AN ANALYSIS OF TECHNICAL EFFICIENCY FOR EUROPEAN FOOTBALL TEAMS

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ABSTRACT

AN ANALYSIS OF TECHNICAL EFFICIENCY FOR EUROPEAN FOOTBALL TEAMS

Football has developed an increasing economic importance over the past years, demonstrated by an increasing capital markets presence and the rapid growth in the sports industry and its market (Bell et al., 2012). Since the middle of 1950s, there has been an academic interest in sports economics. For more than a half century, many journals and books have been published about this field of interest. Research on the sports economics has become increasingly inquisitive in the case of theoretical approach and in the usage of econometric methodology in order to get better analysis. Also, governing bodies, such as football federations, have crucial roles on the development of their domestic football. In other words, football federations are the main institutions that are expected to deal with issues on football. To do so, these organisations enact some reforms, as it has happened in Turkish Süper Lig, that are believed to find solutions on these issues. The purposes of this thesis are ***i)*** to analyse the existing literature about the measurement of efficiency of football clubs, ***ii)*** to perform Data Envelopment Analysis (DEA) to identify appropriate production sets and to evaluate the performance of football clubs regarding to offensive, defensive and team approaches in the five biggest European football leagues: English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1 for the seasons between 2009-10 and 2017-18, ***iii)*** to compute the efficiency scores of these football clubs by Unconditional and Conditional Order-M estimators, implementing Kernel regression in order to analyze the impact of control variables over efficiency, ***iv)*** to analyse the impact of the institutional change enacted by the Turkish Football Federation (TFF) regarding the implementation of a foreign players' quota with a Difference in Differences (DiD) technique grafted on the computation of DEA bootstrapped scores. The main results are that Italian Serie A is found as the most efficient football league in defensive efficiency (98.7%) among the five biggest European football leagues. The same can be said for the Spanish La Liga in team efficiency (80.7%) and a bit less unambioguosly for the French Ligue 1 in offensive efficiency (95.0%). Among control variables, manager changes have a consistently negative impact on overall efficiency of football teams, while numbers of games in a season have a positive and significant impact. The interpretation of these results needs, of course, further research. On the other hand, controlling for the above variables, and perhaps more interestingly, we find a positive impact on efficiency for participating to international tournaments, promotion of a team and roster value of football clubs, and a negative impact for average roster age, roster size and share of new players. Finally, for Turkish football, it is found that the reform implemented by the TFF had a significant and negative impact on Turkish football clubs: the implementation of a foreign players' quota diminished the efficiency of Turkish football clubs.

Keywords: European Football Efficiency DEA Conditional Order-M

INTRODUCTION AND MAIN RESULTS

In the global economy, many sports activities stand in the system as actors that can change the balance of their respective economies. It is fair to say that the most influential game in all the sports industry is football. Football is well-established as the most popular game in the world and can be regarded as a different field altogether within sports economics (Göllü, 2012). Today football has an audience of almost 6 billion people, and the growth of the economics of this sport has already reached more than $7 billion globally (Deloitte, 2018). Overall, almost 80% of this growth rate has come from European football (Deloitte, 2018). Within the world's economies, the growth rate of football has been continuously increasing over the years (Szymanski and Kuypers, 1999; Bell et al., 2012). Clubs, employees, referees, coaches and players in football industry also affect many sectors that exist in economics. Returns or gains of sportive achievements have many impacts on economy and finance (Barajas et al., 2005).

Since the middle of 1950s, there has been an academic interest in sports economics. For instance, Rottenberg (1956) was the first defining "uncertainty of game" or "uncertainty of outcome hypothesis" (UOH) in his paper related to the demand on sporting events. In another study, Neale (1964) investigated the characteristics of fans during these events by pointing out uncertainty of outcome hypothesis. For more than a half century, many journals and books had been published about this field of interest. In addition, there have been many studies on some types of sports such as baseball, basketball and football. Initially, these studies have begun to deal with Major Baseball League in the U.S.A. and continued to be analysed (Hunt and Lewis, 1976; Hill et al., 1982; Zimbalist, 1994; Fizel et al., 1996; Gustafson et al., 1999; Butler, 2002; Ahn and Lee, 2007; Bradbury and Drinen, 2008; Krautmann and Donley, 2009). Moreover to those, there have been many researches on basketball (Zak et al., 1979; Grier and Tollison, 1990; Brown and Sauer, 1993; Berri and Eschker, 2005; Perline and Stoldt, 2007; Addesa, 2011; Deutscher, 2011; Gencer et al., 2011; De Saá Guerra et al., 2012; Ozmen, 2012; Boroujerdi et al., 2013; Casals and Martinez, 2013; Radovanović et al., 2013; García et al., 2014; Brosed Lázaro et al., 2014; Joo and Oh, 2015; Meletakos et al., 2016; Del Corral, 2017) and mostly on National Basketball Association (NBA) in the United States of America (Chatterjee and Lehmann, 1997; Hofler and Payne, 1997; Berri, 1999; Gandar et al., 2000; Taylor and Trogdon, 2002; Eschker et al., 2004; Berri et al., 2005; Leadley and Zygmont, 2005; Hofler and Payne, 2006; Kahn, 2006; Morse et al., 2007; Rascher and Solmes, 2007; Sánchez et al., 2007; Lee and Berri, 2008; Zimmer and Kuethe, 2009; Berri, 2010; Katayama

and Nuch, 2011; Simmons and Berri, 2011; Mongeon and Winfree, 2012; Lee and Worthington, 2013; Lane et al., 2014; Jane, 2016; Feddersen et al., 2018). There are also some researchers that have studied on college basketball, National Collegiate Athletic Association (NCAA), in the U.S.A. (Humphreys, 2000; Matheson and Baade, 2004; Paul and Weinbach, 2005; Wolfers, 2006; Zimmer and Kuethe, 2008; Rimler et al., 2010; Paul and Weinbach, 2011; Trail and Kim, 2011; Lopez and Matthews, 2015; Mills and Salaga, 2015; Borghesi, 2018).

In the field of sports economics, National Football League (NFL) has also been studied by various researchers (Garvey, 1989; Murrell and Curtis, 1994; Gray and Gray, 1997; Carlino and Coulson, 2004; Edelman, 2007; Champion Jr, 2008; Fortunato, 2008; McGowan and Mahon, 2009; Mondello and Maxcy, 2009; Oates, 2009; Alamar, 2010; Johnson, 2010; Nesbit and King, 2010; Robbins, 2010; Paul and Weinbach, 2011; Mitten and Hernandez, 2012; Vogan, 2014). As far as football economics is concerned, there have been many studies about professional football clubs. For example, the economics of professional football clubs was already studied by Sloane (1971) discussing how football clubs are a form of economic organization and they target to maximize their utility. In the second chapter of this thesis, more studies related with football economics, regarding to sportive performance analysis, might be found in detail.

Research on the sports economics has become increasingly inquisitive in the case of theoretical approach and in the usage of econometric methodology in order to get better analysis (Dobson and Goddard, 1998). Moreover, these researches have generally been gathered over team based performance (Dawson and Dobson, 2002) and individual player based performance in order to measure and analyse the relation between the fields of football and economics (Kulikova and Goshunova, 2014).

Nowadays, it is possible to collect dataset about the performances of football teams and their players via several detailed sports data providers (e.g. Opta Sports, Transfermarkt GmbH & Co. KG, STATS, etc.). In addition, new techniques have been developed to evaluate relative performance analysis.

The purposes of this thesis are ***i)*** to analyse the existing literature about the measurement of efficiency of football clubs, ***ii)*** to perform Data Envelopment Analysis (DEA) to identify appropriate production sets and to evaluate the performance of football clubs regarding to offensive, defensive and team approaches in the five biggest European football leagues:

English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1 for the seasons between 2009-10 and 2017-18, ***iii)*** to compute the efficiency scores of these football clubs by Unconditional and Conditional Order-M estimators, implementing Kernel regression in order to analyze the impact of control variables over efficiency, ***iv)*** to analyse the impact of the institutional change enacted by the Turkish Football Federation (TFF) regarding the implementation of a foreign players' quota through a Difference in Differences (DiD) .

The thesis is organized in four main chapters: The first chapter deals with historical developments on modern football in the five biggest European football leagues. The second chapter is a literature review of recent researches on the efficiency of football teams. The third chapter presents the assessment of technical efficiency of football teams in the biggest five European football leagues, measuring efficiency through Unconditional and Conditional Order-M estimators and using Kernel regression in order to analyze the impact of control variables over efficiency. In the fourth and final chapter, the implementation of a foreign players' quota in the Turkish Süper Lig is assessed with respect to its impact of efficiency of the Süper Lig vis-à-vis the five biggest European football leagues.

Since football has become a very competitive sector, professional football clubs must find the best usage of resource allocation method. After the FIFA Financial Fair Play financial-economic restrictions, efficient use of resource allocation has become a must for all profession football clubs (García-Cebrián et al., 2018). The measurement of sportive performance can also obtain valuable information to club managers in order to make decisions whether to hire players or to go on more investment on its own reserve of young players, or not (Dawson et al., 2000). It also helps coaches to create tactics formations and strategies and to guide players in their trainings and improvements of individual technical skills (Guzmán, 2006).

Although there are many qualified studies in the literature about measuring the efficiency of football clubs by using various indicators, a joint evaluation of the efficiency of football clubs in the biggest five European leagues has not yet been addressed. This thesis aims to fill this gap, also overcoming the strictures of two-stage efficiency measurement in the literature. The efficiency of football clubs has been used as initially productivity analysis of football clubs regarding their managerial policies and decisions. Initially, the efficiency of those football clubs has been evaluated by creating the most convenient production sets by using DEA

(Espitia-Escuer and Garcia-Cebrian, 2006). After the selection of appropriate production sets is carried out through DEA, the efficiency of European football clubs, and the relevance of some contextual variables in determining efficiency, are jointly evaluated through an unconditional order-m approach (Daraio and Simar, 2008). Adding to the originality of this work, a new concept of sportive efficiency (team efficiency) is suggested and adopted along with the more usual concepts of offensive and defensive efficiency, a some hitherto unused variables are included in the production sets of football teams.

Regarding the performance of the biggest five leagues analysed in Chapter 3, the Italian Serie A is found to be the most efficient defensively, while, according to the technique that has been adopted, the Italian Serie A, the English Premier League and the French Ligue 1 share the primacy as far as offensive performance is concerned. The Spanish La Liga is found as the league with the highest team efficiency. As far as efficiency determination is concerned, we consistently find in Chapter 3 that the number of manager changes is associated with a lower efficiency of football teams. It is important to stress that our empirical analysis cannot give a precise causal interpretation of this finding. The number of manager changes could proxy, for instance, a series of unfortunate events that affect a team season. Yet, it is useful to allow for this indicator when assessing the impact on efficiency determination of other factors. Among the latter, roster size has a consistently negative impact on efficiency, especially for the offensive and team performance. This also applies to the condition of being promoted to the league, while the contrary is true for the numbers of games played in a season. Participation to an international tournament and average roster value have also a consistently positive influence on performance in a league, also for defensive efficiency. The other indicators yield less decisive results, although the impact of the shares of foreign and international players is generally favourable and that of the share of new players is detrimental.

In Chapter 4, the recent issues in Turkish football are analysed regarding to new foreign players' quota implemented by the Turkish Football Federation. In the 2015-16 season, a new rule allowing playing with foreign players unlimitedly in each football teams' first-eleven was introduced in Turkey. The conditional order-m approach adopted in Chapter 3, is ill-suited to deal with interactive categorical variables that are at the heart of the DiD analysis. We rely instead on an approach characterised by the combination of DEA for the measurement of efficiency of football teams and a set of regression-based techniques for the application of a DiD setup on these efficiency measures. It must be however stressed from the outset that we are not interested in a two-stage analysis of efficiency in order to analyse extensively various

sources of relative inefficiency. Rather, both input and output-oriented bias-corrected scores are analysed through regression analysis, using fixed- and random-effects OLS, truncated and fractional regression models, because of the convenience of regression analysis for implementing the DiD protocol. Summing up the results of Chapter 4, it can be said the foreign players' quota reform had weakly positive effects on the offensive performance of Turkish football teams, strongly positive effects on their team efficiency, and negative (although not always significant) effects on their defensive efficiency. All this is in broad agreement with the strength of the influence of foreign players' ratio on offensive, defensive and team efficiency that could be gathered for the big five leagues in Chapter 3. The findings about the relative performance of the big five leagues are also very much aligned with those of Chapter 3.

CHAPTER 1: THE EUROPEAN FOOTBALL LEAGUES:

HISTORICAL DEVELOPMENTS AND ANALYTICAL ISSUES

1.1 Introduction to Modern Football

Although football has a great popularity nowadays, it has not found much room among scientific and cultural studies until certain periods (Morrow, 1999). Soccer is underestimated by the academic and intellectual environment on the grounds (Cenikli et al., 2017). It is seen as an issue that should not be of interest to anyone who deals with heavy subjects such as politics and economics or who expresses emotions with aesthetic creativity. Although the idea that football will not have a scientific point of view, it may seem to be the cause of indifference, however, the way that football is handled in the media and popular level influences the distance of these academic circles to football.

Football has spread rapidly to the world and it has been adopted in almost all the world. The fact that football is loved by all classes (Cenikli et al., 2017). The meaning attributed to football is different in South America, Africa, or Australia. Also, football was modernized in the 19th century as a result of the Industrial Revolution, politicized between two world wars and commercialized to a great extent by post-1980 neoliberal policies. The interest of the academic environment in football has also increased as a result of increasing violence and hooliganism in the 1980s (Giulianotti, 2002), and immediately after the neoliberal economic policies affected football, football was mostly handled by the commercial dimension of the academic environment (Cenikli et al., 2017).

1.2. The History of Modern Football

The ‘foot-played’ ball games are based on earlier times. There is no definite information about when the first foot play, which has similar aspects to today's football, started to play. However, in China, which pioneered many technological and social developments, the play 'cuju', which was played in the ages before Christ, is mentioned by some sources as the oldest football-like game (Cenikli et al., 2017).

It is unthinkable that in the periods when the interaction of societies with each other is quite limited, the foot games are similar to each other. For this reason, these foot games, which are not based on common rules, have been played with different nomenclatures by different meanings in different ways in different geographies (Giulianotti, 2002). In China, for example, the name of the game is 'Cuju', while some different forms of football are 'lunatic' in Japan, 'Marn Grook' in Australia, 'Harpastum' in Ancient Rome, 'La Soule' in Normandy, 'Calcio' in Florence', Italy (Aktükün, 2010).

1.3. The Foundation of Football Association (the FA)

On 26 October 1863, a Football Association (FA) was established with the participation of some schools in London (Giulianotti, 2002). In the meetings held during the establishment of the Federation, opposing views were made in determining the rules. Soccer and rugby football are clearly separated because of the different ideas about playing the ball manually (Wahl, 2005). In the meetings held after the establishment of FA in 1863, the rules were formalized and a wide-ranging agreement was reached. The FA Cup was dominated by the aristocratic university teams in the south of England in its early years. *Blackburn Rovers FC*, who managed to reach the FA Cup Final in 1882, overturned this habit. Since *Blackburn Rovers FC* is a team from the north of England, unlike most clubs, it consists of players from the working class (Cenikli et al., 2017). This success of *Blackburn Rovers FC* was an indication that football could spread not only in aristocratic schools but also in the north and in the working class. Thus, amateur-wealthy players began to change the football (Goldblatt, 2008).

After the first FA Cup was organized, the interest of the clubs in this tournament increased. New clubs were established during this time. The number of teams participating in the FA Cup was over a hundred in the late 1880s. A negative aspect of the cup was that the teams to be eliminated in the first rounds will spend almost a year without a match (Giulianotti, 2002). This was a very long time for both players and fans. Therefore, in 1888, the idea of organizing a tournament in the league format had been emerged. Followingly, The English Football League was founded in 1888 and the Scottish Football League was founded in 1890 (Cenikli et al., 2017). With this system, the teams participating in the league were defeated but they could play many games during a football year. In addition, this system allowed the players to spend more time in this game and the professionalism of football (Giulianotti, 2002).

1.4. The Expansion of Football via England

England, the creator country of modern football, was the most modern and developed country in the nineteenth century. Britain's economic superiority and economic policies mediated the spread of football to the world during this period. Britain's expansionist policy in the nineteenth century meant that the British poured capital and invested in many places in the world (Giulianotti, 2002). For this reason, British people from various professions immigrated to related countries as engineers, technicians, workers, businesspeople. However, the only reason for this migration was not only for economic matters. Many British students were educated in schools outside the country, or for political reasons, many British troops went to other countries (Cenikli et al., 2017). For economic reasons, these people took football all over the world (Goldblatt, 2008). This fact explains why some Spanish football clubs were established by English groups.

Towards the end of the nineteenth century, clubs in Europe began to play international encounters. However, these encounters had not yet been played under a central organization; a friendly match. Football, as in the first years in the UK, had been accepted as the game of wealthy and educated people in Europe. Similarly, in Europe, the game started to be played as amateur and professionalization started later than in England. During these periods, football ws played in a festive and welcoming environment that reflects the amateur spirit as it had not yet been commercialized and politicized (Wahl, 2005).

1.5. Industrialization of Football

In the twentieth century, football clubs started to become as corporations. This is the reason of structural changes in football. Becoming a corporation gave the clubs many advantages. We may gather these advantages under two main titles such as institutionalization and professionalization; and increasing the income (Akşar, 2005). In order for football clubs to be active actors in developing industrial football, they have to get more shares from this market. The reason of contention to get maximum share from ‘Cake’ forced the clubs to create new income sources. Therefore, they opened to capital market in order for financing and supplying long-term and lower cost funds. After these clubs headed to capital market, they also have become an institutional structure as appropriate for development of industrial football (Akşar, 2005). Thus, the clubs may both provide valuable funds from capital market and become institutional and professional.

Another reason for the clubs to enter the capital market by public offerings is that they can increase their capital or funds. Thus, they can finance all income under 'corporation'. The main goal is to enter or inject cash to their capital. Besides, investors see these clubs as 'secure firms' as they have stocks in the capital market and also some financial institutions are the controlling these clubs' interactions. It means that a club that has stocks in the capital market promote to upper levels. The clubs that have stocks in capital market are known as 'very secure firms' in the capital market (Akşar, 2005). It became obligatory for the clubs to enter the capital market because of creating extra funds for big sponsorships and transfers (especially funds for a valuable transfer budget). Moreover, the banks also consider these clubs as secure, since the brand equity of the club is given at their annual financial statements.

1.6. The History and Development of English Football

Football is a national sport in England that has a huge impact on the rules of modern football (Rosca, 2011). The first modern laws of football were published and implemented in England in 1863 (Mason, 1981). In addition, the UK has more than 40,000 football clubs and also it is considered that more clubs than all other countries (Rosca, 2011).

Football began to professionalize in 1885 in England. The first professional football team in the world *Notts County FC* was founded on the island in 1888, the Aston Villa chairman William McGregor's inaugurated by the initiative. It also went down in history as the first professional league in the world. The first season's champion was *Preston North End FC* and they also managed to unseat the season. In the league where there was an incredible competition, only four teams reached the championship three times in a row. These teams were *Huddersfield FC*, *Arsenal FC*, *Liverpool FC* and *Manchester United FC*.

Until the 1980s, one of the most popular leagues in Europe, the British League, fell with the rise of '*holganism*' (Mason, 1981). Then, In 1992, the United Kingdom Football Federation, with a radical decision, terminated the league and established the *Premier League* instead because of financial issues of football clubs (Mason, 1981). At the beginning, twenty-two teams played in the first season of the Premier League, where as in 1995, the number of football clubs in the league fell to twenty teams. UK has the initial establishments of football clubs and institutions in Europe by the oldest football club, *Sheffield United FC*, the oldest professional football club, *Notts County FC*, the oldest football federation, *England Football Federation*, the first national team, the oldest qualifying tournament FA Cup and the oldest

national Football League (Buraimo et al., 2006). Today, the Premier League, the UK's highest-level league, is one of the world's most popular and richest league (Anderson, 2008). *Manchester United FC*, *Liverpool FC*, *Arsenal FC* and *Chelsea FC* are among the most famous clubs in the world. A total of four English teams won the UEFA Champions League trophy. In addition, England National Football Team won the World Cup once in 1966 in its football history.

There are many cup competitions in which clubs from different levels of football pyramid face each other. The two major domestic competitions are the *FA Cup* and the *England League Cup*. The winners of these trophies are eligible to participate in the UEFA Europa League (The FA, 2018). The first three teams finish the Premier League attend to the UEFA Champions League, the fourth goes to round of UEFA Champions League Playoff tour goes. Winner of the Champions League Cup of the previous year, unless they does qualify for the Champions League, is eligible for the UEFA Europa League, the FA Cup winner of the Europa League Playoff round three of the European League qualifying rounds, which won the England League Cup in the previous season.

1.6.1. English Premier League

Premier League is the highest-level division of English football. In the Premier League, where a total of 20 teams are challenging, the regular season matches are played between August and May. Each club has a total of thirty-eight Premier League games during a season. At the end of the season, the first four teams in the Premier League get the right to participate the UEFA Champions League, while the next three teams qualify for the UEFA Europa League and the last three teams relegate the Football League Championship.

Since the establishment of 1992-93 season, forty-six football clubs in total have participated in the Premier League, only *Manchester United FC*, *Blackburn Rovers FC*, *Arsenal FC*, *Chelsea FC*, *Manchester City FC* and *Leicester City FC* clubs have reached the championship. *Manchester United FC* has won 13 Premier League titles and is the most successful club in general classification. On the other hand, *Liverpool FC* is the UK's most successful club on both domestic and international tournaments. Other clubs which put successful effort in the worldwide tournaments are *Tottenham FC*, *Everton FC*, *Nottingham Forest FC* and *Aston Villa FC*. Although the Premier League was sponsored by *Carling* from

1993 to 2001, *Barclays Bank* has been sponsored since 2001 and named the *Barclays Premier League*.

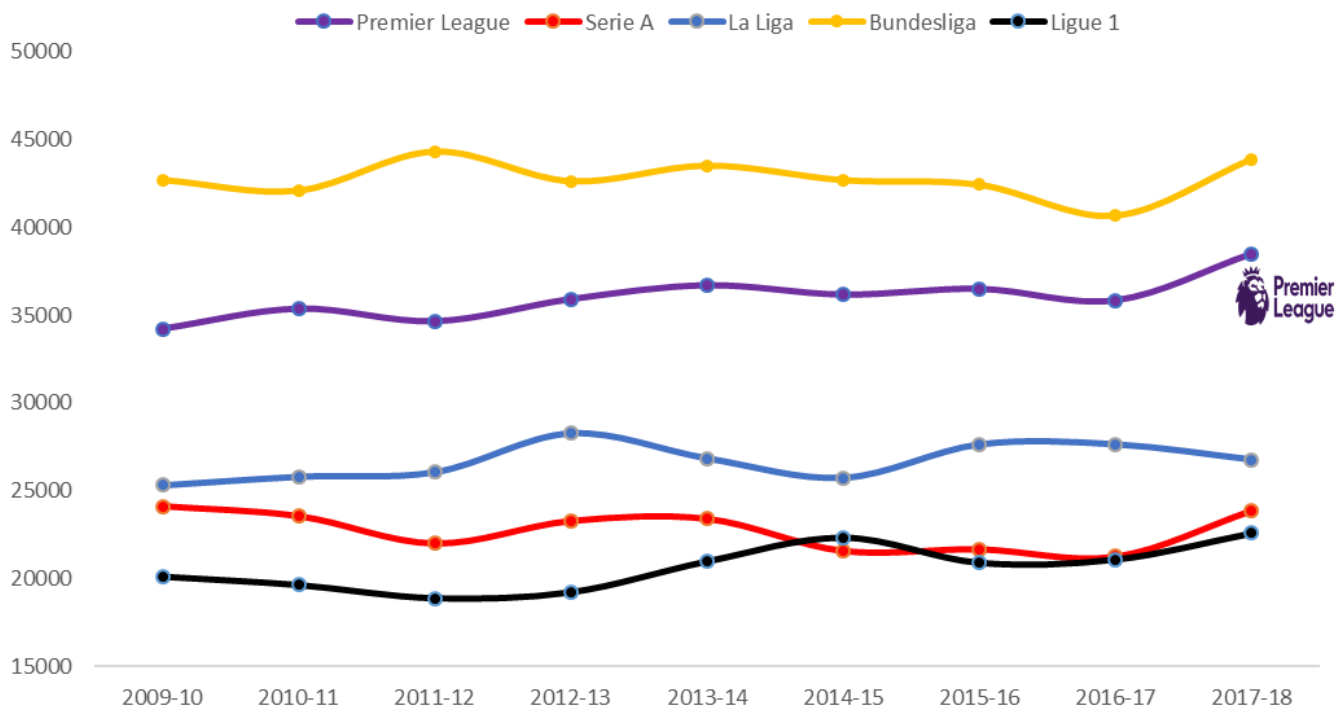
In their report, mentioning the significant economic impact of the Premier League football, Earns&Young states that from 1992-93 season up to nowadays, the Premier League has reached the highest reputation globally. In addition, they explain how the Premier League has reached the highest level of stadium utilization among the all other major European Leagues by 96%, apart from a considerable growth in broadcast revenues of TV coverages (EY, 2019). EY's Chief Economist, Mark Gregory expresses how substantially the Premier League showed a contribution to football with these words:

> "*The Premier League is a globally recognised brand, built upon high-quality football. The League's global success feeds into its capacity to generate economic and social returns within the UK. The strength of the Premier League broadcast offering, which is based on a committed global fanbase, is key to its success. The Premier League has also become an active member of the global community, presenting many commercial opportunities for the UK. Our latest report clearly shows that a successful Premier League is good not just for football but for the country as a whole.*"

According to the Premier League Executive Director, Bill Bush, pointed out the EY report in which mentions the main contribution of the Premier League clearly extends across the football itself. Bill Bush also exemplifies it by a basic model. He believes that the Premier League is a football competition in which several high-level football players all around the world are playing at very many of best football clubs and has desirous football fans watching them. Moreover, the Premier League has all capabilities and capacities to broadcast it to the rest of the world (EY, 2019). Bill Bush continues his interview with these sentences (EY, 2019):

> *"Great football gives us the economic success to invest in our own competition and provide unparalleled support to the EFL, youth development, the non-league system and community football. The national economy benefits from over £1billon in overseas earnings and over £3billion in tax because our clubs strive so hard to get the football right."*

Figure 1. Average per Game Attendance of Premier League Comparing to Biggest European Football Leagues (2009-10 to 2017-18)

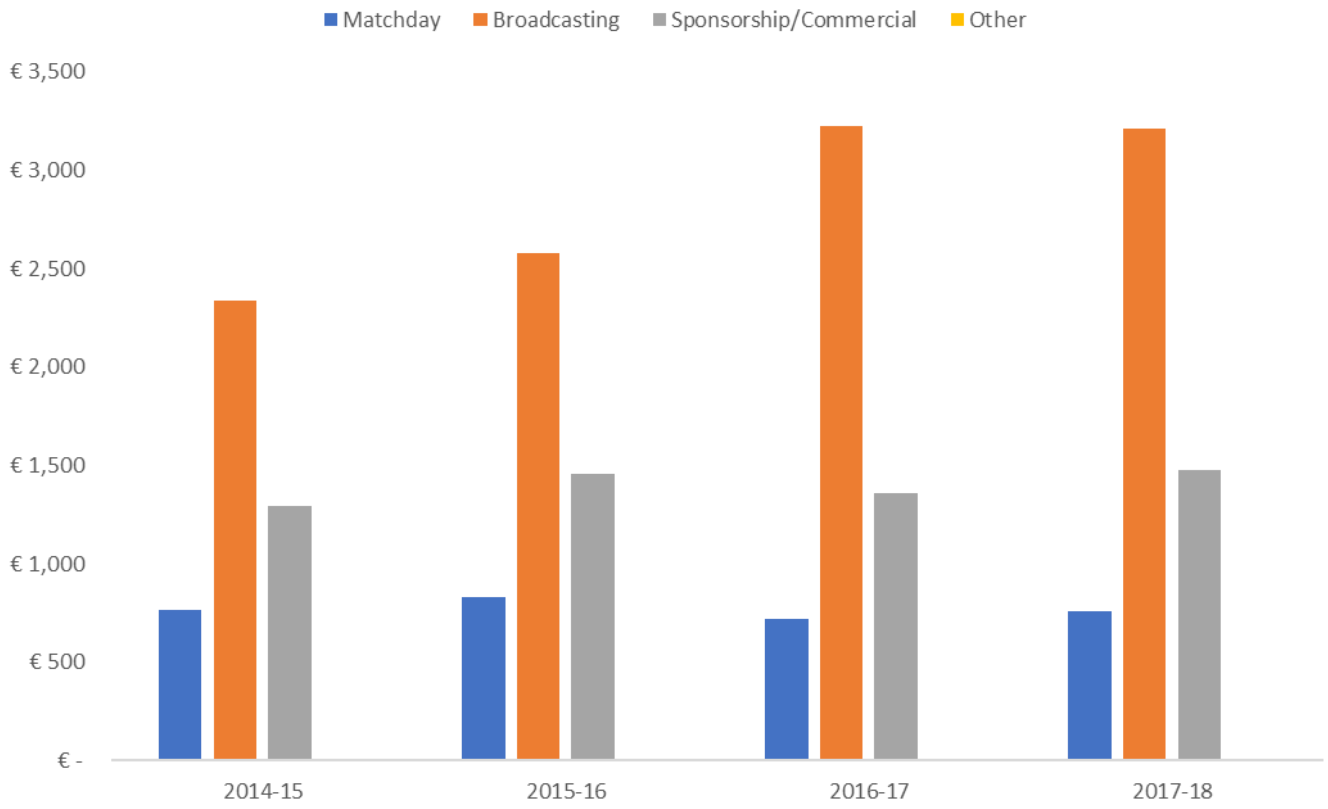


Source: Deloitte

Figure 1 shows the average per game attendance of the Premier League for seasons between 2009-10 and 2017-18 with respect to other biggest European football leagues such as Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1. In average per game attendance, English Premier League has the second highest level compared with other European football leagues. According to the figure 1, it can be said that average attendance per game in the Premier League was reached its peak in 2017-18 season, by 7% rise with respect to the previous season, and also this is the highest level in almost the last 60 years (Deloitte, 2018). One of the main reason for this peak was Tottenham Hotspur's matches at Wembley Stadium in which 123% increase occurred in the season (Deloitte, 2018).

On the other hand, Premier League clubs' average attendance drop by 2% in 2016-17. The major part of this reduction occurred from the supporters of Aston Villa FC and Newcastle United FC since they relegated to Championship. While, the minimum average attendance occurred in 2009-10 season (Deloitte, 2017).

Figure 2. English Premier League Clubs' Revenue from 2014-15 to 2017-18 (€m)



Source: Deloitte

Figure 2 shows revenues of English Premier League clubs from 2014-15 to 2017-18 seasons. Accordingly, football clubs in the Premier League had a raising trend in total revenues for the given seasons. More specifically, Premier League football clubs reached to €4.4 billion on total revenues, generating 53.1% of it from broadcasting revenues. In 2014-15 season, Premier League clubs gained more than €768K from matchday revenues, generating by premium distributions from the UEFA competitions and gate receipts. In addition, sponsorship revenues reached to €1.3 billion because of the impact of participation to international cups (Deloitte, 2016). The 72% of commercial revenues of football clubs in the Premier League were achieved by Manchester City FC, Liverpool FC, Tottenham Hotspur FC, Chelsea FC and Manchester United FC in 2014-15 season.

On the next season, the Premier League football clubs' revenues increased by almost 10%, mostly coming from broadcast income with the UEFA distributions (Deloitte, 2017). The effect of performance success of Manchester City FC reached to semi-final in the UEFA Champions League and Liverpool FC to the final in the UEFA Europe League on the previous season, broadcasting revenues jumped up by 20% in 2016-17.

In addition, Manchester United FC generated the highest revenue not only in the Premier League, but also in the world football, reaching to £581 million in both 2015-16 and 2016-17 seasons, while Leicester City FC succeeded to have the highest revenue growth in 2016-17, the season after they won the title of Premier League, by £234 million (Deloitte, 2018).

Figure 2 remarks total revenue of football clubs in English Premier League rose to €5.4 billion in 2017-18 season. The major part of these revenues were generated by Chelsea FC, Liverpool FC, Manchester City FC and Tottenham Hotspur FC and they made contribution to the revenue growth of the Premier League in overall (Deloitte, 2019).

Table 1. The List of Champion Football Clubs in the English First Division and Premier League

Clubs	Wins	Seasons
Manchester United	20	1907–08, 1910–11, 1951–52, 1955–56, 1956–57, 1964–65, 1966–67, 1992–93*, 1993–94*, 1995–96*, 1996–97*, 1998–99*, 1999–2000*, 2000–01*, 2002–03*, 2006–07*, 2007–08*, 2008–09*, 2010–11*, 2012–13*
Liverpool	18	1900–01, 1905–06, 1921–22, 1922–23, 1946–47, 1963–64, 1965–66, 1972–73, 1975–76, 1976–77, 1978–79, 1979–80, 1981–82, 1982–83, 1983–84, 1985–86, 1987–88, 1989–90
Arsenal	13	1930–31, 1932–33, 1933–34, 1934–35, 1937–38, 1947–48, 1952–53, 1970–71, 1988–89, 1990–91, 1997–98*, 2001–02*, 2003–04*
Everton	9	1890–91, 1914–15, 1927–28, 1931–32, 1938–39, 1962–63, 1969–70, 1984–85, 1986–87
Aston Villa FC	7	1893–94, 1895–96, 1896–97, 1898–99, 1899–1900, 1909–10, 1980–81
Sunderland	6	1891–92, 1892–93, 1894–95, 1901–02, 1912–13, 1935–36
Chelsea	6	1954–55, 2004–05*, 2005–06*, 2009–10*, 2014–15*, 2016–17*
Manchester City	5	1936–37, 1967–68, 2011–12*, 2013–14*, 2017–18*
Newcastle United	4	1904–05, 1906–07, 1908–09, 1926–27
Sheffield Wednesday	4	1902–03, 1903–04, 1928–29, 1929–30
Wolverhampton Wanderers	3	1953–54, 1957–58, 1958–59
Leeds United	3	1968–69, 1973–74, 1991–92
Huddersfield Town	3	1923–24, 1924–25, 1925–26
Blackburn Rovers	3	1911–12, 1913–14, 1994–95*
Preston North End	2	1888–89, 1889–90
Tottenham Hotspur	2	1950–51, 1960–61
Derby County	2	1971–72, 1974–75
Burnley	2	1920–21, 1959–60
Portsmouth	2	1948–49, 1949–50
Sheffield United	1	1897–98
West Bromwich Albion	1	1919–20
Ipswich Town	1	1961–62
Nottingham Forest	1	1977–78
Leicester City	1	2015–16*

Source: The Premier League

* represents for the Premier League titles.

Table 1 represents the list of champions in the English First Division and Premier League (after 1992-93 season) from 1888 to until today. It is seen that there are twenty-four different football clubs have won the title of these championships. It can be observed that Preston North End FC was the first champion of the league in 1888 when the league had begun. They also continued their initial success in following season (from 1888-89 to 1889-90). They managed to be champion in the league two times in the league history.

According to the table 1, it can be said that the most successful team of the Premier League is Manchester United FC who have reached 20 glorious victories. In addition to their magnificent achievements, they succeeded to lift the trophy three times in a row in two different periods (from 1998-99 to 2000-01 and 2006-07 to 2008-09). By showing remarkable efforts, Manchester United FC also reached to the happy ending on UEFA Champions League at the same year when they lifted the league trophy in 1998-99 and 2007-08 seasons. Among the all English football clubs, Manchester United FC is the only team succeeded to win FIFA Club World Cup in 1999 and 2008 years.

Liverpool FC and Arsenal FC are following their rival for the number of championship titles in the Premier League with eighteen and thirteen championships, respectfully. Liverpool FC performed well to win the league trophy mostly during 1970s and 1980s, whereas Arsenal FC lifted the league trophy in a row in 1930s and also they had remarkable effort during 1990s as well. Similar to Manchester United FC, Liverpool FC also managed to make double in both league and international competitions, the UEFA Champions League, by winning it in 1976-77 and 1983-84 seasons; and the UEFA Europa League in 1972-73 and 1975-76 seasons. Interestingly, they have won more trophies in European tournaments rather than the Premier League in their history. Arsenal FC, on the other hand, could not make the same success by winning both domestic and international cups in the same football season in their history.

Table 1 shows that Everton FC and Aston Villa FC are following their competitors with nine and seven championships, respectfully. Although it seems that Everton FC was dominating the league in the first half of 20^{th} century, they had their last two championships in 1984-85 and 1986-87. Different from than others, Aston Villa FC dominated the English football with remarkable championships in the late of 1890s and their last championship came up in 1980-81 season.

When we look at the table 1, it is seen that Sunderland FC have six championships in the history of English football league. Moreover, triumphant teams in European competitions,

Chelsea FC and the last champion of the Premier League, Manchester City FC lifted the league trophy six and five times in their history, respectfully. Except the one in 1954-55 season, Chelsea FC retitled the Premier League after 2004-05 football seasons, whereas Manchester City FC are similar to their rival with several wins in the league in recent years.

Following their competitors, Newcastle United FC and Sheffield Wednesday FC have hold four league trophies in which was won before 1930s. Besides, the teams with three championships are seen in the table 1 such as Wolverhampton Wanderers FC, Leeds United FC, Huddersfield Town FC and Blackburn Rovers FC. Although the first two championships belong to Preston North End FC, they could not have any other league trophy in their history. Similar to them, Tottenham Hotspur FC, Derby County FC, Burnley FC and Portsmouth FC have hold two championships of Premier League. Although they have one league trophy, Leicester City FC made a remarkable effort in 2015-16 season and surprised all football authorities by winning the Premier League. In addition, Sheffield United FC, West Bromwich Albion FC, Ipswich Town FC and Nottingham Forrest FC have been holding the league trophy one time at their hall of fame.

1.7. The History and Development of Italian Football

Calcio, the word means football in Italian, is the most famous sport in Italy (Baroncelli and Lago, 2006). Italy National Football Team is one of the most successful teams in the world (FIFA, 2018). They won the World Cup four times in the years 1934, 1938, 1982 and 2006, coming after Brazil where they achieved to win the trophy five times (FIFA, 2018). Moreover, Italian National Football Team succeeded to participate to World Cup tournaments seventeen times and it placed them in the top four on rankings of the FIFA (FIFA, 2018). Their achievements did not end there, since they completed the European Football Championship as the first in 1968 and the runners-up in 2000 and 2012. They also once brought the Summer Olympics Trophy to their museum. (FIFA, 2018).

Italian clubs are also one of the most successful teams in Europe (UEFA, 2018), with twelve Champions League and nine European League and Super Cups (UEFA, 2018) trophy winnings. *Serie A*, Italy's top-level football league, is listed among the best national football leagues in the world. *Juventus FC*, one of the world's most famous clubs, such as *FC Internazionale* and *AC Milan*, that is in Milano (UEFA, 2018). *Juventus FC* and *AC Milan* are

also founding members of the European Clubs Association (ECA, 2018). Furthermore, there are many Italian football players who candidate to win the *Ballon d'Or* award almost in every year (Coggin, 2017). Hence, Italian football is one of the best in Europe among different leagues and competitions.

Other types of football are known to play in Italy in ancient times. The oldest type of the football, '*harpastum'*, was played during the Roman Empire (Malde, 2014). This game may have influenced other types, such as medieval football, with the expansion of the empire. Since the 16th century, different types of football have been played in Florence apart from modern football (Giovanelli, 2018). Some famous Florentines played this game, especially the members of the Medici family, such as Piero, Lorenzo and Alessandro Medici. In Italy, the word "*calcio*", which was referred as a pre-kick, later used in football.

Modern football rules came to Italy during the 1880s (Giovanelli, 2018). The answer to the question of which club was the first Italian football club is a bit controversial, however, it is the *Genoa Cricket & Football Club* established to represent England in 1863 by a British who was mentioned the most in popular history (Football Italia, 2014). Three years later, in 1896, a man named James Richardson Spensley came to Genoa with a football division and became Italy's first coach (Whelan, 2012).

The first national tournament was organized by the Italian Gymnastics Federation (IFFHS, 2017). *The Udinese Calcio*, team of Udine, won this glorious tournament. In 1897, the tournament was held by S.G. and The Torinese team won. In 1898, the Italian Football Federation (FIGC) is finally organizing their first tournament. This tournament is considered the first regular national championship and the champion was *Genoa CFC*.

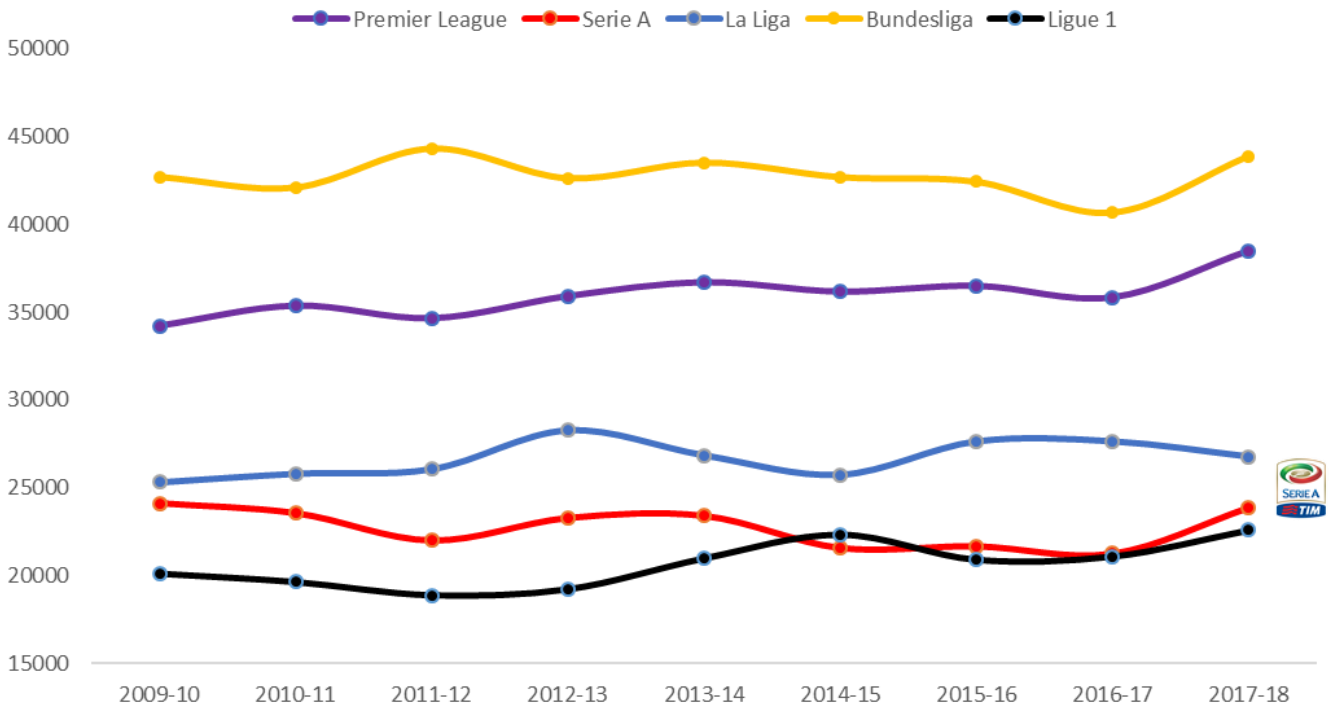
1.7.1. Italian Serie A

Serie A is the top of the Italian football leagues. The main sponsor is the Italian telecommunications company TIM (Telecom Italia Mobile). It is one of the most challenging leagues in European leagues. There are 20 teams competing in each season. Serie A began in 1898 while the regional leagues continued until that date (FIGC, 2018). The season-winning team is referred to as *the scudetto* and in the next season's uniform, they put on a coat of three colors of the Italian flag. Although the first champion of Serie A was *Genoa CFC*, recent years show that the most successful teams are *Juventus FC*, *AC Milan* and *FC Internazionale*.

