49(260)	0.93±0.49(239)	0.91±0.48(183)	0.83±0.51(255)	0.92±0.52(263)	0.95±0.51(294)	0.91±0.49(180)
Dribble	1.62±0.89(286)	1.51±0.71(77)	1.38±0.68(161)	1.47±0.64(181)	1.51±0.82(169)	1.63±0.82(144)	1.45±0.76(159)	1.5±0.74(182)	1.51±0.75(201)	1.46±0.66(121)
Offside	2.25±0.96(92)	2.28±0.74(33)	1.85±0.74(47)	1.94±0.63(43)	1.85±0.72(50)	2.23±0.79(45)	2.00±0.7(49)	1.73±0.76(50)	1.92±0.69(61)	2.14±0.89(34)
YC	1.85±0.69(260)	1.74±0.78(79)	1.72±0.61(143)	1.62±0.58(161)	1.72±0.56(158)	1.94±0.74(130)	1.69±0.69(140)	1.6±0.54(167)	1.68±0.6(197)	1.84±0.65(82)
TT	0.74±0.37(421)	0.75±0.44(132)	0.76±0.41(292)	0.72±0.44(297)	0.76±0.39(273)	0.72±0.36(204)	0.69±0.42(273)	0.73±0.42(307)	0.71±0.4(333)	0.72±0.42(187)
Interception	0.67±0.36(427)	0.66±0.39(133)	0.67±0.38(292)	0.63±0.41(299)	0.67±0.4(275)	0.66±0.32(207)	0.66±0.41(277)	0.69±0.43(311)	0.66±0.4(337)	0.69±0.41(188)
Clearance	0.62±0.37(416)	0.61±0.38(133)	0.58±0.34(291)	0.58±0.37(298)	0.57±0.35(269)	0.66±0.39(202)	0.61±0.4(276)	0.55±0.34(302)	0.58±0.37(332)	0.59±0.37(190)
BS	1.31±0.53(334)	1.21±0.56(100)	1.31±0.52(223)	1.14±0.55(237)	1.26±0.57(217)	1.35±0.53(162)	1.23±0.52(211)	1.2±0.59(243)	1.29±0.57(257)	1.3±0.56(150)
Foul	1±0.47(416)	0.95±0.53(125)	0.99±0.55(280)	0.99±0.51(285)	1.01±0.49(265)	0.99±0.48(203)	0.98±0.53(262)	1.00±0.52(298)	1.01±0.52(325)	0.98±0.56(181)
Assist	2.45±0.94(67)	2.47±1.02(21)	2.13±0.58(27)	2.02±0.64(28)	2.11±0.51(25)	2.32±0.91(43)	2.12±0.65(39)	2.01±0.64(21)	2.22±0.78(26)	2.25±0.66(33)
Touch	0.23±0.12(431)	0.24±0.16(135)	0.24±0.13(297)	0.23±0.13(305)	0.23±0.12(277)	0.22±0.11(209)	0.21±0.12(280)	0.22±0.13(312)	0.23±0.12(340)	0.22±0.13(192)
KP	1.67±0.8(301)	1.51±0.61(82)	1.41±0.56(173)	1.48±0.73(154)	1.61±0.74(173)	1.58±0.81(150)	1.49±0.7(169)	1.54±0.74(173)	1.64±0.69(209)	1.44±0.72(112)
PA	0.09±0.06(431)	0.1±0.07(135)	0.09±0.06(297)	0.09±0.08(305)	0.1±0.06(277)	0.08±0.06(209)	0.08±0.07(280)	0.09±0.07(312)	0.09±0.07(340)	0.08±0.05(192)
Pass	0.3±0.16(431)	0.3±0.2(135)	0.31±0.17(297)	0.31±0.17(305)	0.31±0.16(277)	0.29±0.14(209)	0.28±0.16(280)	0.3±0.17(312)	0.31±0.17(340)	0.29±0.17(192)
Cross	1.44±1(246)	1.58±0.83(71)	1.25±0.81(139)	1.35±0.82(143)	1.26±0.81(147)	1.47±0.97(118)	1.35±0.86(144)	1.25±0.82(143)	1.26±0.85(179)	1.36±0.99(91)
AccCross	1.77±0.97(146)	2.01±1.14(40)	1.56±0.73(84)	1.57±0.81(70)	1.58±0.75(82)	1.82±1.03(75)	1.65±0.85(83)	1.53±0.78(76)	1.68±0.81(103)	1.65±0.78(58)
LB	0.54±0.3(430)	0.52±0.29(135)	0.5±0.31(297)	0.52±0.33(304)	0.53±0.3(277)	0.51±0.29(208)	0.45±0.28(280)	0.54±0.32(311)	0.54±0.31(340)	0.5±0.29(191)
AccLB	0.69±0.36(423)	0.72±0.44(135)	0.64±0.37(294)	0.7±0.42(302)	0.64±0.36(273)	0.73±0.37(205)	0.6±0.38(277)	0.67±0.37(304)	0.7±0.36(334)	0.63±0.39(190)
ThB	2.06±1.01(127)	2.13±1.2(37)	1.79±0.71(57)	1.65±0.71(61)	1.86±0.76(63)	2.09±1.09(70)	1.79±0.93(66)	1.73±0.71(54)	1.78±0.63(72)	1.89±0.99(51)
AccThB	2.25±1.02(72)	2.82±1.24(16)	2.08±0.62(37)	1.63±0.64(23)	2.08±0.73(35)	2.33±1.23(40)	1.82±1.06(33)	2.01±0.77(29)	1.89±0.58(32)	2.14±1.01(31)

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 2. Descriptive statistics of the variability of full backs' performance under five competing situations (arbitrary unit).