Apart from these football clubs, *AS Roma*, *SSC Napoli*, *ACF Fiorentina* and *SS Lazio* are the most well-known teams. Each 10 championship is awarded with a 'star'. That is why *Juventus FC* has the right to carry three stars, whereas *AC Milan* and *FC Internazionale* have one star on their jerseys. At the end of the season, the last three teams fall to *Serie B* (Lega Nazionale Professionisti, 2018).

Serie A has begun in 1898 (IFFHS, 2017). However, Serie A was played in a regional league until 1929, became the nationalist league in the 1929-1930 season with the attempts of the Football Federation and reached *Ambrossiana*, the first championship of the most important tournament. An interesting and motivating application in Serie A is *Scudetto*. The season-winning team is called the *Scudetto*, and in the next season's uniform, winner puts on a suit with three colors of the Italian flag.

Figure 3. Average per Game Attendance of Serie A Comparing to Biggest European Football Leagues (2009-10 to 2017-18)



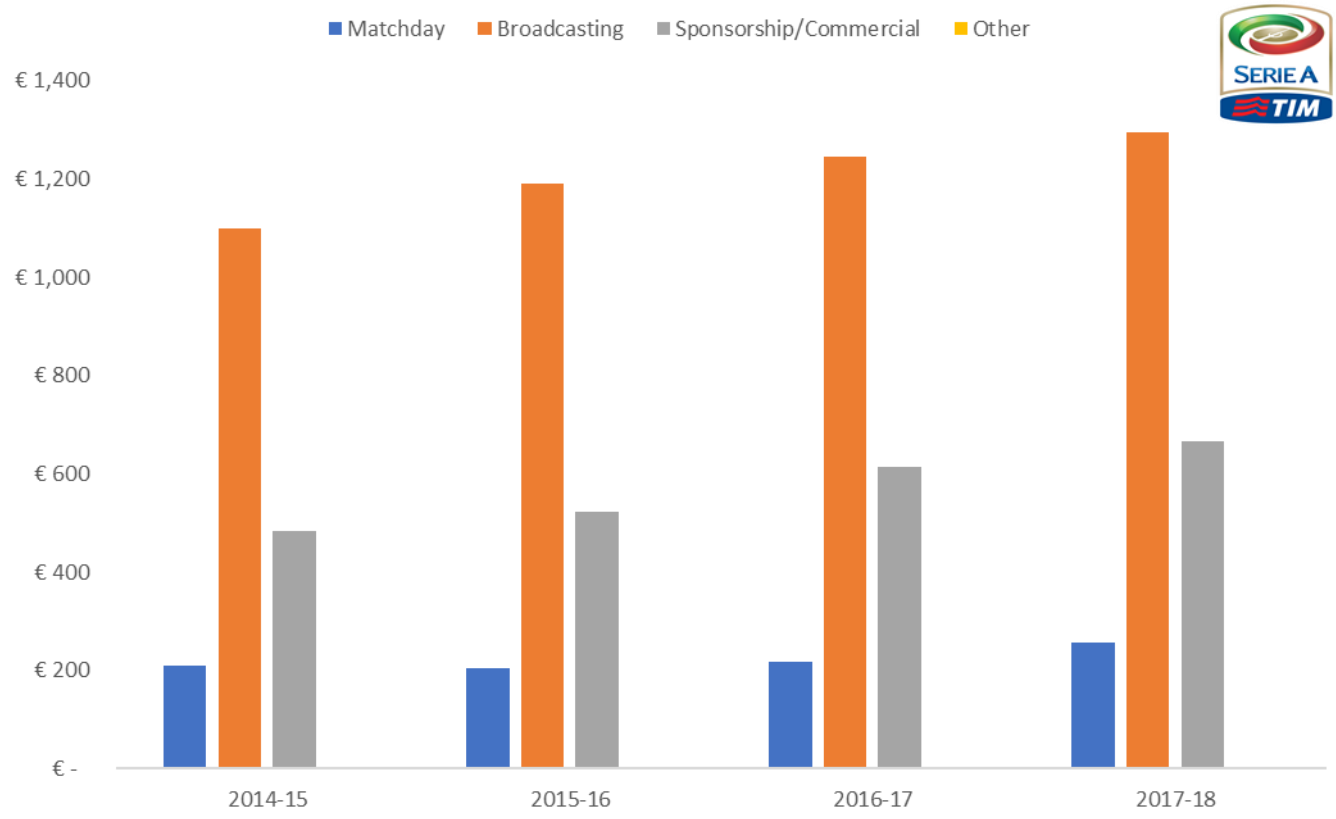
Source: Deloitte

Figure 3 presents the average per game attendance of the Serie A for seasons between 2009-10 and 2017-18 comparing to other biggest European football leagues such as English Premier League, Spanish La Liga, German Bundesliga and French Ligue 1.

Among these European football leagues, Serie A retain fourth place in total attendance terms for the last nine seasons. Although the lowest average attendance per match was reached to 21,262 in 2016-17 seasons, there was a significant jump by 12.1% on the following season, achieving 23,848 average attendance per match (Deloitte, 2019). Nevertheless, the highest average attendance level was recorded, unlikely to the Premier League and La Liga, in 2009-10 season.

Recently, Serie A average attendance per match raised to more than 25,000 - which was the highest level achieved since 2003-04 season - including 7% increase by Juventus due to the transfer of Cristiano Ronaldo (Deloitte, 2019).

Figure 4. Italian Serie A Clubs' Revenue from 2014-15 to 2017-18 (€m)



Source: Deloitte

Figure 4 displays matchday, broadcasting and sponsorship/commercial revenues of Italian Serie A football clubs between 2014-15 and 2017-18 seasons. According to the figure 4, it can be stated that Italian Serie A has specific characteristics as far as revenues are concerned. In other words, unlike in the Premier League and Ligue 1, all kinds of broadcast and sponsorship/commercial revenues have increased throughout the period under scrutiny. In 2014-15, broadcast revenues formed 63.1% of total revenues in the Serie A.

In particular, the most six successful Italian clubs such as Juventus FC, AC Milan, AS Roma, FC Internazionale, SSC Napoli and ACF Fiorentina generated 7% of the total revenue in the Serie A (Deloitte, 2016). Also, Italian football clubs received €693K from matchday and sponsorship/commercial incomes.

On the following season, total revenues of Italian football clubs jumped up by 7% due to increase in UEFA distributions, revenue growth in broadcast rights after Infront Sports & Media and rise in commercial revenues in which Juventus FC singly gained almost €29m (Deloitte, 2017). In 2016-17, Serie A clubs recorded more than €2 billion, with 8% growth. The big part of this jump generated from €91m (17%) increase in commercial revenues with respect to the previous season. In particular, FC Internazionale's acquisition by Chinese electronics retailer Suning provided more than 80% of it (Deloitte, 2018).

In 2017-18, Serie A clubs recorded over €3 billion total revenues in which was for the first time in the league history. More specifically, 52.3% of total revenues were driven by broadcast revenues in 2017-18 season. Another contribution also recorded from commercial revenues of FC Internazionale and AS Roma, that gained the second highest UEFA distribution. Considerably, the growth of matchday income increased by 24% due to the additional matches of AC Milan and FC Internazionale at San Siro for the UEFA Champions League (Deloitte, 2019).

Table 2. The List of Champion Football Clubs in Italian Serie A

Clubs	Wins	Seasons
Juventus FC	34	1905, 1925–26, 1930–31, 1931–32, 1932–33, 1933–34, 1934–35, 1949–50, 1951–52, 1957–58, 1959–60, 1960–61, 1966–67, 1971–72, 1972–73, 1974–75, 1976–77, 1977–78, 1980–81, 1981–82, 1983–84, 1985–86, 1994–95, 1996–97, 1997–98, 2001–02, 2002–03, 2004–05, 2005–06, 2011–12, 2012–13, 2013–14, 2014–15, 2015–16, 2016–17, 2017–18
AC Milan	18	1901, 1906, 1907, 1950–51, 1954–55, 1956–57, 1958–59, 1961–62, 1967–68, 1978–79, 1987–88, 1991–92, 1992–93, 1993–94, 1995–96, 1998–99, 2003–04, 2010–11
FC Internazionale	18	1909–10, 1919–20, 1929–30, 1937–38, 1939–40, 1952–53, 1953–54, 1962–63, 1964–65, 1965–66, 1970–71, 1979–80, 1988–89, 2005–06, 2006–07, 2007–08, 2008–09, 2009–10
Genoa CFC	9	1898, 1899, 1900, 1902, 1903, 1904, 1914–15, 1922–23, 1923–24
Torino FC	7	1926–27, 1927–28, 1942–43, 1945–46, 1946–47, 1947–48, 1948–49, 1975–76
Bologna FC	7	1924–25, 1928–29, 1935–36, 1936–37, 1938–39, 1940–41, 1963–64
US Pro Vercelli	7	1908, 1909, 1910–11, 1911–12, 1912–13, 1920–21, 1921–22
AS Roma	3	1941–42, 1982–83, 2000–01
SS Lazio	2	1973–74, 1999–2000
SSC Napoli	2	1986–87, 1989–90
ACF Fiorentina	2	1955–56, 1968–69
UC Sampdoria	1	1990–91
H. Verona FC	1	1984–85
Cagliari Calcio	1	1969–70
USD Novese	1	1921–22
AS Casale	1	1913–14

Source: Federazione Italiana Giuoco Calcio (FIGC)

Table 2 represents the list of champions in the Italian Serie A from 1898 to until today. It is seen that there are sixteen different football clubs have won the Serie A championship. It can be observed that Genoa CFC was the first champion of Serie A in 1898 when the league had begun. They also continued their initial success for the following two seasons (from 1898 to 1900). They managed to be champion in Serie A nine times in the league history, however, Genoa CFC have not been champion in the Serie A since 1923-24 football season.

According to the table 2, it can be said that the most successful team of Serie A is Juventus FC who have reached thirty-four glorious victories. In addition to their magnificent achievements, they succeeded to put three colors of the Italian flag seven times in a row since

they have been champion in Italian Serie A for the last seven seasons. If one may look carefully, it is seen that Juventus FC have broken new ground in the Serie A by having seven championships in a row since this achievement has been happening for the first time in the history of Italian Serie A football league. By showing remarkable efforts, Juventus FC were so close to lift both domestic and international cups in the same year, whereas although they managed to accomplish for Serie A, they were runner-up in the UEFA Champions League for the seasons of 1972-73, 1996-97, 1997-98, 2002-03, 2014-15, 2016-17 and as being finalist of the last year, 2017-18. AC Milan and FC Internazionale are following Juventus FC on winning the title of Serie A. Both *Milanese* football clubs have eighteen important championships in the league so far. AC Milan had three championships in a row between the seasons of 1991-92 and 1993-94, whereas FC Internazionale lifted the trophy of Serie A five times in a row from 2005-06 to 2009-10. It also must be considered that FC Internazionale showed remarkable performance in 2009-10 football season when they lifted both the Serie A and the UEFA Champions League cups at the same year. Likewise their rival, AC Milan also managed to put valuable effort for the year of 1993-94 when they reached victories at both the Serie A and the UEFA Champions League cups and in 1967-68 in which the tournament had different name, the UEFA European Cup Winner's Cup. They were so close to previous season, 1992-93, by reaching the championship in the Serie A, however, concluding the UEFA Champions League with runner-up position.

Table 2 also shows that Torino FC, Bologna FC and US Pro Vercelli have seven times championships in Italian Serie A. Among these three teams, US Pro Vercelli did not give rein to any other teams and lifted the trophy five teams in a row in Serie A from 1908 to 1912-13. Moreover, represented team from *Turin*, Torino FC succeeded to be champion in the league four times in a row from 1945-46 to 1948-49.

1.8. The History and Development of Spanish Football

Football is the most recognized and famous sport in Spain (Torrebadella-Flix et al., 2017). The Spanish Football Federation (RFEF), the national governing body, is in charge of organizing the Spanish King's Cup with La Liga (RFEF, 2012) and directing the Spanish National Football Team, the former champion of the World Cup in 2010 (FIFA, 2018).

In Spain, in the late 19th century with modern football, British immigrants were introduced to foreign sailors who came to the country by ship and Spanish students were returning to the country after studying in Britain. The oldest club in Spain, *RC Recreativo de Huelva*, was founded on 23 December 1889 by the *Rio Tinto Company*, which employs both Mackey and British workers. *Gimnàstic de Tarragona* (founded in 1886) and *Sevilla Fútbol Club* (founded in 1890) were not considered as the first club since they did not have a football branch until 1914 and 1905, respectfully. The first official football match in Spain was held on March 8, 1890 in Sevilla, at *Tablada Hippodrome*. The *RC Recreativo de Huelva* team played against *Sevilla Fútbol Club*, who had been established with all of the people working as water workers in Sevilla. All the players who played on both teams except the two Spanish players were British. This is the reason why name of the team is not *Sevilla CF* (club de fútbol), but *Sevilla FC* (football club). *Sevilla Fútbol Club* team won the match 2-0 against *RC Recreativo de Huelva* and started their career with the first win in Spanish football history (Rull, 2014).

In the 1890s in the Basque Country, the name of *Bilbao Football Club*, which was established by British shipyard workers and miners, was changed to *Athletic Bilbao* as the Basque students returned from Britain. This early start of Britain led to the use of English words like *Recreation Club, Athletic Club de Bilbao* (Torrebadella-Flix et al., 2017).

In terms of both domestic and international competitions, Spain's most successful teams are *FC Barcelona* and *Real Madrid CF*. These two teams took the UEFA Champions League trophies eighteen times to the museum in total. *Real Madrid CF* is the most successful team in Europe by winning thirteen UEFA Champions League and two UEFA League Cups. *Real Madrid CF*, in addition, managed to lift the trophy of UEFA Champions League for the first time among all European football clubs, where its name was the European Champion Clubs' Cup. *FC Barcelona* and *Real Madrid CF* have a total of fifty-four La Liga titles. Spanish clubs have won the UEFA Cup Winners' Cup seveb times and the UEFA Europa League Cup six times (UEFA, 2018).

1.8.1. Spanish La Liga

La Liga is the top league of the Spanish soccer league. The main sponsor of the league is the royal family. It covers all leagues, although it is generally used for the top league, the first league. The top two leagues, the Primera División (1st League) and the Segunda División (2nd League), consist of professional teams, while the other leagues are amateurs (RFEF, 2012).

La Liga have begun quite late compared to the other two major leagues, the Serie A and the Premier League. The league, which was first organized in 1929 and its title won by *FC Barcelona*, had a significant change especially after 1950 and nine different teams managed to reach to glorious ending. Famous for its incredible rival contention between *Real Madrid CF* and *FC Barcelona*, *La Liga* continues to entertain its supporter with developing football mentality.

Table 3. The List of Champion Football Clubs in Spanish La Liga

Clubs	Wins	Seasons
Real Madrid CF	33	1931-32, 1932-33, 1953-54, 1954-55, 1956-57, 1957-58, 1960-61, 1961-62, 1962-63, 1963-64, 1964-65, 1966-67, 1967-68, 1968-69, 1971-72, 1974-75, 1975-76, 1977-78, 1978-79, 1979-80, 1985-86, 1986-87, 1987-88, 1988-89, 1989-90, 1994-95, 1996-97, 2000-01, 2002-03, 2006-07, 2007-08, 2011-12, 2016-17
FC Barcelona	25	1929, 1944-45, 1947-48, 1948-49, 1951-52, 1952-53, 1958-59, 1959-60, 1973-74, 1984-85, 1990-91, 1991-92, 1992-93, 1993-94, 1997-98, 1998-99, 2004-05, 2005-06, 2008-09, 2009-10, 2010-11, 2012-13, 2014-15, 2015-16, 2017-18
Club Atlético de Madrid	10	1939-40, 1940-41, 1949,50, 1950-51, 1965-66, 1969-70, 1972-73, 1976-77, 1995-96, 2013-14
Athletic Club de Bilbao	8	1929-30, 1930-31, 1933-34, 1935-36, 1942-43, 1955-56, 1982-83, 1983-84,
Valencia CF	6	1941-42, 1943-44, 1946-47, 1970-71, 2001-02, 2003-04
Real Sociedad de Fútbol	2	1980-81, 1981-82
RC Deportivo La Coruña	1	1999-2000
Sevilla FC	1	1945-46
Real Betis Balompié	1	1934-35

Source: Real Federación Española de Fútbol (RFEF)

Table 3 remarks the list of champion football clubs in Spanish La Liga between 1929 to until today. Accordingly, it can be observed that there are nine different football clubs that have won the La Liga title in the Spanish football history. Real Madrid CF is the most winner team of La Liga by thirty-three times in Spain. In addition to their high level of success in the league, they have the record of winning the league title five seasons in a row from 1985-86 to 1989-90. In many of their victories in La Liga, they have managed to win other trophies in domestic and international competitions at the same seasons when they won league title.

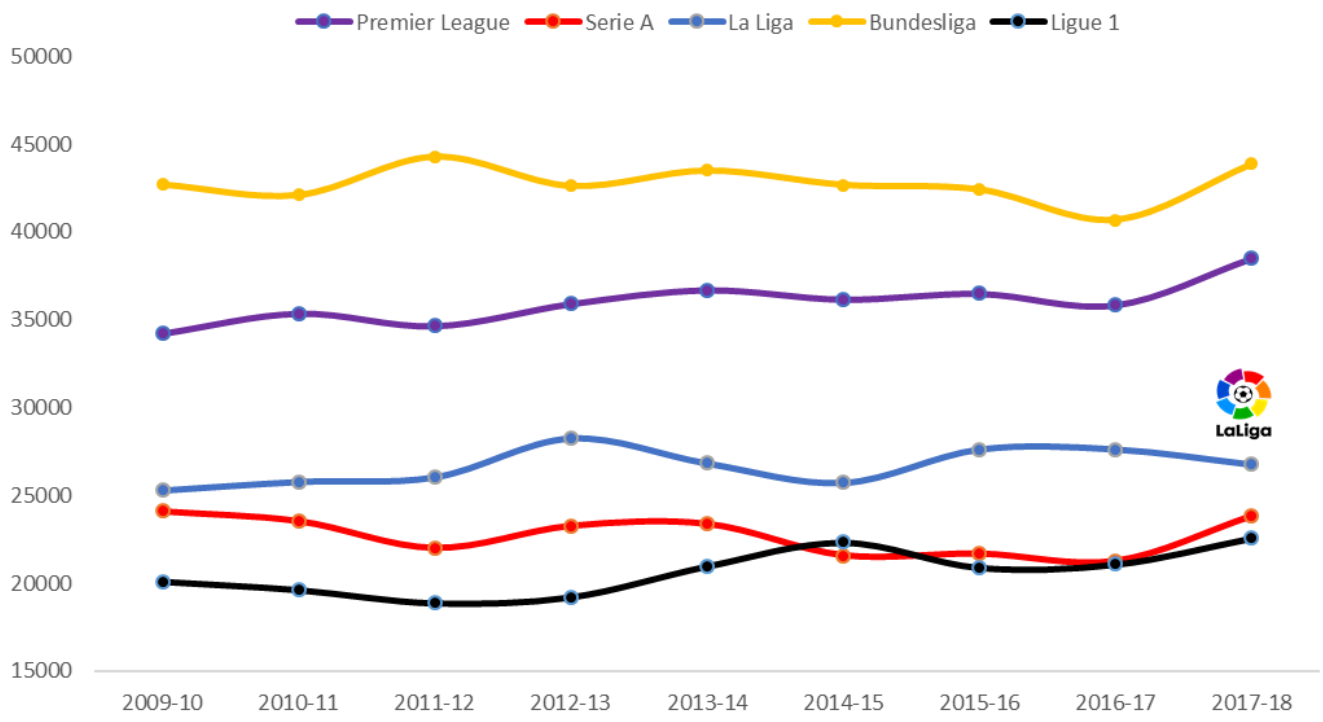
FC Barcelona, the first champion of the La Liga, have also another remarkable performance on the Spanish La Liga with twenty-five championships. Similar to their rival, they honored their fan many times by having more than one trophy in a season including La Liga, Copa del Rey, the UEFA Champions League and the UEFA Super Cup. Furthermore, FC Barcelona are the latest champion of Spanish La Liga since they won the league in 2017-18.

Another important Spanish football club, Atlético Club de Madrid, have been following their competitors with ten La Liga championships in their career. Although they have won many trophies in well-known European competitions such as the UEFA Champions League, the UEFA Europa League and the UEFA Super Cup, they could not succeed to win both domestic and international cups at the same season. Atlético Madrid have also owned one Intercontinental Cup at their museum.

The second champion of the La Liga history, Athletic Club de Bilbao, have owned the La Liga eight times in their career, although those victories mostly happened in the 1930s. Valencia CF have been following the other Spanish teams with six important championships of Spanish La Liga. The half of their league winnings belong to 1940s, however, they achieved to win the league title with valuable performance 2001-02 and 2003-04 seasons.

When we look at the table 3, it can be said that Real Sociedad de Fútbol have owned two La Liga championships in which were gained in a row from 1980-81 to 1981-82. Moreover, there are other Spanish football clubs that have won the Spanish La Liga at least one time in their history such as RC Deportivo La Coruña (1999-2000), Sevilla FC (1945-46) and Real Betis Balompié (1934-35).

Figure 5. Average per Game Attendance of La Liga Comparing to Biggest European Football Leagues (2009-10 to 2017-18)

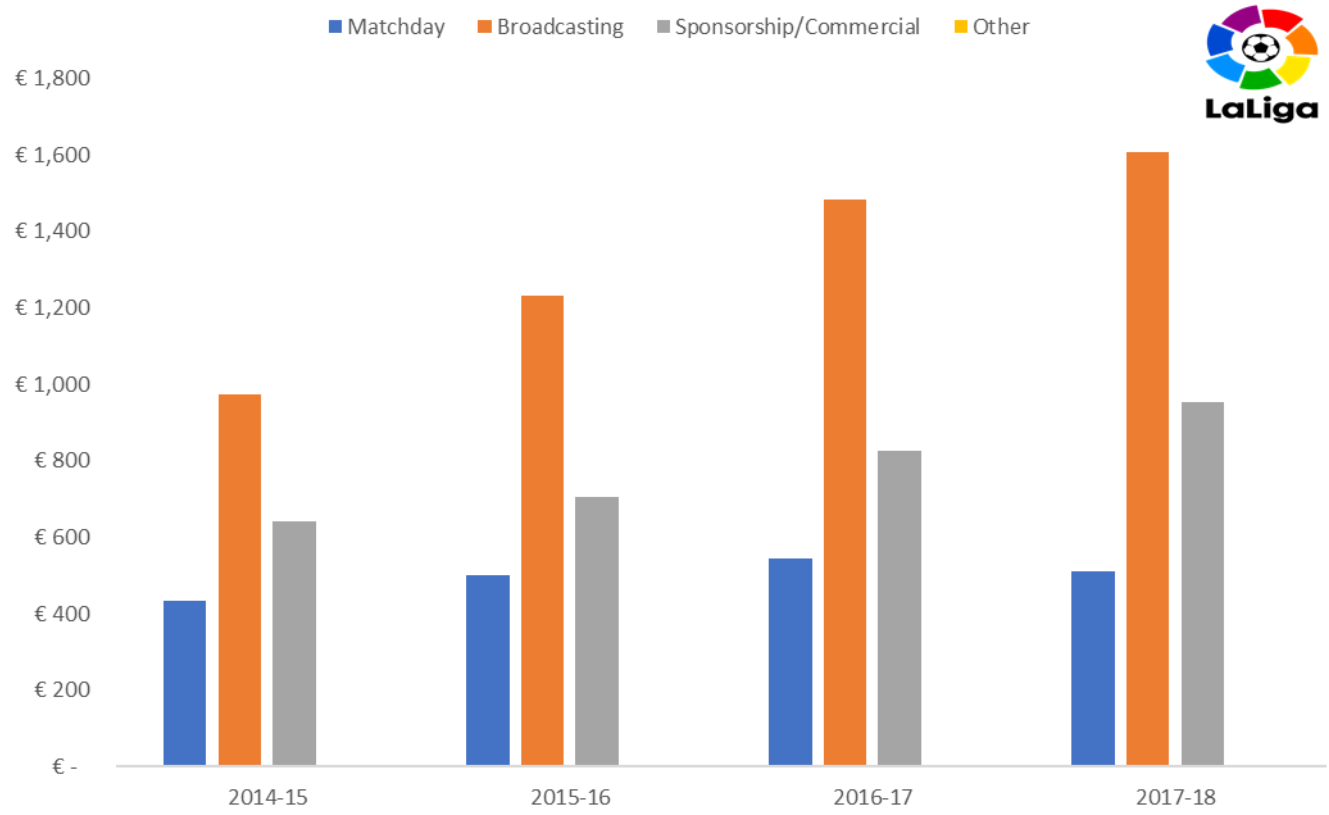


Source: Deloitte

Average per game attendance of La Liga, from 2009-10 to 2017-18, with respect to other biggest European football leagues is demonstrated in figure 5. Accordingly, La Liga has the third largest average attendance per game among the European football leagues (Deloitte, 2019). Similar to the Premier League, La Liga reached its lowest average attendance per game in 2009-10 season by 25,300 among the last nine seasons. For the following four seasons, average attendance had been in a rising tendency and reached to top level in 2012-13 season (28,250 spectators in average per match).

After this season, there occurred a decrease by 4.9% (2013-14) and by 8.91% (2014-15). According to the annual report of Deloitte, the average attendance per game in La Liga for 2015-16 and 2016-17 seasons were almost equal (27,626 and 27,630). Whilst, Despite Atlético Club de Madrid FC moved to a new stadium with higher capacity in 2017-18, there occurred 3,1% drop in average attendance per match in La Liga (Deloitte, 2018).

Figure 6. Spanish La Liga Clubs' Revenue from 2014-15 to 2017-18 (€m)



Source: Deloitte

Figure 6 illustrates revenues of Spanish La Liga football clubs from 2014-15 to 2017-18 seasons. Accordingly, football clubs in the La Liga had increasing trend in total revenues for the given seasons. In particular, La Liga clubs generated over €2 billion total revenues in 2014-15 season, in which 47.5% were driven by broadcast revenues. New partnerships of Atlético Club de Madrid, FC Barcelona and Real Madrid CF caused €45m additional income in which captured 8% of commercial revenue growth in La Liga (Deloitte, 2016). Next season, there occurred a significant jump up by 19% to over €2.4 billion on total revenues compared to 2014-15 season and this rise was largely driven by three year broadcast rights (Deloitte, 2017). In 2016-17, total revenues of football clubs in the La Liga reached to €2.9 billion with 17.1% growth. In particular, 52% of total revenues were generated by broadcast income of La Liga clubs. This financial performance achievement in 2016-17 season made La Liga the second highest revenue-generating league in the world (Deloitte, 2018). Although there was a slight reduction on matchday incomes by almost 7% on the following season, broadcast (7.8%) and sponsorship/commercial (13.4%) revenues of football clubs in the La Liga increased. The major part of this rise occurred due to Real Madrid CF's success in the UEFA Champions League and FC Barcelona's new four-year shirt front sponsorship deal made with Rakuten (Deloitte, 2019).

1.9. The History and Development of German Football

In Germany, football is the most famous and entertaining sport branch (The Economist, 2013). The German Football Association, *Deutscher Fußball-Bund* (DFB) is the national governing body including more than six million members counted in over 26,000 football clubs. The Federation established domestic leagues, in which the *Bundesliga* and *2. Bundesliga* are coming on top of the league system. Moreover, there are domestic tournaments such as the *DFB-Pokal*, represents German Cup, and *DFL-Supercup* represents German Super Cup (Anorak, 2013).

The first football match arguably took place in Braunschweig in 1874. Two schoolteachers, August Hermann and Konrad Koch, initiated the first match after Hermann had obtained a round football from England (Naul and Hardman, 2002). In 1875, Koch published the first German version of the rules of football, although Koch's version of the game still closely resembled Rugby football (Deutsche Akademie Für Fussballkultur, 2011).

The *Dresden English Football Club* is considered the first modern football club in Germany. It was founded in 1874 by Englishmen living and working around Dresden. In the following 20 years the game achieved a growing popularity. Following that, other football clubs were founded in Berlin, Hamburg and Karlsruhe (Wittner, 2006).

The Germany national football team has won four FIFA World Cups (1954, 1974, 1990, 2014), being the joint third most successful nation in the tournament only surpassed by Brazil and Italy (FIFA, 2018). It also holds a record (tied with Spain) three UEFA European Championships (1972, 1980, 1996), and won the FIFA Confederations Cup in 2017 (FIFA, 2018). The Germany women's national football team has won two FIFA Women's World Cups (2003, 2007) and a record eight UEFA European Women's Championships (1989, 1991, 1995, 1997, 2001, 2005, 2009, 2013), as well as a gold medal in the Summer Olympics in 2016. Germany is the only nation that has won both the men's and women's World Cup (UEFA, 2018). No team has more combined men's and women's World Cup championships, and only the United States has won more combined men's and women's regional/continental championships (USA 12 in CONCACAF, Germany 11 in UEFA Euro). Germany was the host of the 1974 FIFA World Cup, UEFA Euro 1988, the 2005 FIFA Confederations Cup and the 2006 FIFA World Cup and the 1989 UEFA European Women's Championship, 1995 UEFA European Women's Championship, 2001 UEFA European Women's Championship, and 2011 FIFA Women's World Cup.

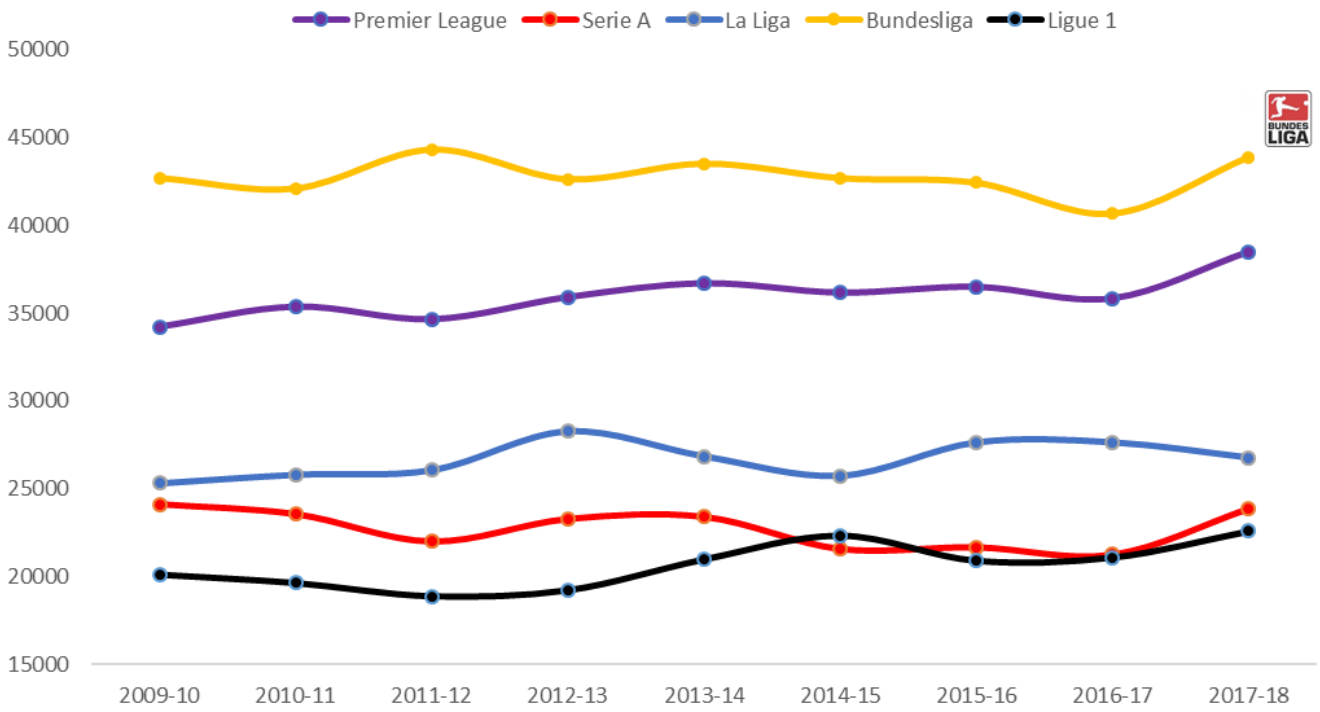
1.9.1. German Bundesliga

Bundesliga is the top level league in German football. The German Bundesliga has been established in 1903. The first champion of the league was VfB Leipzig. Although the Bundesliga includes all football leagues in Germany, it is generally used to define the highest level. There are eighteen teams competing in the league. Bundesliga, in German, has a meaning of 'National League'. The Bundesliga is considered one of the top 5 leagues throughout Europe (Deutscher Fussball-Bund, 2016).

The most successful club in the league, which it has been called as Bundesliga since 1963, is FC Bayern München, which have won the title twenty-five times since 1963. BVB Borussia Dortmund and Borussia VfL Mönchengladbach have been following FC Bayern München with five championships. Among these clubs, the most well-known clubs for their European and national successes are VfL Wolfsburg, FC Schalke 04, Eintracht Frankfurt FAG, VfB Stuttgart, Werder Bremen, Hamburger SV, Bayer 04 Leverkusen.

Given the various German League Associations (including the East German League) held before 1963 (including the East German League), FC Bayern München have won the twenty-three championships in the Bundesliga and since 1969, Berliner FC Dynamo have with ten championships. (Between 1979-88 and all of them as East Germany champion). In the third place there are nine championships (only 1 of them in the Bundesliga - 1968 - others in the previous League Associations) FC Nürnberg. In the Bundesliga, only four stars are allowed in the federation jerseys. The star system is as follows; the first star is given third place in the championship, the second star in the fifth championship, the third star in the tenth championship and the fourth star in the twentieth championship (Deutscher Fussball-Bund, 2016).

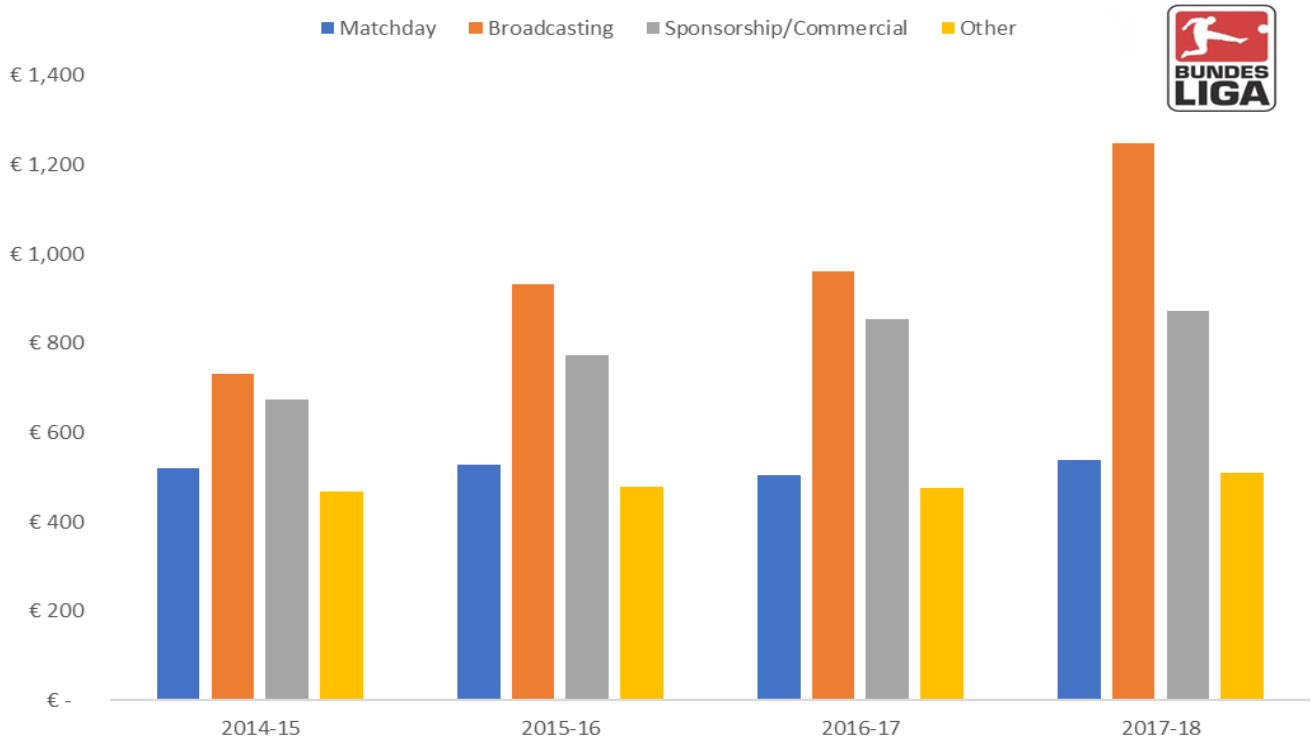
Figure 7. Average per Game Attendance of Bundesliga Comparing to Biggest European Football Leagues (2009-10 to 2017-18)



Source: Deloitte

Figure 7 displays the average per game attendance of the Bundesliga for seasons between 2009-10 and 2017-18 comparing to other biggest European football leagues such as English Premier League, Italian Serie A, Spanish La Liga and French Ligue 1. The annual report of Deloitte released in 2019 states that German Bundesliga has remained the best-attended football league in the world for the last nine seasons, due to lower ticket prices for league games than English Premier League and since Bundesliga has nine clubs with a stadium able to host over 50,000 spectators. According to figure 7, it could be said that the highest attendance per game average was reached in 2011-12 season by more than 44,300 (with 95% of average utilization level) and this led sponsorship revenues raised for football clubs in the Bundesliga on the following season (Deloitte, 2013). On the other hand, on the following seasons, there occurred slight reduction and the lowest average attendance per game in the Bundesliga was recorded in 2016-17 season. Following season, in 2017-18 season, there was 5.71% of increase in average attendance and this could be due to the help of promoted teams, such as Fortuna Düsseldorf and 1. FC Nürnberg, to Bundesliga.

Figure 8. German Bundesliga Clubs' Revenue from 2014-15 to 2017-18 (€m)



Source: Deloitte

Figure 8 presents matchday, broadcasting, sponsorship/commercial and other revenues of German Bundesliga football clubs from 2014-15 to 2017-18 seasons. Similar to the Premier League, the Serie A, the La Liga and the Ligue 1, football clubs in the Bundesliga had generated an increasing trend during these four seasons. According to figure 8, it can be said that Bundesliga clubs' recorded €2.4 billion total revenue in 2014-15 season. The major part of total revenue was driven from broadcast by 30.5%, sponsorship/commercial revenues followed it by €673K (28.1%). On the following season, football clubs in Bundesliga proceeded to raise sponsorship and commercial revenues by having €1.3 billion, in which equals to 47% of total revenue in 2015-16 (Deloitte, 2017). Although matchday revenues of Bundesliga clubs recorded 5% loss, broadcasting (3%) and sponsorship/commercial (10%) revenues increased and total revenue reached to €2.8 billion, compared with 2015-16 season. Nevertheless, Bundesliga clubs recorded total revenue more than €3 billion in 2017-18 season due to new four-year media rights arrangements (Deloitte, 2019). Moreover, matchday revenues in Bundesliga jumped by 7% up partially due to the impact on attendance of Stuttgart FC and Hannover 96 (more than 91% capacity utilization), when they were promoted to the Bundesliga in 2017-18 season. Along with these clubs, FC Schalke 04 and Eintracht Frankfurt FAG made contribution for the growth in both sponsorship and other commercial revenues, in which was recorded 4% (Deloitte, 2019).

Table 4. The List of Champion Football Clubs in German Bundesliga

Clubs	Wins	Seasons
FC Bayern München	28	1931–32, 1968–69, 1971–72, 1972–73, 1973–74, 1979–80, 1980–81, 1984–85, 1985–86, 1986–87, 1988–89, 1989–90, 1993–94, 1996–97, 1998–99, 1999–2000, 2000–01, 2002–03, 2004–05, 2005–06, 2007–08, 2009–10, 2012–13, 2013–14, 2014–15, 2015–16, 2016–17, 2017–18
FC Nürnberg	9	1919–20, 1920–21, 1923–24, 1924–25, 1926–27, 1935–36, 1947–48, 1960–61, 1967–68
BVB Borussia Dortmund	8	1955–56, 1956–57, 1962–63, 1994–95, 1995–96, 2001–02, 2010–11, 2011–12
FC Schalke 04	7	1933–34, 1934–35, 1936–37, 1938–39, 1939–40, 1941–42, 1957–58
Hamburger SV	6	1922–23, 1927–28, 1959–60, 1978–79, 1981–82, 1982–83
VfB Stuttgart	5	1949–50, 1951–52, 1983–84, 1991–92, 2006–07
Borussia VfL Mönchengladbach	5	1969–70, 1970–71, 1974–75, 1975–76, 1976–77
SV Werder Bremen	4	1964–65, 1987–88, 1992–93, 2003–04
FC Kaiserslautern	4	1950–51, 1952–53, 1990–91, 1997–98
FC Köln	3	1961–62, 1963–64, 1977–78
VfB Leipzig	3	1902–03, 1905–06, 1912–13
SpVgg Greuther Fürth	3	1913–14, 1925–26, 1928–29
Hertha BSC	2	1929–30, 1930–31
Viktoria 89 Berlin	2	1907–08, 1910–11
Dresdner SC	2	1942–43, 1943–44
Hannover 96	2	1937–38, 1953–54
Karlsruher FV	1	1909–10
Holstein Kiel	1	1911–12
1860 München	1	1965–66
SW 1890 Berlin	1	1904–05
Karlsruher SC	1	1908–09
F. Düsseldorf	1	1932–33
Eintracht Frankfurt FAG	1	1958–59
VfL Wolfsburg	1	2008–09
Freiburger FC	1	1906–07
Rapid Wien	1	1940–41
VfR Mannheim	1	1948–49
SW Essen	1	1954–55
E. Braunschweig	1	1966–67

Source: Deutscher Fussball Bund (DFB)

Table 4 shows the list of champion football clubs in German Bundesliga from 1903 to nowadays. There have been twenty-nine different German football clubs brought the Bundesliga to their hall of fame up to now. As it is mentioned above, FC Bayern München are the most title winner team in the German Bundesliga and they have been champion since 2012-13 season in the league. In many of their victories of Bundesliga, they have managed to win other domestic and international trophies at the same seasons when they won the league title. For example, in 2012-13 season, FC Bayern München have won not only Bundesliga, but also DFB-Pokal, the German Cup, DFL-Supercup, UEFA Champions League and UEFA Super Cup at the same time.

FC Nürnberg, impressive former champion during 1920s, have won nine important title in the German Bundesliga in their professional career. Unlikely to FC Bayern München, FC Nürnberg have not lifted any trophy in the European competitions, yet. BVB Borussia Dortmund, the former title owner, have succeeded to win the Bundesliga eight times in their history. In one of their Bundeliga title, in 2011-12, they have also won DFB-Pokal at the same season and have made their fan delightful. FC Schalke 04, the former UEFA Europa League champion in 1997, have succeeded to win the Bundesliga seven times, in which most of the trophies have been lifted during 1930s.

Former title owner in the UEFA Champions League in 1983, Hamburger SV, have won the title of Bundesliga six times, on the other hand, VfB Stuttgart and Borussia VfL Mönchengladbach have been titled as champion in the Bundesliga five times in their professional career. On the other hand, SV Werder Bremen, the former winner of UEFA Cup Winner's Cup in 1992, and FC Kaiserslautern have won the title four times in their history. The first champion of Bundesliga, VfB Leipzig have been titled three times as champion in the league. Similar to them, FC Köln and SpVgg Greuther Fürth have become the champion of Bundesliga three times in their professional career.