Variable	Full Back									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
Shot	1.46±0.65(325)	1.4±0.6(80)	1.33±0.64(226)	1.36±0.58(181)	1.41±0.67(208)	1.44±0.57(150)	1.34±0.62(196)	1.37±0.58(219)	1.44±0.63(250)	1.35±0.56(75)
ShotOT	2.11±0.81(173)	1.97±0.66(34)	1.75±0.57(111)	1.84±0.69(88)	1.84±0.61(98)	2.16±0.82(84)	1.82±0.65(103)	1.75±0.62(94)	1.86±0.61(106)	1.8±0.69(4)
Disp	1.37±0.61(333)	1.29±0.49(86)	1.33±0.54(218)	1.24±0.58(218)	1.36±0.55(207)	1.35±0.65(170)	1.3±0.56(197)	1.26±0.55(218)	1.26±0.56(250)	1.36±0.61(143)
UnsTouch	1.35±0.59(316)	1.22±0.67(93)	1.24±0.54(206)	1.29±0.56(202)	1.26±0.57(205)	1.37±0.6(152)	1.24±0.54(187)	1.22±0.51(216)	1.27±0.56(255)	1.31±0.56(84)
Fouled	1.15±0.52(387)	1.03±0.55(104)	1.11±0.54(264)	1.11±0.58(249)	1.13±0.55(253)	1.13±0.52(182)	1±0.54(237)	1.14±0.56(261)	1.13±0.56(305)	1.06±0.51(124)
AW	1.12±0.55(376)	1.02±0.47(108)	1.09±0.56(264)	1.07±0.52(243)	1.13±0.57(241)	1.07±0.53(180)	1.01±0.52(238)	1.1±0.55(245)	1.09±0.56(287)	1.02±0.56(177)
Dribble	1.35±0.66(309)	1.18±0.63(84)	1.24±0.58(211)	1.27±0.57(192)	1.28±0.62(192)	1.36±0.62(153)	1.25±0.58(188)	1.21±0.59(199)	1.26±0.63(240)	1.28±0.59(168)
Offside	2.42±0.91(100)	2.31±0.97(29)	1.97±0.71(68)	1.89±0.75(52)	2.06±0.82(51)	2.34±0.89(54)	1.95±0.71(62)	1.82±0.73(52)	2.06±0.73(63)	2.07±0.9(174)
YC	1.94±0.71(225)	1.77±0.7(62)	1.78±0.66(114)	1.69±0.6(140)	1.84±0.6(137)	1.95±0.8(102)	1.68±0.6(109)	1.76±0.62(148)	1.84±0.61(174)	1.78±0.78(68)
TT	0.69±0.33(414)	0.61±0.37(117)	0.66±0.39(298)	0.67±0.38(276)	0.69±0.35(270)	0.68±0.34(197)	0.66±0.43(268)	0.67±0.38(295)	0.66±0.36(331)	0.68±0.43(144)
Interception	0.74±0.36(414)	0.65±0.4(117)	0.73±0.42(295)	0.71±0.38(275)	0.72±0.35(269)	0.73±0.38(198)	0.71±0.42(265)	0.71±0.37(292)	0.71±0.38(330)	0.74±0.41(135)
Clearance	0.6±0.31(414)	0.57±0.35(118)	0.65±0.4(299)	0.57±0.34(277)	0.57±0.3(269)	0.64±0.33(198)	0.69±0.36(267)	0.59±0.35(294)	0.59±0.33(331)	0.68±0.36(189)
BS	1.6±0.67(314)	1.52±0.71(82)	1.54±0.67(191)	1.44±0.67(196)	1.48±0.62(199)	1.72±0.68(138)	1.65±0.72(169)	1.46±0.61(208)	1.46±0.61(241)	1.7±0.8(186)
Foul	0.94±0.5(401)	0.93±0.48(109)	0.91±0.53(283)	0.92±0.52(260)	0.92±0.51(259)	0.96±0.5(194)	0.9±0.51(252)	0.96±0.52(274)	0.92±0.51(314)	0.94±0.52(190)
Assist	2.39±0.88(108)	2.33±0.81(25)	1.97±0.63(71)	1.96±0.58(44)	2.17±0.79(47)	2.34±0.99(69)	1.97±0.7(66)	2.05±0.72(48)	2.17±0.78(34)	1.89±0.9(45)
Touch	0.20±0.11(415)	0.22±0.12(118)	0.21±0.13(300)	0.21±0.12(277)	0.21±0.11(270)	0.22±0.11(198)	0.2±0.12(268)	0.21±0.11(296)	0.21±0.11(331)	0.19±0.12(136)
KP	1.31±0.57(331)	1.39±0.61(83)	1.12±0.53(235)	1.29±0.56(203)	1.3±0.56(207)	1.23±0.57(163)	1.17±0.51(207)	1.27±0.58(219)	1.28±0.58(252)	1.19±0.57(44)
PA	0.1±0.06(415)	0.1±0.07(118)	0.1±0.07(300)	0.1±0.07(277)	0.1±0.06(270)	0.1±0.06(198)	0.09±0.07(268)	0.09±0.07(296)	0.1±0.06(331)	0.1±0.07(191)
Pass	0.28±0.13(415)	0.28±0.15(118)	0.27±0.16(300)	0.27±0.15(277)	0.27±0.13(270)	0.28±0.15(198)	0.26±0.15(268)	0.26±0.14(296)	0.26±0.13(331)	0.24±0.15(155)
Cross	0.85±0.55(343)	0.8±0.58(94)	0.7±0.44(245)	0.81±0.52(228)	0.82±0.5(220)	0.81±0.55(170)	0.73±0.45(223)	0.77±0.48(242)	0.79±0.48(269)	0.69±0.49(191)
AccCross	1.41±0.61(282)	1.33±0.57(68)	1.21±0.61(201)	1.39±0.6(162)	1.41±0.59(175)	1.34±0.61(139)	1.23±0.63(170)	1.37±0.62(188)	1.35±0.59(212)	1.25±0.61(191)
LB	0.46±0.28(414)	0.54±0.31(118)	0.52±0.32(299)	0.59±0.33(277)	0.54±0.31(269)	0.52±0.26(198)	0.53±0.33(266)	0.54±0.33(295)	0.54±0.32(330)	0.51±0.3(156)
AccLB	0.74±0.42(410)	0.77±0.48(115)	0.7±0.41(294)	0.8±0.44(266)	0.75±0.44(265)	0.74±0.42(197)	0.71±0.43(262)	0.77±0.47(287)	0.74±0.45(323)	0.72±0.44(120)
ThB	2.47±0.9(92)	2.33±0.97(24)	1.85±0.55(61)	2.12±0.68(44)	2.16±0.59(48)	2.59±1.04(47)	1.95±0.79(53)	1.91±0.46(46)	2.04±0.53(56)	1.98±0.86(191)
AccThB	2.42±0.7(33)	2.75±1.27(8)	1.88±0.47(30)	2.32±0.55(11)	2.06±0.49(16)	2.49±0.78(18)	2.04±0.72(23)	2.18±0.62(14)	2.3±0.56(17)	2.04±0.62(189)

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 3. Descriptive statistics of the variability of wide midfielders' performance under five competing situations (arbitrary unit).