Former DFB-Pokal titled winners, Dresdner SC and Hannover 96, have won the Bundesliga two times in their history. In addition, Hertha BSC and Viktoria 89 Berlin succeeded to win the title of league two times during their professional career. There are also several German football clubs won the Bundesliga title at once (see table 4).

1.10. The History and Development of French Football

Football is the most recognized and popular sports branch in France (Wood, 2014). The national governing body, the French Football Federation (FFF), is the controller of all aspects of football in the country. The Federation is responsible for organizing the *French Cup*, as well as for men, women and young national teams, but the main responsibility has given to FFF to regulate *Ligue 1* and *Ligue 2*. The FFF is also responsible for organizing the *French League Cup*. France, the first football club by the British immigrants, was announced by The Scotsman newspaper published: "A number of English gentlemen living in Paris have lately organized a football club... The football contests take place in the Bois de Boulogne, by permission of the authorities and surprise the French amazingly". The football was introduced to the city of Le Havre in 1872 thanks to the British seafarers with modern football (Wood, 2014).

Ligue 1 and Ligue 2, France's top two league leagues, are organized by FFF. The FFF is responsible for a total of forty-six teams in these leagues, where twenty teams in *Ligue 1*, twenty teams in *Ligue 2* and eighteen in *Championnat National*. *The French Cup* and the *French League Cup* are two big cup organizations. However, with many other organizations, football clubs of different levels face each other (Fédération Française de Football, 2018).

The French National Team is one of the teams that play high-level football in Europe. In 1998, the peak of his career led by Zinedine Zidane, France won the World Cup'98 and European Football Championship in 2000 with the same generation. Also, with newer and dynamic generation, they reached the glorious victory in the European Football Championship in 2016.

1.10.1 French Ligue 1

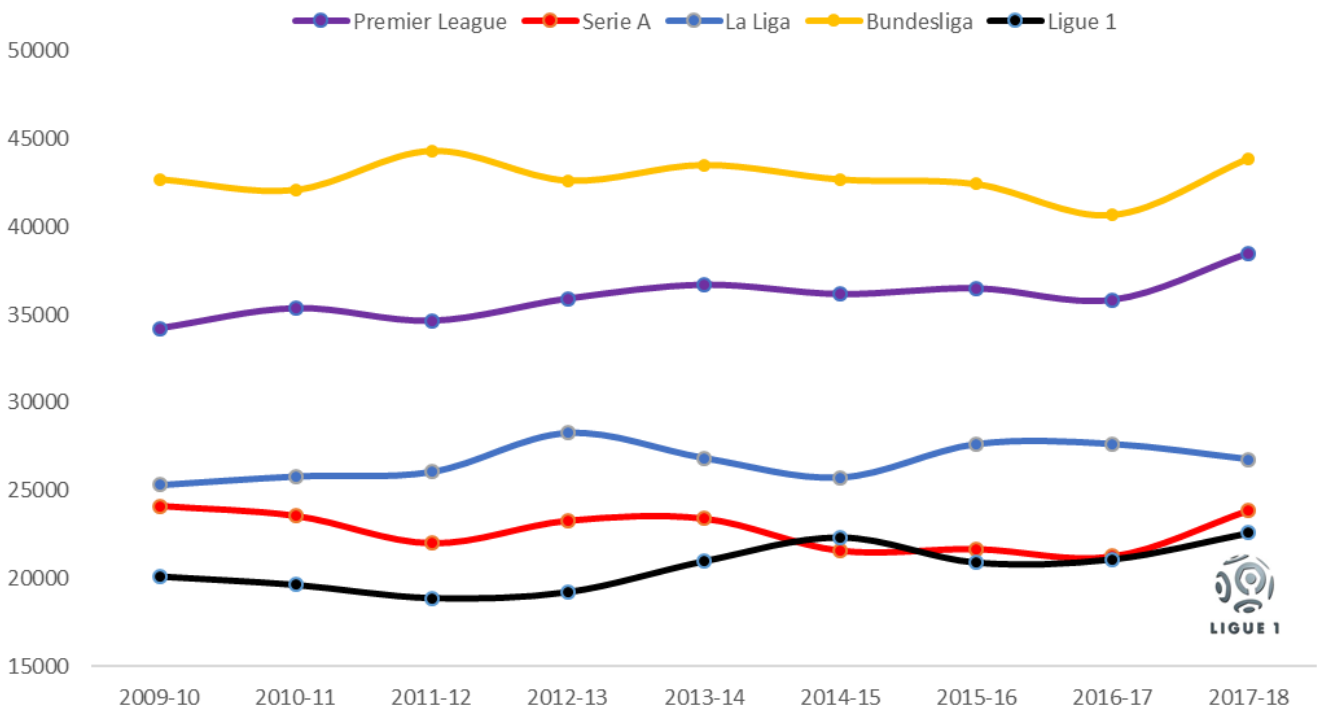
Ligue 1 is the top football league in France. The first season of Ligue 1 began on September 11, 1932, with the name of *National League* before it took up *Division 1* (Fédération Française de Football, 2018). In 2002, name of the league has changed to *Ligue 1*. The first champion of the French league was Olympique lillois in which was formed into a merge with SC Fives and Lille OSC in 1944.

Throughout the history of the league, nineteen different teams have won the championship, and with ten championships, *Olympique de Marseille* and *AS Saint-Étienne* are the most

successful teams in the history of the league. In the last season of the league, *Paris Saint-Germain FC* became the team that reached the championship.

Together with Ligue 2, at a lower level, *Ligue de Football* is one of the two leagues found in *Professionnel* (Fédération Française de Football, 2018). The season starts in August and ends in May. Each team has two matches with each other, one is in their own field and the other is away, lasting for thirty-eight weeks. At the end of the season, teams place at the first three get the right to participate the UEFA Champions League, the fourth goes to the UEFA Europa League, whereas last three ranks relegate to Ligue 2. Furthermore, The UEFA coefficients rank Ligue 1 at fifth, after the Premier League, the La Liga, the Serie A and the Bundesliga.

Figure 9. Average per Game Attendance of Ligue 1 Comparing to Biggest European Football Leagues (2009-10 to 2017-18)



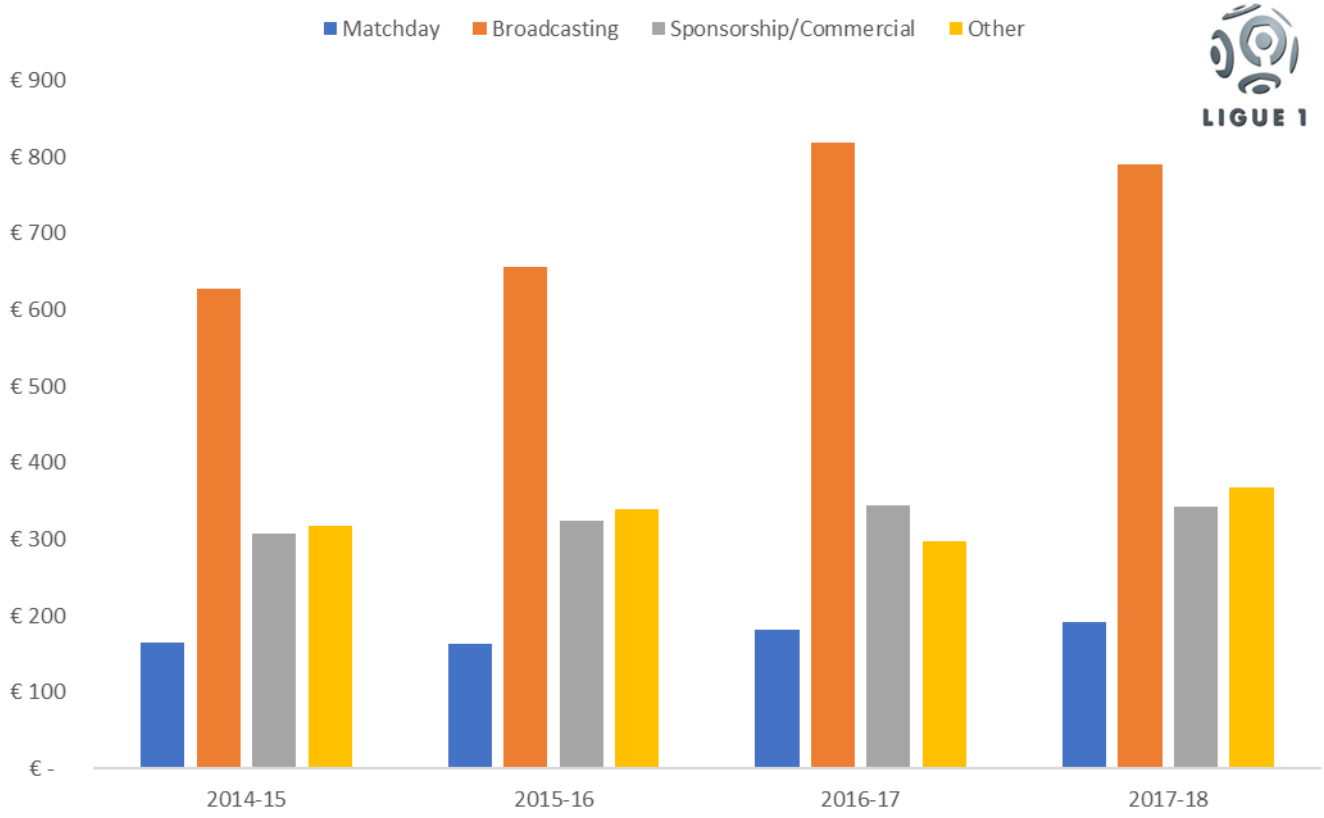
Source: Deloitte

Average per game attendance of Ligue 1 for seasons between 2009-10 and 2017-18 compared with the Premier League, the Serie A, the La Liga and the Bundesliga is presented in figure 9. Accordingly, one could state that the lowest average attendance per match in Ligue 1 was reached in 2011-12 season by 18,900 (Deloitte, 2013). On the other hand, there was a

significant and continuous rise until 2014-15 season, due to the impact of transferred players (e.g. Zlatan Ibrahimovic to Paris-Saint Germain FC in 2012-13, Radamel Falcao to AS Monaco in 2013-14, James Rodriguez to AS Monacoin 2013-14, Edinson Cavani to Paris-Saint Germain FC in 2013-14), to Ligue 1.

Nevertheless, the highest level in terms of average attendance was occurred in 2017-18 season in Ligue 1 (by 22,580), right after EURO 2016 in France. In 2016-17 season, although there was a huge investment made in France for building new stadiums and upgrading the old ones for EURO 2016, it was recorded as the least-attended average attendance per match among the big five European football leagues (Deloitte, 2017).

Figure 10. French Ligue 1 Clubs' Revenue from 2014-15 to 2017-18 (€m)



Source: Deloitte

Figure 10 shows matchday, broadcasting, sponsorship/commercial and other revenues of French Ligue 1 football clubs between 2014-15 and 2017-18 seasons. Similar to the other big European football leagues, total revenues recorded in the Ligue 1 had increasing trend for the given seasons. In addition, unlikely to the other big European football leagues, other commercials mostly generated more income than sponsorship revenues to Ligue 1 clubs.

Accordingly, it can be stated that football clubs in the Ligue 1 recorded €1.4 billion total revenue in 2014-15 season. In particular, 44.3% of it was generated from broadcast revenues. Moreover, although sponsorship/commercial revenues of AS Monaco illustrated a decrease by €124 million, Paris Saint-Germain FC's income from these parts reached to €481 million in 2014-15 season.

In addition, Paris Saint-Germain FC solely recorded almost half of the aggregated revenues in the same season from both sponsorship and other commercial activities of football clubs in Ligue 1 (Deloitte, 2016).

On the following season, there occurred a slight reduction on matchday incomes by only €1 million, whilst broadcast (€28 million), sponsorship (€18 million) and other commercial (€22 million) revenues jumped up. Despite the fact that major parts of stadium capacity developments were completed couple years before the EURO 2016, average attendance per game and matchday revenues were not increased significantly. Similar to the previous season, Paris Saint-Germain FC recorded 35% of total revenue and 60% of its growth in the Ligue 1 solely (Deloitte, 2017).

In 2016-17, Ligue 1 clubs recorded €1.6 billion on total revenue and almost 50% of it was driven from broadcat revenues. In addition, broadcast revenues in the Ligue 1 jumped up 20% due to a new four-year domestic broadcasting rights (Deloitte, 2018). Next season, total revenues in Ligue 1 increased by 3%.

Although there was reduction by €28 million in broadcast and by €3 million in sponsorship revenues, matchday (5%) and other commercial (24%) revenues jumped up mostly due to the financial performance success of Paris Saint-Germain FC (Deloitte, 2019).

Table 5. The List of Champion Football Clubs in French Ligue 1

Clubs	Wins	Seasons
Olympique de Marseille	10	1928–29, 1936–37, 1947–48, 1970–71, 1971–72, 1988–89, 1989–90, 1990–91, 1991–92, 2009–10
AS Saint-Étienne	10	1956–57, 1963–64, 1966–67, 1967–68, 1968–69, 1969–70, 1973–74, 1974–75, 1975–76, 1980–81
AS Monaco	8	1960–61, 1962–63, 1977–78, 1981–82, 1987–88, 1996–97, 1999–00, 2016–17
FC Nantes	8	1964–65, 1965–66, 1972–73, 1976–77, 1979–80, 1982–83, 1994–95, 2000–01
Paris Saint-Germain FC	7	1985–86, 1993–94, 2012–13, 2013–14, 2014–15, 2015–16, 2017–18
Olympique Lyon	7	2001–02, 2002–03, 2003–04, 2004–05, 2005–06, 2006–07, 2007–08
FC Bordeaux	6	1949–50, 1983–84, 1984–85, 1986–87, 1998–99, 2008–09
Stade de Reims	6	1948–49, 1952–53, 1954–55, 1957–58, 1959–60, 1961–62
Lille OSC	5	1913-14, 1932-33, 1945–46, 1953–54, 2010–11
RC Roubaix	5	1901–02, 1902–03, 1903–04, 1905–06, 1907–08
Standard Athletic Club	5	1893–94, 1894–95, 1896–97, 1897–98, 1900–01
OGC Nice	4	1950–51, 1951–52, 1955–56, 1958–59
Helvétique Marseille	3	1908–09, 1910–11, 1912–13
Le Havre ACF	3	1898–99, 1899–00, 1918–19
RC Paris	2	1906–07, 1935–36
FC Sochaux	2	1934–35, 1937–38
FC Sète	2	1933–34, 1938–39
Club Français	1	1895–96
RC Lens	1	1997–98
CA Paris	1	1926–27
US Tourcoing	1	1909–10
RC Strasbourg	1	1978–79
Gallia Club Paris	1	1904–05
FC Saint-Raphaël	1	1911–12
Stade Français FC	1	1927–28
Roubaix-Tourcoing	1	1946–47
AJ Auxerre	1	1995–96
Montpellier HSC	1	2011–12

Source: Fédération Française de Football (FFF)

Table 5 shows the list of champion football clubs in French Ligue 1. Accordingly, twenty-eight various football clubs are seen who have won the league title since the beginning of the competition. Team based view approves that Olympique de Marseille and AS Saint-Étienne are the most league trophy winner clubs in the French football league. Both clubs have won

the Ligue 1 ten times in their professional careers. Also, Olympique de Marseille succeeded to be first winner of Ligue 1 in the history. One of their league victories also doubled with an international trophy winning in the UEFA Cup, the former version of UEFA Europa league, in 1990-91 season. Another shareholder of the Ligue 1 trophies, AS Saint-Étienne, also have lifted the league trophy ten times in their history. In the some of their league victories, they also succeeded to win another domestic trophies such as Coupe de France and international trophies like the European Cup, the former version of the UEFA Champions League. Following those clubs, AS Monaco and FC Nantes have won eight important league trophies in their professional careers. Although they were dominating the league with several victories, both of French football clubs could not display the same performance on both domestic and international competitions. The latest winner of Ligue 1, Paris Saint-Germain FC, have won seven glorious victories in the league marathon and have honored their supporters by doubling their title as being champion in other domestic competitions such as Coupe de France and Coupe de Ligue. Following their rivals, Olympique Lyon and FC Bordeaux, have also won the Ligue 1, seven and six times, respectfully, and put remarkable efforts on domestic competitions as well.

Stade de Reims, have lifted the league trophies six times, whereas Lille OSC, RC Roubaix and Standard Athletic Club succeeded to win the Ligue 1 five times. Apart from those football clubs, OGC Nice have reached the victory on the league marathon four times, while Helvétique Marseille and Le Havre ACF have won three times in their professional careers. RC Paris, FC Sochaux and FC Sète have delighted their funs two times on winning the Ligue 1. There are also some football clubs won the title of the league at once such as Club Français, RC Lens, CA Paris, US Tourcoing, RC Strasbourg, Gallia Club Paris, FC Saint-Raphaël, Stade Français FC, Roubaix-Tourcoing, AJ Auxerre and Montpellier HSC.

1.11. The Performance of Big-Five European League Clubs in European Competitions

Similar to their primary goal to win championships on their domestic leagues, football clubs have also aim to show successful performance – both sportive and financial – on European competitions. Football clubs in the big five European leagues mainly compete in the UEFA Champions League, the UEFA Europa League, and naturally the UEFA Super Cup, since the usual finalists have been from the big five European football leagues. For decades, it is clearly

seen that football clubs in the big five European leagues have been dominating these European competitions with a significant sportive and financial performance.

Table 6. The List of Big Five European League Clubs in European Competitions

Clubs	UEFA Champions League	UEFA Europa League	UEFA Cup Winner's Cup	UEFA Super Cup
Real Madrid CF	13	2	-	4
FC Barcelona	5	-	4	5
AC Milan	7	-	2	5
Liverpool FC	5	3		3
FC Bayern München	5	1	1	1
Juventus FC	2	3	1	2
Atlético Club de Madrid	-	3	1	3
Manchester United FC	3	1	1	1
Sevilla FC	-	5	-	1
FC Internazionale	3	3	-	-
Chelsea FC	1	1	2	1
Olympique de Marseille	2	3	-	-
Valencia CF	-	1	1	2
Parma FC	-	2	1	1
Nottingham Forest FC	2	-	-	1
Tottenham Hotspur FC	-	2	1	-
Paris Saint-Germain FC	-	-	2	1
Aston Villa FC	1	-	-	1
Stade de Reims	2	-	-	-
AS Monaco	1	-	1	-
Borussia Dortmund	1	-	1	-
B. Mönchengladbach	-	2	-	-
Hamburger SV	1	-	1	-
SS Lazio	-	-	1	1
Arsenal FC	-	-	1	-
Manchester City FC	-	-	1	-
Ipswich Town FC	-	1	-	-
West Ham United FC	-	-	1	-
AS Saint-Étienne	1	-	-	-
FC Bordeaux	-	1	-	-
Stade Rennais FC	1	-	-	-
SC Bastia	-	1	-	-
Eintracht Frankfurt	-	1	-	-

Source: UEFA

Table 6. The List of Big Five European League Clubs in European Competitions (Cont'ed)

Clubs	UEFA Champions League	UEFA Europa League	UEFA Cup Winner's Cup	UEFA Super Cup
Bayer 04 Leverkusen	-	1	-	-
FC Schalke 04	-	1	-	-
SV Werder Bremen	-	-	1	-
1. Magdeburg	-	-	1	-
Real Zaragoza	-	-	1	-
SSC Napoli	-	1	-	-
AFC Fiorentina	-	-	1	-
US Sampdoria	-	-	1	-

Source: UEFA

Table 6 shows the list of big five European league football clubs in European competitions, namely in the UEFA Champions League, the UEFA Europa League, the UEFA Cup Winner's Cup and the UEFA Super Cup. Accordingly, there have been forty-one different football clubs from the big five European League that succeeded to win title(s) in European competitions since their first tournament participation.

Real Madrid CF has been the most European competition winner among the other big five European league clubs so far and thirteen of these trophies were from the UEFA Champions League. Apart from their rival, FC Barcelona have reached the happy ending in European competitions by lifting the UEFA Champions League five times, the UEFA Cup Winner's Cup four times and the UEFA Super Cup five times in their professional career. Also, they have put valuable performance and effort on worldwide competitions by holding the FIFA Club World Cup three times in their history. The most European title owner in Italy, AC Milan, have put remarkable effort on European tournaments and have become the most successful team by winning seven UEFA Champions League, two UEFA Cup Winner's Cup and five UEFA Super Cup and placed third coming after Real Madrid CF and FC Barcelona.

According to the table 6, it is seen that Liverpool FC have been the most trophy winner in European tournaments among the all other English football clubs, winning the UEFA Champions League five times, the UEFA Europa League three times and the UEFA Super Cup three times. The most Bundesliga title owner FC Bayern München is following them by eight title won in the European competitions. Following them, the most successful Serie A football club, Juventus FC, have won the UEFA Champions League two times, the UEFA

Europa League three times, the UEFA Cup Winner's Cup one time and the UEFA Super Cup two times during the European challenges at its history. Moreover, the first English European Cup title winner, Manchester United FC have won three UEFA Champions League, one UEFA Europa League, one UEFA Cup Winner's Cup and one UEFA Super Cup througrout their club history. Whilst, there are other English football clubs such as Chelsea FC, Nottingham Forest FC, Aston Villa FC, Tottenham Hotspur FC, Arsenal FC, Manchester City FC, Ipswich Town FC and West Ham United FC.

Eight of the French football clubs, namely they are Olympique de Marseille, Paris Saint-Germain FC, Stade de Reims, AS Monaco, AS Saint-Étienne, FC Bourdeaux, Stade Rennais FC and SC Bastia, have won several trophies in European competitions. Among those football clubs, Olympique de Marseille have been the most trophy winner in European competitions by holding the UEFA Champions League two times and the UEFA Europa League three times. In addition, Stade de Reims have won the UEFA Champions League two times, while AS Monaco, AS Saint-Étienne and Stade Rennais FC succeeded to win it only one time in their professional careers. Although they could not achieve to win the biggest trophy in European competitions, Paris Saint-Germain FC have won the UEFA Cup Winner's Cup two times and the UEFA Super Cup one time in their history. FC Bordeaux and SC Bastia also succeeded to win the UEFA Europa League trophy at once in their professional careers.

For Bundesliga clubs, it can be said that nine of the German football clubs, (FC Bayern München, BVB Borussia Dortmund, Borussia VfL Mönchengladbach, Hamburger SV, Eintracht Frankfurt FAG, Bayer 04 Leverkusen, FC Schalke 04, SV Werder Bremen and 1. FC Magdeburg) have won several trophies in European competitions. In addition, FC Bayern München have been the most title winner in the UEFA Champions League. Although the seasons were different, they have been only German football club in which succeeded to win trophies in the UEFA Champions League, the UEFA Europa League, the UEFA Cup Winner's Cup and the UEFA Super Cup. Moreover, the first European cup winner was BVB Borussia Dortmund by winning the UEFA Cup Winner's Cup in 1965-66 season.

Although, Italian football clubs have been second by winning thirty-seven trophies after Spain (fifty-one trophies) in all these European competitions, they could not have managed to continue successfully glories for the last decade. However, the very most Serie A winner, Juventus FC, have been showing utmost level of performance by being finalist in the UEFA

Champions League two times (2014-15 and 2016-17 seasons) in order to reverse the fail to a glorious triumph.

Table 7 displays the comparison of Italian football clubs with football clubs from the English Premier League, the Spanish La Liga, the German Bundesliga and the French Ligue 1 in European competitions from 1950s to 2019. Italian football clubs have played against their opponents in the UEFA Champions League, the UEFA Europa League, the UEFA Super Cup, the UEFA Cup, the Cup Winners' Cup, the Intertoto Cup, the Champions Cup and the Fairs Cup. In addition, Italian football teams have been matched against their European opponents in group stages, knockout phases (last sixteen teams), quarter-final, semi-final and final levels (RSSSF, 2019).

Table 7. Italian Football Clubs Against Other Biggest Four European Clubs in European Competitions (from 1950s to 2019)

Seasons	England				Spain				Germany				France			
	P	W	D	L	P	W	D	L	P	W	D	L	P	W	D	L
1950-60	4	1	1	2	8	1	0	7	6*	3*	2*	1*	2	1	1	0
1960-70	31	12	6	13	29	14	5	10	37*	19*	6*	12*	13	9	3	1
1970-80	25	6	10	9	18	9	0	9	41*	14*	9*	18*	8	3	0	5
1980-90	9	6	2	1	33	11	7	15	52*	23*	10*	19*	24	12	9	3
1990-00	40	18	11	11	48	20	6	22	44	20	9	15	53	27	11	15
2000-10	76	24	16	36	97	31	28	38	67	29	20	18	46	12	16	18
2010-19	56	20	13	23	74	16	19	39	46	13	9	24	36	25	9	2
TOTAL	241	87	59	95	307	102	65	140	293	121	65	107	182	89	49	44

Source: RSSSF *** refers to football clubs from East Germany and West Germany are included.**

Among these European competitions, most of their wins over other European opponents have been seen in the UEFA Champions League (a hundred-and-forty-four games) as well as the majority of their losses (a hundred-and-ninty-eight games) between 1950s and 2019. More importantly, Italian football clubs have played thirty-seven final games in the UEFA Champions League (eight games), the Champions Cup (seven games), the UEFA Super Cup (seven games), the Cup Winners' Cup (six games), the UEFA Cup (five games) and the Fairs Cup (two games) against football clubs from England, Italy, Spain, Germany and France. Among those final games, Italian football clubs succeeded to win all the UEFA Super Cup finals (six) along with the UEFA Champions League (three), the UEFA Cup (three), the Cup Winners' Cup (three), the Champions Cup (two) and the Fairs Cup (one) finals between 1950s and 2019 (RSSSF, 2019).

Generally, it is seen that Spanish and English football clubs have had more wins over Italian football clubs, whilst Italian football clubs have had dominance over German and French football clubs in European competitions. When we consider game performances of Italian football clubs based on decades and countries, it can be said that winning ratio of Italian teams had reached its highest level by 49.1% in 1960-70 seasons.

Considering number of games increased over the decades, Italian football clubs had winning ratio by 46% in 1990-2000 seasons where they lifted many trophies in several European competitions. For the past two decades, this ratio has continued to drop gradually. On the other hand, the lowest winning ratio is seen in 1950-60 seasons by 30% against football clubs from these countries.

In particular, it is seen that Italian football clubs had dominance over English football clubs in 1980-90 and 1990-2000 seasons by winning ratios 67% and 45% respectfully, whilst other periods had passed contrarily for Italian football clubs against English teams. In addition, over the last decade, competition between Italian and English football clubs has been almost identical.

Although they had supremacy over Spanish football clubs in 1960-70 seasons, Italian football clubs could not show solid performance against Spanish teams. Even though football clubs in these countries had almost equal wins against each other between 1990-2000 and 2000-10 seasons 41.6% and 31.9% respectfully, the winning ratio of Italian football clubs over Spanish ones dropped to 21.6 % over the past decade.

Except seasons in 1970-80 and 2010-19, Italian football clubs had significant dominance over German football clubs in European tournaments. Although the highest winning ratio is seen in 1960-70 seasons, there had been an increase on Italian football clubs winning ratio between 1970-80 and 2000-10 seasons. However, the lowest winning ratio of Italian teams over German football clubs is seen over the past decade (by 28.2%).

For the comparison of Italian and French football clubs in European competitions, it can be said that overall Italian clubs have been in dominance over French football teams between 1950s and 2019. In particular, it is seen that Italian football teams reached the highest winning ratio over French clubs by 69.4% in which the highest winning ratio of Italian football clubs among these football teams that play in the four biggest European leagues. Nevertheless, the lowest winning ratio of Italian football teams over French football clubs is seen in 2000-10 seasons (by 26%).

Thus far, football clubs from the big five European leagues have been described regarding their sportive achievements on both domestic and European competitions. For decades, it has been questioned whether winning titles are a sufficient benchmark for a valid sportive performance for football clubs (Morrow, 1999). The following chapters of this thesis aim to discuss other kinds of approaches to the measurement of performance for football clubs.

CHAPTER 2: RESEARCH ISSUES AND RECENT DEVELOPMENTS IN THE EFFICIENCY ANALYYSIS OF FOOTBALL TEAMS

2.1. Performance and Efficiency in Football

Measuring efficiency has become mandatory in professional football. Since football has become a very competitive sector, professional football clubs must find the best allocation of potentially scarce resources. Indeed, after the FIFA Financial Fair Play financial-economic restrictions, efficient use of resource allocation has become a must for all professional football clubs (García-Cebrián et al., 2018). The measurement of sportive performance can also provide valuable information to club managers in order to make decisions whether to hire players or to go on more investment on its own reserve of young players, or not (Dawson et al., 2000). It also helps coaches to create tactics formations and strategies and to guide players on the level of their trainings and improvements in individual technical skills (Guzmán, 2006).

Efficiency can be defined as the ability to maximize goals for given resources, or to minimize resources for given goals (Charnes et al., 1978). The goals of football clubs can be categorized under two main titles: sportive and financial goals. The latter relate to the problems that club managers face within the classical gain maximization problem for the investment (Morrow, 1999). If football clubs become companies, each of them must respect a business plan in order survive in the market. Later in the literature, the sportive goals of the professional club managers (e. g. the number of sportive victories) also been started to be proposed (Kocaaydın, 2013).

More precisely, technical efficiency relates to the maximization of outputs for given inputs and technology (if output-oriented) or the minimization of inputs for given outputs and technology (if input-oriented). Cost efficiency relates to the minimizazion of costs for given input prices and outputs.

The purpose of this chapter is to present and analyse the literature about efficiency measurement of football teams. In the following part of this chapter, these previous studies will be summarized and interpreted individually and displayed into tables regarding to their fundamental contents and methodology.

2.2. Previous Studies on Efficiency Evaluation

Studies dealing with efficiency in football can be categorized as parametric and non-parametric methods. While parametric methods use regression analysis, non-parametric methods deal with the overall measurement of the efficiency on production sets formed by selected inputs and outputs without positing any functional relationship among them (Kulikova and Goshunova, 2013). The most common type of non-parametric method is DEA.

In this chapter, studies in the literature will be discussed under four different headlines: studies just using DEA, studies using DEA along with regression models, studies using stochastic frontier analysis (SFA) and studies using regression analysis.

All the tables below include some classifications regarding to the efficiency domain that has been treated: sportive efficiency, financial efficiency or mixed. By sportive efficiency, we mean an analysis dealing with production sets where both inputs and outputs are related to field performance. In financial efficiency, both inputs and outputs relate to financial variables and performance. Mixed efficiency refers to more hybrid types of analysis, where inputs and outputs may belong to different domains (either field or financial performance). The types of efficiencies are represented with capital letters in which “S” represents studies regarding to sportive efficiency, “F” shows studies related to financial efficiency and “M” displays researches on both sportive and financial efficiency. For that reason, the studies will be presented not simply according to their publication year, but also depending on the type of efficiency considered in the study. Studies considered under sportive efficiency relate to production set that are only related with sportive characteristics of football teams, while financial efficiency relates to output variables relevant to financial or fiscal characteristics of football teams.

2.2.1. Studies using Data Envelopment Analysis

Table 8 summarizes some basic features of studies in the literature that have relied only on non-parametric methods (mainly DEA). We provide information about the data, the methodology and the production set, as well as some descriptive statistics of the efficiency scores, when available.

Table 8. Studies using Data Envelopment Analysis

Author/Year	Data	Methodology	T	Input Variables	Output Variables
Espitia-Escuer, M. & Garcia-Cebrian, L.I. (2006)	Spanish La Liga (1998/99-2004/05)	DEA (Technical Efficiency-Output-oriented) Mean: 1.367	S	1. Players' Talent (Sporting talent, physical conditions, experience, etc.)	1. Points
Espitia-Escuer, M. & Garcia-Cebrian, L.I. (2010)	Champions League (2002/03-2006/07)	DEA (Technical Efficiency-Input-oriented)	S	1.Attacking Plays 2.Number of Players 3.Ball Possession 4.Goal Attempts 5.Number of League Games	1.Results
Gonzalez-Gomez, F. & Picaso-Tadeo, A. (2010a)	Spanish La Liga (2001/02-2006/07)	DEA (Technical Efficiency-Output-oriented) Mean: 0.791	S	1.Number of Squad Players 2.Average Number of Spectators (per match) 3.Number of Games (only league) 4.Trophies in National and International Competitions	1.Points 2.Number of Rounds in King's Cup (Domestic) 3.Number of Games in European Competitions
Picaso-Tadeo,A. & Gonzalez-Gomez, F. (2010b)	Spanish La Liga (2001/02-2006/07)	DEA (Technical Efficiency-Output-oriented)	S	1.Number of Squad Players 2.Seasons in the First Division (Dummy for year) 3. Average Number of Spectators (per match)	1.Points 2.Number of Rounds in King's Cup (Domestic) 3.Number of Games in European Competitions
Tiedemann, T. et al. (2011)	German Bundesliga (2002/03-2008/09)	Non-concave Metafrontier Model (Output-oriented) Mean: 0.907	S	1.Playing time of a player (minutes)	1.Goals Scored 2.Assists 3.Tackle 4.Pass
Santìn, D. (2014)	Real Madrid Players (1946/47-2009/10)	DEA (Super Efficiency and VRS) (Output-oriented)	S	1.Number of season for each player has team experience	1. Number of League Games 2.Number of National Titles Won 3.Number of International Titles Won 4.Goals Scored
Rossi et al. (2018)	Italian Serie A (2000/01 – 2009/10)	DEA (Technical Efficiency-Output-oriented)	S	1.Players' Offensive Performance 2. Goals Scored	1. Points
				1. Players' Defensive Performance 2. Reverse of Goals Conceded	1. Points
Haas, D.J. (2003a)	English Premier League (2000/01)	DEA (CRS, VRS and Scale Efficiency-Input-oriented) Mean (CRS): 0.670 Mean(VRS): 0.730 Mean(Scale): 0.900	M	1.Players' annual wage bill 2.The monthly wage of manager	1.Points 2.Number of Spectators (Audiences) 3.Revenue

Haas, D.J. (2003b)	American Major League Soccer (2000/01)	DEA (CRS, VRS and Scale Efficiency- Input-oriented) Mean (CRS): 0.940 Mean(VRS): 0.990 Mean(Scale): 0.940	M	1. Clubs total wages and salaries reduced by the amount paid to the manager 2.The salary of manager 3.Population of the clubs' home town	1.Points (Equation 1)
				1. Clubs total wages and salaries reduced by the amount paid to the manager 2.The salary of manager 3.Population of the clubs' home town	1.Revenue (Equation 2)
				1. Clubs total wages and salaries reduced by the amount paid to the manager 2.The salary of manager 3.Population of the clubs' home town	1.Number of Spectators (Equation 3)
Haas, D.J. et al (2004)	German Bundesliga (1999/00-2000/01)	DEA (CRS, VRS and Scale Efficiency- Input-oriented) Mean (CRS): 0.780 Mean(VRS): 0.806 Mean(Scale): 0.965	M	1. Wages (Players) 2. Wages (Coaches)	1.Points 2.Revenue
Barros, C.P. & Leach, S. (2006)	English Premier League (1998/99-2002/03)	DEA (CRS-Model & VRS Model) (Technical Efficiency- Output-oriented)	M	1.Number of Players 2.Wages 3.Net Assets 4.Stadium Facilities Expenditures	1.Points 2.Attendance 3. Financial Turnover
Guzmán, I. & Morrow, S. (2007)	English Premier League (1997/98-2002/03)	1.DEA 2.Canonical Correlation Analysis (CCA) 3.Malmquist Productivity Index (Technical Efficiency- Input-oriented) Mean: 0.845	M	1. Staff Costs 2. Bonuses by Director 3. Other Expenses	1.Points 2.Revenue
Douvis, J. & Barros, C.P. (2009)	Portuguese Primeira Liga & Greece Super League (1999/00-2002/03)	1.DEA 2.Malmquist Productivity Index (Technical Efficiency- Output-oriented) <u>Greek League</u> Mean: 0.964 <u>Porteguese League</u> Mean: 1.027	M	1.Number of Players 2.Total Costs	1.Revenues 2.Points (in Champions League) 3. Attendance

Soleimani-Damaneh, J. et al. (2011)	Iranian Premier League (2009-10)	1.DEA 2.Analytical Hierarchy Process (Technical Efficiency-Input-oriented) Mean: 0.803	M	1.Fixed Assets 2.Wages (Players) 3.Wages (Coaches) 4.Wages (Staff)	1.Points 2.Stadium Attendance 3.Revenues
Kulikova, L.I. & Goshunova,A.V. (2014)	11Football Leagues (51 Clubs) (2007-08)	DEA (Technical Efficiency-Output-oriented) Mean: 0.869	M	1.Total Costs 2.Intangible Assets 3.Borrowed Capital 4.Purchases of Players' Registrations 5.Personal Costs 6.Average Number of Player Staff 7. Number of points scored in national championship for the season 2007-08.	1.Financial Turnover 2.Ranking
Pyatunin et al. (2016)	Champions League (2011/12-2013/14)	DEA (CRS, VRS and Scale Efficiency-Input-oriented) Mean (CRS): 0.958 Mean(VRS): 0.980 Mean(Scale): 0.978	M	1. Staff Cost 2. Market Value of Squad 3.Country Strength Coefficient 4.International Cups 5.Participating Champions League (only)	1.Revenue 2.Points 3.Qualifications for European Tournaments 4.Qualifications for Champions League 5.Prize money for sportive performance in European Cups
Wyszyński, A. (2016)	Polish First Division (2014/15)	DEA (CRS, VRS and Scale Efficiency-Output-oriented) Mean (CRS): 0.701 Mean(VRS): 0.776 Mean(Scale): 0.703	M	1.Wages	1.Points 2.Revenue 3.Average number of audience watching matches in NC+TV 4.Average number of spectators in stadium
Guzmán, I. (2006)	Spanish La Liga (2000/01-2002/03)	1.DEA (CRS, VRS and Scale Efficiency-Input-oriented) 2.Malmquist Productivity Index (Mean:1.026) 3.Sustainable Growth Model Mean (CRS): 0.602 Mean(VRS): 0.792 Mean(Scale): 0.761	F	1.Staff Costs 2.Overall Expenses	1.Financial Turnover (Income, Broadcasting, Gate Earnings, etc)

Espitia-Escuer and Garcia-Cebrian (2006) analyzed football teams in Spanish La Liga between the seasons of 1998-99 and 2004-05 in order to assess sportive efficiency of football teams in La Liga by using output-oriented DEA. In their study, the number of points has been pitched against given resources such as talent, physical conditions and experience of football players on each team. According to findings, the authors claim that teams at the top of league table are more efficient comparing to other teams. Accordingly, teams that could not manage to stay in the First Division did not use their resources efficiently.

Different from their first study, Espitia-Escuer and Garcia-Cebrian (2010) analyzed football teams in Champions League from 2002-03 to 2006-07 football seasons by using input-oriented DEA in order to evaluate their sportive performance. This is the first study that analyses football teams that play in the Champions League. The authors selected as inputs the attacking plays of each team during the game, number of players, ball possession in the match, goal attempts of teams and number of their league games; whereas the results of games were considered as output of the model. Unsurprisingly, they find that in order for teams to achieve good results in the tournament resources should be used efficiently. Moreover, some football teams played matches in the Champions League from 2002-03 to 2006-07 seasons were detected to have inefficient performance since they did not use different or various tactics and this led them misspend their resources.

A similar study was provided by Gonzales-Gomez and Picazo-Tadeo (2010a). The authors analyzed three main competitions such as La Liga, King's Cup – one of the domestic competitions – and European competitions (i.e. the UEFA Champions League, the UEFA Europa League) for the football seasons between 2001-02 and 2006-07. In this study, output-oriented DEA was used by defining inputs such as number of players in squads, average number of spectators per match, number of games for each season and overall trophies won by national and international competitions during the selected football seasons. As outputs, the authors chose overall points for each team, number of rounds in King's Cup that each football team reaches and the number of games teams play in European competitions. According to the findings, two teams that performed the highest income among the Spanish football teams, Real Madrid CF and FC Barcelona, had the highest performance. In addition, also Getafe CF and Villareal FC had game results similar to their potential performance. Finally, most of these Spanish football teams have more efficient performance in the League and European competitions than King's Cup.

In their article, the main motivation of Picazo-Tadeo and Gonzalez-Gomez (2010b) was to see whether several competitions affect first league football teams' sportive performance positively. The authors used on Spanish football teams for seasons from 2001-02 to 2006-07. an output-oriented DEA model by setting as inputs the number of players on each team, number of seasons football teams played in the La Liga and average number of spectators per match; whereas outputs were the overall points that each football team earned, number of rounds in domestic cup, that is King's Cup, and the number of games played in the UEFA Champions League and the UEFA Europa League. In conclusion, Picazo-Tadeo and Gonzalez-Gomez (2010) stressed that allowing for league games is not enough to measure the sportive performance of Spanish football teams, and thus, other competitions must be also considered.

Dealing with player-based (rather than team-based) efficiency analysis, Santin (2014) analyzed technical efficiency for legend players in Real Madrid CF between the 1946-47 and 2009-10 football seasons by using a super-efficiency output-oriented DEA model. The observation sample included football players from the signing of Luis Molowny Arbelo until the end of Raul Gonzalez' professional contract. His paper presented the first study about efficiency analysis of players throughout a football club's history. Santin (2014) used the number of seasons for each player as an input, while outputs included the number of league games for each season, the number of national titles which players won during their football career, the number of international titles that they earned and how many goals these players scored. The most efficient players of Real Madrid CF's history are found to be Juanito Alonso as goalkeeper; Fernando Hierro, Marquitos, Sánchez and Camacho as defenders; Del Sol, Pirri, Guti and Schuster as midfielders; and Gento, Kopa and Di Stefano as forwarders. The study also indicates that four-three-three formation is the most suitable tactic for these players to reach efficiency in the manner of scoring goals and containing games in all domestic and European competitions.

Tiedemann et al. (2011) investigated sportive performance of German Bundesliga football players for the seasons between 2002-03 and 2008-09, by using non-parametric meta-frontier analysis. Their study represented player-based performance analysis rather than team-based efficiency evaluation. Inputs included number of minutes that football players' effort during each game, while outputs were consisting of number of goals scored, overall assists made, tackles and passes of players. Their findings showed that there is very significant relationship between players' efficiency and the league position of football teams in the end of each

season in German Bundesliga. Moreover, the authors indicated that using the meta-frontier approach yields the measurement of each football players' optimum formation position in teams and is useful to monitor how players' performance develops during a season.

A recent research on the efficiency of Italian Serie A football clubs was provided by Rossi et al. (2018). In their paper, authors questioned the effect of Calciopoli corruption scandal in 2006 football season on the sportive efficiency of Italian football clubs. They used output-oriented DEA on a panel dataset from 2000-01 to 2009-10 seaons. In addition, they distinguished between offensive and defensive input variables, while overall points always represented the output variable. More specifically, offensive input variables were goals scored, overall shots, shots on target, assists, counter attacks, completed crosses, cross rate, attempted crosses, completed passes, total team non-shot touches of ball and useful dribbles. On the other hand, authors set defensive input variables such as goals conceded, opponents' off-sides, ball clearances, interceptions, anticipations, recovered ball, goalkeeper catches, saves, tackles, yellow cards, red cards and fouls committed. They found that point-deductioned football clubs had become less efficient since their manager had to alter their usual formation tactics after these sanctions, which significantly and negatively affected efficiency.

In the literature, there are several studies comprising the assessment of both sportive and financial efficiency of football clubs in many football leagues. Haas (2003a) questioned the productive efficiency of football teams in English Premier League for 2000-01 football season. The author utilized several input-oriented DEA models such as Constant returns to scale (CRS), Variable returns to scale (VRS) and Scale efficiency in order to compare the differences and similarities of mixed efficiency of English football teams. Players' annual wage and the monthly wage of managers are used as inputs, conversely, overall points at the end of each football season, number of spectators per match and revenues of football teams are the outputs. According to the findings, the overall ranking of Premium League at the end of each football season does not significantly correlate with the overall ranking of efficiency of English football teams. Moreover, the author presumed that having highly qualified players did not result in high performance for teams.