Variable	Wide Midfielder									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
Shot	0.78±0.51(252)	0.74±0.49(69)	0.74±0.51(132)	0.83±0.53(120)	0.81±0.51(147)	0.74±0.53(115)	0.77±0.46(104)	0.76±0.53(131)	0.79±0.53(170)	0.68±0.45(77)
ShotOT	1.19±0.56(197)	1.08±0.57(53)	1.05±0.56(99)	1.17±0.53(94)	1.26±0.52(113)	1.07±0.58(93)	1.1±0.54(80)	1.14±0.52(100)	1.18±0.55(124)	1.02±0.6(66)
Disp	0.78±0.47(250)	0.71±0.53(70)	0.75±0.53(129)	0.72±0.47(124)	0.79±0.48(145)	0.79±0.48(115)	0.73±0.53(105)	0.75±0.5(130)	0.78±0.48(167)	0.69±0.49(76)
UnsTouch	0.87±0.53(226)	0.84±0.6(63)	0.85±0.51(115)	0.82±0.53(106)	0.84±0.5(134)	0.89±0.55(100)	0.87±0.55(97)	0.83±0.52(119)	0.89±0.51(157)	0.81±0.57(66)
Fouled	0.87±0.51(259)	0.81±0.47(74)	0.83±0.51(130)	0.83±0.52(123)	0.88±0.53(153)	0.82±0.5(116)	0.77±0.49(103)	0.88±0.55(134)	0.84±0.54(177)	0.82±0.55(78)
AW	1.1±0.58(207)	1.04±0.6(59)	1.07±0.56(100)	0.99±0.64(96)	1.16±0.54(118)	1.08±0.63(96)	1.09±0.55(93)	1.08±0.55(98)	1.07±0.6(134)	1.01±0.58(69)
Dribble	1.01±0.6(227)	0.9±0.6(63)	0.88±0.6(112)	0.96±0.56(107)	0.96±0.6(131)	1.02±0.64(104)	0.94±0.58(94)	0.91±0.59(114)	1.01±0.56(150)	0.94±0.63(74)
Offside	1.33±0.65(121)	1.4±0.49(39)	1.18±0.54(62)	1.34±0.55(56)	1.15±0.62(66)	1.41±0.59(58)	1.11±0.54(57)	1.35±0.58(55)	1.26±0.61(73)	1.17±0.63(41)
YC	1.61±0.6(98)	1.45±0.49(40)	1.36±0.63(33)	1.51±0.49(42)	1.47±0.5(56)	1.68±0.6(41)	1.61±0.47(32)	1.46±0.38(48)	1.43±0.54(60)	1.6±0.5(23)
TT	0.83±0.48(255)	0.72±0.5(66)	0.77±0.52(130)	0.83±0.54(127)	0.82±0.49(151)	0.81±0.48(113)	0.74±0.48(102)	0.79±0.5(132)	0.83±0.5(172)	0.73±0.51(77)
Interception	0.92±0.54(248)	0.87±0.51(71)	0.93±0.53(125)	0.81±0.56(116)	0.89±0.54(150)	0.95±0.55(105)	0.85±0.58(100)	0.96±0.55(134)	0.91±0.53(163)	0.9±0.57(76)
Clearance	1.05±0.65(222)	1.13±0.56(59)	1.01±0.64(105)	0.96±0.63(107)	1±0.63(125)	1.07±0.58(100)	1.11±0.56(94)	0.99±0.67(108)	1.01±0.6(148)	0.97±0.63(66)
BS	1.61±0.64(85)	1.45±0.61(28)	1.33±0.43(37)	1.5±0.61(40)	1.55±0.52(45)	1.57±0.62(38)	1.32±0.7(27)	1.42±0.44(42)	1.54±0.57(52)	1.52±0.45(29)
Foul	0.91±0.52(255)	0.77±0.5(74)	0.87±0.58(128)	0.89±0.54(121)	0.89±0.52(149)	0.92±0.53(114)	0.86±0.53(101)	0.93±0.5(129)	0.92±0.53(172)	0.81±0.53(73)
Assist	1.75±0.55(76)	1.73±0.57(23)	1.5±0.46(36)	1.62±0.36(33)	1.72±0.53(34)	1.72±0.52(46)	1.56±0.61(36)	1.67±0.46(28)	1.68±0.53(26)	1.42±0.51(39)
Touch	0.19±0.1(268)	0.24±0.21(75)	0.18±0.11(138)	0.18±0.12(133)	0.18±0.1(159)	0.19±0.11(119)	0.17±0.12(110)	0.18±0.11(141)	0.18±0.11(182)	0.18±0.11(83)
KP	0.96±0.52(235)	0.9±0.48(66)	0.84±0.55(121)	0.97±0.53(113)	0.91±0.54(139)	0.97±0.49(106)	0.92±0.5(100)	0.94±0.54(124)	0.96±0.56(161)	0.81±0.5(70)