Similar to his previous study, Haas (2003b) analysed the efficiency of football teams in the American Major League Soccer (MLS) during the 2000-01 football season. Inputs included clubs' total wages and salaries reduced by the amount paid to the manager, population of the

clubs' hometown and the salary of manager on each team. Outputs were overall points of each team in the end of season, the number of spectators per match and the revenue of football clubs. However, each output corresponded to a different production set. According to the findings of his work, Haas (2003) indicated that the number of spectators per game is the dominant output in the sense that it yields the highest efficiency score for each football team.

Haas et al. (2004) investigated the efficiency of football teams in German Bundesliga for 1999-2000 and 2000-01 football seasons through various input-oriented DEA models. The authors chose a preferred production set where inputs were formed as players' wages and managers' wages while overall points and total revenues of football clubs were chosen as outputs. According to their findings, there was not any correlation between rankings of football teams and their efficiency scores.

Barros and Leach (2006) assessed the efficiency of the football clubs in English Premier Football League, during the seasons between 1998-99 and 2002-03, from both a sportive and financial standpoint. In order to do so, they adopted both output-oriented DEA-VRS and DEA-CRS models, and took the number of players, wages of players, net assets and expenditures on stadium facilities as inputs, and overall points, the number of spectators per game and financial turnover as outputs. According to the evidence of this study, most of the football clubs in the English Premier League achieved an efficient DEA-VRS performance. On the other hand, football teams had quite different scale efficiencies: teans with larger roster size performed higher efficiency scores comparing to teams with smaller roster size. Moreover, football teams with high financial turnover and belonging to a larger city also showed higher efficiency. The population and the richness of a city turned out as one of the main drivers of clubs' financial performance.

Guzmán and Morrow (2007) investigated efficiency and productivity of English Premier League football teams from 1997-98 to 2002-03 seasons. Efficiency was evaluated both from a sportive and financial standpoint through input-oriented DEA and Canonical Correlation Analysis (CCA), while a Malmquist Productivity Index (Malmquist, 1953) was utilized for the assessment of productivity growth. Guzmán and Morrow (2007) only took financial indicators as inputs: staff cost expenditures, bonus premiums given by the director of team and other expenses. On the other hand, outputs were given by overall points and total revenue of football clubs. The authors concluded that most of English Premier League teams managed to be close to full technical efficiency and that teams' performance has been improving

limitedly regarding to the technological frontier. Arguably, larger improvements could be made relating to scale efficiency. CCA links two sets of variables by forming linear combinations of variables maximizing their reciprocal correlation (Hotelling, 1936). Guzmán and Morrow (2007) pointed out that using DEA together with CCA would reveal more factual levels of correlation for the assessment of efficiency. More specifically, in their study, it had been shown that although some football teams achieved the high rankings at the table, such as Arsenal FC at second position, Chelsea FC at fourth position and Liverpool FC at fifth position, they could not operate high efficiency scores regarding to their performances on the field. On the contrary, the teams which demonstrated high efficiency on the field, they could not manage to end up the league at high rankings (i.e. Birmingham FC at thirteenth position and West Bromwich Albion at nineteenth position).

In the literature, we generally see studies that measure the efficiency including single football leagues. However, Douvis and Barros (2009) carried out a comparative analysis of football efficiency in Portuguese Primeira Liga and Greece Super League for the seasons from 1999-2000 to 2002-03. In this study, output-oriented DEA and a Malmquist Productivity Index (Malmquist, 1953) were used in order to assess the technical efficiency of football clubs, taking the number of players and total costs as inputs, and revenues, points at the league table and the number of spectators per match as outputs. According to the main findings of this study the Portuguese Primeira Liga was more successful than the Greece Super League since in the way of both sportive and financial returns. The reason why Greek football teams were more inefficient comparing than Portuguese teams was given in terms of less appropriate managerial structures in Greek teams. As a final conclusion, although the Greek National Team won the Euro 2004 tournament, there was no adequate improvement of efficiency of football teams in Greece Super League.

Kulikova and Goshunova (2014) presented a comparative efficiency measurement of 11 professional football leagues and 51 professional football clubs from Australia, Brazil, England, France, Germany, Italy, Netherlands, Portugal, Russia, Scotland and Spain for the 2007-08 season. Their study investigated sportive and financial performance by using output-oriented DEA. The authors designated some input variables such as total costs, intangible assets, borrowed capital, purchases of players' registrations, personal costs, the average number of players, and the overall points made in leagues. On the other hand, financial turnover and rankings in the leagues of football teams were selected as outputs. In this study, the size of football clubs and their capital structures had a positive and significant impact on

efficiency. Unlike in Barros et al. (2010), bigger football clubs have lower financial efficiency since they gain lower returns on their investments. Moreover, they stated that the capitalization of purchased players' registration significantly affects the efficiency of football clubs since those clubs prefer to use different type of accounting policy on their balance-sheets.

Similar to Espitia-Escuer and Garcia-Cebrian (2010), but extending the analysis to allow for some financial variables, Pyatunin et al. (2016) measured sportive and financial efficiency of 48 European football teams compete in both domestic and international tournaments from 2011-12 to 2013-14. The authors used input-oriented DEA-CRS, DEA-VRS and measured also scale efficiency. In their study, inputs consisted of staff costs, the market value of roster, a country strength coefficient, a participation dummy to international cups and a participation dummy to the UEFA Champions League only. Five variables were selected as outputs: revenue, overall points, qualification success for European tournaments, qualification success for the UEFA Champions League only and prize money gained from sportive performance in European tournaments. According to the findings, it can be said that, since teams promoted to European competitions, they had a good source of income and they were more efficient than the ones that did not participate at international cups. Yet, strong teams in their domestic leagues such as Real Madrid CF, FC Barcelona and Paris Saint-Germain FC could not manage to reach full efficiency even though they won the domestic championships since they had extra expenses in their inputs. This behaviour can be explained in terms of these teams targeting victory in the UEFA Champions League.

Mostly, studies focus on the efficiency evaluation of professional football clubs in European countries, such as England, Spain, Germany, Italy and France. Different than these researches, Wyszyński (2016) analyzed efficiency in the Polish First Division, Ekstraklasa, for season 2014-15. He used output-oriented DEA-CRS and DEA-VRS models in order to assess the sportive and financial efficiency of Polish football clubs, also measuring their scale efficiency. Only one input, wages paid, was included in the production set as input, whereas there were several output variables: overall points, total revenues, average audience watching matches from TV broadcastings and average stadium attendance per game. According to the findings of the study, most Polish football clubs were found inefficient. Yet, high salaried football clubs such as Legia FC and Lech Poznan FC were efficient since they gained high league rankings and revenues. On the other hand, despite the fact that Podbeskidzie FC and

Bełchatów FC managed to reach full efficiency, they could not save themselves from relegation.

Soleimani-Damaneh et al. (2011) featured evaluating the performance of Iranian football clubs for season 2009-10 using input-oriented DEA and Analytical Hierarchy Process (AHP). The efficiency of Iranian football teams was estimated by choosing financial input variables such as fixed assets of clubs, wages of players, managers and staff on each team. By contrast, overall points at the league table, stadium attendance per game and revenues of were defined as outputs. The findings indicated that Iranian football teams performed 80% efficiency level on average in the league for the season 2009-10. The results highlighted large differences between efficiency and league rankings. Moghavemat FC, Aboomoslem FC and Shahin FC managed to reach full efficiency during the season being placed at the bottom side of the league table. Sepahan FC and Zob Ahan FC, on the other hand, completed the season at the top rank of the league in spite of being very inefficient. This was explained by authors in terms of huge payments of wages to players and coaches and of the mishandling clubs owned by the government, which brought about low profitability.

Guzmán (2006) analyzed in detail the financial efficiency and sustainable growth of Spanish football clubs between the 2000-01 and 2002-03 seasons. In addition to DEA-CRS and DEA-VRS models, Guzmán (2006) also utilized a Malmquist Productivity Index (Malmquist, 1953) and a Sustainable Growth Model (Higgins, 1977). Inputs were given by staff costs and overall expenses whereas financial turnovers (e.g. income, broadcasting, gate earnings, etc.) were set as outputs. The study found that more than half of all teams were efficient, likely because technological advances helped the financial performance of Spanish football clubs. Furthermore, football clubs that performed efficiently such as Real Madrid CF, Deportivo La Coruna FC and Real Betis Balompié were also found close to a sustainable growth ratio.

2.2.2. Studies using Data Envelopment Analysis and Regressions (Two-Stage Models)

In the literature, there are also several studies, displayed in table 9, that investigate sportive and financial efficiency of football clubs in many football leagues following two-stage analysis where efficiency measurement is typically carried out through DEA and the evaluation of efficiency determination is done through regression analysis.

Table 9. Studies using Data Envelopment Analysis (Two-Stage Models)

Author/Year	Data	Methodology	T	Input Variables	Output Variables
Boscá, E.J. et al. (2009)	Italian Serie A & Spanish La Liga (2000/01-2002/03)	1.DEA (Technical Efficiency-Output-oriented) 2. OLS Serie A Mean(Att):0.819 Mean(Def):0.750 La Liga Mean(Att):0.768 Mean(Def):0.790	S	FIRST STAGE	
				1.Shots on goal 2.Attacking Play 3.Crosses 4.Ball Possession	1.Goals Scored
				SECOND STAGE	
				1. Received Shots 2. Attacks in area 3.Crosses by opponent 4.Ball Possession	1.Goals Conceded (Inverse)
Sala-Garrido, R. et al. (2009)	Spanish La Liga (2000/01-2007/08)	1.DEA (Technical Efficiency-Output-oriented) 2.OLS Mean (Att):0.860 Mean(Def):0.810	S	FIRST STAGE	
				1.Shots on Goal 2.Attacks Play 3.Crosses 4.Minutes of Ball Possession	1.Goals Scored
				1.Shots Received 2.Attacks in area by Opponent 3.Crosses by Opponent 4.Ball Possession by Opponent	1.Goals Conceded (Inverse)
				SECOND STAGE	
				1.Attack Efficiency Scores 2.Defence Efficiency Scores	1. Points

Villa, G. & Lozano, S. (2016)	Spanish La Liga (2013/14)	1.DEA 2.Tobit Regression Mean(home): 0.792 Mean(away): 0.784 Mean(total): 0.788	S	FIRST STAGE	
				1.Ball Possesion(home) 2.Shots at Goal (home) 3.Corner Kicks(home) 4.Penalties(home) 5.Saves(home) 6.Ball Turnovers(home) 7.Steals(home) 8.Team Market Value (home)	1.Goals Scored (home)
				1.Ball Possesion(away) 2.Shots at Goal (away) 3.Corner Kicks(away) 4.Penalties(away) 5.Saves(away) 6.Ball Turnovers(away) 7.Steals(away) 8.Team Market Value (away)	1.Goals Scored (away)
				1.Ball Possesion(total) 2.Shots at Goal (total) 3.Corner Kicks(total) 4.Penalties(total) 5.Saves(total) 6.Ball Turnovers(total) 7.Steals(total) 8.Team Market Value (total)	1.Goals Scored (total)
				SECOND STAGE	
				1.Derby Games 2.Yellow Cards 3.Red Cards 4.Substitutions 5.Referee	1.Scoring Efficiency
Garcia-Sánchez, I.M. (2007)	Spanish La Liga (2002/03-2004/05)	DEA (Technical Efficiency, Pure Technical Efficiency, Scale Efficiency-Output-oriented) Technical Eff: Mean (Att): 0.841 Mean (Def): 0.724 Pure Tech. Eff: Mean (Att): 0.906 Mean (Def): 0.766 Scale Eff: Mean (Att): 0.928 Mean (Def): 0.954	M	FIRST STAGE	
				1. Number of attacking movements 2.Passes to penalty area 3.Shots on target 4.Goals Scored	1.Points
				1.Turnover (Ball) 2.Savings 3.Goals Conceded (Inverse)	1.Points
				SECOND STAGE	
				1.Efficiency scores from first stage	1.Ranking
				THIRD STAGE	
				1. Index of operating effectiveness estimated in the second stage 2.Stadium Capacity 3.Population of the province	1. Attendance in Stadiums

Barros, C.P., Assaf, A. & Sá-Earp, F. (2010)	Brazilian First Division (2006/07)	1.DEA (Technical Efficiency) 2.OLS Mean: 0.870	M	FIRST STAGE	
				1.Operational Costs 2.Total Assets 3.Team Payroll	1.Attendance in Stadiums 2.Total Receipts 3.Points
				SECOND STAGE	
				1.Wins 2.Losts 3.Goals Scored 4.Goals Conceded 5.Metropolitan Area (dummy) 6.Size of the Club (dummy)	1.Technical Efficiency Score
Barros, C.P. Garcia-del-Barrio, P. (2011)	Spanish La Liga (1995/96-2003/04)	1.DEA (CRS Model, VRS Model and Scale Efficiency-Output-oriented) Mean(CRS): 0.813 Mean(VRS): 0.912 Mean(Scale): 0.886 2. OLS	M	FIRST STAGE	
				1.Operating Cost 2.Total Assets 3.Team Payroll	1.Attendance Receipt (€) 2.Other Receipts
				SECOND STAGE	
				1.Game System 2. Number of Players 3.Number of Home Grown Players 4.Foreign Players	1.DEA-CRS Efficiency Score
Kounetas, K. (2014)	Greece Super League (2000/01-2008/09)	1.DEA (bootstrap) (Technical Efficiency-Output-oriented) Mean (2000-04): 0.924 Mean (2005-08): 0.905 2.OLS	M	FIRST STAGE	
				1.Total Players' Transfer Expenses 2.Operational Costs	1.Points
				SECOND STAGE	
				1.Profit Margin 2.Total Assets to Debt Ratio 3.Clubs' Age 4.Clubs' Location 5.Goal Ratio	1.Total Attendance 2.Bootstrap Technical Efficiency Scores

Sala-Garrido et al. (2009) analyzed the efficiency of Spanish football clubs for the seasons between 2000-01 and 2007-08 at La Liga. The authors divided sportive production sets into defensive and offensive. At the first stage of efficiency analysis, the offensive production set was formed by variables such as shots on target, attacking movements, crosses made by offensive players and ball possession as inputs, with goals scored as outputs. For the defensive production set, the authors used received shots, attacks made by the opposition, crosses made by opponents and ball possession as inputs. Output was given by inverse of goals conceded. The second stage of efficiency analysis assessed the impact of offensive and

defensive efficiency scores on overall points gained by Spanish football teams during eight seasons. It was found that both defensive and offensive efficiency have a significant impact on final ranking at the league table for Spanish football clubs. Moreover, offensive efficiency becomes important in order to be placed at high ranking. On the other hand, defensive efficiency crucially affects the capability of football clubs not to be relegated.

Villa and Lozano (2016) assessed the efficiency on scoring goals for football clubs at Spanish La Liga during 2013-14 season. Their study contained two-stage analysis for the measurement of efficiency by using DEA model and Tobit Regression. The authors developed three different production sets, namely for home games, away games and total, which all contain inputs such as ball possession, shots on goal, corner kicks, penalty shootouts, savings by goalkeepers, ball turnovers, stealing ball by tackles and team market value. The output variable of these three production sets was goals scored during matches. At the second stage, the technical efficiency scores were defined as dependent variable in a Tobit regression whereas the independent variables included the number of derby games, the number of yellow cards, the number of red cards, the number of substations and the characteristics of referees. According to the findings, it can be said that the number of fouls had significant and negative impact on scoring goals. However, there was not any significant impact of the number of red cards, substitutions, derby games and the characteristics of referee on scoring efficiency of Spanish football teams.

García-Sánchez (2007) discussed the efficiency and the effectiveness of Spanish football clubs using a three-stage, output-oriented, DEA approach for the seasons between 2002-03 and 2004-05 in La Liga. The author developed two different production sets in order to measure technical, pure technical and scale efficiency of Spanish football teams. In the first production set, she used the number of attacking movements, passes to penalty area, shots on target and the number of goals scored as input function. In the second production set, it can be seen that turnovers in the game, savings by goalkeepers and goals conceded in inverse form were placed in input function. The same outputs were used for both production sets, that is, the overall points gained by football teams. At the second stage of the analysis, García-Sánchez (2007) defined the efficiency score from the first stage as input and final ranking of all teams as output. Finally, at the third stage of the analysis, the author used the index of operating effectiveness estimated in the second stage, the stadium capacities of First Division teams and population of the province as inputs. On the other hand, the attendance in stadiums per game was used as output. According to the findings, efficiency was found 72% for the

defence and 84% for the offence of Spanish football clubs for the seasons of 2002-03 and 2004-05 in La Liga. Moreover, the champion of La Liga in 2004-05 season, FC Barcelona, was found the most efficient football club in both defensive and offensive play among the La Liga football teams. Another important finding was that social effectiveness, estimated at the third stage of the analysis and found at around 89%, is related to the efficiency of Spanish football clubs.

Comparably to García-Sánchez (2007), Barros and Garcia-del-Barrio (2011) developed a two-stage analysis of productivity drivers and market dynamics in the Spanish La Liga for the seasons between 1995-96 and 2003-04. Their analysis contained various DEA models (CRS and VRS) at the first stage, whereas they used Ordinary Least Square (OLS) to detect the impact of factors on efficiency. More specifically, the input variables in the first-stage production set included operational costs of football clubs, total assets of football clubs and team payrolls, while the outputs were set by the receipts gained by attendance in stadiums and other receipts. Similar to previous findings in the literature (Espitia-Escuer and Garcia-Cebrian, 2006; Guzmán, 2006; García-Sánchez, 2007; Boscá et al., 2009; Sala-Garrido et al., 2009, Picaso-Tadeo, and Gonzalez-Gomez, 2010), they concluded that Spanish football clubs performed at a high level of efficiency, with Real Madrid CF and FC Barcelona reached full efficiency from 1995-96 to 2003-04 seasons at La Liga. In addition, the results of the second stage analysis showed that defensive strategy in game system of football clubs increase the efficiency of the team. Likely, the number of home-grown and foreign players had significant and positive impact on performance efficiency.

Some the studies considered so far only consider the Spanih La Liga. Boscá et al. (2009) analysed the defensive and offensive efficiency of both Italian and Spanish football clubs for the seasons from 2000-01 to 2002-03. The authors divided production sets into defensive and offensive. Regarding to that, offensive inputs included shots on goal, attacking plays, crosses made during the game towards opposition zone and ball possession, whereas output was formed by goals scored. For the defensive production set, the authors used, as inputs, received shots, attacks made by the opposition, crosses made by the opponent and ball possession, and, as output, the inverse of goals conceded. One of the main findings of this study was that Serie A was found, efficiency-wise, less homogenous and competitive than La Liga for the seasons between 2000-01 and 2002-03. In addition, defensive efficiency in Italy provides more points compared to offensive efficiency. In Spain the situation is quite the opposite. To be placed at high rankings at the league, it is important for Spanish teams to be offensively efficient.

Barros et al. (2010) carried out the first study of (sportive and financial) efficiency of Campeonato Brasileiro Série A, during the 2006-07 season. In the first stage of the analysis operational costs of football clubs, their total assets and team payrolls were defined as inputs whereas attendance in stadiums, total receipts and overall points gained by football clubs were defined as outputs. In the second stage, the efficiency scores obtained from the first-stage analysis were regressed on wins, losses, goals scored, goals conceded, metropolitan areas of football clubs belong and the size of squads. The results indicate that the characteristics of cities and the size of football clubs had significant impacts on performance efficiency of football clubs.

Final victories or successes of a national team in international tournaments (e.g. World Cup, Euro Cup, etc.) raise expectations that football clubs belonging to that country are going to perform better. Much as Douvis and Barros (2009), Kounetas (2014) analyzed the efficiency of Greek football teams before and after the 2004 Euro Cup that was won by Greece. A two-stage analysis was performed on Greece Super League clubs from 2000-01 to 2008-09 using bootstrapped DEA and OLS. At the first stage, inputs were total amount of players' transfer expenses and operational costs, whereas points gained was the output. In the second stage of the analysis, two OLS models were developed that included as dependent variables either attendance in stadiums or bootstrapped technical efficiency scores, and, as independent variables, profit margin of clubs, total assets to debt ratio, clubs' age, clubs' location and goal ratio. The findings are that victory in the 2004 Euro Cup actually brought about a reduction in efficiency, since there had been huge amounts of expenditures on transfers and new expensive players' contracts. Second-stage analysis confirmed a rise in inefficiency, mainly linked to a diminishing assets-to-debt ratio.

2.2.3. Studies using Stochastic Frontier Analysis

Distinctly to the studies in the literature which have been analysed so far, table 10 shows works investigating the performance analysis of football clubs using Stochastic Frontier Analysis (SFA). SFA is an econometric technique positing a functional relationship between the dependent and the independent variables, as well as a decomposition of the error tems in inefficiency and a purely random component. Usually, SFA relates to a cost frontier approach assessing efficiency in terms of cost minimization (Aigner et al., 1977).

Table 10. Studies using Stochastic Frontier Analysis

Author/Year	Data	Methodology	T	Independent Variables	Dependent Variables
Kern, M. & Süssmuth, B. (2005)	German Bundesliga (1999/00-2000/01)	Stochastic Frontier Model	M	1.International Cups 2.Wages (Players) 3.Wages (Coaches) 4.Fan potential based on recent UEFA report 5.Net intra-seasonal transfer of players 6. Intra-seasonal signing up of a new coach	1.Revenues (Equation 1) 1.Points (League + Domestic Cup) (Equation 2)
Frick, B. & Simmons, R. (2008)	German Bundesliga (1981/82-2002/03)	Stochastic Frontier Model	M	1.Wages 2.Coach Salary 3.Coach career points (from league games) 4.Season experience of coach 5.Length of tenure in the league 6.Dummy variable for the fact of firing team head coach during the season in question	1.Points
Barros, C.P. & Leach, S. (2007)	English Premier League (1998/99-2002/03)	Stochastic Frontier Model (Cost Function)	F	1.Wages 2.The price of capital (amortization of players/number of players) 3.The price of capital (stadium expenditures/net assets and liabilities) 4.Points 5.Attendance 6.Financial Turnover 7.Number of Population 8.Income of The City 9.International Cups	1. Operational Costs
Barros, C.P. et al. (2008)	Spanish La Liga (1994/95-2004/05)	1.Stochastic Frontier Model 2.Latent Class Model	F	1.Labor Price 2.Capital Price 3.Points*Points 4.Labor P.*Labor P. 5.Capital P.*Capital P. 6.Points*Labor P. 7.Points*Capital P. 8.Labor P.*Capital P. 9.Trend 10.Squared Trend 11.Latent Variable 1 12.Latent Variable 2	1.Points
Barros, C.P. & Garcia-del-Barrio, P. (2008)	English Premier League (1998/99-2003/04)	Stochastic Frontier Model (Cost Function)	F	1. Sales 2. Points 3. Attendance 4. The price of workers 5. The price of capital premises 6. Capital investment	1. Operational Costs
Barros, C.P. et al. (2009)	Spanish La Liga (1995/96-2004/05)	Stochastic Frontier Model (Cost Function)	F	1. Sales 2. Points 3. Average Attendance 4. The price of workers 5. The price of capital premises 6. The price of capital investment	1. Operational Costs

Kern and Süssmuth (2005) proposed one of the first studies on efficiency measurement using SFA. They investigated managerial efficiency in Bundesliga for the seasons between 1999-2000 and 2000-01. The authors used six independent variables, namely participating international competitions, players' wages, coaches' wages, fan potential based on recent UEFA report, net intra-seasonal transfer of players and intra-seasonal signing up of a new coach in football clubs. Revenues of football clubs and overall points gained from league and domestic cups were formed as dependent variables in two separate equation. The evidence from this study implies that football teams with talented players are more likely to be efficient comparing to the ones do not have players with skill constitution. In addition, it was found that high salary payment making to managers do not have significant effects on the performance of football teams. The contrary turned out to be true that inter-seasonal transfer of players and signing up of a new coach.

Also Frick and Simmons (2008) focused on managerial efficiency in the German Bundesliga by analysing seasons from 1981-82 to 2002-03. In order to evaluate technical efficiency of coaches in German football through a SFA, the authors used the following independent variables: wages distributed by football teams, salaries earned by coaches, career points calculated by league games, coaches' experiences in leagues, the length of tenure in the Bundesliga and a dummy variable that represents the fact of firing team head coach during the season. On the other hand, overall points that Bundesliga clubs gained at the end of each season were considered as dependent variables. They found that managers mainly had German nationality as these head coaches preferred seldom to carry out their career abroad. The lack of mobility created an impact factor on manager salaries, and naturally, the financial conditions of football clubs.

The first investigation into financial efficiency of football clubs in the English Premier League from 1998-99 to 2002-03 seasons through SFA was made by Barros and Leach (2007). Their independent variables were total wages, the price of capital made by the amortization of a player over number of players, the price of capital made by stadium expenditures over net assets and liabilities, overall points gained by football teams, the attendance in stadiums per matches, financial turnover of the club, the number of population in cities where football teams are belonged, income of the city in which related to the football club and participating the international tournaments. Operational costs were used as dependent variable of the model. The results of their analysis showed that overall points, the attendance per matches, the population of cities where football teams belonged, and

participating international tournaments had significant and negative relationship with total wages. The income of the city in which related to the football club, however, was found to affect positively to total wages. Barros and Leach conclude that developing strategies improving sportive performances can also be conducive to cost reduction.

Another important study contains the efficiency measurement of the football clubs in the English Premier League using SFA was published by Barros and Garcia-del-Barrio (2008). They analysed the financial efficiency of English football clubs involving seasons between 1998-99 and 2003-04. Their independent variables were sales revenues of football clubs, overall points gained during seasons, the attendance in the stadiums per matches, the price of employees, the price of capital premises of the clubs and the price of capital investment made by football teams. Again, operational costs were used as dependent variable of the model. They find that the price of employees, the price of capital premises of the clubs and the price of capital investment have a negative and significant impact on operational costs. Contrarily, sales revenues of football clubs and the attendance in the stadiums per matches affect significantly and positively the operational costs of clubs.

Corresponding to previous studies (Barros et al., 2008; Barros and Garcia-del-Barrio, 2008), Barros et al. (2009) examined cost efficiency of Spanish football clubs in La Liga from the seasons 1995-96 to 2004-05 using SFA. Independent variables in their model were the sales revenues of football clubs, overall points gained during seasons, the attendance in the stadiums per matches, the price of employees, the price of capital premises of the clubs and the price of capital investment made by football teams. Once more, operational costs were the dependent variable. According to their findings, Real Madrid CF and FC Barcelona had been found the most efficient football clubs by way of financial stability and performance between 1995-96 and 2004-05 seasons.

2.2.4. Other Studies using Regression Analysis

From the earliest literature, studies in football economics have focused on efficiency determination both in the sportive and financial fields using simple regression models (where the error term was not decomposed in inefficiency and a purely random component). These studies are presented at table 11.

Table 11. Other Studies using Regression Analysis

Author/Year	Data	Methodology	T	Independent Variables	Dependent Variables
Carmichael, F. Thomas, D. & Ward, R. (2001)	English Premier League (1996/97-1998/99)	Fixed effect OLS	S	1.Goals Scored 2.Goals Conceded 3.Overall Shots 4.Own Goals Conceded 5.Pass 6.Dribbles 7.Red Card 8.Saves 9. Ball Touches	1.Points (Equation 1) 2.Goals Scored (Equation 2) 3.Goals Conceded (Equation 3) 4.Overall Shots (Equation 4a and 4b)
Dawson, P. Dobson, S. & Gerrard, B. (2002)	English Premier League (1997/98)	OLS	S	1.Total League Appearances in Career of Players 2.Total Career Goals Scored of Players 3.Number of Previous Clubs of Players 4.Age (in year and month) 5. Total League Appearances of Players in Previous Seasons 6.Total Goals Scored of Players in Previous Seasons 7.Divisional Status of Club Registered with in Previous Season	1.Wages
Karaca, O. (2008)	36 European Leagues (2002/03-2006/07)	OLS	S	1.Population of the Country 2.GNI (per capita) 3.Average Temperature of each Country (Yearly) 4.Percante of Foreign Players	1.UEFA Country Ranking Points (Equation 1) 2.FIFA/Coca-Cola World Ranking Points (Equation 2)
Beck, N. & Meyer, M. (2012)	German Bundesliga (1992/93-2002/03)	Fixed effect OLS	S	1.Age 2.Nationality 3.League Experience 4.Ranking 5.Points 6.Match Significance 7.Geographical Distances 8.International Cup	1.Goal Differences (Goals Scored – Goals Conceded)

Dawson, P. et al. (2000)	English Premier League (1992/93-1997/98)	1.Fixed and Random effect OLS	M	1. Transfer Value of players 2.Wages 3.Previous Club of players 4.Age 5.Total League Goals 6.Total League Appearances 7.League Goals in the previous season 8.Divisional Status of the player in the previous season 9. League Appearances in the previous season 10.Time Trend	1. Winning Percentage (Equation 1) 2.Points (Equation 2)
Torgler, B. & Schmidt, S.L. (2007)	German Bundesliga (1995/96-2003/04)	Fixed Effect OLS (Weighted)	M	1.Salary 2.Age 3.Changed Team 4.Average Age of Team-mates 5.Average number of exchanges of Team-mates 6.Average number of sent-offs of team-mates	1.Goals Scored (Equation 1) 2.Assists (Equation 2)
Carmichael, F. et al. (2011)	English Premier League (1997/98-2001/02)	1. Fixed and Random effect OLS	M	1.Tenure in years at the current club at the start of the season 2.Manager Turnover 3.Player's range of skills and abilities 4.The ratio of points distributed as home and away 5.International Cups	1.Points of club's divided by total points achieved by other teams (in %) (Equation 1) 2. Club's share of revenue gained in the season (Equation 2) 3.Wages (Equation 3)
Yamamura, E. (2015)	Japanese J-League (1993/94-2011/12)	1.Fixed Effect OLS 2.Dynamic Panel Model	M	1.Average annual salary of players (Wages) 2.Inter-team annual salary (Herfindahl Index)	1.Rate of wins

Carmichael et al. (2001) analyzed the sportive efficiency of football clubs in the English Premier League from 1996-97 to 1998-99 seasons. The authors used fixed effect OLS regression model, and took several independent variables such as goals scored, goals conceded, overall shots made by teams, own goals conceded, the number of passes made, the

dribbles made by teams, the amount of red cards shown, savings by the goalkeepers and ball touches. The dependent variable, on the other hand, was formed by overall points gained by football teams during 1996-97 and 1998-99 seasons. The main findings showed that football clubs need to focus on accurate passes and dribbles in order to maximize scoring goals and points to gain. Moreover, ball possession was found positively affecting efficiency.

Dawson and Dobson (2002) also analyzed the sportive efficiency of English football clubs during the 1997-98 season. Their OLS analysis considered such independent variables as total league appearances in career of players, total career goals scored by players, the number of previous clubs of players, age of managers, total league appearances of players in previous seasons and divisional status of football clubs registered with in previous season, whereas the dependent variable was total wages. The main results of their study are that the conditions of experience in leagues had positive and significant impact on the efficiency of football clubs. On the contrary, the other control variables, such as age and total career goals scored, were not found strongly significant.

Karaca (2008) focused on the impact of foreign players on efficiency. He examined 36 European Leagues (Austria, Belarus, Belgium, Bosnia and Herzegovina, Croatia, Cyprus, Czech Republic, Denmark, England, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Israel, Italy, Latvia, Lithuania, Malta, Netherlands, Northern Ireland, Norway, Poland, Portugal, Romania, Russian Federation, Scotland, Slovenia, Spain, Sweden, Switzerland, Turkey and Ukraine) by using OLS regression analysis for the seasons between 2002-03 and 2006-07. In his analysis, the population of the country, GNI per capita, the yearly average temperature of each country and the percentage of foreign players at each football team were selected as independent variables. On the other hand, UEFA country ranking points and FIFA world ranking points were set as dependent variables in two different regressions. The findings of his work revealed that foreign players had a positive and significant impact on their domestic football teams, whereas they did not have any impact on the efficiency of their national teams.

Beck and Mayer (2012) examined the efficiency of football clubs in German Bundesliga for the seasons from 1992-93 to 2002-03 through fixed-effect OLS analysis. In their research, in order to detect the sportive efficiency of football clubs, the authors decided to use age of players, nationality of players, league experiences regarding to the players' appearances, ranking of the league table, overall points gained by football teams, match significance or

importance, geographical distances between clubs' facilities and participating international competitions were formed as independent variables. On the other hand, they defined goal difference as their dependent variable. Regarding to the results of their study, Beck and Mayer (2012) stated that football clubs with more heterogeneity performed less efficiently. They also concluded that flat-back-four tactic formation created inefficiency.

Dawson et al. (2000) pioneered the analysis of the efficiency of managers in professional football clubs by analysing the evolution of managerial efficiency over time in football clubs in the English Premier League for the seasons from 1992-93 to 1997-98. The authors developed fixed and random OLS in order to analyse the impact of managerial changes during the season on football teams, they selected as independent variables the transfer value of players, wages, previous club of players, age, total league goals of players, total league appearances of players, league goals scored by players at the previous season, divisional status of players in the previous season, the league appearances of players during the previous season and a time trend. The winning percentage and overall points gained by football clubs established the dependent variables in their estimation model. Their findings suggested that managerial efficiency tended to diminish during the seasons between 1992-93 and 1997-98 among all football clubs in the Premier League.

Torgler and Schmidt (2007) analysed the performance of football players in German Bundesliga for seasons from 1995-96 to 2003-04. The authors estimated a fixed effect OLS regression model by taking several independent variables such as wages of players, average age of players, players' changes of team, average age of team-mates, average number of exchanges of team-mates and average number of red cards shown to team-mates. Goals scored and assists made were the dependent variables in two separate regression models. The results of their study indicated that an increase on wages causes significant reduction on the efficiency of football clubs in German Bundesliga. In addition, exchanging team-mates and red cards have negative impact more on football teams rather than individual player-based efficiency, and the average age of players was not found a significant determinant of team performance. The authors also concluded that goals scored and assists made by the players significantly enhanced the efficiency of football clubs.

Charmichael et al. (2011) analyzed the links between sportive and financial successes on team performance on English football teams for the seasons from 1997-98 to 2001-02. In this paper, the analysis of three different fixed and random effect OLS regression models were

used with several independent variables such as tenure in years at the current club at the beginning of each season, manager turnover, players' range of skills and abilities, the ratio of overall points distributed as home and away gains and participating international tournaments. The three dependent variables were overall points of clubs divided by total points achieved from other teams, clubs' share of revenue gained during each season and wages of players. According to the evidence, participating to European competitions had a positive effect on both sportive and financial development of football clubs and enhanced their efficiency. Furthermore, wages of players, which are strongly related with the revenues of football clubs, were also found as a leading positive influence on the efficiency of football players.

Yamamura (2015) provided on of the few studies concerning a non-European league. His paper discussed about the effect of wage disparity to team performance in the Japanese J-League for seasons from 1993-94 to 2011-12. The average annual salary of players and inter-team annual salary, and the rate of wins of Japanese football clubs were respectively taken as independent and dependent variables. Wage disparity was found to diminish the efficiency of football clubs. In addition, talented and foreign players also brought about an inefficient resource allocation in Japanese football clubs.

2.3. Concluding Remarks

In this chapter, previous studies about efficiency of football have been presented with respect to various methodologies. These studies have been categorized under two main approaches such as parametric and non-parametric methods. Studies with parametric methods usually include classical regression analysis, but a few of them also involve SFA. Researches using non-parametric methods mostly rely on DEA.

This chapter aimed to highlight contributions related to the use of new variables, indicators and methodologies, possibly filling gaps in the literature. Studies have been divided in four main categories, namely, studies just using DEA, studies using DEA and regression in a two-stage set-up, studies using SFA and studies using simple regression analysis. These studies related to the efficiency analysis of sportive (Dawson et al., 2000; Carmichael et al., 2001; Dawson et al., 2002; Espitia-Escuer and Garcia-Cebrian, 2006; Garcia-Sánchez, 2007; Frick and Simmons, 2008; Karaca, 2008; Boscá et al., 2009; Sala-Garrido et al., 2009; Espitia-Escuer and Garcia-Cebrian, 2010; Gonzalez-Gomez and Picaso-Tadeo, 2010; Picaso-Tadeo and Gonzalez-Gomez, 2010; Yamamura, 2010; Tiedemann et al., 2011; Beck and Meyer,

2012; Kounetas, 2014; Santìn, 2014; Villa and Lozano, 2016; Rossi et al., 2018) and financial performance (Guzmán, 2006; Barros and Leach, 2007; Barros et al., 2008; Barros and Garcia-del-Barrio; 2008; Barros et al., 2009; Barros and Garcia-del-Barrio, 2011). In some studies, researchers have investigated both sportive and financial efficiency of football clubs (Haas, 2003; Haas et al., 2004; Kern and Süssmuth, 2005; Barros and Leach, 2006; Guzmán and Morrow, 2007; Torgler and Schmidt, 2007; Douvis and Barros, 2009; Barros et al., 2010; Carmichael et al., 2011; Soleimani-Damaneh, et al., 2011; Kulikova and Goshunova; 2014; Pyatunin et al., 2016; Wyszyński, 2016).

Findings across studies in the literature tend to be rather consistent. Focusing on Spanish La Liga and English Premier League (since most works focus on these leagues), it turns out that a few teams are consistently efficient. Real Madrid CF and FC Barcelona (Espitia-Escuer and Garcia-Cebrian, 2006; García-Sánchez, 2007; Boscá et al., 2009; Sala-Garrido et al., 2009; Gonzales-Gomez and Picazo-Tadeo, 2010; Kulikova and Goshunova, 2014; Villa and Lozano, 2016) are almost invariably found efficient in the Spanish La Liga and in the UEFA Champions League (Espitia-Escuer and Garcia-Cebrian, 2010; Pyatunin et al., 2016). Liverpool FC, Chelsea FC, Manchester United FC and Arsenal FC show a similar performance in the English Premier League (Barros and Leach, 2006; Guzmán and Morrow, 2007; Kulikova and Goshunova, 2014).

Typical input variables that relate to offensive performance are the number of shots (Garcia-Sánchez, 2007; Boscá et al., 2009; Sala-Garrido et al., 2009; Espitia-Escuer and Garcia-Cebrian, 2010; Villa and Lozano, 2016), crosses (Boscá et al., 2009; Sala-Garrido et al., 2009; Rossi et al., 2018), corners, penalties (Villa and Lozano, 2016) and dribbles (Carmichael et al., 2001; Rossi et al., 2018). Input variables for defensive performance evaluation are typically interceptions (Villa and Lozano, 2016; Rossi et al., 2018), tackles (Tiedemann et al., 2011; Rossi et al., 2018), received shots (Boscá et al., 2009; Sala-Garrido et al., 2009), saves (Carmichael et al., 2001; Garcia-Sánchez, 2007; Villa and Lozano, 2016; Rossi et al., 2018). Also committed fouls and offsides (Rossi et al., 2018) have been used in the previous studies. Other input variables such as ball possession (Boscá et al., 2009; Sala-Garrido et al., 2009; Espitia-Escuer and Garcia-Cebrian, 2010; Villa and Lozano, 2016), passes (Carmichael et al., 2001; Garcia-Sánchez, 2007; Tiedemann et al., 2011; Rossi et al., 2018), yellow cards (Villa and Lozano, 2016; Rossi et al., 2018) and red cards (Carmichael et al., 2001; Villa and Lozano, 2016; Rossi et al., 2018) are chosen to evaluate a novel concept, the team efficiency of football clubs.

Significant examples of output variables are goals scored (Carmichael et al., 2001; Garcia-Sánchez, 2007; Boscá et al., 2009; Sala-Garrido et al., 2009; Barros et al., 2010; Villa and Lozano, 2016), inverse of goals conceded (Carmichael et al., 2001; Garcia-Sánchez, 2007; Boscá et al., 2009; Sala-Garrido et al., 2009; Barros et al., 2010; Villa and Lozano, 2016), goal rate (Kounetas, 2014) and points (Haas, 2003; Haas et al., 2004; Barros and Leach, 2006; Espitia-Escuer and Garcia-Cebrian, 2006; Garcia-Sánchez, 2007; Guzmán and Morrow, 2007; Douvis and Barros, 2009 ; Gonzalez-Gomez and Picaso-Tadeo, 2010; Picaso-Tadeo and Gonzalez-Gomez, 2010; Soleimani-Damaneh et al., 2011; Pyatunin et al., 2014; Wyszyński, 2016).

Finally, typical control variables used in the two-stage analysis (at the second stage) include the number of games (Espitia-Escuer and Garcia-Cebrian, 2010; Gonzalez-Gomez and Picaso-Tadeo, 2010; Santin, 2014), the size or capacity of roster (Barros and Leach, 2006; Douvis and Barros, 2009; Espitia-Escuer and Garcia-Cebrian, 2010; Gonzalez-Gomez and Picaso-Tadeo, 2010; Picaso-Tadeo and Gonzalez-Gomez, 2010), the number of foreign players (Barros and Garcia-del-Barrio, 2011), the quota of international players (Beck and Meyer, 2012), the quota of new players (Torgler and Schmidt, 2007), participation to international competitions (Kern and Süssmuth, 2005; Gonzalez-Gomez and Picaso-Tadeo, 2010; Santin, 2014; Pyatunin et al., 2014), average age of roster (Dawson et al., 2000; Dawson et al., 2002; Torgler and Schmidt, 2007; Beck and Meyer, 2012), the roster or market value of each football club (Dawson et al., 2000; Villa and Lozano, 2016), number of managers on each season (Kern and Süssmuth, 2005; Frick and Simmons, 2008; Carmichael et al., 2011) and season (tournament year) dummies (Picaso-Tadeo and Gonzalez-Gomez, 2010; Santin, 2014).

Perusal of this list reveals that, thanks to the adoption of new databases, a contribution to the literature could be made by including in the analysis such new variables as fouls made by opponent defenders (input of offensive performance), or as aerials won (input of team performance). As contextual variables, usually adopted in the literature at the second stage of the analysis, we will be able to include a list of important indicators, including foreign players ratio (the ratio of the number of foreign players divided by the number of roster players), international players ratio (the ratio of the number of international players divided by the number of roster players), new players ratio (the ratio of the number of new players divided by the number of roster players) and roster value ratio (the ratio of market value divided by the roster size), beside country and season dummy variables. A novel contribution in this

ambit will be made by using an indicator for promotion of the club to the first division. More detailed information is provided in the next chapter (see '3.2.1. Definitions of the Variables').

Also, considering the domains of the analysis (sportive, financial, or mixed), it seems fair to say that the production sets considered in many works are of a rather ad hoc nature, probably because of data availability. This is especially true in the case of the mixed models, where non-field variables often change in nature and role. In this thesis, we will use a rather rich dataset to model sportive efficiency rigorously. Some financial variables will then be used only as contextual indicators. However, it should also be stressed that two-stage (or three-stage) procedures have come under important criticism (Simar and Wilson, 2007), basically because excluding potentially relevant information at the first-stage of the analysis could lead to inconsistent efficiency measures. Hence, arguably the main novelty in this thesis (at lesst as fas as sports economics is concerned) relates to the adoption of a novel empirical procedure. More specifically, unlike in many previous studies, two-stage efficiency analysis is superseded by a conditional order-m analysis of efficiency and its determination. A conditional order-m will be implemented in order to assess the impact of a set of potential determinants (controls) on the efficiency of football clubs. A further important gap of the literature on football teams' efficiency is its lack of counterfactual analysis. In this thesis, the effects of a new regulation on the quota of foreign players implemented by the Turkish Football Federation is analysed in Chapter 4 through a Differences in Differences analysis. In that case, we will not be able to rely on conditional order-m, but DEA scores will be computed according to a single-stage procedure that avoids the pitfalls of two-stage analysis.

Further gaps of the literature that can be filled here are that most analyses in the literature concern only one or two countries for a very few years. In this thesis, the five big European leagues (English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1) will be analysed together for a non-negligible time span, the seasons between 2009-10 and 2017-18. A final, more tentative, contribution to the literature relates to the development of a new efficiency concept, namely 'team' efficiency, in addition to offensive and defensive efficiency. More detail about this concept will be provided in Chapter 3.

CHAPTER 3: THE TECHNICAL EFFICIENCY OF FOOTBALL TEAMS:

A CONTITIONAL ORDER-M ANALYSIS FOR FIVE EUROPEAN FOOTBALL LEAGUES

3.1. Technical Efficiency of European Football Teams

As it can be understood from the previous chapter, efficiency of football has been discussed and studied for many years until now. Although the main question on defining the success on football has not been clarified yet (Morrow, 1999), measuring efficiency of football teams could be useful methodology in order to rank the level of success regarding to the usage of resource allocation (García-Cebrián et al., 2018).

In this thesis, in the course of efficiency measurement, the biggest five European football leagues, such as English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, will be analysed together.

Adding to the originality of the dataset, three different concepts of efficiency (offensive, defensive, and team) will be considered, and some novel variables will be used in the measurement of efficiency. What is however more distinctive of the present analysis is that, after that production sets have selected using DEA, a conditional order-m analysis will be implemented.

This procedure will yield both unconditional and conditional order-m efficiency scores and will allow a consistent assessment of the role of potential efficiency determinants through kernel regressions.

3.2. Data

The dataset in this research include thirty-six variables, divided into three categories such as input, output and control variables (see table 27), with 882 observations including 169 football clubs from the biggest five European football leagues. The full list of football clubs and their leagues in this research will be presented in the appendix.

Table 12. The Categorization of Football Clubs Regarding to Their Domestic Leagues

Football League	Number of Football Clubs	Season
English Premier League	36 Clubs	2009-10 to 2017-18
Italian Serie A	34 Clubs	2009-10 to 2017-18
Spanish La Liga	35 Clubs	2009-10 to 2017-18
German Bundesliga	28 Clubs	2009-10 to 2017-18
French Ligue 1	36 Clubs	2009-10 to 2017-18

Table 12 shows the categorization of football clubs regarding to the biggest five leagues in Europe such as English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1 for the seasons between 2009-10 and 2017-18.

The dataset has been collected from Transfermarkt GmbH & Co. KG (www.transfermarkt.com), Mackolik Internet Hizmetleri A.S. (www.mackolik.com) and Whoscored.com (www.whoscored.com). This dataset for European leagues has been constructed jointly with Prof. Francesco Addesa from Leeds Beckett University and Prof. Giambattista Rossi from Birkbeck College, London.

The dataset includes several variables, which are displayed and illustrated in table 13. As said above, in this thesis a new efficiency concept will be considered, namely 'team' efficiency, which will relate to performances that cannot be strictly ascribed to offensive and defensive efficiency. These performances are indicated in the table 13.

Table 13. The Dataset Categorized Regarding to Variable Types and Ambit

Name of the Variable	Type of Variable	Characteristic of Variable
Shots	X = Input	Offensive
Crosses	X = Input	Offensive
Corners	X = Input	Offensive
Penalties	X = Input	Offensive
Fouled	X = Input	Offensive
Dribbles	X = Input	Offensive
Interceptions	X = Input	Defensive
Tackles	X = Input	Defensive
Received Shots	X = Input	Defensive
Saves	X = Input	Defensive
Fouls	X = Input	Defensive
Offside	X = Input	Defensive
Ball Possessions	X = Input	Team
Passes	X = Input	Team
Aerial Wins	X = Input	Team
Yellow Cards	X = Input	Team
Red Cards	X = Input	Team
Bookings	X = Input	Team
Goals Scored	Y = Output	Offensive
Goals Conceded (Inverse)	Y = Output	Defensive
Goal Rate	Y = Output	Offensive
Points	Y = Output	Offensive + Defensive + Team
Games	Z = Control	Offensive + Defensive + Team
Roster Size	Z = Control	Offensive + Defensive + Team
Foreign Players	Z = Control	Offensive + Defensive + Team
International Players	Z = Control	Offensive + Defensive + Team
New Players	Z = Control	Offensive + Defensive + Team
Foreign Players Ratio	Z = Control	Offensive + Defensive + Team
International Players Ratio	Z = Control	Offensive + Defensive + Team
New Players Ratio	Z = Control	Offensive + Defensive + Team
International Cups	Z = Control	Offensive + Defensive + Team
Promoted	Z = Control	Offensive + Defensive + Team
Age	Z = Control	Offensive + Defensive + Team
Roster Value	Z = Control	Offensive + Defensive + Team
Roster Value Ratio	Z = Control	Offensive + Defensive + Team
Manager	Z = Control	Offensive + Defensive + Team
Country (Dummy)	Z = Control	Offensive + Defensive + Team
Season (Dummy)	Z = Control	Offensive + Defensive + Team

***Roster Size, Foreign Players, International Players and New Players include players at least played 1 min during the season.**

3.2.1. Definitions of the Variables

In the analysis of efficiency, the definitions of variables regarding to their characteristics are given as follows:

Input Variables:

- **Shots:** The number of shots made on target to opponent in the match per game.
- **Crosses:** The number of crosses made by the offensive players per game.
- **Corners:** The number of corner kicks earned in attacking movements per game.
- **Penalties:** Total amount of penalty kicks earned by offensive players per season.
- **Fouled:** The number of fouls made by the opponent team per game.
- **Dribbles:** The distance of dribbles made by offensive players per game.
- **Interceptions:** The number of interceptions made by defensive players per game.
- **Tackles:** The number of tackles made by the defensive players per game.
- **Received Shots:** The number of shots received by the opponent team per game.
- **Saves:** The number of saves by the goalkeeper per game.
- **Fouls:** The number of fouls made to opponent team per game.
- **Offsides:** The number of offside positions per game.
- **Ball Possessions:** The percentage of ball possessions per game.
- **Passes:** The percentage of successful passes per game.
- **Aerial Wins:** The number of aerial challenges won per game.
- **Yellow Cards:** The number of yellow cards shown at each team per season.
- **Red Cards:** The number of red cards shown at each team per season.
- **Bookings:** The sum of yellow and red cards shown at each team per season.

Output Variables:

- **Goals Scored:** The number of goals scored by each team per season.
- **Goals Conceded (Inverse):** The number of goals conceded calculated inversely by each team per season.
- **Goal Rate:** The ratio of goals scored divided by goals conceded per season.
- **Points:** The number of points earned by each team per season.

Control Variables:

- **Games:** The number of games played by each team per season.
- **Roster Size:** Total number of players in squad at each team per season.
- **Foreign Players:** Total number of foreign players at each team per season.
- **New Players:** Total number of new players at each team per season.
- **International Players:** Total number of international experienced players at each team per season.
- **Foreign Players Ratio:** The ratio of the number of foreign players divided by the number of roster players at each team per season.
- **New Players Ratio:** The ratio of the number of new players divided by the number of roster players at each team per season.
- **International Players Ratio:** The ratio of the number of international experienced players divided by the number of roster players at each team per season.
- **International Cups:** Dummy variable for the participation of international competitions per season (1 = YES, 0 = NO).
- **Promoted:** Dummy variable for promoted teams for the next year per each season (1 = YES, 0 = NO).
- **Age:** The average of players' age at each team per season.
- **Roster Value:** The market value of each time regarding to their roster per season.
- **Roster Value Ratio:** The ratio of market value divided by the roster size of each team per season.
- **Manager:** The number of managers at each team per season.
- **Country (Dummy):** Country dummy variables for England, Italy, Spain, Germany and France.
- **Season (Dummy):** Season dummy variables from 2009-10 to 2017-18.

The majority of these variables have already been used in previous studies. For instance, input variables for offensive efficiency analysis were set by number of shots (Garcia-Sánchez, 2007; Boscá et al., 2009; Sala-Garrido et al., 2009; Espitia-Escuer and Garcia-Cebrian, 2010; Villa and Lozano, 2016), crosses (Boscá et al., 2009; Sala-Garrido et al., 2009; Rossi et al., 2018), corners, penalties (Villa and Lozano, 2016) and dribbles (Carmichael et al., 2001; Rossi et al., 2018).

Inputs for defensive efficiency evaluation are interceptions (Villa and Lozano, 2016; Rossi et al., 2018), tackles (Tiedemann et al., 2011; Rossi et al., 2018), received shots (Boscá et al., 2009; Sala-Garrido et al., 2009), saves (Carmichael et al., 2001; Garcia-Sánchez, 2007; Villa and Lozano, 2016; Rossi et al., 2018), fouls committed and offsides (Rossi et al., 2018) were used in the previous studies.

Some other types of input variables, which are used in this thesis to construct a novel concept of efficiency, team efficiency, have also been used in past research. They are ball possession (Boscá et al., 2009; Sala-Garrido et al., 2009; Espitia-Escuer and Garcia-Cebrian, 2010; Villa and Lozano, 2016), passes (Carmichael et al., 2001; Garcia-Sánchez, 2007; Tiedemann et al., 2011; Rossi et al., 2018), yellow cards (Villa and Lozano, 2016; Rossi et al., 2018) and red cards (Carmichael et al., 2001; Villa and Lozano, 2016; Rossi et al., 2018).

Output variables taken from previous studies include goals scored (Carmichael et al., 2001; Garcia-Sánchez, 2007; Boscá et al., 2009; Sala-Garrido et al., 2009; Barros et al., 2010; Villa and Lozano, 2016), inverse of goals conceded (Carmichael et al., 2001; Garcia-Sánchez, 2007; Boscá et al., 2009; Sala-Garrido et al., 2009; Barros et al., 2010; Villa and Lozano, 2016), goal rate (Kounetas, 2014) and points (Haas, 2003; Haas et al., 2004; Barros and Leach, 2006; Espitia-Escuer and Garcia-Cebrian, 2006; Garcia-Sánchez, 2007; Guzmán and Morrow, 2007; Douvis and Barros, 2009 ; Gonzalez-Gomez and Picaso-Tadeo, 2010; Picaso-Tadeo and Gonzalez-Gomez, 2010; Soleimani-Damaneh et al., 2011; Pyatunin et al., 2014; Wyszyński, 2016) were taken as an example from the previous studies.

Similarly, there are control variables taken from previous studies such as the number of games (Espitia-Escuer and Garcia-Cebrian, 2010; Gonzalez-Gomez and Picaso-Tadeo, 2010; Santin, 2014), the size or capacity of roster (Barros and Leach, 2006; Douvis and Barros, 2009; Espitia-Escuer and Garcia-Cebrian, 2010; Gonzalez-Gomez and Picaso-Tadeo, 2010; Picaso-Tadeo and Gonzalez-Gomez, 2010), number of foreign players (Barros and Garcia-del-Barrio, 2011), number of international players (Beck and Meyer, 2012), new players (Torgler and Schmidt, 2007), participation to international competitions (Kern and Süssmuth, 2005; Gonzalez-Gomez and Picaso-Tadeo, 2010; Santin, 2014; Pyatunin et al., 2014), average age of football teams (Dawson et al., 2000; Dawson et al., 2002; Torgler and Schmidt, 2007; Beck and Meyer, 2012), the roster or market value of each football club (Dawson et al., 2000; Villa and Lozano, 2016), number of managers on each season (Kern and Süssmuth, 2005; Frick and

Simmons, 2008; Carmichael et al., 2011) and season dummies in which represents seasons from 2009-10 and 2017-18 (Picaso-Tadeo and Gonzalez-Gomez, 2010; Santin, 2014).

In this thesis, most of these controls are included as ratios. For example, this includes foreign players ratio (the ratio of the number of foreign players divided by the number of roster players), international players ratio (the ratio of the number of international players divided by the number of roster players), new players ratio (the ratio of the number of new players divided by the number of roster players), roster value ratio (the ratio of market value divided by the roster size).

Furthermore, in this thesis some novel variables will be used in the analysis of efficiency, like fouls made by opponent defenders (input of offensive performance), aerials won (input of team performance and control variables like promoting to the top league, are used in order to contribute to the previous studies in the literature.

3.2.2. Code Names of the Variables

In empirical research, all variables will have a code name, which is presented below.

For the input variables refer to attacking play, $\boldsymbol{MSHOT_{it}}$ represents the number of shots made on target to opponent for in the match per game for team i, in t season. $\boldsymbol{CROSS_{it}}$ is the number of crosses made by the offensive players per game for team i, in t season. $\boldsymbol{CORNER_{it}}$ refers to the number of corner kicks earned in attacking movements per game for team i, in t season, while $\boldsymbol{PENALTY_{it}}$ is total amount of penalty kicks earned by offensive players per season for team i, in t season. Moreover, $\boldsymbol{FOULED_{it}}$ is the number of fouls made by the opponent team per game for team i, in t season, whereas $\boldsymbol{DRIBBLE_{it}}$ represents the distance of dribbles made by offensive players per game for team i, in t season.

For the input variables related with defensive play, $\boldsymbol{INTERCEPTION_{it}}$ represents the number of interceptions made by defensive players per game for team i, in t season and $\boldsymbol{TACKLE_{it}}$ is the number of tackles made by the defensive players per game for team i, in t season. In addition, $\boldsymbol{RSHOT_{it}}$ refers to the number of shots received by the opponent team per game for team i, in t season and $\boldsymbol{SAVE_{it}}$ is the number of saves by the goalkeeper per game for team i, in t season. Moreover, $\boldsymbol{FOUL_{it}}$ represents the number of fouls made to opponent team per game for team i, in t season and the last variable refers to defensive play is $\boldsymbol{OFFSIDE_{it}}$ in which represents the number of offside positions per game for team i, in t season.

The input variables related with team efficiency are $\boldsymbol{POSSESSION_{it}}$ that is the percentage of ball possessions per game for team i, in t season and $\boldsymbol{PASS_{it}}$representing the percentage of successful passes per game for team i, in t season. Furthermore, $\boldsymbol{AERIALWON_{it}}$ is the number of aerial challenges won per game for team i, in t season. The variables related with discipline are $\boldsymbol{YELLOW_{it}}$ represents the number of yellow cards shown for team i, in t season, whereas $\boldsymbol{RED_{it}}$ is the number of red cards shown for team i, in t season, and overall, $\boldsymbol{BOOKING_{it}}$ is the sum of yellow and red cards shown for team i, in t season.

As far as output variables are concerned, $\boldsymbol{SCORED_{it}}$ represents the number of goals scored by team i, in t season, while $\boldsymbol{CONCEDED_{it}}$ is the number of goals conceded inversely by team i, in t season. In addition, $\boldsymbol{GOALRATIO_{it}}$ refers to the ratio of goals scored divided by goals conceded for team i, in t season. $\boldsymbol{POINT_{it}}$ is the number of points earned by team i, in t season.

For the control variables, $\boldsymbol{GAME_{it}}$ represents the number of games played by team i, in t season, while $\boldsymbol{ROSTER_{it}}$ defines total number of players in squad for team i, in t season. In addition to control variables, $\boldsymbol{FOREIGN_{it}}$ refers to total number of foreign players for team i, in t season, whereas $\boldsymbol{NEWPLAYER_{it}}$ is total number of new players for team i, in t season. Moreover, $\boldsymbol{INTERNATIONAL_{it}}$ represents total number of international experienced players for team i, in t season. While $\boldsymbol{FOREIGNRATIO_{it}}$ defines the ratio of the number of foreign players divided by the number of roster players for team i, in t season, $\boldsymbol{NEWRATIO_{it}}$ is the ratio of the number of new players divided by the number of roster players for team i, in t season and $\boldsymbol{INTERRATIO_{it}}$ refers to the ratio of the number of international players divided by the number of roster players for team i, in t season. Furthermore, $\boldsymbol{CUP_{it}}$ defines dummy variable for the participation of international competitions for team i, in t season and $\boldsymbol{PROMOTED_{it}}$ represents dummy variable for promoting to the top division for the next year for team i, in t season. Variables with code names proceed with $\boldsymbol{AGE_{it}}$ that is the average of players' age for team i, in t season. Also, $\boldsymbol{ROSTERVALUE_{it}}$ defines the market value of each time regarding to their roster for team i, in t season and $\boldsymbol{VALUERATIO_{it}}$ represents the ratio of market value divided by the roster size for team i, in t season. Lastly, $\boldsymbol{MANAGER_{it}}$ refers to the number of managers for team i, in t season. $\boldsymbol{COUNTRY_{it}}$ is dummy variable for England, Italy, Spain, Germany and France with respect to team i, in t season. Finally, $\boldsymbol{SEASON_{it}}$ represents season dummies between 2009-10 and 2017-18 seasons for team i, in t season.

Some variables, such as $LNGAME_{it}$, $LNROSTER_{it}$ and $LNVALUERATIO_{it}$, are taken in natural logarithms. Other ones, like $INV\_CONCEDED_{it}$, INV_RSHOT_{it}, INV_FOULS_{it}, $DISCIPLINE_{it}$ are inverted. $DISCIPLINE_{it}$ is the inverse of the sum of red and yellow cards

Tables 14 and 15 show the descriptive statistics of input and output variables for the five biggest European football leagues such as English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1 between 2009-10 and 2017-18 seasons.

Table 14. The Descriptive Statistics of Input Variables

Variable	Obs.	Mean	St. Dev.	Min	Max
$MSHOT_{it}$	882	12.87	2.171	8.4	21.9
$CROSS_{it}$	882	20.54	3.845	9.0	34.0
$CORNER_{it}$	882	5.13	0.887	2.9	8.1
$PENALTY_{it}$	882	5.35	4.130	0.0	26.0
$FOULED_{it}$	882	13.39	2.089	7.3	21.9
$DRIBBLE_{it}$	882	8.71	2.678	3.6	20.3
$INTERCEPTION_{it}$	882	16.99	4.035	8.3	36.8
$TACKLE_{it}$	882	19.88	2.356	13.4	27.2
$RSHOT_{it}$	882	12.87	2.088	6.2	20.4
INV_RSHOT_{it}	882	0.08	0.015	0.05	0.17
$SAVE_{it}$	882	3.02	0.555	1.4	4.8
$FOUL_{it}$	882	14.10	2.243	8.3	21.0
INV_FOULS_{it}	882	0.08	0.012	0.05	0.13
$OFFSIDE_{it}$	882	2.43	0.580	0.9	4.6
$POSSESSION_{it}$	882	50(%)	4.417	37(%)	67.4(%)
$PASS_{it}$	882	77.25(%)	4.836	55.9(%)	89.6(%)
$AERIALWON_{it}$	882	15.60	4.978	4.9	36.0
$YELLOW_{it}$	882	74.81	19.545	34.0	143.0
RED_{it}	882	4.37	2.591	0.0	14.0
$BOOKING_{it}$	882	79.17	20.865	36.0	155.0
$DISCIPLINE_{it}$	882	0.14	0.004	0.007	0.028

Table 15. The Descriptive Statistics of Output and Control Variables

Variable	Obs.	Mean	St. Dev.	Min	Max
$SCORED_{it}$	882	50.46	16.672	21.0	121.0
$CONCEDED_{it}$	882	50.42	12.448	17.0	94.0
$INV\_CONCEDED_{it}$	882	0.02	0.006	0.1	0.05
$GOALRATIO_{it}$	882	1.14	0.734	0.3	5.4
$POINT_{it}$	882	51.17	16.477	15.0	102.0
$GAME_{it}$	882	44.95	6.713	35.0	69.0
$LNGAME_{it}$	882	3.8	0.143	3.4	4.3
$ROSTER_{it}$	882	29.19	3.529	19.0	42.0
$LNROSTER_{it}$	882	3.37	0.120	2.9	3.7
$FOREIGN_{it}$	882	15.30	4.902	1.0	31.0
$NEWPLAYER_{it}$	882	11.74	4.475	3.0	28.0
$INTERNATIONAL_{it}$	882	13.82	5.871	0.0	28.0
$FOREIGNRATIO_{it}$	882	0.53	0.154	0.03	0.9
$NEWRATIO_{it}$	882	0.40	0.133	0.1	0.8
$INTERRATIO_{it}$	882	0.48	0.199	0.0	0.9
CUP_{it}	882	0.30	0.454	0.0	1.0
$PROMOTED_{it}$	882	0.15	0.352	0.0	1.0
AGE_{it}	882	25.22	1.203	21.6	28.9
$LNAGE_{it}$	882	3.23	0.047	3.0	3.4
$ROSTERVALUE_{it}$	882	142,000,000	138,000,000	13,800,000	787,200,000
$VALUERATIO_{it}$	882	4,917,461	4,833,115	496,428.6	27,500,000
$LNVALUERATIO_{it}$	882	15.06	0.808	13.1	17.1
$MANAGER_{it}$	882	1.49	0.745	1.0	6.0

According to the table 14, it can be said that in these European football leagues averagely 12.9 shots on target has been made and the lowest shots on target made by SC Bastia with 8.4 per game in 2014-15 season, while Chelsea made 21.9 shots on target per game in 2009-10 season. If we look at the five biggest European football leagues, the average shots received on goal have been found 12.9 per game between 2009-10 and 2017-18 seasons. More explicitly, Manchester City FC succeeded to receive the lowest shots on their goal by 6.2 shots per game

in the last season in the English Premier League. Differently, Frosinone Calcio received the highest amount of shots on their goal by 20.4 per game in 2015-16 season in the Italian Serie A. In the five biggest European leagues, goalkeepers have saved 3.0 shots per game for the last 9 seasons. The highest saves came from goalkeepers of Hellas Verona FC from the Italian Serie A in the last season. However, although they conceded 32 goals and placed 2nd in the Italian Serie A in 2015-16 season, goalkeepers of SSC Napoli recorded the lowest save by 1.4 per game.

Regarding to ball possession, football teams in the five biggest European leagues have possessed the ball 50% per game on average for the last 9 seasons. In particular, FC Barcelona, from Spanish La Liga, recorded the highest rate of ball possession by 67.4% per game in 2010-11 season, when they also succeeded to win the UEFA Champions League. However, the lowest rate of ball possession belongs to SV Darmstadt by 37% per game in 2015-16 season. If we look at the goals scored in the five biggest European football leagues, it is seen that teams have scored 50.4 goals to their opponents per season game on average from 2009-10 to 2017-18 seasons. The most goal scorer football team was recorded as Real Madrid CF from the Spanish La Liga by finding the nets of opponent teams 121 times in 2011-12 season. On the other hand, the lowest goal scorer team, AC Arles-Avignon, scored 21 goals in 2010-11 season in the French Ligue 1. On the other hand, in five biggest European football leagues such as English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, football teams have been conceded 50.4 goals per season from their opponents for the last nine seasons. The winner of German Bundesliga in 2015-16, FC Bayern München, were the minimum goal conceder in their league by 17 goals, however, the relegated team in the Spanish La Liga in 2016-17 season, CA Osasuna were conceded 94 goals in that season and it was recorded the highest amount comparing to the rest of football clubs in the five biggest European leagues. When we look at the goal rate, in which was calculated by goals scored divided by goals conceded, it can be said that in those leagues, goal rate has been found 1.1 per seasons between 2009-10 and 2017-18. More specifically, since they scored the least goal in their league in 2010-11, AC Arles-Avignon reached 0.3 goal rate in the same year, that is, they scored only 30% of their conceded goals. On the contrary, the ultimate recorded five champions in both domestic and European competitions in 2012-13 season, FC Bayern München reached 5.4 goal rates in which means that they scored goals five times more than they conceded.

In addition, football teams in the five biggest European leagues have recorded 51.1 points per season on average for the last 9 seasons in their league. In particular, Juventus FC succeeded to reach the highest point level among the rest of football clubs in those leagues, by 102 points in 2013-14 season, and it was also recorded the highest level of points gained in a season in the Italian Serie A. Unlikely to their competitor, Pescara 1936 gained 15 points in 2016-17, could not save themselves to be relegated, and that was the lowest level among the five biggest European football leagues.

Considering the five biggest European football leagues, per season, the average amount of players in roster has been 29 for the last 9 seasons. Among those European football teams, Borussia Mönchengladbach from the German Bundesliga reached the minimum amount of roster by registering 19 players in 2014-15 season, whereas the highest roster was in Fulham FC from the English Premier League with 42 players in 2013-14 season. When we look at the foreign player ratio on roster, the situation becomes a bit different. For example, in all of these leagues, the average foreign player ratio on roster has been 53% for the last nine seasons. More specifically, Athletic Bilbao, from the Spanish La Liga, recorded the lowest foreign player ratio on their roster by 0.3% in 2009-10 season, whereas Watford FC from the English Premier League reached to 93% of foreign player ratio and it was recorded as the highest ratio on foreign players on a roster among the rest of football teams in the five biggest European leagues. Regarding to the new players ratio, the main table becomes different. For instance, the average ratio of new players on rosters in the five biggest European leagues has been recorded as 40% for the last nine years, that is, the 40% of squad size on football teams have been formed by new players. Real Madrid CF, from the Spanish La Liga, had the lowest ratio of new players by 10% in 2012-13 season, whereas ACF Fiorentina, from the Italian Serie A, recorded the highest ratio of new players on their roster by 82% in 2017-18 season.

Football players with international experience are assumed to make important contributions to their team. Most of the football teams in the five biggest European leagues follow this assumption and aim to transfer international experienced players. In the English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, football teams have registered almost 14 international experienced players on average on their roster for the seasons between 2009-10 and 2017-18. Among those football teams, SC Paderborn 07 held the lowest amount of international experienced players by not registering any of them in 2014-15. On the contrary, Fulham FC (in 2013-14) and AC Milan (in 2014-15) had the

highest amount of international experienced players on their roster by 28 of them among the rest of football teams in the five biggest European leagues.

Considering the international experienced player ratio on roster, football teams on those leagues have registered almost half of their roster (48%) on average with international experienced players for the last nine seasons. SC Paderborn again reserved no (0%) international experienced players on their roster only in 2014-15 season, whereas the winner of UEFA Champions League in 2009-10, FC Internazionale and the English Premier League champion in 2013-14, Manchester City FC had the highest ratio of international experienced players on their roster by 96% comparing to the other football teams in the five biggest European leagues.

In the five biggest European leagues, the average age of football teams has been 25.2 for the last 9 seasons. In particular, Lille OSC from the French Ligue 1 had the youngest roster comparing to the other football clubs in those leagues by 21.6 average age in 2017-18 season. On the other hand, the oldest roster in average was detected in AC Milan, from the Italian Serie A, by 28.9 in 2009-10 season. The market value of a football club is financially important for the club managers. Most of the football clubs aim to increase the roster value of their team to achieve financial efficiency. For the last 9 seasons, in the English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, the roster value, or market value, of football clubs in those leagues has been €142,000,000 on average. More specifically, FC Barcelona reached to the level of the most expensive football club by €787,200,000 roster value in 2016-17. On the other hand, the lowest roster value was recorded in RC Lens by €13,750,000 in 2014-15 season.

3.3. Methodology

In the sports economics literature, there are two main approaches to study efficiency of professional football clubs: financial efficiency measurement and sports efficiency measurement (Kulikova & Goshunova, 2014). Financial efficiency refers to the ability of a football club to make a profit. Sportive efficiency, on the other hand, addresses success on the field due to certain actions off the field. Although there are many qualified studies in the literature about measuring the efficiency of football clubs by using various indicators, a joint evaluation of the efficiency of football clubs in the five biggest European leagues has not yet

been addressed. This thesis will present a unique conditional order-m measurement of efficiency for the five biggest European leagues. Initially, DEA is used in order to define the most convenient production sets. After the selection of production sets, the conditional order-m model will be implemented. This will yield unconditional and conditional order-m efficiency estimates and allow a consistent assessment of the impact of control variables through a kernel regression model. We define and explain in detail below these techniques.

3.3.1. Data Envelopment Analysis (DEA)

Non-parametric methods deal with the overall measurement of the efficiency on production sets formed by selected inputs and outputs without positing any functional relationship among them. DEA is arguably the most popular non-parametric method, initially introduced by Farrell (1957). The purpose of the DEA is to identify the efficiency of any kind of business activity (in our case, football clubs) by constructing an efficiency frontier, thus creating a benchmark for the inefficiency of the other business activities, football clubs, which are not included in the frontier of efficiency.

The idea for the assessment of efficiency principally relies on optimization. In other words, finding the Pareto optimum (or Pareto efficiency) point is used to determine DEA efficiency. In this field, Pareto efficiency identifies all production units for which it is not possible to produce additional output for given resources and technology. Consequently, a decision-making unit (DMU) reaches full efficiency when there is no longer a possibility to raise output levels without a rise in a single or more inputs, and vice versa (Kulikova, 2013).

We may illustrate solving the maximization problem formally as follows (Lissitsa et al., 2003):

$e_0 = \frac{\sum_{j=1}^{s} u_j y_{j0}}{\sum_{i=1}^{r} v_i x_{i0}} \rightarrow$ maximizing with subject to:

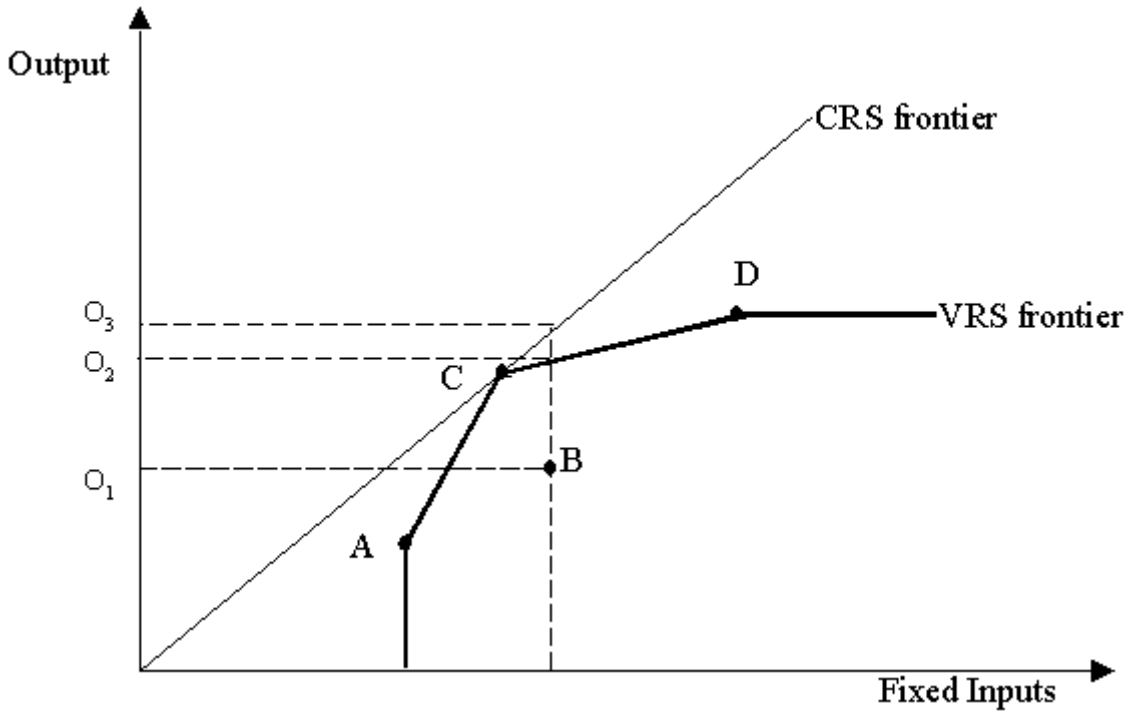
$\frac{\sum_{j=1}^{s} u_j y_{jm}}{\sum_{i=1}^{r} v_i x_{im}} \leq 1$; m = 1, 2, ..., n

$u_j v_i \geq 0$; j = 1, 2, ..., s ; i = 1, 2, ..., r

where $x_{im} y_{jm}$ represents the number of inputs and outputs of DMU and $u_j v_i \geq 0$ displays weighted values for inputs and outputs.

Figure 11 illustrates the measurement of efficiency for a hypothetical DMU B vis-à-vis a DEA frontiers with constant returns to scale (CRS) and variable returns to scale (VRS). As can be seen from figure 11, efficiency measurement can be either input- or output-oriented. In this thesis, we shall keep in with most of the literature, by keeping an output orientation of the analysis. To repeat, this supposes that DMUs are expected to maximize outputs for given inputs.

Figure 11. DEA CRS and VRS frontiers



Source: Lissitsa et al., 2003

DMUs are put on a scale between 0 and 1, representing respectively the lowest efficiency and maximum efficiency for certain given inputs and outputs. The expected estimation is to obtain a ratio as high as possible by maximizing e_0 (Charnes, Cooper and Rhodes, 1978).

DEA is a well-established technique designed to evaluate the relative efficiency for a group of comparable DMUs and has several advantages. For instance, it can be oriented either to minimise inputs (for given outputs) or to maximise outputs (for given inputs). Furthermore, multiple inputs and outputs can be considered without a priori assumptions for a specific functional form of production technologies. Finally, DEA returns a simple summary

efficiency measurement for each DMU, without requiring a priori for relative weighting scheme for the input and output variables. In this thesis, we adopt the version of DEA that allows variable returns to scale to characterise the frontier (a version often dubbed DEA-VRS), and rely on Farrell (1957)'s measure of distance from the frontier, which considers equi-proportional (radial) input reductions or output expansions.

However, some concerns should be addressed before DEA is accepted as a routine tool in applied analysis. As DEA is an estimation procedure that relies on extreme points, it may be extremely sensitive to data selection and model specification. Also, it is well-known that the DEA estimator for technical efficiency is biased by construction and does not easily lends itself to the analysis of the impact of contextual variables on efficiency. On the other hand, DEA is ill-suited to assess the impact of potential determining variables on the levels of efficiency (Simar and Wilson, 2007). Specific techniques have been developed in the literature for this, among which conditional order-m (Cazals et al., 2002; Daraio and Simar, 2005) is perhaps foremost. Conditional order-m is also more robust vis-à-vis the presence of outliers in the dataset. For these reasons we will rely on the conditional order-m approach to compute efficiency scores and analyze the impact of contextual variables on them. However, given the computational cost of this procedure, the most appropriate production sets will be chosen through DEA estimates.

Both DEA and conditional order-m will be output-oriented in our empirical analysis, because this is by far the most widely spread option in the literature, at least as far as sportive efficiency is concerned.

3.3.2. Production Sets

After that variables have been categorized in the "Offensive", "Defensive" and "Team" ambits, the most satisfactory composition of the production set has been found by selecting the sets providing the highest mean efficiency. This criterion was already proposed in Farrell (1957). The selection process for offensive, defensive and team approach efficiency scores is presented in tables 16, 17 and 18, respectively.

Table 16. The Combinations of Production Sets for the DEA Offensive Efficiency

#	Input (X)	Output (Y)	DEA Scores
1	***Dribbles+Fouled+Corners+Penalties+Shots+Crosses***	***Goals Scored+Points***	**0.720**
2	*Dribbles+Fouled+Corners+Penalties+Shots*	*Goals Scored+Points*	0.709
3	*Dribbles+Fouled+Corners+Penalties+Crosses*	*Goals Scored+Points*	0.696
4	*Dribbles+Corners+Penalties+Shots+Crosses*	*Goals Scored+Points*	0.694
5	*Dribbles+Corners+Penalties+Shots*	*Goals Scored+Points*	0.686
6	*Dribbles+Fouled+Penalties+Shots+Crosses*	*Goals Scored+Points*	0.685
7	*Dribbles+Fouled+Corners+Penalties*	*Goals Scored+Points*	0.684
8	*Dribbles+Fouled+Corners+Shots+Crosses*	*Goals Scored+Points*	0.679
9	*Dribbles+Fouled+Penalties+Shots*	*Goals Scored+Points*	0.670
10	*Dribbles+Fouled+Corners+Shots*	*Goals Scored+Points*	0.668
11	*Dribbles+Penalties+Shots+Crosses*	*Goals Scored+Points*	0.665
12	*Fouled+Corners+Penalties+Shots+Crosses*	*Goals Scored+Points*	0.653
13	*Dribbles+Fouled+Corners+Crosses*	*Goals Scored+Points*	0.646
14	*Fouled+Corners+Penalties+Shots*	*Goals Scored+Points*	0.646
15	*Dribbles+Fouled+Shots+Crosses*	*Goals Scored+Points*	0.644
16	*Dribbles+Corners+Shots+Crosses*	*Goals Scored+Points*	0.644
17	*Corners+Penalties+Shots+Crosses*	*Goals Scored+Points*	0.630
18	*Fouled+Corners+Shots+Crosses*	*Goals Scored+Points*	0.623
19	*Dribbles+Fouled+Penalties+Crosses*	*Goals Scored+Points*	0.622
20	*Dribbles+Corners+Penalties+Crosses*	*Goals Scored+Points*	0.622
21	*Fouled+Corners+Penalties+Crosses*	*Goals Scored+Points*	0.617
22	*Fouled+Penalties+Shots+Crosses*	*Goals Scored+Points*	0.609

***DEA Scores stand for the mean value of efficiency. As usual in the literature, we provide scores bounded between zero and one (the latter standing for full efficiency).**

Table 17. The Combinations of Production Sets for the DEA Defensive Efficiency

#	Input (X)	Output (Y)	DEA Scores (Mean)
1	***Saves+Tackles+Offsides+Received Shots+Fouls+Interceptions***	***Goals Conceded + Points***	**0.710**
2	*Saves+Tackles+Offsides+Received Shots+Fouls*	*Goals Conceded + Points*	0.696
3	*Interceptions+Tackles+Offsides+Received Shots+Fouls*	*Goals Conceded + Points*	0.691
4	*Interceptions+Saves+Offsides+Received Shots+Fouls*	*Goals Conceded + Points*	0.690
5	*Tackles+Offsides+Received Shots+Fouls*	*Goals Conceded + Points*	0.679
6	*Interceptions+Offsides+Received Shots+Fouls*	*Goals Conceded + Points*	0.675
7	*Interceptions+Saves+Tackles+Received Shots+Fouls*	*Goals Conceded + Points*	0.673
8	*Saves+Offsides+Received Shots+Fouls*	*Goals Conceded + Points*	0.672
9	*Saves+Tackles+Received Shots+Fouls*	*Goals Conceded + Points*	0.658
10	*Interceptions+Saves+Received Shots+Fouls*	*Goals Conceded + Points*	0.654
11	*Interceptions+Tackles+Received Shots+Fouls*	*Goals Conceded + Points*	0.654
12	*Interceptions+Saves+Tackles+Offsides+Received Shots*	*Goals Conceded + Points*	0.625
13	*Saves+Tackles+Offsides+Received Shots*	*Goals Conceded + Points*	0.616
14	*Interceptions+Tackles+Offsides+Received Shots*	*Goals Conceded + Points*	0.615
15	*Interceptions+Saves+Offsides+Received Shots*	*Goals Conceded + Points*	0.608
16	*Interceptions+Saves+Tackles+Received Shots*	*Goals Conceded + Points*	0.600
17	*Interceptions+Saves+Tackles+Offsides+Fouls*	*Goals Conceded + Points*	0.553
18	*Saves+Tackles+Offsides+Fouls*	*Goals Conceded + Points*	0.549
19	*Interceptions+Saves+Offsides+Fouls*	*Goals Conceded + Points*	0.545
20	*Interceptions+Tackles+Offsides+Fouls*	*Goals Conceded + Points*	0.545
21	*Interceptions+Saves+Tackles+Fouls*	*Goals Conceded + Points*	0.510

***DEA Scores stand for the mean value of efficiency. As usual in the literature, we provide scores bounded between zero and one (the latter standing for full efficiency). Also, we consider the inverse of Received Shots and Fouls.**

Table 18. The Combinations of Production Sets for the DEA Team Efficiency

#	Input (X)	Output (Y)	DEA Scores
1	***Pass+Discipline+Ball Possession+Aerial Won***	***Goal Rate+Points***	**0.593**
2	*Aerial Won+Discipline+Ball Possession*	*Goal Rate+Points*	0.577
3	*Aerial Won+Pass+Ball Possession*	*Goal Rate+Points*	0.571
4	*Aerial Won+Pass+Discipline*	*Goal Rate+Points*	0.565
5	*Aerial Won+Ball Possession*	*Goal Rate+Points*	0.558
6	*Pass+Discipline+Ball Possession*	*Goal Rate+Points*	0.557
7	*Aerial Won+Pass*	*Goal Rate+Points*	0.543
8	*Discipline+Ball Possession*	*Goal Rate+Points*	0.542
9	*Pass+Discipline*	*Goal Rate+Points*	0.541
10	*Pass+Ball Possession*	*Goal Rate+Points*	0.535
11	*Aerial Won+Discipline*	*Goal Rate+Points*	0.472

***DEA Scores stand for the mean value of efficiency. As usual in the literature, we provide scores bounded between zero and one (the latter standing for full efficiency).**

The chosen production sets, on which conditional order-m estimates will rely, are reported again in table 19.

Table 19. Production Sets of Inputs and Outputs for DEA Model

PRODUCTION SETS	INPUT (X)	OUTPUT (Y)
Offensive	*Dribbles+Fouled+Corners+Penalties+ Shots+Crosses*	*Goals Scored+Points*
Defensive	*Saves+Tackles+Offsides+Received Shots+Fouls+Interceptions*	*Goals Conceded+Points*
Team	*Pass+Discipline+Ball Possession+ Aerial Won*	*Goal rate+Points*

3.3.3. Unconditional Order-M & Conditional Order-M and Kernel Regression

The conditional order-m approach, initiated by Cazals et al. (2002) and subsequently developed by Daraio and Simar (2005), is based on the fundamental idea of using contextual variables to identify the most similar observations, and estimating the efficiency around windows of these similar observations. Comparing the efficiency scores obtained unconditionally and conditionally on this similarity yields information about the impact of contextual variables that avoids the pitfalls of the two-stage analyses usually adopted in the literature (Simar and Wilson, 2007). Besides, the conditional order-m approach does not require contextual variables to have a monotonous relationship with the production set; does not need an a priori decision regarding the (output-increasing or output-decreasing) role played by these variables, and, finally, easily allows for a plurality of contextual variables to be brought into play at the same time. The visualization of the impacts of these variables can be achieved through the so-called partial smooth regression plots where only one such factor at a time is allowed to change and the rest are kept at fixed values; for instance, the rest of the contextual factors are set at the first, the second or the third quartile (Daraio and Simar, 2005; Badin et al. 2008; De Witte and Kortelainen, 2008).

More formally, for the given amount of set of resources where $X \in \Re_{+}^{p}$, in order to produce the output vector defined by $Y \in \Re_{+}^{q}$, the unconditional order-m efficiency will be given by:

$$\hat{\theta}_{m,n}(x,y) = \breve{E}\left(\theta_m(x,y) \;\middle|\; Y \geq y\right) = \int_0^{\infty}[1 - \breve{F}_{X:Y,n}(ux|y)]^m du, u \in \Re^{+} \qquad (1)$$

Next, the conditional order-m efficiency would be:

$$\hat{\theta}_{m,n}(x,y|z) = \breve{E}\left(\hat{\theta}_m^z(x,y)\middle|y,z = \int_0^{\infty}[1 - \breve{F}_{X|Y,Z,n}(ux|y,z)]^m du\right) \qquad (2)$$

where:

$$\hat{\theta}_m^z(x,y) = \inf\{\theta|(\theta x,y) \in \Psi_m^z(y)\} \qquad (3)$$

and

$$\Psi_m^z(y) = \{(x,y') \in \Re_{+}^{p+q}|x \geq X_i, y' \geq y, i = 1,\ldots,m\} \qquad (4)$$

$$\hat{F}_{X|Y,Z,n}(x|y,z) = \frac{\sum_{i=1}^{n} I(x_i \leq x, y_i \geq y) K_{\hat{h}}(z,z_i)}{\sum_{i=1}^{n} I(y_i \geq y) K_{\hat{h}}(z,z_i)} \qquad (5)$$

where $I(x_i \leq x, y_i \geq y)$ is an indicator function, $\hat{h}$ the estimation of the appropriately sized bandwidth and $K_{\hat{h}}(z, z_i)$ is a generalized multivariate kernel function. For the definition of this kernel function, it must be taken into consideration that there are three potential types of contextual variables (Z_s) involved in the model (such as continuous, ordered discrete, and unordered discrete). In this respect, the i^{th} unit would be as follows:

$$Z_i = (Z_i^c, Z_i^o, Z_i^u), i = 1, \dots, n \qquad (6)$$

where $Z_i^c \in \Re^+$ would be the vector of continuous variables, $Z_i^0 \in \Re^v$ the vector of ordered discrete variables, and $Z_i^u \in \Re^w$ the vector of unordered discrete variables and Z_i^c, Z_i^o, Z_i^u the s^{th} components of Z_i^c, Z_i^o and Z_i^u, respectively. Furthermore, it is also assumed that $Z_{is}^o \in \{0,1, \dots, c_s - 1\}\ s = 1, \dots, v$ and $Z_{is}^u \in \{0,1, \dots, d_s - 1\}\ s = 1, \dots, w$ being $c_s \geq 2$ and $d_s \geq 2$ the different values for Z_{is}^o and Z_{is}^u respectively.