PA	0.09±0.07(268)	0.11±0.09(75)	0.09±0.08(138)	0.09±0.09(133)	0.09±0.07(159)	0.09±0.07(119)	0.08±0.06(110)	0.1±0.08(141)	0.1±0.08(182)	0.09±0.07(83)
Pass	0.23±0.13(268)	0.29±0.22(75)	0.22±0.14(138)	0.23±0.15(133)	0.22±0.12(159)	0.24±0.14(119)	0.22±0.15(110)	0.21±0.13(141)	0.22±0.13(182)	0.24±0.15(83)
Cross	0.83±0.56(227)	0.82±0.49(59)	0.73±0.49(118)	0.86±0.52(112)	0.75±0.53(133)	0.85±0.57(100)	0.77±0.54(92)	0.77±0.51(120)	0.75±0.52(152)	0.85±0.54(71)
AccCross	1.22±0.58(149)	1.23±0.59(37)	1.15±0.52(80)	1.25±0.55(69)	1.16±0.57(86)	1.22±0.59(69)	1.13±0.6(67)	1.21±0.48(76)	1.19±0.55(93)	1.16±0.56(48)
LB	0.73±0.48(251)	0.72±0.51(71)	0.67±0.46(127)	0.69±0.45(120)	0.73±0.49(147)	0.72±0.48(113)	0.75±0.53(100)	0.71±0.44(132)	0.73±0.48(169)	0.63±0.46(78)
AccLB	0.89±0.57(235)	0.85±0.51(66)	0.84±0.54(117)	0.85±0.53(111)	0.91±0.6(137)	0.86±0.53(105)	0.85±0.53(90)	0.88±0.57(123)	0.87±0.59(153)	0.77±0.54(74)
ThB	1.51±0.62(117)	1.45±0.41(36)	1.35±0.56(53)	1.37±0.59(52)	1.54±0.57(53)	1.41±0.56(65)	1.46±0.59(58)	1.33±0.52(55)	1.47±0.58(64)	1.28±0.48(44)
AccThB	1.85±0.67(66)	1.68±0.4(21)	1.36±0.6(32)	1.55±0.63(28)	1.84±0.43(23)	1.74±0.57(41)	1.6±0.67(36)	1.5±0.57(28)	1.7±0.59(34)	1.55±0.63(29)

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 4. Descriptive statistics of the variability of central midfielders' performance under five competing situations (arbitrary unit).

Variable	Central Midfielder									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
Shot	1.06±0.57(474)	1.02±0.53(135)	0.99±0.57(308)	1.07±0.55(290)	1.04±0.57(279)	1.07±0.59(245)	0.92±0.56(275)	1.06±0.55(297)	1.1±0.55(336)	0.94±0.56(215)
ShotOT	1.54±0.74(334)	1.43±0.61(102)	1.37±0.6(202)	1.52±0.59(174)	1.51±0.65(186)	1.51±0.77(174)	1.28±0.63(186)	1.55±0.59(186)	1.56±0.63(208)	1.42±0.66(158)
Disp	1.03±0.59(460)	0.97±0.54(130)	1.01±0.54(297)	0.97±0.59(288)	1.02±0.52(263)	1.04±0.65(240)	0.96±0.58(273)	1±0.53(288)	0.99±0.57(320)	1.01±0.59(209)
UnsTouch	1.15±0.6(411)	1.09±0.55(125)	1.12±0.59(270)	1.1±0.6(265)	1.07±0.59(232)	1.19±0.6(220)	1.08±0.58(255)	1.11±0.57(252)	1.13±0.59(287)	1.15±0.59(197)
Fouled	0.95±0.49(480)	0.89±0.51(147)	0.94±0.53(323)	0.91±0.53(307)	0.97±0.52(278)	0.89±0.47(252)	0.9±0.52(299)	0.94±0.52(315)	0.96±0.51(341)	0.88±0.53(239)
AW	1.2±0.59(437)	1.08±0.59(135)	1.07±0.58(283)	1.12±0.53(268)	1.2±0.56(251)	1.15±0.58(227)	1.04±0.53(263)	1.18±0.56(278)	1.19±0.57(306)	1.01±0.53(220)
Dribble	1.25±0.6(397)	1.15±0.63(126)	1.16±0.53(237)	1.18±0.58(248)	1.22±0.57(231)	1.24±0.62(207)	1.13±0.61(230)	1.21±0.53(246)	1.2±0.57(276)	1.11±0.6(190)
Offside	2.01±0.94(158)	2.05±0.85(34)	1.65±0.69(89)	1.84±0.68(63)	1.78±0.72(70)	1.96±0.91(93)	1.7±0.67(81)	1.78±0.64(68)	1.74±0.73(88)	1.84±0.69(63)