Hence, the standard multivariate product kernel function used would be:

$$K_h(z, z_i) = \prod_{s=1}^{r} \frac{1}{h_s^c} l^c\left(\frac{z_s^c - z_{is}^c}{h_s^c}\right) . \prod_{s=r+1}^{r+v} l^0(z_s^0, z_{is}^0 h_s^0) . \prod_{s=r+v+1}^{r+v+w} l^u(z_s^u, z_{is}^u h_s^u) \qquad (7)$$

where $l^c(.), l^0(.)$ and $l^u(.)$ are univariate kernel functions, and h_s^c, h_s^o and h_s^u are the respective bandwidths for the continuous ordered discrete, and unordered discrete variables.

It is necessary to choose a kernel function with convenient bandwidths. Each bandwidth defines different partial frontiers upon which the kernel regression is estimated (Kourtesi et al., 2012; Fuentes et al., 2015). Finding an efficiency score lower than 1, it means that a DMU is 'super-efficient'. On the other hand, if the efficiency score is equal to 1, it means that the DMU is efficient. Finally, if the efficiency score is above 1, it implies the DMU is inefficient.

The calculation of both unconditional and conditional order-m efficiency scores must be carried out on a given sub-sample (window) of observations. The size of this window must be chosen in a way that stabilizes the number of super-efficient observations found in the analysis (De Witte and Kortelainen, 2008). For instance, in the present case, stability of super-efficient observations is found at a window size of 250 observations.

3.4. Findings of Unconditional Order-M

In this part of the research, the technical efficiency of the biggest five European football leagues, English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, will be analysed using unconditional order-m. In the findings of unconditional order-m, the average efficiency scores of football clubs which have been taken part in their leagues during these nine seasons will be tabled and explained in detail for the seasons between 2009-10 and 2017-18. However, the efficiency scores of all football clubs for each season will be presented in the Appendix part.

The initial ranking of the efficiency scores are prepared regarding to the overall efficiency scores of the football clubs. Also, football clubs that reached to the full efficiency (100%) is expressed regarding to type of efficiencies and seasons. It is important to remark that unconditional output-oriented efficiency scores are represented for each league in inverse terms in order to ease presentation and have scores bounded between zero and one.

Figure12. Efficiency in the Premier League (from 2009-10 to 2017-18)

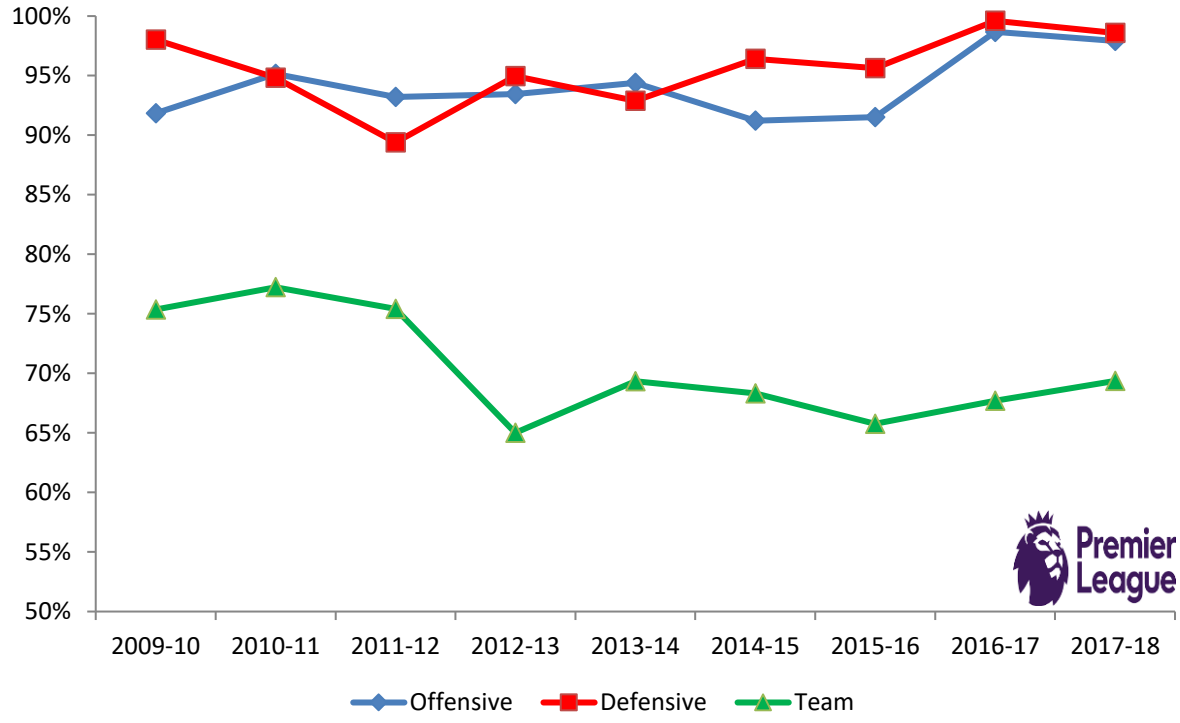


Figure 12 shows the average offensive, defensive and team efficiency of football clubs in the Premier League for the seasons between 2009-10 and 2017-18. According to the figure 12, it can be said that English football clubs have displayed more offensive and defensive efficiency rather than team efficiency. On average, English football clubs have demonstrated 94.1%

efficiency on offensive performance along with 95.6% and 70.4% efficiency rate on defensive and team performances between 2009-10 and 2017-18 seasons, respectfully.

English Premier League clubs had stable offensive efficiency for the seasons between 2009-10 and 2015-16, however, they recorded a 7.2% jump for the next season. In particular, Manchester United FC and Tottenham FC showed full efficiency on offensive performance. Although there was a slight decrease on defensive efficiency between 2009-10 and 2011-12 season, Premier League clubs increased their defensive performance and reached to the highest level (99.6%) in 2016-17. In this season, almost all football clubs (except Arsenal FC) reached full efficiency on their defensive performance.

Figure 13. Efficiency in the Serie A (from 2009-10 to 2017-18)

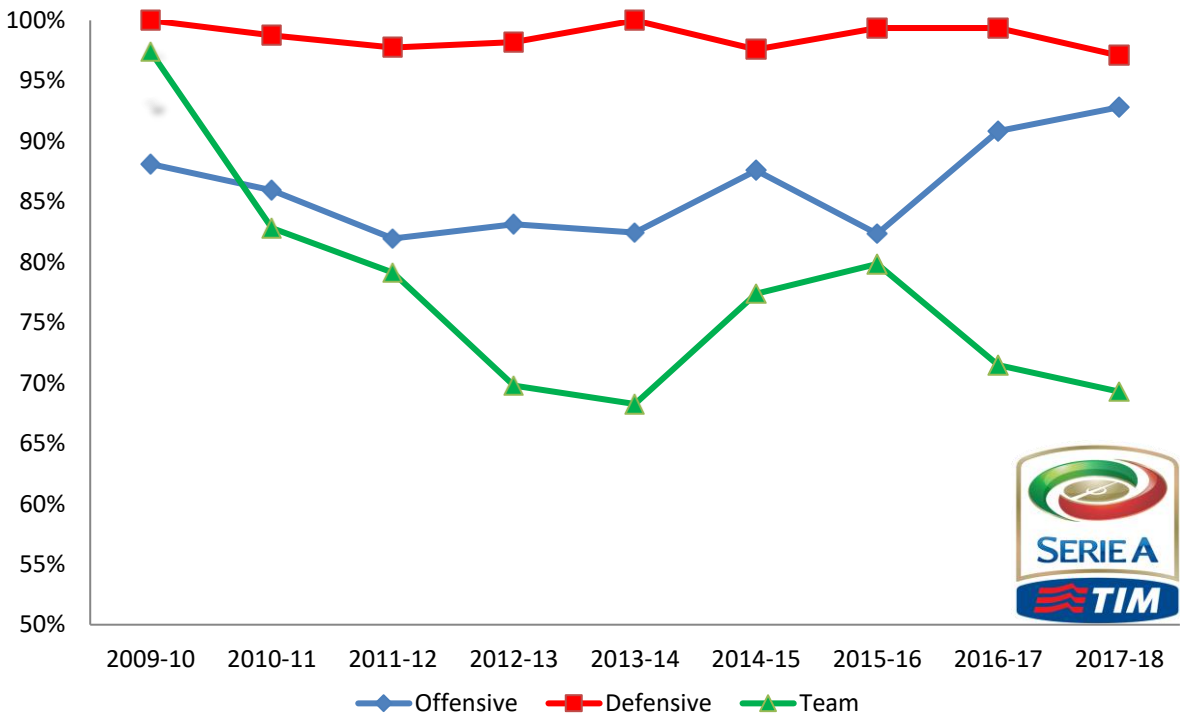


Figure 13 represents the average offensive, defensive and team efficiency of football teams in the Serie A from 2009-10 to 2017-18 seasons. Accordingly, it can be stated that Italian football clubs have displayed more efficient performance on defence rather than on offense and team. Moreover, Serie A clubs have recorded the highest average defensive efficiency score (98.7%) among the other big four European Leagues. On average, Italian football clubs have shown 86.1% efficiency on average offensive performance along with 98.7% and 77.3% efficiency rate on average defensive and team performances. Beside the decreasing trend on the efficiency of team performance among the Italian football clubs (average team efficiency

performance of Serie A football clubs sharply decreased from 2009-10 to 2013-14 season), there has been an increasing trend of efficiency on offensive performance after the 2015-16 season. In particular, Juventus FC showed full efficiency on offensive performance for the related seasons.

On the other hand, football clubs in Italian Serie A recorded full efficiency on defensive performance by 100% in 2013-14 season. More specifically, all Serie A clubs were fully efficient on defensive performance in this season. This remarkable defensive efficiency was never witnessed in other big four European leagues at any season.

Figure 14. Efficiency in the La Liga (from 2009-10 to 2017-18)

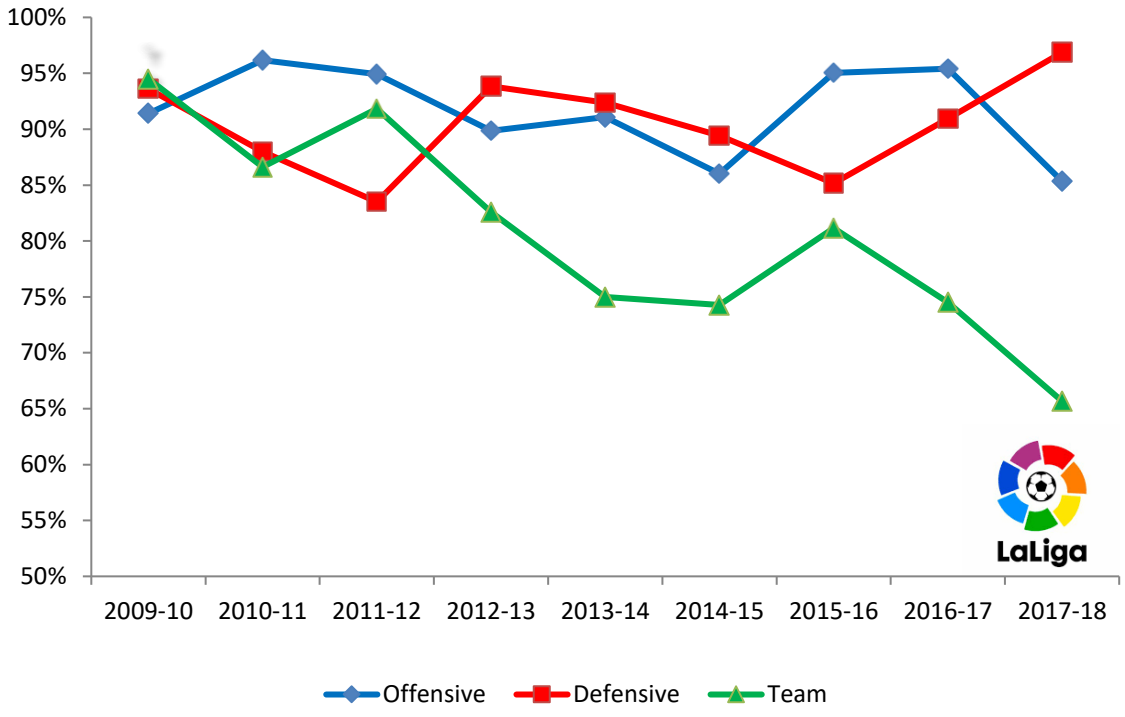


Figure 14 displays the average offensive, defensive and team efficiency of football clubs in the La Liga between 2009-10 and 2017-18 seasons. Overall, La Liga football clubs have displayed more efficient performance on offense and defense rather than team performance. On average, Spanish football clubs have presented 91.7% efficiency on offensive performance along with 90.4% and 80.7% efficiency rate on defensive and team performances from 2009-10 to 2017-18 seasons, respectfully. Moreover, La Liga clubs recorded the highest average team efficiency score by 80.7% compared with football clubs in the other big European

leagues. Yet, there has been a decreasing trend in the efficiency of team performance by 16.8% on the Spanish football clubs, with a very sharp fall from 2011-12 to 2013-14.

Figure 15. Efficiency in the Bundesliga (from 2009-10 to 2017-18)

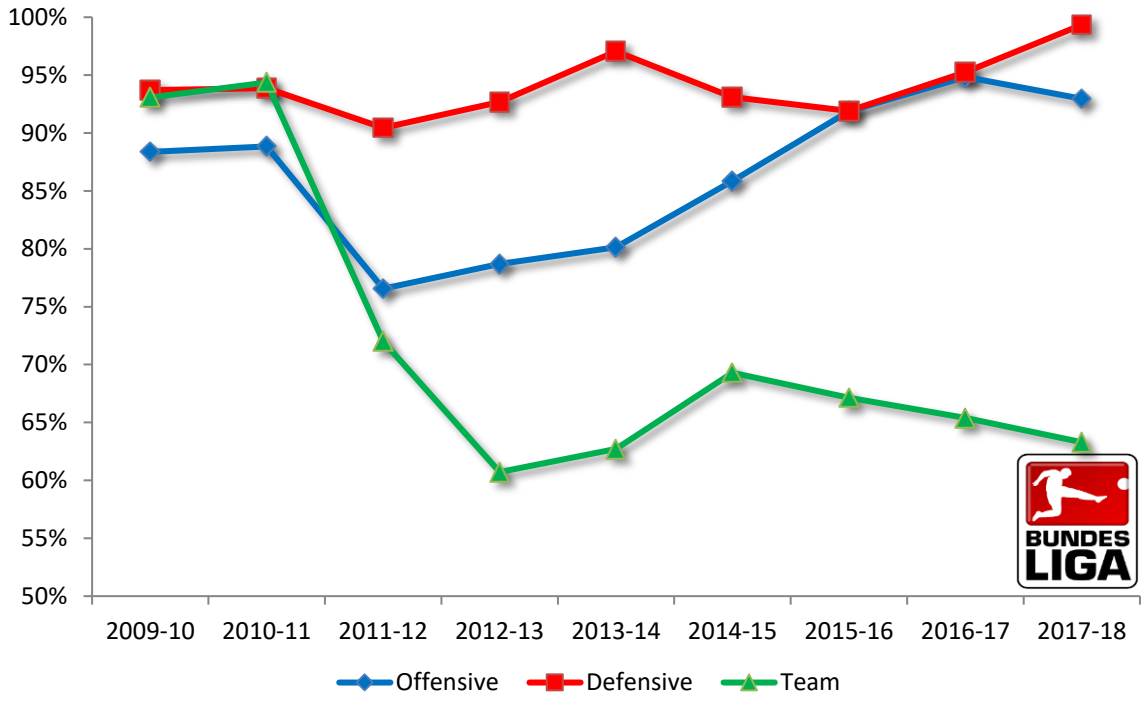


Figure 15 shows the average offensive, defensive and team efficiency of football teams in the Bundesliga from 2009-10 to 2017-18 seasons. According to the figure 15, it can be stated that also German football clubs averagely have displayed more inefficient team performance compared with offensive and defensive performance. On average, German football teams have displayed 86.5% efficiency on offensive performance along with 94.2% and 72.0% efficiency rate on defensive and team performances for the seasons between 2009-10 and 2017-18, respectively. The most salient trend in the Bundesliga is the sharp decrease of the efficiency level of team performances by almost 33.7% from 2010-11 to 2012-13 on German football clubs. On the other hand, efficiency of offensive performance has been rising. In particular, Bundesliga clubs such as FC Bayern München and Borussia Dortmund performed full efficiency on offensive performance during these seasons.

Figure 16. Efficiency in the Ligue 1 (from 2009-10 to 2017-18)

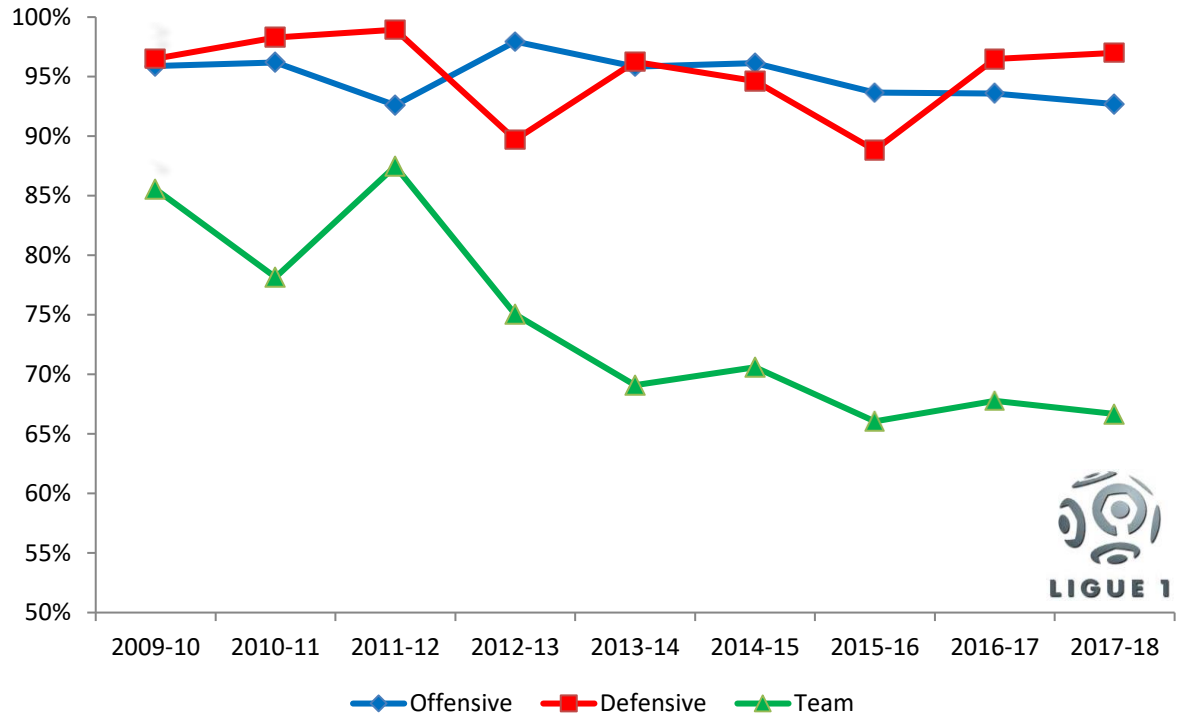


Figure 16 represents the average offensive, defensive and team efficiency of football teams in the Ligue 1 for the seasons between 2009-10 and 2017-18. According to the figure 16, it can be stated that French football clubs have displayed more efficient performance on offense and defence rather than team performance. On average, football clubs in the Ligue 1 have shown 95.0% efficiency on offensive performance, which is the highest average offensive performance among the other big European football league clubs along with 95.2% and 74.0% efficiency rate on defensive and team performances for the last nine seasons, respectively.

To sum up, French football clubs have shown the highest offensive efficiency on average (95.0%), whilst Italian Serie A clubs recorded the maximum average defensive efficiency (98.7%). Actually, the Italian Serie A recorded full efficiency on defensive performance in 2013-14. Finally, La Liga clubs reached the highest average team efficiency at an average 80.7%. Yet, team performance yielded consistently lower efficiency levels than offensive and defensive performance, with a decreasing trend for the seasons between 2009-10 and 2017-18 for all five leagues.

3.5. Findings of Conditional Order-M

The findings of conditional order-m are presented at figures 17-19 in order to display offensive, defensive and team efficiencies of football clubs from five big European football leagues, English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1. These efficiency scores are presented averagely for the seasons between 2009-10 and 2017-18, classified as offensive, defensive and team performances. The list of conditional order-m results for each football clubs will be presented in the Appendix part.

The initial ranking of the efficiency scores are prepared regarding to the overall efficiency scores of the football clubs. Also, football clubs that reached to the full efficiency (100%) is expressed regarding to type of efficiencies and seasons. It is important to remark that unconditional output-oriented efficiency scores are represented for each league in inverse terms in order to ease presentation and have scores bounded between zero and one.

Figure 17. Offensive Efficiency Scores of Football Clubs in Big-Five European Leagues

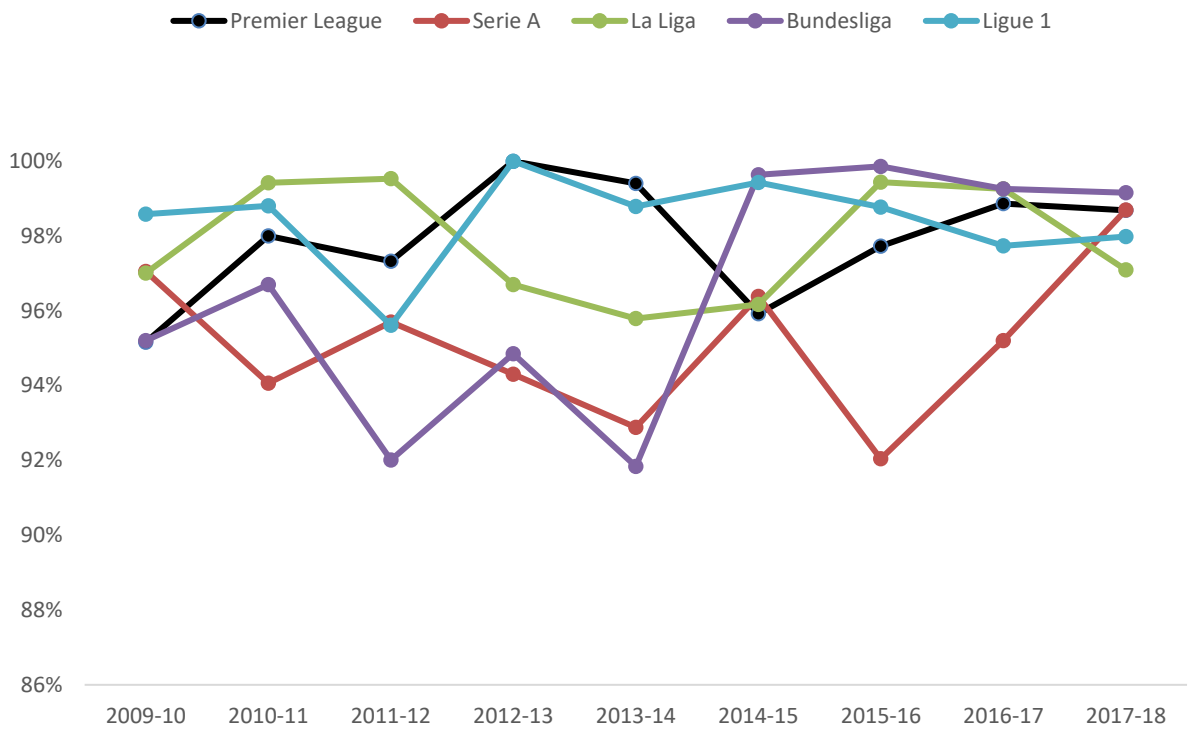


Figure 17 shows conditional order-m results averagely for offensive efficiency of football clubs in big five European leagues, English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, for the seasons between 2009-10 and 2017-18. Accordingly, football clubs in Ligue 1 performed the highest offensive efficiency on average

by 98.4% for the last nine seasons. On the other hand, among the big five European football leagues, Serie A clubs displayed the lowest offensive efficiency by 95.1% on average during these seasons. In 2012-13 season, football clubs in the Premier League and Ligue 1 shared the primacy with full offensive efficiency. In addition, offensive efficiency of Bundesliga clubs jumped from 2013-14 to 2014-15 by 7.8%, whilst Serie A clubs' offensive efficiency increased by 6.6% between 2015-16 and 2017-18 seasons. Although there were slight decrease on offensive efficiency of La Liga football teams from 2011-12 to 2013-14, they managed to rise it for the following two seasons.

Figure 18. Defensive Efficiency Scores of Football Clubs in Big-Five European Leagues

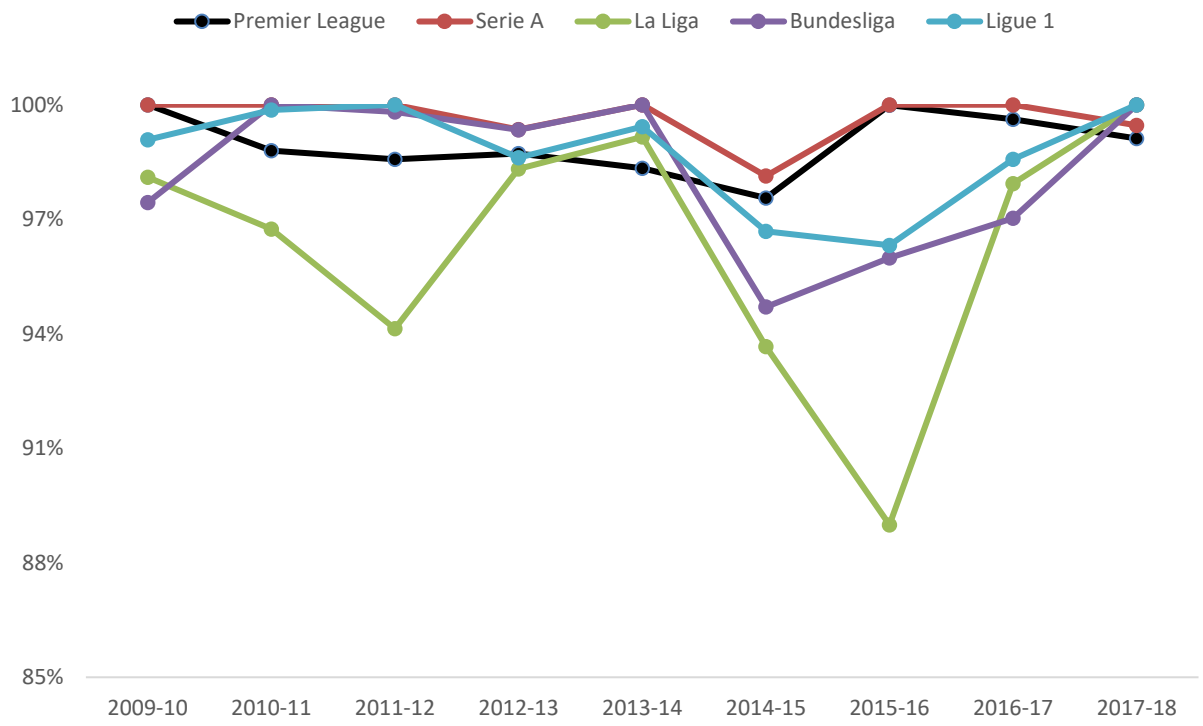


Figure 18 presents conditional order-m results averagely for defensive efficiency of football clubs in big five European leagues, namely English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, for the seasons from 2009-10 to 2017-18. It can be said that Italian Serie A clubs performed remarkably the highest defensive efficiency on average for the last nine seasons. More specifically, Serie A football teams had reached full efficiency by 99.7% in 2009-10, 2010-11, 2013-14, 2015-16 and 2016-17 seasons. Football clubs from the Premier League follows Serie A clubs by 99.0% defensive efficiency on average for the last nine seasons. On the other hand, La Liga clubs performed the lowest

defensive efficiency on average by 96.3% for the seasons between 2009-10 and 2017-18. Moreover, defensive efficiency of Spanish clubs decreased sharply by 10.2% from 2013-14 to 2015-16, where also it was the lowest defensive efficiency among the big five European football leagues. However, after this diminish, Spanish clubs dramatically increased their defensive efficiency by 11.0% and reached to full efficiency in 2017-18 season.

Figure 19. Team Efficiency Scores of Football Clubs in Big-Five European Leagues

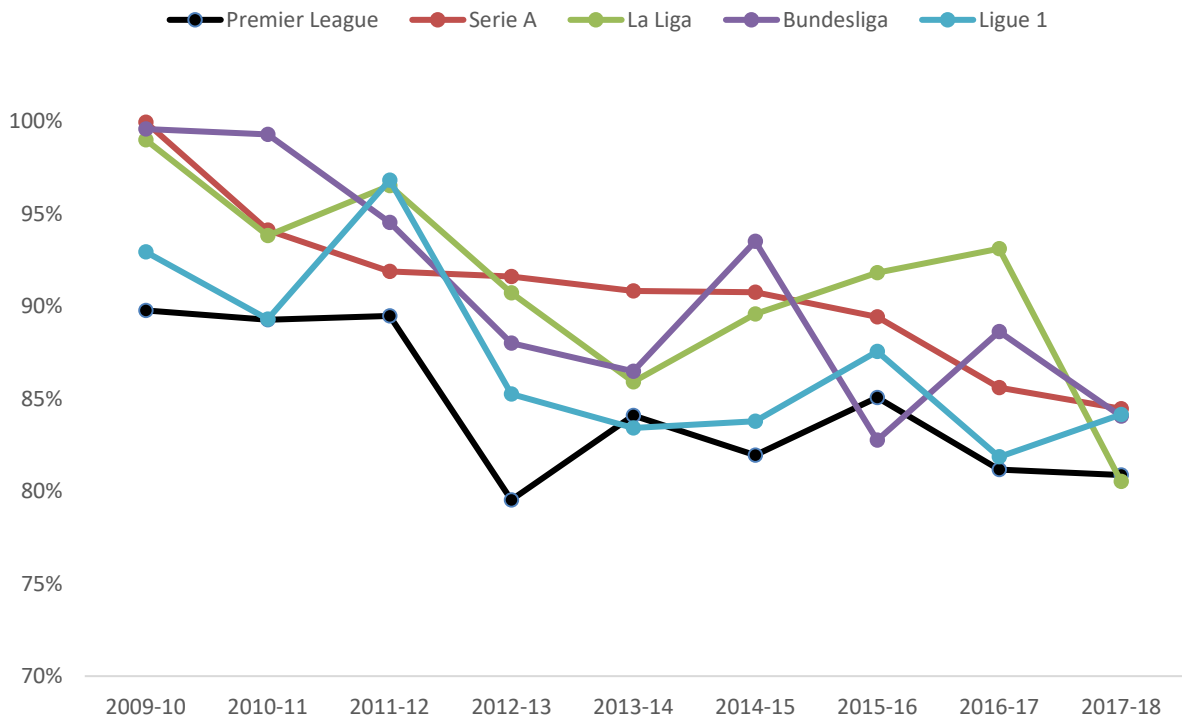


Figure 19 illustrates conditional order-m results averagely for team efficiency of football clubs in big five European leagues, English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, across the seasons 2009-10 and 2017-18. According to figure 19, one may interpret that Spanish La Liga clubs, unlikely their offensive and defensive performance efficiencies, performed the highest team efficiency on average by 91.2% during the last nine seasons compared to the other European football leagues. On the other hand, football clubs in the Premier League had the lowest team efficiency by 84.6%. Except the Ligue 1 clubs, football clubs' team efficiency from other European leagues recorded diminish from 2009-10 to 2013-14 seasons, and the most dramatic one was belong to German Bundesliga clubs by 13.1%. Different from their defensive efficiency, Italian Serie A

clubs' team efficiency had always on downward way from 99.9% to 84.5% for the last nine seasons.

3.5.1. Kernel Regression Results on Offensive Efficiency

We will now proceed to present results from kernel regressions on the efficiency of offensive, defensive and team performances in the biggest five European football leagues. In all regression models, we have chosen to include $\boldsymbol{MANAGER_{it}}$, $\boldsymbol{LNAGE_{it}}$ and $\boldsymbol{LNROSTER_{it}}$ as they were the more consistently significant regressors in previous studies. For each type of performance (offensive, defensive and team) we will present first results without the inclusion of country dummies, and then proceed to the inclusion of these dummies.

Regression results include coefficients, the z-ratio (the term within brackets, which is the ratio between coefficients and a measure of their standard error), the bandwidth of contextual variables over which conditional scores are computed and a coefficient of determination (an R-Square).

Table 20 shows kernel regression results on the efficiency of offensive performances in English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, without country dummies.

Table 20. Kernel Regression Results on Offensive Efficiency (without Country Dummies)

	# of Managers	(ln)Age	(ln)Roster	(ln)Games	Promoted	Cup	Int. Players Ratio	New Players Ratio	Foreign Players Ratio	(ln) Roster Value Ratio	R-Square
Eq. 1	**- 0.047**	- 0.030	- 0.052	**0.192**							
	(0.000*)**	(0.098)	(0.114)	**(0.000***)**							**0.31448**
Bwth	**0.89412**	0.04962	0.16414	**0.08263**							
Eq. 2	**- 0.057**										
	(0.000*)**	**- 0.029**	**- 0.033**		**2e-06**						
Bwth	**1.35423**	**(0.001**)**	**(0.027*)**		**(0.000***)**						**0.29776**
		0.04663	**0.09545**		**0.36512**						
Eq. 3	**- 0.042**	**0.003**	- 0.033			**2e-06**					
	(0.000*)**	**(0.023*)**	(0.220)			**(0.000***)**					**0.28499**
Bwth	**1.35324**	**0.02997**	0.07123			**0.29974**					
Eq. 4	**- 0.053**	**-0.073**	**- 0.054**				**0.072**				
	(0.000*)**	**(0.001**)**	**(0.009**)**				**(0.036*)**				**0.36990**
Bwth	**1.37836**	**0.02834**	**0.11996**				**0.09031**				
Eq. 5	**- 0.051**	**-0.005**	- 0.047					**- 0.064**			
	(0.000*)**	**(0.005**)**	(0.105)					**(0.017*)**			**0.27534**
Bwth	**1.58815**	**0.05274**	0.08763					**0.18525**			
Eq. 6	**- 0.055**	- 0.071	- 0.037						**0.058**		
	(0.000*)**	(0.124)	(0.263)						**(0.023*)**		**0.24481**
Bwth	**0.90693**	0.06124	0.16664						**0.11430**		
Eq. 7	- 0.057	**0.518**	- 0.043							0.025	
	(0.415)	**(0.000***)**	(0.690)							(0.087)	**0.23951**
Bwth	0.89596	**0.06010**	0.12836							0.65417	

In all regressions of table 20, except that in the last one, number of managers have significant and negative impact on the efficiency of offensive performances on football clubs. In other words, as the number of managers employed in a team increases, the offensive efficiency of teams tends to diminish. Roster size of the football clubs has also a negative effect on the efficiency of offensive performance. An increase in the number of players in the squad probably creates instability in the first eleven. Average age of football teams does not have a consistent effect over the offensive efficiency.

Games in a season have a positive and significant effect on offensive efficiency. When teams play not only in the league but also in other domestic and/or international competitions, the efficiency of offensive performance on team is increasing regarding to the form of players. This can mean that in order to rise the efficiency of offensive players, they must play more matches to get fit in the pitch.

All the other variables, but for the ratio of new players in a team, have a positive and generally significant effect on the efficiency of offensive performance. The result about the ratio of new players chimes in with the interpretation that a large and unstable squad has a detrimental effect on offensive performance.

We will now switch to an analysis that includes country dummies in the kernel regressions. More precisely, country dummy variables for $\boldsymbol{FRANCE_{it}}$, $\boldsymbol{GERMANY_{it}}$, $\boldsymbol{ITALY_{it}}$ and $\boldsymbol{SPAIN_{it}}$ are used in order to measure the performance of these leagues compared to that in $\boldsymbol{ENGLAND_{it}}$. Table 21 presents kernel regression results on the efficiency of offensive performances in the English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, with country dummies.

Table 21. Kernel Regression Results with Country Dummy Variables on Offensive Efficiency

	France	Germany	Italy	Spain	# of Managers	(ln)Age	(ln)Roster	(ln)Games	Promoted	Cup	Int. Player Ratio	New Player Ratio	Foreign Player Ratio	(ln) Roster Value Ratio	R-Square
Eq. 1	- 0.019	**- 0.043**	0.002	**- 0.058**	**- 0.034**	0.043	**- 0.117**	**0.004**							
	(0.064)	**(0.004**)**	(0.896)	**(0.000***)**	**(0.000***)**	(0.388)	**(0.001**)**	**(0.000***)**							**0.0404**
Bwth	0.52015	**11920**	12391	**11424**	**2.87812**	20340	**43516**	**5.96486**							
Eq. 2	- 0.012	**- 0.066**	0.002	**- 0.066**	**- 0.038**	0.026	**- 0.119**		**- 0.036**						
	(0.317)	**(0.000***)**	(0.983)	**(0.000***)**	**(0.000***)**	(0.854)	**(0.005**)**		**(0.000***)**						**0.2667**
Bwth	46254	**52076**	46490	**10230**	**1.37562**	0.05112	**0.11896**		**0.5651**						
Eq. 3	**- 0.018**	**- 0.068**	0.006	**- 0.069**	**- 0.029**	0.091	**- 0.097**			**0.044**					
	(0.047*)	**(0.000***)**	(0.942)	**(0.000***)**	**(0.000***)**	(0.219)	**(0.025*)**			**(0.000***)**					**0.2208**
Bwth	**0.57798**	**33822**	17245	**36645**	**0.51042**	0.05203	**0.12047**			**0.510**					
Eq. 4	**0.022**	**- 0.053**	**0.031**	**- 0.045**	**- 0.035**	- 0.052	**- 0.101**				**0.130**				
	(0.038*)	**(0.000***)**	**(0.026*)**	**(0.001**)**	**(0.000***)**	(0.724)	**(0.010*)**				**(0.000***)**				**0.2271**
Bwth	**40919**	**48844**	**10859**	**69201**	**1.35895**	0.05198	**0.12031**				**33176**				
Eq. 5	**- 0.022**	**- 0.070**	- 0.006	**- 0.065**	**- 0.037**	0.270	**- 0.110**					- 0.018			
	(0.024*)	**(0.000***)**	(0.706)	**(0.000***)**	**(0.000***)**	(0.215)	**(0.004**)**					(0.618)			**0.1908**
Bwth	**0.49674**	**84458**	13099	**12863**	**20768**	47744	**43517**					0.117			
Eq. 6	0.005	**- 0.061**	0.007	**- 0.053**	**- 0.041**	- 0.010	**- 0.117**						**0.108**		
	(0.151)	**(0.000***)**	(0.605)	**(0.003**)**	**(0.000***)**	(0.200)	**(0.002**)**						**(0.000***)**		**0.1912**
Bwth	0.47814	**14495**	74977	**13726**	**23521**	21174	**15772**						**0.14647**		
Eq. 7	0.003	**- 0.047**	**0.034**	**- 0.054**	**- 0.035**	0.083	**- 0.091**							**0.030**	
	(0.328)	**(0.001**)**	**(0.017*)**	**(0.000***)**	**(0.000***)**	(0.596)	**(0.036*)**							**(0.000***)**	**0.24770**
Bwth	58451	**52899**	**12407**	**94930**	**1.36836**	0.05375	**0.11114**							**15755**	

Regarding to table 21, it can be seen that, allowing for some covariates, the Italian Serie A is now found the most efficient in offensive performance, which was the most efficient in unconditional order-m comparisons, the French Ligue 1 now comes the second, compared to the English Premier League

The significance of average team age now completely disappears. Most other results are qualitatively unchanged, but the positive effect of average roster value is now more significant, whilst the negative effect of the new players' ratio fades away. The negative effect of roster size is now, on the other hand, stronger.

3.5.2. Kernel Regression Results on Defensive Efficiency

Table 22 displays kernel regression results on the efficiency of defensive performances in the English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, without country dummies.

Table 22. Kernel Regression Results on Defensive Efficiency (without Country Dummies)

	# of Managers	(ln)Age	(ln)Roster	(ln)Games	Promoted	Cup	Int. Players Ratio	New Players Ratio	Foreign Players Ratio	(ln) Roster Value Ratio	R-Square
Eq. 1	**- 0.017**	**0.106**	-0.008	0.029							
	(0.000*)**	**(0.050*)**	(0.720)	(0.160)							**0.03979**
Bwth	**1.85324**	**0.16563**	0.20574	0.28813							
Eq. 2	**- 0.019**	0.082	- 0.018		**-0.024**						
Bwth	**(0.000***)**	(0.081)	(0.614)		**(0.000***)**						**0.02961**
	1.89322	0.14724	0.05163		**0.45911**						
Eq. 3	**- 0.012**	**0.166**	0.004			**0.026**					
Bwth	**(0.001**)**	**(0.001**)**	(0.909)			**(0.000***)**					**0.05699**
	1.79912	**0.12145**	0.32764			**0.53011**					
Eq. 4	**- 0.019**	0.042	0.003				**0.052**				
Bwth	**(0.000***)**	(0.598)	(0.946)				**(0.000***)**				**0.09348**
	2.23654	0.10812	0.12596				**0.14836**				
Eq. 5	**- 0.017**	0.083	- 0.024					0.006			
Bwth	**(0.000***)**	(0.155)	(0.189)					(0.499)			**0.04604**
	1.84063	0.16455	0.20474					0.15674			
Eq. 6	**- 0.019**	0.067	- 0.012						**0.051**		
Bwth	**(0.000***)**	(0.243)	(0.520)						**(0.001**)**		**0.06971**
	1.37025	0.08314	0.21536						**0.22261**		
Eq. 7	**- 0.017**	0.057	- 0.013							**0.016**	
Bwth	**(0.000***)**	(0.326)	(0.877)							**(0.000***)**	**0.06356**
	1.89295	0.19265	0.12336							**1.06974**	

Regarding to the results in table 22, it can be stated that number of managers employed has always a negative and significant impact on the efficiency of defensive performance. Similar to what was found for offensive performance, changes of managers in team are linked to a lower efficiency. On the other hand, unlike for offensive efficiency, roster size, number of games and the new players ratio are never significant. This is a bit counterintuitive, as one would expect squad instability to have an even stronger role now than for offensive performance.

Among the other variables, average team age has now always a positive sign, and participating international cups, the international players ratio, the foreign players ratio, and the average roster value are positive and significant. On the other hand, the promotion indicator is now significant and negative.

Table 23 presents kernel regression results on the efficiency of defensive performances in the English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, with country dummies.

Table 23. Kernel Regression Results with Country Dummy Variables on Defensive Efficiency

	France	Germany	Italy	Spain	# of Managers	(ln)Age	(ln)Roster	(ln)Games	Promoted	Cup	Int. Player Ratio	New Player Ratio	Foreign Player Ratio	(ln) Roster Value Ratio	R-Square
Eq. 1	- 0.006	- 0.008	**0.026**	**- 0.046**	**- 0.011**	0.022	- 0.023	0.031							
	(0.606)	(0.434)	**(0.015*)**	**(0.000***)**	**(0.016*)**	(0.296)	(0.305)	(0.275)							**0.09343**
Bwth	12407	50361	**74773**	**0.49613**	**2.23711**	26918	65918	0.26525							
Eq. 2	- 0.007	- 0.012	**0.024**	**- 0.043**	**- 0.013**	- 0.016	- 0.002		- 0.010						
	(0.423)	(0.245)	**(0.027*)**	**(0.000***)**	**(0.001**)**	(0.946)	(0.946)		(0.271)						**0.07977**
Bwth	11394	76904	**40161**	**62263**	**95253**	0.16169	0.20601		75083						
Eq. 3	- 0.002	- 0.011	**0.023**	**- 0.042**	- 0.008	0.059	- 0.006			**0.027**					
	(0.937)	(0.937)	**(0.031*)**	**(0.000***)**	(0.082)	(0.112)	(0.486)			**(0.000***)**					**0.11413**
Bwth	0.57835	0.57896	**0.54512**	**0.47165**	25401	11399	30742			**74517**					
Eq. 4	0.002	- 0.007	**0.030**	**- 0.032**	**- 0.011**	- 0.002	- 0.012				0.034				
	(0.964)	(0.481)	**(0.012*)**	**(0.001**)**	**(0.014*)**	(0.218)	(0.417)				(0.109)				**0.10082**
Bwth	87736	12137	**25769**	**0.48463**	**34910**	13512	17269				0.28731				
Eq. 5	- 0.006	- 0.011	**0.028**	**- 0.043**	**- 0.012**	0.004	- 0.018					- 0.015			
	(0.560)	(0.287)	**(0.020*)**	**(0.000***)**	**(0.011*)**	(0.294)	(0.313)					(0.576)			**0.08523**
Bwth	72826	73707	**63864**	**0.49265**	**11510**	61269	33382					0.2841			
Eq. 6	- 0.006	- 0.010	**0.027**	**- 0.039**	**- 0.012**	- 0.006	- 0.016						0.011		
	(0.646)	(0.336)	**(0.024*)**	**(0.000***)**	**(0.011*)**	(0.171)	(0.364)						(0.723)		**0.08653**
Bwth	87737	20410	**98396**	**0.47298**	**18429**	34134	11844						0.28265		
Eq. 7	0.001	- 0.007	**0.027**	**- 0.040**	**- 0.010**	0.023	- 0.011							0.001	
	(0.963)	(0.478)	**(0.012*)**	**(0.000***)**	**(0.021*)**	(0.212)	(0.471)							(0.107)	**0.09285**
Bwth	47287	21489	**68001**	**0.48389**	**12847**	28230	19169							2.49015	

Table 23 reiterates the unconditional order-m results in the sense that Italian Serie A is detected as the most efficient football league regarding to defensive efficiency. It also turns out that the Spanish football league is found the least efficient in this field, compared to the English Premier League.

As regards the other variables, they all lose significance, but for the change of managers indicator, whose coefficient is always negative, and participating to international cups that maintains a positive sign. The average roster value also nears significance and maintains a positive sign.

3.5.3. Kernel Regression Results on Team Efficiency

Table 24 displays kernel regression results on the efficiency of team performances in the English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, without country dummies.

Table 24. Kernel Regression Results on Team Efficiency (without Country Dummies)

	# of Managers	(ln)Age	(ln)Roster	(ln)Games	Promoted	Cup	Int. Players Ratio	New Players Ratio	Foreign Players Ratio	(ln) Roster Value Ratio	R-Square
Eq. 1	**- 0.088**	**0.358**	**- 0.122**	**0.211**							
	(0.000*)**	**(0.000***)**	**(0.003**)**	**(0.000***)**							**0.35809**
Bwth	**2.23774**	**0.10362**	**0.19030**	**0.08043**							
Eq. 2	**- 0.116**	**0.228**	**- 0.136**		**0.000**						
	(0.000*)**	**(0.040*)**	**(0.000***)**		**(0.000***)**						**0.50111**
Bwth	**2.22613**	**0.02033**	**0.06714**		**0.15136**						
Eq. 3	**- 0.076**	**0.345**	- 0.049			**0.111**					
	(0.000*)**	**(0.000***)**	(0.170)			**(0.000***)**					**0.37233**
Bwth	**1.26096**	**0.07623**	0.15511			**0.48545**					
Eq. 4	**- 0.112**	**0.168**	**- 0.120**				**0.071**				
	(0.000*)**	**(0.000***)**	**(0.000***)**				**(0.000***)**				**0.40064**
Bwth	**0.97465**	**0.49037**	**0.17414**				**0.14932**				
Eq. 5	**- 0.118**	**0.292**	**- 0.107**					- 0.175			
	(0.000*)**	**(0.000***)**	**(0.000***)**					(0.510)			**0.36912**
Bwth	**0.63374**	**0.05415**	**0.20703**					0.05374			
Eq. 6	**- 0.118**	0.031	**- 0.111**						**- 0.052**		
	(0.001)**	(0.145)	**(0.000***)**						**(0.003**)**		**0.36229**
Bwth	**0.50469**	0.07435	**0.29974**						**0.14336**		
Eq. 7	**- 0.109**	**0.219**	**- 0.133**							**0.029**	
	(0.006)**	**(0.093)**	**(0.008**)**							**(0.120)**	**0.45179**
Bwth	**0.48412**	**0.09924**	**0.18265**							**0.38224**	

According to table 24, the number of managers and the roster size have a significant and negative impact on the efficiency of team performances. On the contrary, average age is found to impact significantly and positively on team efficiency. Also, most other variables have positive and significant effects, but for the new players ratio, which is insignificant, and the foreign players ratio that is negative and significant.

Table 25 presents kernel regression results on the efficiency of team performances in the English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga and French Ligue 1, with country dummies.

Table 25. Kernel Regression Results with Country Dummy Variables on Team Efficiency

	France	Germany	Italy	Spain	# of Managers	(ln)Age	(ln)Roster	(ln)Games	Promoted	Cup	Int. Player Ratio	New Player Ratio	For. Player Ratio	(ln) Roster Value Ratio	R-Square
Eq. 1	0.033	**0.051**	**0.080**	**0.102**	**- 0.056**	0.162	**- 0.230**	**0.007**							
	(0.084)	**(0.011*)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	(0.321)	**(0.000***)**	**(0.000***)**							**0.23989**
Bwth	63995	**49095**	**15880**	**56956**	**34029**	0.04223	**42937**	**44092**							
Eq. 2	0.016	0.002	**0.054**	**0.097**	**- 0.068**	0.070	**- 0.222**		**- 0.045**						
	(0.389)	(0.479)	**(0.004**)**	**(0.000***)**	**(0.000***)**	(0.860)	**(0.000***)**		**(0.006**)**						**0.20078**
Bwth	22751	54687	**37287**	**24153**	**18491**	0.04265	**0.27417**		**24740**						
Eq. 3	0.032	0.005	**0.064**	**0.097**	**- 0.049**	**0.250**	**- 0.175**			**0.123**					
	(0.056)	(0.563)	**(0.001**)**	**(0.000***)**	**(0.000***)**	**(0.006**)**	**(0.001**)**			**(0.000***)**					**0.28739**
Bwth	50571	43355	**40916**	**0.45269**	**32791**	**23960**	**0.18863**			**0.4908**					
Eq. 4	**0.080**	0.030	**0.096**	**0.174**	**- 0.067**	- 0.045	**- 0.173**				**0.255**				
	(0.000*)**	(0.243)	**(0.000***)**	**(0.000***)**	**(0.000***)**	(0.869)	**(0.002**)**				**(0.000***)**				**0.20628**
Bwth	**15684**	35635	**54310**	**70531**	**1.34498**	0.03165	**42932**				**0.28896**				
Eq. 5	0.026	0.010	**0.088**	**0.113**	**- 0.066**	0.065	**- 0.184**					**- 0.218**			
	(0.189)	(0.598)	**(0.000***)**	**(0.000***)**	**(0.000***)**	(0.861)	**(0.000***)**					**(0.000***)**			**0.22464**
Bwth	74794	17520	**73282**	**94432**	**1.34287**	0.04266	**0.31054**					**12907**			
Eq. 6	0.026	0.010	**0.064**	**0.124**	**- 0.070**	0.061	**- 0.243**						0.088		
	(0.215)	(0.503)	**(0.001**)**	**(0.000***)**	**(0.000***)**	(0.227)	**(0.000***)**						(0.072)		**0.21723**
Bwth	94840	56105	**10331**	**0.48763**	**2.23751**	0.04496	**0.22263**						14832		
Eq. 7	**0.081**	**0.045**	**0.073**	**0.132**	**- 0.065**	0.220	**- 0.159**							**0.061**	
	(0.000*)**	**(0.017*)**	**(0.001**)**	**(0.000***)**	**(0.000***)**	(0.209)	**(0.007**)**							**(0.000***)**	**0.19417**
Bwth	**51680**	**99024**	**47832**	**42064**	**1.97264**	0.03112	**46821**							**47037**	

According to table 25, the Spanish football league is found to be the most efficient as in the unconditional order-m estimates. The previous results from table 24 mostly carry through, although the new players ratio is now significant (and negative) and the foreign players ratio has now a positive sign.

To sum up, we have provided a unique joint evaluation of the efficiency of football clubs in the biggest five European leagues. We have dealt with both offensive and defensive team performance, and also considered an additional concept, that of 'team' performance. After having selected through DEA some appropriate production sets, we have implemented a conditional order-m approach. This has allowed the joint computation of efficiency scores and the impact of a set of contextual variables on the performance of football clubs.

We found that the Italian Serie A consistently shows the most efficient defensive performances, whilst, according to the technique that has been adopted, the Serie A and the French Ligue 1 share the primacy as far as offensive performance is concerned. We also consistently found that the number of manager changes is associated with a lower efficiency of football teams. It is important to stress that our empirical analysis cannot give a precise causal interpretation of this finding. The number of manager changes could proxy, for instance, a series of unfortunate events that affect a team season. Yet, it is useful to allow for this indicator when assessing the impact on efficiency determination of other factors. Among the latter, roster size has a consistently negative impact on efficiency, especially for the offensive and team performance. This also applies to the condition of being promoted to the league, while the contrary is true for the numbers of games played in a season. Participation to an international tournaments and average roster value have also a consistently positive influence on performance in a league, also for defensive efficiency. The other indicators yield less decisive results, although the impact of the shares of foreign and international players is generally favourable and that of the share of new players is detrimental.

CHAPTER 4: REFORM EFFECTIVENESS AND UNRESOLVED ISSUES IN FOOTBALL: THE CASE OF TURKISH SUPER LEAGUE

4.1. The History and Development of Turkish Football

Modern football step on for the first time through Turkey goes beyond in the end of 19th century. British introduced the football to the society that live in cities in which those had mercantile ports, that were, İstanbul, İzmir (Smyrna) and Selanik (Kurt et al., 1997). After a while, Italians, Rums and Armenians also joined to British, and thereby, the number of people and football teams began to increase in the region. During the Ottoman Empire, it was known that the first football match had been played in Selanik. The Britons founded a team in 1894, namely Football Club Smyrna. Interestingly, the FC Smyrna joined 1906 Summer Olympics and they got their first international success by achieving 2nd position, after Denmark. Afterwards, while the Rums had moved to İstanbul, they brought football to the city as well (Kurt et al., 1997).

Turkish Football Federation (TFF), also named as Turkish Football Association, was established on 23 April 1923 and became governing body of association football in Turkey. Turkish Football Federation was accepted to be a member of FIFA in 1923 and the national team, *Milli Takım*, had their first debut match with Romania resulted by 2-2 draw. UEFA, the biggest confederation that established under FIFA in 1954, approved the membership to be European country of Turkey in 1962 and the career of the national team had officially begun (TFF, 2017).

Officially, the first Turkish football club, *Galatasaray SK Spor Kulübü*, was established in 1905 and the club was '*locomotive force'* among the following founded clubs such as *Fenerbahçe Spor Kulübü* in 1907 and *Beşiktaş Jimnastik Kulübü* 1910 (Beşiktaş JK was founded initially in 1903, however, they were not purposed as football team). Thereafter, many other football clubs began to be founded mainly in İzmir and İstanbul cities (Tanış, 2015).

As a result of improvement among the football teams in the domestic leagues, a few big rival teams thrived, the *biggest-four*, namely Galatasaray SK, Fenerbahçe SK, Beşiktaş JK and Trabzonspor SK. In 2009-10 football season, a new leading star team who won the title of Turkish Super League, Bursaspor SK, emerged.

At the first time of its history the national team, *Milli Takım* achieved to participate EURO 96 in England, by eliminating Sweden in the group games. On the next international tournament, FIFA World Cup 2002, *Milli Takım* had remarkable glory with achieving 3rd position in the tournament and surprised many football authorities and communities. Meanwhile, it was claimed that this achievement was welded by the splendid performance of Galatasaray SK between the years 1998-2001, when they won the UEFA Cup and the Super Cup trophies.

In the following years, the Turkish national team in EURO 2006 put another remarkable performance by recording the national team as semi-finalist in the tournament. However, right after this period, the national team and domestic leagues in Turkish Super League displayed unsuccessful remarks where Turkish Football Federation begun to be questioned and came under huge criticiss because of their governance over Turkish football.

It is a clear fact that the governance bodies of football have been struggled on many issues (Akşar, 2005). Indeed, these governance bodies – national football federations – were aware of those issues and were processing some radical or non-radical reforms in order to eliminate these problems that had been occurred. However, just as declaring those reforms have been applied, it did not always make tangible solutions over those problems (Boniface and Yergüz, 2007).

In recent times, an increasing concern has been raised over the public opinion and the media about the governance of Turkish Football Federation regarding to its reliability and effectiveness on the improvement of Turkish Football. The former football director and manager of national teams of Turkey, Mr. Fatih Terim had organized a meeting with press conference in Antalya on 9th of January 2014 and he declared a vital issue that still is occurred in Turkish Football:

"*Now, we all are aware of the main issues on our football. In fact, we moved further on diagnostic. A treatment, very radical one, is needed immediately. We all agree on that case. It is the time to act rather than to give statements. We do not need a change, but we need reform."*

Surely, those problems on Turkish football did not arise once in a time and they are not only recent issues. Terim's assignation was clearly about the whole accumulation at the last couple of decenniums on Turkish football. These critical areas that were seen as a necessity to put reforms on and they led Turkish Football Federation to begin to be questioned by the public

opinion and the media. Moreover, Turkish Football Federation established a unit, or department, that specifically aimed to be intensified on daily and past issues that are being discussed by the public opinion. Responding those issues, TFF decided to change the regulation of foreign players' quota as a reformative implementation.

4.2. Foreign Player Quota and its Implementation in Turkish Football

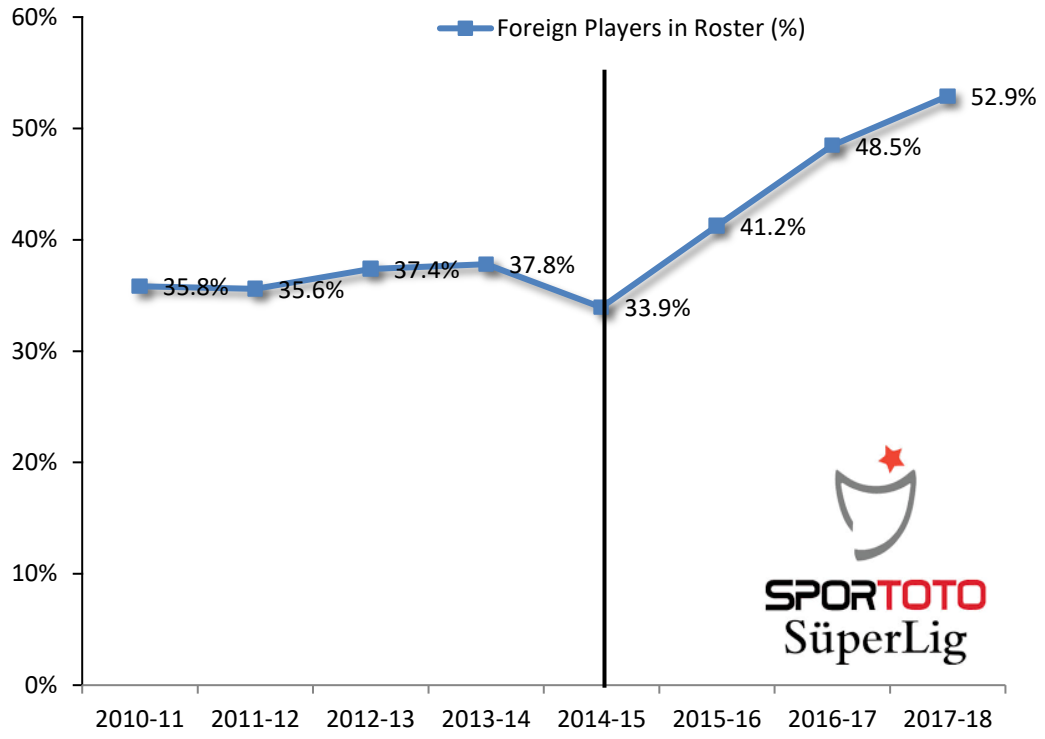
As in all of Europe, one of the most important changes in Turkish football was the Bosman case. In Belgium, R.C. Jean Marc Bosman's contract, whose professional football life was going on with Liegois FC, ended in June 1990, and the process that started after can be seen as a turning point in European football player transfers (Antonioni and Cubin, 2000). The club, Liegois FC, argued that Bosman should not play in any team for two years (Dabschechk, 1996). In response, Bosman's lawyers argued that players in the European Union (EU) should be allowed to transfer to another club without paying any price, based on the right of free movement of workers (Pearson, 2004). As a result of the lawsuit, the club, whose contract has been terminated, has taken the decisions to terminate the application of foreign restrictions and the freedom to contract with the club they choose (Browstone, 2010). After these decisions, there have been radical changes in world football. Many clubs' and counties' quota systems in Europe had argued that foreign players should play in the leagues, but this idea was not successfully happened (Briggs, 2005). At the last point, it was seen that the restriction of foreign players has been removed in many countries' football leagues (Schmidt, 2007).

Although the transfer of foreign players in Turkish football was older than the professionalism process, officially, the first foreign transfer of Turkish football was carried out in 1951 with Oscar Garo (Yüce, 2015). The TFF made the first restriction on foreign players in 1951, allowing them to hold only one foreign player in their squad and this continued until 1966. Although it was changed to 3+1 (three players in the pitch, one player in the bench) in 1996, however, in the middle of the 1998-1999 season, The Football Federation altered the foreign player quota to 5 (Üçışık, 1999). In 2001-2002, 5 + 1 + 2 system was introduced. According to this system, football teams could sign a contract with a total of 8 players, but no more than 5 players in the field, 1 player could take part in the bench and 2 players could stand in the tribune (Altay et al., 2011). In the 2005-2006 season, it was accepted by the Federation that football teams in the Super League could play with 6 foreign players on field in a match. Then, the foreign player quota changed again to 6 + 1 in 2007-2008 season (Yüce, 2015).

In the 2011-2012 season, the clubs were able to sign a contract with the foreign players they wanted, but the 6 + 2 rule continued for these 18 players in roster overall. Although the rule was valid on the next season, The TFF had submitted a status indicating that the number of foreign players will be gradually reduced and will vary by year. According to the new status, in the 2013-2014 season, football teams could have signed a contract with a maximum of 10 foreign players and could have 6 foreign players registered on the competition name list. For the next season, in 2014-15, football clubs could sign a contract with up to 8 foreign players and could have 5 foreign national players written to the competition name list (Yüce, 2015).

Meanwhile, football authorities were questioning the performance of football teams and lack of success in the European competitions and focusing on the restrictions related to foreign players since it was considered that they could have a positive impact on the performance of their team. Henceforth, in the end of 2014-15 season, the final status of foreign players' quota has been renewed indicating a reform movement in Turkish football by the Turkish Football Federation. That is, beginning by 2015-2016 season, the following rules, which was in fact a liberalisation of the presence of foreign players, came into force. According to this '14 home-grown players rule' by Turkish Football Federation, football clubs may register maximum 28 players in their roster and at least 14 of them must hold the eligibility of playing in the Turkish national team. Although it seemed that there occurs another quota for foreign players since it is limited to 28 players registration in roster for the league, teams can choose the first eleven by foreign players without any restriction. In other words, all foreign players might be in the field and at the bench during the match.

Figure 20. The Ratio of Foreign Players on Turkish Football Clubs (2010-11 to 2017-18)

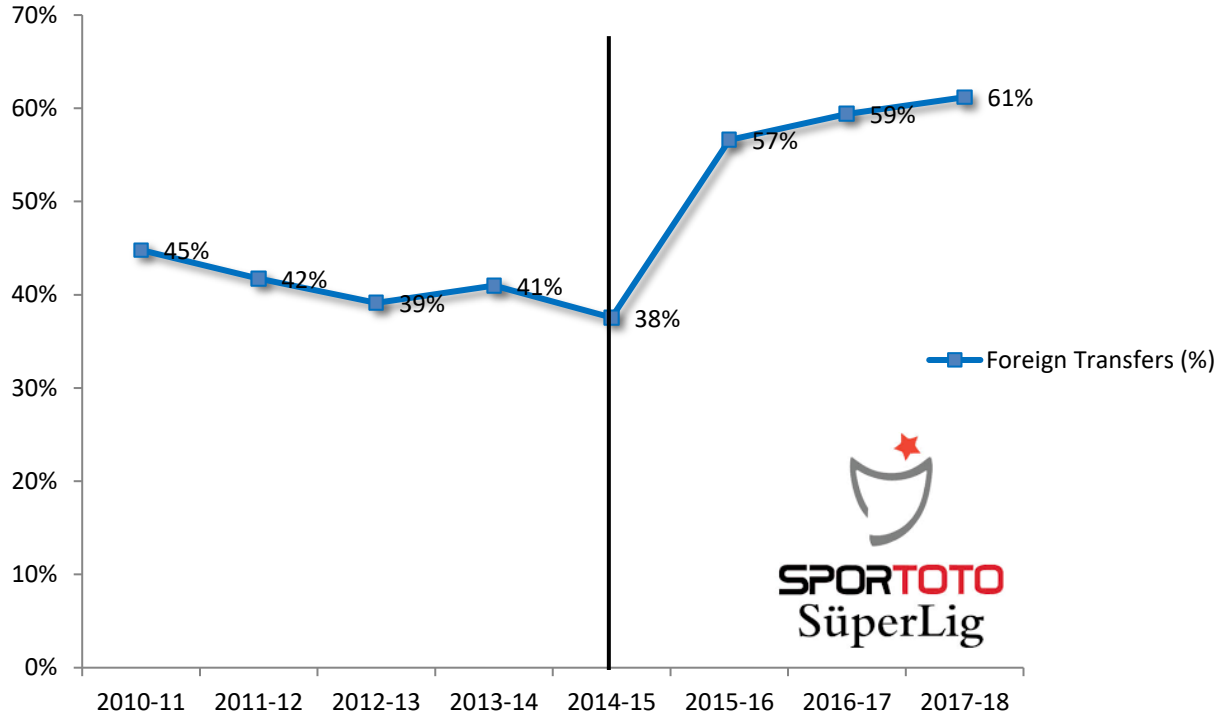


Data Source: Transfermarkt

Figure 17 expresses the average ratio of foreign players on rosters of football clubs in Turkish Super League from 2010-11 to 2017-18. Although there had been limitations on the registration of foreign players at some specific periods, Turkish football clubs have embodied at least 35% foreign players on their roster for the last eight seasons. Since there was limitation on the registration of foreign players on roster with maximum eight contract at each Turkish club during 2014-15 season, the ratio of foreign players reached the lowest level on teams' roster comparing to the other seasons given.

A significant change in the ratio of foreign players in Turkish clubs was seen in the beginning of 2015-16 season. In other words, after Turkish Football Federation implemented the new status of foreign players' quota, the percentage of foreign players at each roster have tended to increase ever since. More specifically, in the season of 2017-18, football clubs registered foreign players more than half of their roster on average. Considering the last status of foreign players in the league, at most 14 players out of 28 players ought to be home-grown, that is, this proves that the majority of Turkish football clubs preferred to register 14 foreign players on their roster on the last season in the Super League.

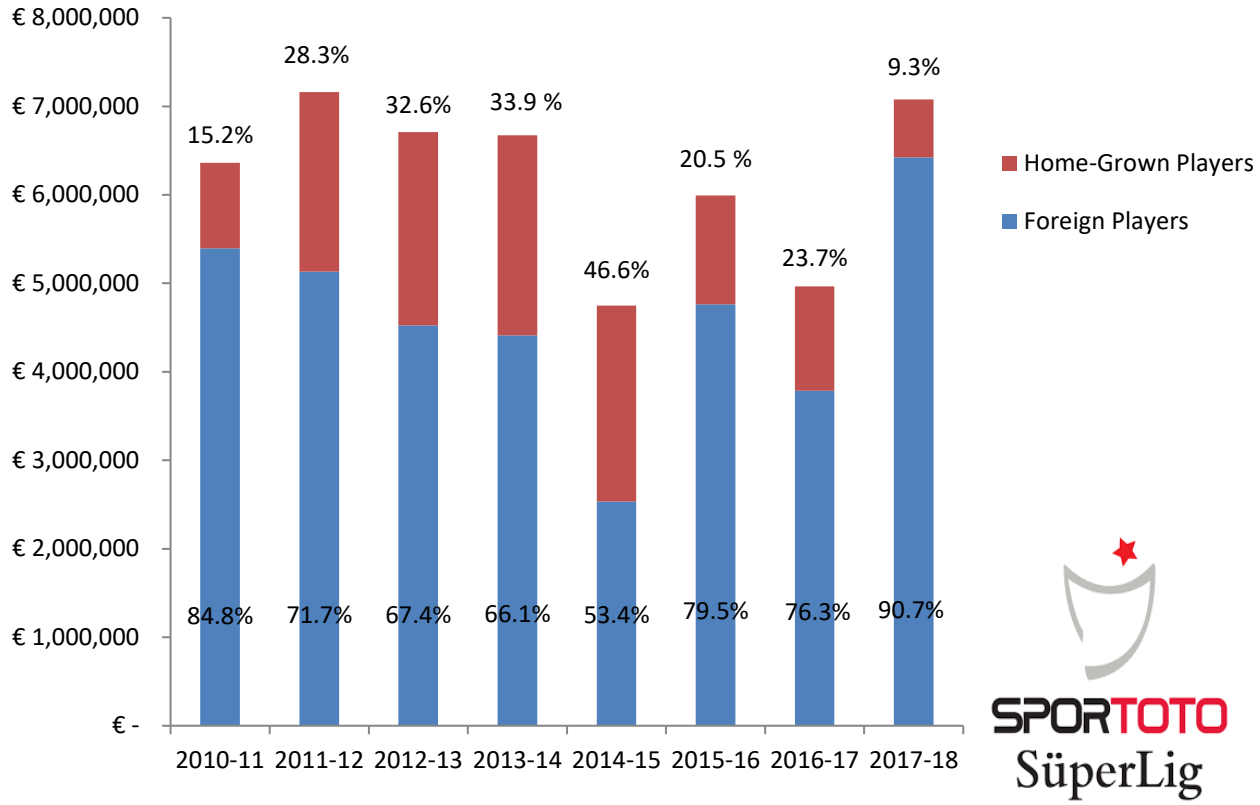
Figure 21. The Ratio of Foreign Player Transfers in Turkish Super League (2010-11 to 2017-18)



Data Source: Transfermarkt

Corresponding to the previous ratio, figure 18 presents the ratio of foreign player transfers in Turkish Super League starting by 2010-11 season until 2017-18. Here, only players being transferred or loaned by another football clubs are considered. Based on the raise of foreign players limitation for long years, Turkish football clubs headed to make contract with home-grown players and it caused a substantive decrease on the ratio of foreign player transfers comparing to domestic based players until the end of 2014-15 season. Especially at that season, since there was limitation of foreign players with at most 8 players on each roster, the rate of foreign player transfers hit the lowest level by 38% on average. By the beginning of 2015-16 season, when Turkish Football Federation altered the status of foreign players' quota, the percentage of foreign player transfers significantly increased. After the new status have begun to be implemented, Turkish football clubs raised their foreign player transfers by 19% in the following season. In addition, by 2017-18, at least 6 out of each 10 players transferred into Turkish football clubs were foreign players.

Figure 22. Transfer Expenses of Football Clubs in the Super League (2010-11 to 2017-18)



Data Source: Transfermarkt

Related with the ratio of foreign players on teams' rosters, figure 19 shows transfers expenses of football clubs categorized as foreign and home-grown players in Turkish Super League between 2010-11 and 2017-18 seasons. Since there was limitation of foreign players registration on rosters, the distribution of foreign players' transfer expenses tended to decrease gradually until the beginning of 2015-16 season. On the other hand, after the new status of foreign players' quota made by TFF, the distribution of the expenditure on foreign players' transfer significantly increased compared to home-grown ones. Moreover, the rate of transfer budget spent on foreign players reached to peak level in the last season by 90.7% on average in Turkish football clubs.

This chapter of the thesis investigates the impact of the 2015-16 reform on Turkish football implemented by Turkish Football Federation (TFF). In order to do this, first, unconditional order-m results for Süper Lig clubs will be developed and, next, a Difference in Differences (DiD) analysis will be performed. The reason why Turkish Super Lig was not involved in the previous chapter is that data for Turkish football were less complete than for the other countries. On the other hand, a thorough reform such as the one implemented in Turkey was

not implemented in other countries. Hence it was thought that a counterfactual analysis of this reform could be advantageously made keeping the analysis of efficiency determination carried out in the previous chapter as a benchmark. Differently from the previous chapter, a difference in differences (DiD) analysis has been applied in order to analyse the impact of the implementation of foreign players' quota on the performance of Turkish football clubs. To do this, the dataset is divided into two parts, before (from 2010-11 to 2014-15) and after periods (from 2015-16 to 2017-18) of the foreign players' quota implementation by TFF. The new rule on foreign players' quota has begun to be implemented in the beginning of 2015-16 season.

4.3. The Data

The dataset from the previous chapter has been integrated with variables collected from Turkish Football Federation Databank, Transfermarkt GmbH & Co. KG (www.transfermarkt.com), Mackolik Internet Hizmetleri A.S. (www.mackolik.com) and Whoscored.com (www.whoscored.com). It includes 928 observations including 200 football clubs. The full names of football clubs and their leagues will be attached in the appendix.

Table 26. The Categorization of Football Clubs Regarding to Their Domestic Leagues

Football League	Number of Football Clubs	Season
English Premier League	36 Clubs	2010-11 to 2017-18
Italian Serie A	34 Clubs	2010-11 to 2017-18
Spanish La Liga	35 Clubs	2010-11 to 2017-18
German Bundesliga	28 Clubs	2010-11 to 2017-18
French Ligue 1	36 Clubs	2010-11 to 2017-18
Turkish Super League	31 Clubs	2010-11 to 2017-18

Table 26 displays the categorization of football clubs among leagues (English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga, French Ligue 1 and Turkish Super League) for the seasons between 2010-11 and 2017-18.

Unlike in the previous chapter, the period of observation begins in 2010-11 season. Some relevant input variables are not included in the analysis as they are not available for the Turkish Super League. They relate to offensive (the numbers of crosses and dribbles), defensive (the number of tackles) and team (the numbers of passes and aerials won) performance. We report below some descriptive statistics. The code names of the variables are the same of the previous chapter.

Table 27. The Descriptive Statistics of Input Variables

Variable	Obs.	Mean	St. Dev.	Min	Max
$MSHOT_{it}$	928	12.75	2.115	8.4	19.6
$CORNER_{it}$	928	4.87	1.243	0.2	8.1
$PENALTY_{it}$	928	5.07	3.794	0.0	26.0
$FOULED_{it}$	928	13.17	2.253	6.6	18.8
$INTERCEPTION_{it}$	928	16.55	4.025	7.1	36.8
$RSHOT_{it}$	928	12.81	2.099	6.2	20.4
INV_RSHOT_{it}	928	0.08	0.014	0.05	0.17
$SAVE_{it}$	928	3.11	0.931	1.4	7.0
$FOUL_{it}$	928	14.03	2.227	8.3	19.9
INV_FOULS_{it}	928	0.08	0.012	0.05	0.13
$OFFSIDE_{it}$	928	2.33	0.572	0.9	4.6
$POSSESSION_{it}$	928	49.86(%)	4.468	37(%)	67.4(%)
$YELLOW_{it}$	928	74.85	18.464	34.0	143.0
RED_{it}	928	4.37	2.546	0.0	14.0
$BOOKING_{it}$	928	79.23	19.606	36.0	155.0
$DISCIPLINE_{it}$	928	0.14	0.003	0.007	0.028

Table 27 shows the descriptive statistics of input variables for the big five European football leagues such as English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga, French Ligue 1 and Turkish Super League between the 2010-11 and 2017-18 seasons.

Football leagues averagely 12.8 shots on target has been made and the lowest shots on target made by SC Bastia with 8.4 per game in 2014-15 season, while Chelsea FC made 21.9 shots on target per game in 2010-11 and 2011-12 seasons.

In these leagues, football clubs have used 4.8 corner kicks on average for the last eight seasons. There are two football clubs reached the highest amount of corner-kicks (8.1 per game) such as Liverpool FC in 2011-12 and FC Internazionale in 2016-17 seasons. On the other hand, Gaziantepspor SK and Kayserispor SK from Turkish Super League had 0.2 corner-kicks per game on average in 2010-11 season and they have been the lowest corner-kick using team among the other football clubs in these leagues.

In the five biggest European leagues and Turkish Super League, football clubs have used penalty kicks 5.0 times per game on average between 2010-11 and 2017-18. Although there have been twenty-seven teams had not used any penalty during these seasons, Chelsea FC used 26 penalties and reached the highest amount in 2013-14 season.

Moreover, table 27 displays that in the five biggest European leagues and Turkish Super League, defensive players have made 13.1 foul to attacking players per game on average during the given seasons. Among those football teams, Akhisar Belediyespor SK and Konyaspor SK defensive players made the lowest foul to attacking players in their opponent teams by 6.6 fouls per game in 2016-17 season. On the contrary, the maximum fouls were made by Bursaspor defenders in 2014-15 season by 18.8 fouls per game.

For interceptions, it has been recorded that football teams have made 16.5 interceptions per game on average during the given seasons. It appears that Real Zaragoza SAD from Spanish La Liga put more attention on this issue and they reached 36.8 interceptions per game in 2011-12 season. On the other hand, one of the teams in the Super League, Mersin İdmanyurdu, carried out by 7.1 interceptions per game in 2012-13 season.

If we look at these football leagues, the average shots received on goal have been found 12.8 per game between 2010-11 and 2017-18 seasons. More explicitly, Manchester City FC succeeded to receive the lowest shots on their goal by 6.2 shots per game in the last season in the English Premier League. Differently, Frosinone Calcio received the highest amount of shots on their goal by 20.4 per game in 2015-16 season in the Italian Serie A.

Furthermore, in the five biggest European leagues and Turkish Super League, goalkeepers have saved 3.1 shots per game for the last eight seasons. The highest saves came from goalkeepers of Beşiktaş JK (2016-17 and 2017-18 seasons) and FenerbahçeSK (2017-18 season) from the Turkish Super League. However, although they conceded 32 goals and placed 2nd in the Italian Serie A in 2015-16 season, goalkeepers of SSC Napoli recorded the lowest save by 1.4 per game.

The number of fouls per game has been recorded by 14.0 on average from 2010-11 to 2017-18 seasons. In particular, the maximum number of fouls per game was made by VfL Wolfsburg defenders (19.9) in 2011-12 season. Regarding to ball possession, football teams in the five biggest European leagues and Turkish Super League have possessed the ball 49.8% per game on average for the last eight seasons. In particular, FC Barcelona, from Spanish La Liga, recorded the highest rate of ball possession by 67.4% per game in 2010-11 season.

In these six European leagues, football players have been shown 74.8 yellow cards and 4.4 red cards per game on average for the seasons between 2010-11 and 2017-18. To be more precise, RCD Espanyol were the highest yellow card shown team by 143 per game in 2012-13, whereas Sevilla FC (in 2012-13), Montpellier HSC (in 2013-14), Atalanta BC (in 2015-16) and SC Bastia (in 2016-17) were the highest amount of red card shown teams in these six European football leagues. On the other hand, while BVB Borussia Dortmund were the team that shown the lowest amount of yellow cards per game (by 34 yellow cards) in 2011-12.

Table 28. The Descriptive Statistics of Output and Control Variables

Variable	Obs.	Mean	St. Dev.	Min	Max
$SCORED_{it}$	928	49.93	16.213	20.0	121.0
$CONCEDED_{it}$	928	49.90	12.452	17.0	94.0
$INV\_CONCEDED_{it}$	928	0.02	0.007	0.11	0.059
$AVERAGE_{it}$	928	1.14	0.716	0.2	5.4
$POINT_{it}$	928	50.5	16.270	11.0	102.0
$GAME_{it}$	928	44.43	6.708	35.0	69.0
$LNGAME_{it}$	928	3.7	0.145	3.5	4.3
$ROSTER_{it}$	928	29.64	3.742	19.0	46.0
$LNROSTER_{it}$	928	3.38	0.123	2.9	3.9
$FOREIGN_{it}$	928	15.01	4.716	1.0	31.0
$NEWPLAYER_{it}$	928	12.53	4.995	1.0	36.0
$INTERNATIONAL_{it}$	928	13.73	5.789	0.0	28.0
$FOREIGNRATIO_{it}$	928	0.51	0.152	0.03	0.93
$NEWRATIO_{it}$	928	0.41	0.143	0.03	0.95
$INTERRATIO_{it}$	928	0.46	0.197	0.0	0.96
CUP_{it}	928	0.29	0.450	0.0	1.0
$PROMOTED_{it}$	928	0.15	0.355	0.0	1.0
AGE_{it}	928	25.26	1.191	21.6	28.7
$LNAGE_{it}$	928	3.23	0.048	3.0	3.4
$ROSTERVALUE_{it}$	928	132,000,000	135,000,000	11,950,000	787,200,000
$VALUERATIO_{it}$	928	4,524,740	4,732,960	370,465.1	27,522,222.2
$LNVALUERATIO_{it}$	928	14.94	0.851	12.8	17.1
$MANAGER_{it}$	928	1.55	0.784	1.0	6.0

Table 28 shows the descriptive statistics of output and control variables for the big five European football leagues such as English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga, French Ligue 1 and Turkish Super League from 2010-11 to 2017-18 seasons.

If we look at goals scored, it is seen that teams have scored 49.9 goals on average to their opponents per season game on average from 2010-11 to 2017-18 seasons. The maximum was

recorded as Real Madrid CF from the Spanish La Liga by finding the nets of opponent teams 121 times in 2011-12 season.

On the other hand, the lowest goal scorer team, Kardemir Karabükspor SK, scored 20 goals in 2017-18 season in the Turkish Super League. Football teams have been conceded 49.9 goals per season from their opponents for the last eight seasons.

The winner of German Bundesliga in 2015-16, FC Bayern München, were the minimum goal conceder in their league by 17 goals. Coversely, the relegated team in the Spanish La Liga in 2016-17 season, CA Osasuna, conceded 94 goals in that season.

When we look at the table 28, it can be said that in those leagues, average goal rate has been found 1.1 per seasons between 2010-11 and 2017-18. More specifically, since they scored the least goal in their league in 2017-18, Kardemir Karabükspor SK Karabükspor reached 0.2 goal rate in the same year, that is, they scored only 20% of their conceded goals. On the contrary, the ultimate recorded five champions in both domestic and European competitions in 2012-13 season, FC Bayern München reached 5.4 goal rates in which means that they scored goals 5 times more than they conceded.

Overall points in the league table state the yearly performance of each football clubs. Hence, football teams aim to gain points as much as they can at each season. Football teams in the big five European leagues and Turkish Super League have recorded 50.5 points per season on average for the last 8 seasons in their league. In particular, Juventus FC succeeded to reach the highest point level among the rest of football clubs in those leagues, by 102 points in 2013-14 season, and it was also recorded the highest level of points gained in a season in the Italian Serie A. Unlikely to other teams, MKE Ankaragücü gained 11 points in 2011-12, could not save themselves to be relegated, and that was the lowest level among these six European football leagues.

Moreover, in the five biggest European leagues and Turkish Super League, goalkeepers have saved 3.1 shots per game for the last eight seasons. The highest saves came from goalkeepers of Beşiktaş JK (2016-17 and 2017-18 seasons) and Fenerbahçe SK (2017-18 season) from the Turkish Super League. However, although they conceded 32 goals and placed 2nd in the Italian Serie A in 2015-16 season, goalkeepers of SSC Napoli recorded the lowest save by 1.4 per game. Regarding to ball possession, football teams in the five biggest European leagues and Turkish Super League have possessed the ball 49.8% per game on average for the last 8

seasons. In particular, FC Barcelona, from Spanish La Liga, recorded the highest rate of ball possession by 67.4% per game in 2010-11 season, when they also succeeded to win the UEFA Champions League. However, the lowest rate of ball possession belongs to SV Darmstadt by 37% per game in 2015-16 season.

Regarding to the number of games, it is seen that football teams have played 44.4 games per season on average between 2010-11 and 2017-18 seasons. Among those European football teams, seventeen German football clubs recorded the least amount of game played with 35 games per season since in the Bundesliga there are 34 weeks exist in the calendar. Apart from them, Chelsea FC played the highest amount by 69 games in 2012-13 season, in which they were playing on both domestic and European competitions. Considering the five biggest European football leagues and Turkish Super League, per season, the average amount of players in roster has been 29.6 for the last 8 seasons. Among those European football teams, Borussia VfL Mönchengladbach from the German Bundesliga reached the minimum amount of roster by registering 19 players in 2014-15 season, whereas the highest roster was in Trabzonspor SK from the Turkish Super League with 46 players in 2015-16 season.

However, when we look at the foreign player ratio on roster, the situation becomes a bit different. For example, in all of these leagues, the average foreign player ratio on roster has been 51% for the last eight seasons. More specifically, Athletic Club de Bilbao, from the Spanish La Liga, recorded the lowest foreign player ratio on their roster by 0.3% in 2010-11 season, whereas Watford FC from the English Premier League reached to 93% of foreign player ratio and it was recorded as the highest ratio on foreign players on a roster among the rest of football teams in these European leagues.

Regarding to the new players ratio, the main table becomes different. For instance, the average ratio of new players on rosters in these European leagues has been recorded as 41% for the last eight seasons, that is, the 41% of squad size on football teams have been formed by new players. Fenerbahçe SK, from the Turkish Super League, had the lowest ratio of new players by 0.3% in 2015-16 season, whereas Konyaspor SK, another team from Turkish Super League, recorded the highest ratio in new players on their roster: 95% in 2010-11 season. In addition, football teams have registered almost 14 international experienced players on average on their roster for the seasons between 2010-11 and 2017-18. Among those football teams, SC Paderborn 07 held the lowest amount of international experienced players by not registering any of them in 2014-15. On the contrary, Fulham FC (in 2013-14 season) and AC

Milan (in 2014-15 season) had the highest amount of international experienced players on their roster by 28 of them among the rest of football teams in these six European football leagues.

Considering the international experienced player ratio on roster, football teams on those leagues have registered almost half of their roster (46%) on average with international experienced players for the last eight seasons. SC Paderborn again reserved 0% international experienced players on their roster only in 2014-15 season, whereas the winner of English Premier League in 2013-14, Manchester City FC had the highest ratio of international experienced players on their roster by 96% comparing to the other football teams in those European football leagues.