YC	1.82±0.67(282)	1.63±0.66(92)	1.63±0.5(139)	1.54±0.63(180)	1.68±0.6(171)	1.87±0.68(134)	1.69±0.65(129)	1.58±0.56(175)	1.61±0.65(202)	1.7±0.64(97)
TT	0.71±0.4(509)	0.7±0.47(156)	0.69±0.45(346)	0.69±0.46(339)	0.71±0.43(299)	0.68±0.41(263)	0.69±0.43(316)	0.68±0.4(337)	0.73±0.42(368)	0.65±0.44(254)
Interception	0.79±0.42(494)	0.76±0.48(150)	0.74±0.48(338)	0.78±0.47(335)	0.82±0.43(288)	0.75±0.42(260)	0.74±0.47(313)	0.77±0.44(330)	0.81±0.47(357)	0.74±0.47(255)
Clearance	0.95±0.54(459)	0.95±0.55(141)	0.94±0.55(311)	0.87±0.53(311)	0.91±0.54(271)	0.97±0.54(232)	0.94±0.56(289)	0.85±0.52(311)	0.9±0.53(328)	0.9±0.58(230)
BS	1.61±0.7(316)	1.55±0.71(90)	1.54±0.59(176)	1.39±0.59(213)	1.48±0.57(179)	1.71±0.75(161)	1.53±0.63(173)	1.43±0.66(203)	1.47±0.67(214)	1.48±0.62(141)
Foul	0.89±0.46(495)	0.79±0.52(150)	0.87±0.49(331)	0.81±0.5(324)	0.88±0.48(294)	0.9±0.45(256)	0.84±0.49(306)	0.86±0.5(324)	0.86±0.49(357)	0.85±0.49(244)
Assist	2.12±0.72(148)	2.06±0.72(56)	1.86±0.62(82)	1.85±0.57(70)	2.11±0.61(61)	2±0.68(97)	1.79±0.6(97)	1.91±0.56(55)	1.98±0.72(52)	1.73±0.6(87)
Touch	0.21±0.11(515)	0.21±0.13(158)	0.21±0.12(351)	0.21±0.12(343)	0.21±0.11(304)	0.22±0.12(265)	0.2±0.13(324)	0.2±0.12(344)	0.21±0.13(375)	0.21±0.12(258)
KP	1.1±0.57(431)	1.08±0.6(126)	1±0.54(283)	1.1±0.56(252)	1.12±0.56(253)	1.06±0.58(224)	1±0.54(258)	1.09±0.54(264)	1.09±0.55(300)	1.02±0.56(201)
PA	0.08±0.05(515)	0.08±0.06(158)	0.08±0.06(351)	0.08±0.06(343)	0.08±0.05(304)	0.07±0.04(265)	0.08±0.05(324)	0.08±0.05(344)	0.08±0.05(375)	0.08±0.06(258)
Pass	0.27±0.14(515)	0.27±0.16(158)	0.26±0.15(351)	0.26±0.16(343)	0.26±0.14(304)	0.27±0.15(265)	0.25±0.16(324)	0.25±0.14(344)	0.25±0.15(375)	0.27±0.16(258)
Cross	1.19±0.73(371)	1.11±0.69(109)	1.06±0.62(244)	1.13±0.64(210)	1.12±0.69(207)	1.19±0.69(198)	1.09±0.63(230)	1.07±0.67(204)	1.1±0.65(253)	1.15±0.63(178)
AccCross	1.53±0.8(242)	1.49±0.73(65)	1.38±0.69(150)	1.41±0.65(127)	1.45±0.71(134)	1.53±0.75(129)	1.34±0.71(136)	1.34±0.7(125)	1.41±0.7(167)	1.39±0.65(106)
LB	0.55±0.31(510)	0.55±0.34(157)	0.51±0.33(347)	0.54±0.36(341)	0.53±0.32(301)	0.56±0.3(263)	0.53±0.35(323)	0.53±0.31(341)	0.53±0.34(371)	0.53±0.33(256)
AccLB	0.7±0.4(507)	0.68±0.4(153)	0.62±0.39(341)	0.67±0.44(336)	0.67±0.4(300)	0.7±0.38(261)	0.66±0.41(315)	0.65±0.41(339)	0.67±0.42(367)	0.65±0.43(256)
ThB	1.63±0.75(259)	1.62±0.64(86)	1.4±0.6(147)	1.52±0.6(144)	1.66±0.66(126)	1.54±0.72(146)	1.38±0.62(153)	1.55±0.58(131)	1.6±0.64(161)	1.4±0.66(113)
AccThB	2.04±0.72(153)	2±0.98(54)	1.72±0.6(86)	1.82±0.59(78)	1.93±0.61(66)	1.92±0.63(90)	1.69±0.58(93)	1.93±0.54(72)	1.87±0.55(80)	1.73±0.68(72)

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.

Table 5. Descriptive statistics of the variability of forwards' performance under five competing situations (arbitrary unit).

Variable	Forward									
	Group	Knockout	Home	Away	Non-qualified	Qualified	Non-qualified Opp.	Qualified Opp.	Draw/Lose	Win
Shot	0.6±0.35(203)	0.67±0.42(52)	0.53±0.37(125)	0.62±0.41(118)	0.62±0.39(113)	0.57±0.31(115)	0.49±0.33(112)	0.67±0.41(113)	0.63±0.4(151)	0.54±0.35(79)
ShotOT	1±0.52(187)	1.07±0.49(49)	0.87±0.54(115)	1.01±0.48(104)	1.04±0.54(104)	0.92±0.51(105)	0.86±0.54(104)	1±0.53(101)	1.03±0.55(129)	0.81±0.47(76)
Disp	0.79±0.42(201)	0.76±0.41(52)	0.7±0.43(119)	0.76±0.45(118)	0.79±0.44(111)	0.76±0.46(113)	0.74±0.45(107)	0.76±0.45(113)	0.74±0.43(150)	0.77±0.46(75)
UnsTouch	0.73±0.43(187)	0.72±0.41(46)	0.73±0.48(112)	0.79±0.45(112)	0.68±0.43(100)	0.76±0.48(109)	0.8±0.5(102)	0.75±0.43(107)	0.72±0.46(143)	0.79±0.48(70)
Fouled	0.82±0.46(200)	0.83±0.46(51)	0.78±0.5(121)	0.79±0.53(115)	0.8±0.52(113)	0.79±0.4(111)	0.82±0.47(112)	0.77±0.51(109)	0.76±0.51(150)	0.79±0.46(78)
AW	1.05±0.67(171)	1.09±0.58(37)	1.04±0.63(101)	1±0.61(93)	1±0.61(92)	1.07±0.66(96)	1.03±0.65(90)	0.9±0.61(91)	0.98±0.62(122)	1±0.56(61)
Dribble	1.03±0.57(183)	1.06±0.54(46)	0.99±0.56(106)	0.93±0.57(100)	1.1±0.62(95)	0.93±0.53(107)	0.97±0.53(100)	1.1±0.61(100)	1.07±0.59(136)	0.95±0.52(67)
Offside	1.26±0.55(161)	1.34±0.61(42)	1.12±0.56(100)	1.21±0.52(88)	1.33±0.56(86)	1.15±0.55(91)	1.17±0.58(90)	1.21±0.51(86)	1.26±0.55(112)	1.05±0.57(67)
YC	1.84±0.66(99)	1.83±0.84(29)	1.82±0.65(55)	1.74±0.79(49)	1.64±0.5(48)	1.87±0.7(62)	1.75±0.53(49)	1.62±0.43(50)	1.96±0.65(70)	1.6±0.84(33)
TT	1.03±0.55(192)	1.07±0.43(46)	0.99±0.56(110)	1.06±0.61(110)	1±0.57(98)	1.02±0.56(110)	1.04±0.58(100)	1.02±0.59(102)	1.02±0.58(133)	1.03±0.53(73)
Interception	1.2±0.69(173)	1.31±0.51(44)	1.2±0.62(98)	1.2±0.64(95)	1.16±0.62(92)	1.27±0.7(98)	1.21±0.66(90)	1.19±0.6(85)	1.26±0.61(126)	1.13±0.67(60)
Clearance	1.42±0.67(144)	1.27±0.58(31)	1.32±0.54(73)	1.23±0.64(80)	1.35±0.58(79)	1.4±0.71(79)	1.35±0.63(72)	1.25±0.53(73)	1.34±0.59(97)	1.36±0.67(54)
BS	2.53±0.88(57)	2.15±1.23(19)	1.74±0.44(27)	1.9±0.7(30)	1.91±0.51(29)	2.15±1.08(28)	1.85±0.62(24)	1.89±0.62(26)	1.83±0.57(30)	1.72±0.32(14)
Foul	0.94±0.47(195)	0.84±0.48(48)	0.84±0.52(114)	0.92±0.52(107)	0.89±0.52(108)	0.93±0.47(108)	0.92±0.5(107)	0.95±0.5(106)	0.96±0.51(145)	0.91±0.5(74)
Assist	1.79±0.72(89)	2.01±0.85(24)	1.64±0.5(54)	1.73±0.59(42)	1.67±0.75(33)	1.72±0.62(59)	1.64±0.63(58)	1.72±0.4(33)	1.8±0.59(42)	1.5±0.64(45)
Touch	0.2±0.1(206)	0.19±0.11(52)	0.19±0.11(125)	0.2±0.13(120)	0.18±0.1(114)	0.21±0.11(116)	0.2±0.12(112)	0.2±0.12(113)	0.19±0.11(153)	0.2±0.12(79)
KP	0.86±0.48(195)	0.91±0.47(50)	0.7±0.48(121)	0.9±0.53(108)	0.88±0.56(108)	0.78±0.42(110)	0.77±0.42(108)	0.87±0.56(102)	0.85±0.52(142)	0.67±0.44(75)
PA	0.11±0.08(206)	0.1±0.06(52)	0.1±0.08(125)	0.1±0.08(120)	0.11±0.08(114)	0.11±0.09(116)	0.1±0.07(112)	0.1±0.08(113)	0.1±0.07(153)	0.11±0.09(79)
Pass	0.24±0.12(206)	0.22±0.13(52)	0.23±0.13(125)	0.25±0.16(120)	0.22±0.11(114)	0.26±0.13(116)	0.24±0.14(112)	0.24±0.14(113)	0.23±0.13(153)	0.24±0.14(79)
Cross	0.9±0.55(179)	0.96±0.52(51)	0.85±0.58(111)	0.92±0.56(105)	0.89±0.59(99)	0.89±0.55(100)	0.87±0.54(97)	0.96±0.58(97)	0.92±0.56(129)	0.88±0.53(73)
AccCross	1.45±0.69(127)	1.51±0.56(37)	1.3±0.61(82)	1.45±0.63(60)	1.36±0.57(63)	1.41±0.69(71)	1.29±0.6(69)	1.32±0.65(54)	1.33±0.64(79)	1.33±0.74(49)
LB	0.94±0.53(194)	0.91±0.53(47)	0.93±0.52(115)	0.92±0.56(110)	0.93±0.57(103)	0.94±0.5(112)	0.9±0.48(108)	1±0.57(101)	1±0.59(142)	0.84±0.51(78)
AccLB	1.06±0.57(178)	1.08±0.62(43)	1.03±0.52(105)	1.05±0.55(98)	1.04±0.62(91)	1.06±0.52(104)	1.03±0.5(100)	1.18±0.62(92)	1.12±0.58(125)	0.96±0.51(71)
ThB	1.42±0.68(127)	1.41±0.73(37)	1.29±0.66(70)	1.38±0.6(69)	1.47±0.66(60)	1.4±0.66(80)	1.19±0.55(67)	1.34±0.6(54)	1.41±0.64(76)	1.25±0.63(57)
AccThB	1.81±0.71(90)	1.94±0.66(27)	1.59±0.63(49)	1.54±0.68(43)	1.76±0.42(38)	1.65±0.76(53)	1.47±0.71(46)	1.7±0.62(34)	1.69±0.59(48)	1.39±0.68(36)

Note: Values are presented as mean ± SD. Abbreviations: ShotOT=shot on target; Disp=player is dispossessed on the ball by an opponent-no dribble involved; UnsTouch=Unsuccessful touch; AW=aerial won; YC=yellow card; TT=total tackle; BS=blocked shot; KP=key pass; PA=pass accuracy in %; AccCross=accurate cross pass; LB=long ball; AccLB=accurate long ball; ThB=through ball; AccThB=accurate through ball.