The average age of football teams has been 25.2 for the last eight seasons. In particular, Lille OSC from the French Ligue 1 had the youngest roster comparing to the other football clubs in those leagues by 21.6 average age in 2017-18 season. On the other hand, the oldest roster in average was detected in SS Lazio, from the Italian Serie A, by 28.7 in 2012-13 season. In the English Premier League, Italian Serie A, Spanish La Liga, German Bundesliga, French Ligue 1 and Turkish Super League, the roster value, or market value, of football clubs in those leagues has been €132,000,000 on average between 2010-11 and 2017-18 seasons. More specifically, FC Barcelona reached to the level of the most expensive football club by €787,200,000 roster value in 2016-17. On the other hand, the lowest roster value was recorded in Akhisar Belediyespor SK by €11,950,000 in 2012-13 season.

4.4. Methodology

In this chapter, we cannot use the unconditional order-m approach adopted in Chapter 3, as it is ill-suited to deal with interactive categorical variables that are at the heart of the DiD analysis. Estimating efficiency around windows of similar observations (in terms of contextual variables) collapses when these interaction terms are considered. We will present instead an approach characterised by the combination of DEA for the measurement of efficiency of football teams and a set of regression-based techniques for the application of a DiD setup on these efficiency measures. It must be however stressed from the outset that we are not interested in a two-stage analysis of efficiency in order to analyse extensively various sources of relative inefficiency. Rather, regression analysis is used because of its convenience for implementing the DiD protocol.

The DiD method provides robust estimates of the policy reform if information is available before and after policy intervention about the units included and excluded from the policy, but not on the selection process (see, for example, Meyer, 1995; Angrist and Krueger, 1999). It measures the impact of a change on an outcome by comparing the change over a period in the dependent variable for the treatment group, checking against the change over the same period for the control group. To better understand the structure of the method, let us immediately take the example of the introduction of foreign players' quota in Turkish football. As neither this quota, nor any other relavant policy changes, were introduced in the big five leagues in the period under scrutiny, one can use the latter as a control group to compare the change occurred after the introduction of foreign players' quota in Turkey.

The DiD analysis follows a basic Analysis-of-Variance format. For computational reasons, however, it is convenient to implement it by means of a regression analysis. Our baseline estimates are obtained through the following Ordinary Least Squares (OLS) model with fixed effects at the team level:

$$Efficiency_{it} = \beta_0 + \beta_1 After_t + \beta_2 Turkey_i + \beta_3 DiD_{it} + \mu_i + \varepsilon_{it,} \quad (1)$$

where $Efficiency_{it}$ is the technical efficiency of a team i at time t, $After_t$ is a dummy variable taking the value 1 for the period after the foreign players' quota came into force and 0 otherwise, $Turkey_i$ is a dummy for Turkish teams, Finally, DiD_{it} is the interaction term between $After_t$ and the treatment status. The coefficient β_3 attached to DiD_{it} is our ATE (Average Treatment Effect) estimate, measuring the difference in terms of technical efficiency between Turkish and other teams, before and after the implementation of the law. Term ε_{it} is a stochastic error (in all OLS regressions, standard errors are robust to heteroscedasticity). Fixed effects μ_i account for time-invariant characteristics of a given team. We allow for them, because these persistent characteristics are possibly related not only to the probability of being treated, but also to the impact of the treatment. Hence, as explained in Wooldridge (2002, p. 78), their inclusion contributes to a more robust policy evaluation.

Equation [1] apparently follows the protocol of a two-stage analysis of efficiency, where efficiency scores are first obtained through non-parametric methods and then regressed in order to analyse extensively various sources of relative inefficiency. There are however some

important differences between the present analysis and two-stage approaches. We proceed now to clarify these differences.

In the literature, two main approaches are suggested to consider indicators of the economic or institutional environment within DEA (Cordero-Ferrera *et al.*, 2008; Narbón Perpiñá and De Witte, 2018). The first, one-stage, approach partitions the sample (according to categories of the contextual variables) or includes contextual indicators as inputs when estimating the efficiency frontier (Charnes *et al.,* 1981). The second, two-stage, approach first uses DEA techniques to evaluate the relative DMU efficiency and then regresses the DEA efficiency scores on a set of appropriate covariates. Some econometric problems with the latter approach have been highlighted in the literature (see, e. g., Simar and Wilson, 2007).

In our case, the implementation of a one-stage approach would be problematic if we wanted to allow for team fixed effects. As recalled by Cordero-Ferrera *et al.* (2008), including a large number of variables in the production set would push virtually all the observations on the efficient frontier, rendering the analysis meaningless. However, our dataset makes it possible to partition the sample across categories of interest (pre- and post-reform years; Turkish vs. Turkish teams) and still obtain reasonably large samples. Then, by performing a DiD analysis over the DEA scores obtained in this way we enact the one-stage approach first proposed in Charnes *et al.* (1981)[1]. Also recall that the DEA estimator for technical efficiency is biased by construction (Simar and Wilson 2007). As this bias may be relevant, in our analysis, a bootstrap method has been used to correct it (Simar and Wilson, 1998).

In our baseline setup, equation [1] is estimated through fixed-effect OLS. However, regression analysis of DEA efficiency scores has often stressed the peculiar nature of the outcome variable, bounded between zero and one and with the unity value occurring with non-zero probability for efficient DMU's. Various estimation methods have been proposed to take into proper account these data features. Most notable among them are the truncated regression model proposed in Simar and Wilson (2007) and the fractional regression model described in Ramalho *et al.* (2010). Simar and Wison also propose a bootstrap-based correction of the regression standard errors that allows for the fact that efficiency scores are not (by construction) i.i.d. variables. In our empirical analysis we also provide estimates based on the truncated regression and the fractional regression models. In both these cases, reasons

[1] To be sure, the analogy is complete only when a random effect panel technique is used. Here we prefer fixed effect techniques for the reasons explained above. In any case, it turns out that both estimation procedures yield basically the same results.

of computational feasibility imply the substitution of team fixed effects with country fixed effects.

Truncated regression models account for the situations in which valued sample in dependent variable place upper or lower bound of tresholds in which left out of the observation sample. Simar and Wilson approach is one well known of application among truncated regression models. It maximizes the likelihood function that follows:

$$\mathcal{L}_1 = \prod_{i=1}^{n} \frac{1}{\sigma_\varepsilon} \phi \left(\frac{\theta_i - \mathcal{Z}_i\beta}{\sigma_\varepsilon}\right) \left[1 - \emptyset \left(\frac{c_i - \mathcal{Z}_i\beta}{\sigma_\varepsilon}\right)\right]^{-1} \quad (2)$$

where $\phi(\dots)$ refers to standard normal density and $\emptyset(\dots)$ refers to the distribution function in the equation.

$$\mathcal{L}_2 = \prod_{i|\theta_i > c_i}^{n} \frac{1}{\sigma_\varepsilon} \phi \left(\frac{\theta_i - \mathcal{Z}_i\beta}{\sigma_\varepsilon}\right) \left[1 - \emptyset \left(\frac{c_i - \mathcal{Z}_i\beta}{\sigma_\varepsilon}\right)\right]^{-1} x\ Prob(\mathcal{v}_i > c_i|\alpha)$$
$$x \prod_{i|} \theta_i = c_i \left[1 - Prob(\mathcal{v}_i > c_i|\alpha)\right] \quad (3)$$

where the probability of $\mathcal{v}_i > c_i$ is driven by the determination of $\mathcal{v}$. The final form of their model is shaped after the substraction of probability function occurred above.

$$\mathcal{L}_3 = \prod_{i|\theta_i > c_i}^{n} \frac{1}{\sigma_\varepsilon} \phi \left(\frac{\theta_i - \mathcal{Z}_i\beta}{\sigma_\varepsilon}\right) \prod_{i|\theta_i = c_i}^{n} \emptyset \left(\frac{c_i - \mathcal{Z}_i\beta}{\sigma_\varepsilon}\right) \quad (3)$$

On the other hand, the Fractional Regression Model (FRM), developed by Papke and Wooldridge (2008), and applied to the field of efficiency analysis by Ramalho *et al.* (2010) is an econometrical tool for measuring the variables that take all possible values inside the unit interval. Indeed, if y is bounded between 0 and 1, so the effect of any particular x_j cannot be constant throughout the range of x (unless the range of x_j is very limited). To some extent this problem can be overcome by augmenting a linear model with non-linear functions of x, but

the predicted values from an OLS regression can never be guaranteed to lie in the unit interval. The drawbacks of linear models for fractional data are analogous to the drawbacks of the linear probability model for binary data.

Summing up, we apply a DEA model, selected through a search similar to that described in the previous chapter, separately for Turkey and the big five leagues, and for the periods before and after the Turkish reform. We prefer to use DEA rather than other non-parametric techniques (e.g. FDH), because DEA provides more asymptotically consistent estimates in small samples (Daraio and Simar, 2007). In order to get more information, we provide both input- and output-oriented efficiency scores. Then, in order to detect the impact of the reform (the change in foreign players' quota, actually) on Turkish football, a DiD analysis is performed on these DEA scores, using fixed- and random-effects OLS models, as well as truncated and fractional regression models.

Tables 29 and 30 below respectively indicate the production sets that have been chosen and the sample sizes upon which the DEA models have been estimated.

Table 29. Production Sets of Inputs and Outputs for DEA Model

PRODUCTION SETS	INPUT (X)	OUTPUT (Y)
Offensive	*Fouled + Corners + Penalties + Shots*	*Goals Scored + Points*
Defensive	*Interceptions + Saves + Offsides + Received Shots + Fouls*	*Goals Conceded + Points*
Team	*Discipline + Ball Possession*	*Goal rate + Points*

NB: Received Shots and Fouls, Discipline and Goals Conceded are considered as inverse forms.

Table 30. The Sample Sizes for DEA Model

LEAGUES/ PERIODS	*Before Reform*	*After Reform*
Turkish Süper Lig	***90***	***54***
Big five leagues	***490***	***294***

4.5. Findings from DEA Models

Table 31 illustrates the average offensive, defensive and team efficiency of football teams in these leagues under scrutiny for the seasons between 2010-11 and 2017-18.

Table 31. The Bias-corrected Efficiency Scores for DEA Models, Mean Values

	INPUT ORIENTATION					
LEAGUES/PERIOD	**Before Reform**			**After Reform**		
	Offensive	**Defensive**	**Team**	**Offensive**	**Defensive**	**Team**
Turkish Süper Lig	0.865	0.979	0.893	0.878	0.974	0.948
Big Five Leagues	0.837	0.925	0.841	0.839	0.945	0.809
English Premier League	0.878	0.922	0.839	0.872	0.943	0.796
Italian Serie A	0.805	0.942	0.836	0.807	0.957	0.825
Spanish La Liga	0.829	0.909	0.859	0.848	0.934	0.839
German Bundesliga	0.818	0.927	0.836	0.817	0.940	0.779
French Ligue 1	0.851	0.924	0.834	0.851	0.937	0.804
	OUTPUT ORIENTATION					
LEAGUES/PERIOD	**Before Reform**			**After Reform**		
	Offensive	**Defensive**	**Team**	**Offensive**	**Defensive**	**Team**
Turkish Süper Lig	0.699	0.769	0.637	0.737	0.750	0.730
Big Five Leagues	0.613	0.623	0.529	0.642	0.646	0.521
English Premier League	0.642	0.625	0.538	0.678	0.626	0.519
Italian Serie A	0.575	0.672	0.527	0.617	0.695	0.531
Spanish La Liga	0.604	0.599	0.571	0.670	0.620	0.559
German Bundesliga	0.591	0.630	0.476	0.593	0.672	0.472
French Ligue 1	0.663	0.599	0.535	0.653	0.625	0.525

NB: As usual in the literature, we provide scores bounded between zero and one (the latter standing for full efficiency) also for output-oriented efficiency scores.

When comparing the efficiency of Turkish Süper Lig with the other five European Leagues, it is important to remark that the Turkish sample is much smaller. Hence, although a bias correction has been implemented through bootstrap, the Turkish teams' scores may be biased upwards. There is no reason to believe, however, that this bias changes across the reform years.

Accordingly, it is seen that Süper Lig clubs have displayed more efficiency in defensive performance rather than offensive and team performance during these eight seasons. Apparently, the 2014-15 reform helped the Turkish treams to provide a better team performance. Further interpretation must however be kept for the DiD analysis.

4.6. Findings of Difference-in-Differences Analysis

In this part of the research, both input and output-oriented bias-corrected scores are analysed through regression analysis, using fixed- and random-effects OLS, truncated and fractional regression models are also presented and interpreted in detail. Tables 32-35 display the main results from regression analysis.

Table 32 provides the team fixed-effect OLS regression model results for input and output-oriented offensive, defensive and team efficiency. The initial season is excluded from the model in order to prevent multicollinearity problems.

Table 32. Team Fixed-effect OLS Models on Bias-corrected Efficiency Scores For Offensive, Defensive and Team Performance

Variables	Input-Oriented			Output-Oriented		
	Offensive	**Defensive**	**Team**	**Offensive**	**Defensive**	**Team**
Season 11-12$_i$	0.004 (0.659)	-0.003 (0.488)	0.001 (0.859)	-0.011 (0.487)	**-0.026** **(0.088*)**	-0.001 (0.953)
Season 12-13$_i$	**0.019** **(0.018**)**	-0.002 (0.690)	0.005 (0.344)	-0.004 (0.802)	**-0.034** **(0.036**)**	0.004 (0.814)
Season 13-14$_i$	**0.018** **(0.070*)**	**0.010** **(0.038**)**	-0.004 (0.584)	-0.004 (0.834)	-0.026 (0.141)	-0.022 (0.161)
Season 14-15$_i$	**0.024** **(0.014**)**	-0.002 (0.812)	0.002 (0.826)	0.012 (0.498)	**-0.064** **(0.000***)**	-0.020 (0.178)
Season 15-16$_i$	0.004 (0.733)	**0.013** **(0.014**)**	**-0.030** **(0.000***)**	0.012 (0.511)	-0.020 (0.264)	-0.013 (0.414)
Season 16-17$_i$	**0.020** **(0.044**)**	**0.021** **(0.000***)**	**-0.032** **(0.000***)**	0.024 (0.182)	-0.004 (0.849)	-0.012 (0.469)

Season 17-18$_i$	**0.022 (0.026**)**	**0.027 (0.000***)**	**-0.037 (0.000***)**	0.018 (0.361)	-0.007 (0.712)	-0.024 (0.159)
Reform$_{it}$	**0.023 (0.089*)**	**-0.022 (0.000***)**	**0.090 (0.000***)**	0.006 (0.836)	-0.027 (0.254)	**0.085 (0.000***)**
R^2	***0.03***	***0.10***	***0.18***	***0.02***	***0.03***	***0.04***

*** Reform$_{it}$ refers the implementation of new foreign players' quota.**
**** Seasons from 2011-12 to 2017-18 are dummy variables for *i* team.**

The key variable is *Reform$_{it}$*, showing the effect of the change in foreign players' quota after 2015-16 season on the offensive, defensive and team efficiency of football clubs in Turkish Super League.

According to the results of input-oriented production sets, the reform enacted by TFF has a significant and positive effect on offensive efficiency of Turkish football clubs. Efficiency increases by 2.3% in comparison with teams from other leagues. Similar to offensive efficiency, reform implementation made by TFF affects Turkish teams positively by 9.0% on team efficiency. On the contrary, reform implementation has a significant and negative impact on defensive efficiency of 2.2%.

For the output-oriented production sets, the change in foreign players' quota does not have significant impact on either offensive or defensive efficiency of football clubs on Turkish football teams. Yet, a positive and significant effect of reform implementation by 8.5% on the efficiency of team performance is detected for Turkish football clubs.

Table 33 shows team random-effect OLS regression model results for input and output-oriented offensive, defensive and team efficiency. Since there are no longer team fixed-effects, we can now use country-level fixed effects. We exclude the country dummy for Turkey in order to avoid the multicollinearity trap.

Table 33. Team Random-effect OLS Models on bias-corrected efficiency scores for offensive, defensive and team performance

Variables	**Input-Oriented**			**Output-Oriented**		
	Offensive	**Defensive**	**Team**	**Offensive**	**Defensive**	**Team**
Season 11-12$_i$	0.004 (0.668)	-0.003 (0.514)	0.002 (0.741)	-0.009 (0.570)	-0.022 (0.154)	0.004 (0.783)
Season 12-13$_i$	**0.018 (0.016**)**	-0.003 (0.517)	0.005 (0.316)	0.004 (0.800)	**-0.028 (0.072*)**	0.006 (0.634)
Season 13-14$_i$	0.012	**0.009**	-0.004	0.003	-0.019	-0.016

	(0.137)	**(0.039**)**	(0.569)	(0.902)	(0.271)	(0.283)
Season 14-15$_i$	**0.022**	-0.003	0.001	0.017	**-0.059**	-0.016
	(0.018)**	(0.507)	(0.869)	(0.277)	**(0.000***)**	(0.282)
Season 15-16$_i$	0.001	**0.011**	**-0.029**	0.017	-0.009	-0.004
	(0.972)	**(0.015**)**	**(0.000***)**	(0.298)	(0.606)	(0.811)
Season 16-17$_i$	**0.021**	**0.019**	**-0.031**	**0.032**	0.002	-0.005
	(0.022)**	**(0.000***)**	**(0.000***)**	**(0.053*)**	(0.912)	(0.771)
Season 17-18$_i$	**0.022**	**0.025**	**-0.037**	0.028	0.003	-0.014
	(0.016)**	**(0.000***)**	**(0.000***)**	(0.119)	(0.892)	(0.374)
England$_{it}$	0.012	**-0.054**	**-0.058**	**-0.060**	**-0.148**	**-0.127**
	(0.233)	**(0.000***)**	**(0.000***)**	**(0.005***)**	**(0.000***)**	**(0.000***)**
Gemany$_{it}$	**-0.050**	**-0.053**	**-0.062**	**-0.121**	**-0.127**	**-0.171**
	(0.000*)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**
France$_{it}$	-0.013	**-0.056**	**-0.055**	**-0.058**	**-0.165**	**-0.123**
	(0.199)	**(0.000***)**	**(0.000***)**	**(0.005***)**	**(0.000***)**	**(0.000***)**
Italy$_{it}$	**-0.060**	**-0.039**	**-0.042**	**-0.132**	**-0.103**	**-0.127**
	(0.000*)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**
Spain$_{it}$	**-0.029**	**-0.068**	**-0.030**	**-0.083**	**-0.162**	**-0.077**
	(0.002*)**	**(0.000***)**	**(0.001***)**	**(0.001***)**	**(0.000***)**	**(0.005***)**
Reform$_{it}$	0.012	**-0.024**	**0.088**	0.012	**-0.037**	**0.083**
	(0.347)	**(0.000***)**	**(0.000***)**	(0.637)	**(0.099*)**	**(0.000***)**
R^2	***0.03***	***0.10***	***0.18***	***0.02***	***0.03***	***0.04***

*** Reform$_{it}$ refers the implementation of new foreign players' quota.**
**** Seasons from 2011-12 to 2017-18 are dummy variables for *i* team.**
***** England$_{it}$, Germany$_{it}$, France$_{it}$, Italy$_{it}$ and Spain$_{it}$ are country dummy variables.**

Regarding to the input-oriented results, it can be mentioned that the country efficiency rankings are similar to those obtained in the previous chapter, at least from what one can see from the output-oriented scores (Turkish teams are the most efficient, but this is probably due to an upward bias in their efficiency scores). The reform implementation made by Turkish Football Federation does not have significant effect on the offensive efficiency of Turkish football clubs (although *Reform*$_{it}$ has a positive coefficient). On the other hand, reform implementation has a significant and negative impact on the defensive efficiency of Turkish football clubs (by 2.4% and 3.7%) and affects Turkish teams positively (by 8.8% and 8.3%) as fas as team efficiency is concerned.

Table 34 displays the results of truncated regression for input and output-oriented offensive, defensive and team efficiency.

Table 34. Truncated Regression Models on Bias-corrected Efficiency Scores For Offensive, Defensive and Team Performance

Variables	Input-Oriented			Output-Oriented		
	Offensive	**Defensive**	**Team**	**Offensive**	**Defensive**	**Team**
Season 11-12$_i$	0.004	-0.004	0.002	-0.009	-0.024	0.006
	(0.684)	(0.559)	(0.780)	(0.618)	(0.253)	(0.782)
Season 12-13$_i$	**0.020**	-0.005	0.003	0.006	-0.031	0.005
	(0.040)**	(0.441)	(0.674)	(0.766)	(0.145)	(0.790)
Season 13-14$_i$	0.015	**0.012**	-0.005	0.007	-0.016	-0.009
	(0.116)	**(0.059*)**	(0.436)	(0.732)	(0.466)	(0.583)
Season 14-15$_i$	**0.024**	-0.005	0.001	0.021	**-0.063**	-0.011
	(0.012)**	(0.441)	(0.992)	(0.261)	**(0.002***)**	(0.563)
Season 15-16$_i$	-0.001	**0.013**	**-0.029**	0.020	-0.005	0.006
	(0.996)	**(0.057*)**	**(0.000***)**	(0.303)	(0.811)	(0.777)
Season 16-17$_i$	**0.023**	**0.024**	**-0.031**	**0.036**	0.006	0.005
	(0.019)**	**(0.000***)**	**(0.000***)**	**(0.052*)**	(0.804)	(0.820)
Season 17-18$_i$	**0.024**	**0.035**	**-0.038**	**0.036**	0.012	0.001
	(0.016)**	**(0.000***)**	**(0.000***)**	**(0.053*)**	(0.577)	(0.992)
England$_{it}$	0.012	**-0.114**	**-0.061**	**-0.066**	**-0.180**	**-0.113**
	(0.253)	**(0.000***)**	**(0.000***)**	**(0.001***)**	**(0.000***)**	**(0.000***)**
Gemany$_{it}$	**-0.053**	**-0.113**	**-0.069**	**-0.123**	**-0.161**	**-0.178**
	(0.000*)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**
France$_{it}$	**-0.017**	**-0.116**	**-0.061**	**-0.061**	**-0.197**	**-0.121**
	(0.073*)	**(0.000***)**	**(0.000***)**	**(0.002***)**	**(0.000***)**	**(0.000***)**
Italy$_{it}$	**-0.065**	**-0.091**	**-0.051**	**-0.0129**	**-0.115**	**-0.111**
	(0.000*)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**
Spain$_{it}$	**-0.032**	**-0.129**	**-0.032**	**-0.086**	**-0.189**	**-0.070**
	(0.001*)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**
Reform$_{it}$	0.013	**-0.046**	**0.108**	0.023	-0.054	**0.091**
	(0.374)	**(0.002***)**	**(0.000***)**	(0.417)	(0.114)	**(0.000***)**
$P > Chi^2$	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***

*** Reform$_{it}$ refers the implementation of new foreign players' quota.**
**** Seasons from 2011-12 to 2017-18 are dummy variables for *i* team.**
***** England$_{it}$, Germany$_{it}$, France$_{it}$, Italy$_{it}$ and Spain$_{it}$ are country dummy variables.**

According to the results for input-oriented model, the change on foreign players' quota does not have significant impact on offensive efficiency of Turkish football clubs. Contrarily, it has a significant and negative impact on defensive efficiency by 4.6% on Turkish football clubs, while causing a significant efficiency rise by 10.8% on the team performance of Turkish clubs.

Also for the output-oriented production sets, reform implementation has an insignificant but positive impact on the offensive efficiency of Turkish football clubs. For defensive efficiency, the effect is also insignificant, but sign of the DiD term is negative. Yet, reform implementation made by the TFF has a significant and positive impact on team efficiency of football teams by 9.1% in Turkish Süper Lig. As in the case of the team random-effects estimates, the sign and size of the country dummies is consistent with what we found in the previous chapter.

Table 35 shows the results of fractional logit regression models regarding to input- and output-oriented for offensive, defensive and team efficiency.

Table 35. Fractional Logit Regression Models on Bias-corrected Efficiency Scores For Offensive, Defensive and Team performance, marginal effects

Variables	**Input-Oriented**			**Output-Oriented**		
	Offensive	**Defensive**	**Team**	**Offensive**	**Defensive**	**Team**
Season 11-12$_i$	-0.008	-0.003	0.005	-0.015	-0.025	0.010
	(0.922)	(0.490)	(0.411)	(0.406)	(0.251)	(0.597)
Season 12-13$_i$	0.139	-0.003	0.007	0.005	-0.027	0.007
	(0.122)	(0.455)	(0.382)	(0.773)	(0.199)	(0.704)
Season 13-14$_i$	0.108	**0.011**	-0.004	0.013	0.003	-0.012
	(0.274)	**(0.019**)**	(0.533)	(0.540)	(0.884)	(0.548)
Season 14-15$_i$	**0.189**	-0.001	0.004	0.033	**-0.048**	-0.007
	(0.042)**	(0.773)	(0.499)	(0.232)	**(0.028**)**	(0.724)
Season 15-16$_i$	-0.007	0.006	**-0.014**	0.018	-0.001	0.018
	(0.933)	(0.203)	**(0.050**)**	(0.323)	(0.965)	(0.377)
Season 16-17$_i$	**0.193**	**0.014**	**-0.018**	**0.042**	0.009	0.007
	(0.041)**	**(0.005***)**	**(0.005***)**	**(0.029**)**	(0.711)	(0.730)
Season 17-18$_i$	**0.267**	**0.025**	**-0.026**	**0.050**	0.041	0.001
	(0.008*)**	**(0.000***)**	**(0.000***)**	**(0.018**)**	(0.119)	(0.948)
England$_{it}$	0.081	**-0.065**	**-0.071**	**-0.056**	**-0.165**	**-0.142**
	(0.537)	**(0.000***)**	**(0.000***)**	**(0.024**)**	**(0.000***)**	**(0.000***)**
Gemany$_{it}$	**-0.537**	**-0.067**	**-0.082**	**-0.131**	**-0.158**	**-0.199**
	(0.000*)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**
France$_{it}$	-0.210	**-0.070**	**-0.074**	**-0.066**	**-0.196**	**-0.152**
	(0.104)	**(0.000***)**	**(0.000***)**	**(0.007***)**	**(0.000***)**	**(0.000***)**
Italy$_{it}$	**-0.067**	**-0.049**	**-0.057**	**-0.145**	**-0.110**	**-0.130**
	(0.000*)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**	**(0.000***)**
Spain$_{it}$	**-0.035**	**-0.079**	**-0.023**	**-0.097**	**-0.203**	**-0.059**
	(0.006*)**	**(0.000***)**	**(0.022**)**	**(0.000***)**	**(0.000***)**	**(0.027**)**
Reform$_{it}$	0.126	**-0.021**	**0.128**	0.021	-0.036	**0.112**

	(0.522)	**(0.067*)**	**(0.000***)**	(0.596)	(0.447)	**(0.006***)**
R^2	***0.15***	***0.21***	***0.36***	***0.11***	***0.11***	***0.19***

*** Reform$_{it}$ refers the implementation of new foreign players' quota.**
**** Seasons from 2011-12 to 2017-18 are dummy variables for *i* team.**
***** England$_{it}$, Germany$_{it}$, France$_{it}$, Italy$_{it}$ and Spain$_{it}$ are country dummy variables.**

All the results from table 35 are qualitatively very similar to those in table 34.

Summing up, it can be said the foreign players' quota reform had weakly positive effects on the offensive performance of Turkish football teams, strongly positive effects on their team efficiency, and negative (although not always significant) effects on their defensive efficiency. Hence, it can be said that the reform, at least to some extent, fulfilled its aims. All this is in broad agreement with the relative strength of the influence of foreign players ratio on offensive, defensive and team efficiency that could be gathered for the big five leagues in the previous chapter.

"*Now, we all are aware of the main issues on our football. In fact, we moved further on diagnostic. A treatment, very radical one, is needed immediately. We all agree on that case. It is the time to act rather than to give statements. We do not need a change, but we need reform." Fatih Terim, 9th of January 2014*

Let us to conclude this chapter with the pioneer of the problem detection on Turkish football, Mr.Fatih Terim. As he mentioned about the necessity of reform on Turkish football, began to 'heal' the wound and most of the football authorities touch on this process of his important detection.

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APPENDIX

Table A1: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in English Premier League Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	Chelsea FC	0.981981	1.000000	0.944557
	Manchester United FC	1.032215	1.000000	0.901144
	Tottenham Hotspur FC	1.221054	0.993407	0.965626
	Arsenal FC	1.013041	1.133320	1.128287
	Aston Villa FC	1.000000	1.000000	0.999743
	Manchester City FC	0.995158	1.000000	0.998098
	Liverpool FC	1.178649	1.000000	1.089170
	Everton FC	0.999968	1.000000	1.060446
	Birmingham City FC	1.099986	1.000000	1.099998
	Sunderland AFC	1.000000	1.000000	1.249999
	West Ham United FC	1.404152	1.000000	1.765218
	Fulham FC	1.000000	1.000000	1.537487
	Bolton Wanderers FC	1.000000	1.000000	1.000000
	Stoke City FC	1.000000	1.000000	1.000000
	Wigan Athletic FC	1.540464	1.000000	1.913680
	Blackburn Rovers FC	1.000000	1.099998	1.000000
	Portsmouth FC	1.147059	1.178573	2.602906
	Wolverhampton Wanderers FC	1.000000	1.000000	1.447360
	Burnley FC	1.166677	1.000000	2.000000
	Hull City AFC	1.000000	1.000000	1.833332
2010-2011	Chelsea FC	1.113037	1.014076	1.272703
	Manchester United FC	0.999993	1.000000	1.086971
	Arsenal FC	0.995260	1.249999	1.394348
	Manchester City FC	0.999344	1.137932	1.240127
	Tottenham Hotspur FC	1.445271	1.112906	1.205432
	Liverpool FC	0.999994	1.000000	0.999694
	Fulham FC	1.000000	1.000000	1.317818
	Bolton Wanderers FC	1.000000	1.000000	1.195651
	Sunderland AFC	1.000000	1.106386	1.170225
	Aston Villa FC	1.020828	1.000000	1.290638
	Everton FC	1.331132	1.000000	1.200956
	Wigan Athletic FC	1.099998	1.023761	1.309529
	Newcastle United FC	1.016469	1.000000	1.345091
	West Ham United FC	1.000000	1.372548	1.666666
	Stoke City FC	1.000000	1.000000	1.000000
	Blackburn Rovers FC	1.000000	1.000000	1.000000
	Blackpool FC	1.000000	1.000000	1.815679
	West Bromwich Albion FC	1.000000	1.075676	1.425431
	Birmingham City FC	1.000000	1.000000	1.410243
	Wolverhampton Wanderers FC	1.000000	1.000000	1.549995
2011-2012	Chelsea FC	1.180297	1.206348	1.419358
	Manchester United FC	0.999997	1.000000	0.953456
	Arsenal FC	0.997905	1.240452	1.354559
	Manchester City FC	0.997723	1.000000	0.977393
	Tottenham Hotspur FC	1.207980	1.000000	1.069422
	Liverpool FC	1.211528	1.210066	1.139149
	Fulham FC	1.000000	1.000000	1.352741
	Bolton Wanderers FC	1.130385	1.000000	1.527867
	Sunderland AFC	1.000000	1.466411	1.222072
	Aston Villa FC	1.289486	1.000000	1.630286
	Everton FC	1.137593	1.000000	1.156462
	Wigan Athletic FC	1.142815	1.000000	1.279068
	Newcastle United FC	0.999995	1.000000	1.030125
	Swansea City AFC	1.000000	1.000000	1.170225
	Stoke City FC	1.000000	1.022223	1.022223
	Blackburn Rovers FC	1.020832	1.322056	1.266946
	Queens Park Rangers FC	1.139532	1.000000	1.914713
	West Bromwich Albion FC	1.000000	1.000000	1.382975
	Norwich City FC	1.000000	1.000000	1.170225
	Wolverhampton Wanderers FC	1.000000	1.907003	2.479990

Table A1: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in English Premier League Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	Manchester United FC	0.999994	1.000000	1.026443
	Arsenal FC	0.998713	1.027383	1.268131
	Liverpool FC	1.409825	1.180296	1.491651
	Tottenham Hotspur FC	0.999999	1.000000	1.192837
	Chelsea FC	0.999585	1.040015	1.138828
	Manchester City FC	1.000000	1.000000	1.170800
	Everton FC	1.000000	1.000000	1.369189
	Swansea City AFC	1.000000	1.000000	1.894544
	Fulham FC	1.000000	1.000000	1.793952
	Aston Villa FC	1.000000	1.000000	1.555559
	Southampton FC	1.000000	1.363649	1.694627
	West Ham United FC	1.000000	1.000000	1.195651
	Sunderland AFC	1.102620	1.000000	1.410243
	Queens Park Rangers FC	1.466656	1.428571	2.475187
	Newcastle United FC	1.244246	1.024379	2.165723
	Stoke City FC	1.000000	1.000000	1.309529
	West Bromwich Albion FC	1.000000	1.000000	1.122456
	Wigan Athletic FC	1.042553	1.000000	2.276631
	Norwich City FC	1.000000	1.000000	1.249999
	Reading FC	1.139532	1.000000	1.964299
2013-2014	Liverpool FC	0.994306	1.000000	1.077521
	Manchester City FC	1.000000	1.000000	1.061535
	Chelsea FC	0.999999	1.000000	1.057199
	Arsenal FC	0.999684	1.000000	1.159938
	Everton FC	1.129881	1.083323	1.191665
	Manchester United FC	1.077225	1.000000	1.418185
	Southampton FC	1.000000	1.352932	1.497605
	Crystal Palace FC	1.088877	1.000000	1.066644
	Tottenham Hotspur FC	0.999999	1.000000	1.168483
	Stoke City FC	1.000000	1.000000	1.269336
	Newcastle United FC	1.000000	1.102037	1.750418
	Swansea City AFC	1.000000	1.000000	2.184001
	West Ham United FC	1.099998	1.000000	1.375002
	West Bromwich Albion FC	1.162821	1.638883	1.721793
	Hull City AFC	1.000000	1.000000	1.486355
	Aston Villa FC	1.000000	1.105263	1.447360
	Sunderland AFC	1.157886	1.000000	1.630830
	Fulham FC	1.099998	1.249999	1.749594
	Norwich City FC	1.000000	1.000000	1.697171
	Cardiff City FC	1.375002	1.000000	1.833316
2014-2015	Arsenal FC	1.272716	1.000000	1.200450
	Manchester City FC	1.000000	1.000000	1.186742
	Chelsea FC	0.995755	1.000000	1.018064
	Manchester United FC	0.999937	1.088242	1.390762
	Southampton FC	1.000000	1.000000	1.349798
	Liverpool FC	1.072064	1.403237	1.391979
	Tottenham Hotspur FC	1.000000	1.031246	1.308334
	Stoke City FC	1.000000	1.000000	1.619375
	Swansea City AFC	1.000000	1.000000	1.386817
	West Ham United FC	1.000000	1.000000	1.307540
	Leicester City FC	1.043470	1.000000	1.341456
	Crystal Palace FC	0.999804	1.000000	1.145837
	Everton FC	0.999997	1.000000	1.832573
	Burnley FC	1.303037	1.000000	1.666667
	West Bromwich Albion FC	1.000000	1.000000	1.249999
	Queens Park Rangers FC	1.166677	1.000000	1.833332
	Hull City AFC	1.228561	1.000000	1.571416
	Sunderland AFC	1.419354	1.000000	1.447360
	Newcastle United FC	1.424956	1.125009	1.683714
	Aston Villa FC	1.000000	1.096167	2.340635

Table A1: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in English Premier League Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	Arsenal FC	1.332818	1.000000	1.287509
	Leicester City FC	1.000000	1.000000	1.000000
	Tottenham Hotspur FC	1.115949	1.000000	0.979068
	Manchester City FC	0.999994	1.000000	1.352238
	West Ham United FC	1.058204	1.000000	1.020568
	Southampton FC	1.000000	1.000000	1.325434
	Liverpool FC	1.050027	1.000000	1.399310
	Everton FC	0.999929	1.000000	1.698929
	Chelsea FC	1.181637	1.472196	1.728271
	Manchester United FC	1.000000	1.000000	1.307072
	Watford FC	1.088877	1.000000	1.222214
	Crystal Palace FC	1.166565	1.000000	1.471605
	Sunderland AFC	1.000000	1.441855	1.410243
	Swansea City AFC	1.042553	1.000000	1.723521
	Stoke City FC	1.000000	1.000000	1.475496
	Newcastle United FC	1.000000	1.000000	1.729495
	West Bromwich Albion FC	1.139532	1.000000	1.000000
	AFC Bournemouth	1.047646	1.000000	1.828576
	Aston Villa FC	1.629624	1.000000	3.635098
	Norwich City FC	1.000000	1.000000	1.822205
2016-2017	Chelsea FC	1.000000	1.000000	0.978701
	Tottenham Hotspur FC	0.996972	1.000000	0.924935
	Manchester City FC	1.228127	1.000000	1.256680
	Liverpool FC	1.000000	1.000000	1.192206
	Arsenal FC	1.000000	1.079997	1.200833
	Manchester United FC	0.999968	1.000000	1.292832
	Everton FC	1.000000	1.000000	1.375868
	Southampton FC	1.043470	1.000000	1.819231
	AFC Bournemouth	0.999996	1.000000	1.686429
	West Bromwich Albion FC	1.000000	1.000000	1.000000
	West Ham United FC	1.000000	1.000000	1.657112
	Leicester City FC	1.000000	1.000000	1.249999
	Stoke City FC	1.000000	1.000000	1.395526
	Crystal Palace FC	0.999897	1.000000	1.509987
	Swansea City AFC	1.000000	1.000000	1.691130
	Burnley FC	1.000000	1.000000	1.375002
	Watford FC	1.000000	1.000000	1.549445
	Hull City AFC	1.000000	1.000000	1.821587
	Middlesbrough FC	1.000000	1.000000	2.271096
	Sunderland AFC	1.000000	1.000000	2.291674
2017-2018	Manchester City FC	1.000000	1.000000	0.990212
	Manchester United FC	1.000000	1.000000	1.067588
	Tottenham Hotspur FC	1.000000	1.000000	1.218232
	Liverpool FC	1.000000	1.000000	1.252360
	Chelsea FC	1.000000	1.000000	1.310729
	Arsenal FC	1.000000	1.000000	1.479134
	Burnley FC	1.000000	1.000000	1.018442
	Everton FC	1.000000	1.000000	1.262469
	Leicester City FC	1.000000	1.000000	1.475175
	Newcastle United FC	1.000000	1.000000	1.249999
	Crystal Palace FC	1.266684	1.022728	1.399330
	AFC Bournemouth	1.000000	1.000000	1.683811
	West Ham United FC	1.000000	1.000000	1.472289
	Watford FC	1.000000	1.000000	1.600332
	Brighton & Hove Albion FC	1.000000	1.000000	1.374988
	Huddersfield Town AFC	1.000000	1.189190	1.486410
	Southampton FC	1.162160	1.076934	2.353342
	Swansea City AFC	1.000000	1.000000	1.695504
	Stoke City FC	1.000000	1.000000	1.666667
	West Bromwich Albion FC	1.000000	1.000000	1.774218

Table A2: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Italian Serie A Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	Atalanta BC	1.324257	1.000000	1.000000
	FC Bari 1908	1.000000	1.000000	1.000000
	Bologna FC 1909	1.000000	1.000000	1.000000
	Cagliari Calcio	1.000000	1.000000	1.118561
	Calcio Catania	1.294977	1.000000	1.000000
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.000000
	ACF Fiorentina	1.020832	1.000000	1.170225
	Genoa CFC	0.999995	1.000000	1.000000
	FC Internazionale	0.967074	1.000000	1.000000
	Juventus FC	1.072560	1.000000	1.072721
	SS Lazio	1.530797	1.000000	1.000000
	AS Livorno Calcio	1.666667	1.000000	1.000000
	AC Milan	1.128241	1.000000	1.171432
	SSC Napoli	1.067740	1.000000	1.000000
	SSD Palermo	1.153133	1.000000	1.000000
	Parma Calcio 1913	0.999955	1.000000	1.000000
	AS Roma	1.009657	1.000000	1.000000
	UC Sampdoria	1.000000	1.000000	1.000000
	SS Robur Siena	1.199888	1.000000	1.000000
	Udinese Calcio	1.265472	1.000000	1.000000
2010-2011	FC Bari 1908	1.740755	1.000000	3.333355
	Bologna FC 1909	1.000000	1.000000	1.488889
	Brescia Calcio	1.673694	1.000000	1.000000
	Cagliari Calcio	1.022728	1.066644	1.111113
	Calcio Catania	1.099996	1.000000	1.000000
	AC Cesena	1.139532	1.000000	1.046514
	AC Chievo Hellas Verona FC	1.157886	1.000000	1.136854
	ACF Fiorentina	0.999999	1.000000	1.073180
	Genoa CFC	1.000000	1.097971	1.274500
	FC Internazionale	0.998771	1.000000	1.078949
	Juventus FC	0.998899	1.000000	1.137842
	SS Lazio	1.016180	1.000000	1.000000
	US Lecce	1.000000	1.000000	1.000000
	AC Milan	1.011707	1.000000	1.000000
	SSC Napoli	1.147668	1.000000	1.000000
	SSD Palermo	1.000000	1.000000	1.196439
	Parma Calcio 1913	1.345561	1.000000	1.000000
	AS Roma	1.137915	1.000000	1.269854
	UC Sampdoria	1.726978	1.088877	1.000000
	Udinese Calcio	1.056142	1.000000	1.000000
2011-2012	Atalanta BC	1.000000	1.000000	1.000000
	Bologna FC 1909	1.097966	1.000000	1.000000
	Cagliari Calcio	1.504867	1.121959	1.511399
	Calcio Catania	1.486610	1.000000	1.000000
	AC Cesena	2.136345	1.000000	2.500003
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.265302
	ACF Fiorentina	1.493680	1.021741	1.195651
	Genoa CFC	1.099865	1.000000	1.309529
	FC Internazionale	1.372080	1.206895	1.413295
	Juventus FC	0.992641	1.000000	1.110048
	SS Lazio	1.015314	1.000000	1.048339
	US Lecce	1.305518	1.000000	1.027769
	AC Milan	0.998156	1.000000	1.199598
	SSC Napoli	1.026419	1.000000	1.155938
	Novara Calcio	1.543016	1.000000	1.937543
	SSD Palermo	1.096135	1.000000	1.136854
	Parma Calcio 1913	1.237768	1.000000	1.000000
	AS Roma	0.999338	1.089285	1.464284
	SS Robur Siena	1.000000	1.022728	1.000000
	Udinese Calcio	0.999421	1.000000	0.999930

Table A2: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Italian Serie A Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	Atalanta BC	1.190479	1.000000	1.309529
	Bologna FC 1909	1.236121	1.130385	1.249996
	Cagliari Calcio	1.299071	1.000000	1.616936
	Calcio Catania	1.000000	1.000000	1.000000
	AC Chievo Hellas Verona FC	1.088877	1.000000	1.222214
	ACF Fiorentina	1.111893	1.000000	1.303282
	Genoa CFC	1.210521	1.000000	1.447360
	FC Internazionale	1.271143	1.000000	1.463290
	Juventus FC	1.070981	1.000000	1.137776
	SS Lazio	1.311179	1.000000	1.457974
	AC Milan	1.187190	1.000000	1.252325
	SSC Napoli	1.010433	1.000000	1.077293
	SSD Palermo	1.382347	1.173909	1.994328
	Parma Calcio 1913	1.399408	1.000000	1.183540
	Delfino Pescara 1936	1.814804	1.000000	2.500003
	AS Roma	1.136039	1.064516	1.479033
	UC Sampdoria	1.162672	1.000000	1.279068
	SS Robur Siena	1.000000	1.000000	1.527867
	Torino FC	1.174989	1.000000	2.163181
	Udinese Calcio	0.999990	1.000000	0.999755
2013-2014	Atalanta BC	1.000000	1.000000	1.495091
	Bologna FC 1909	1.995124	1.000000	1.896555
	Cagliari Calcio	1.435711	1.000000	1.940777
	Calcio Catania	1.667822	1.000000	1.718729
	AC Chievo Hellas Verona FC	1.323509	1.000000	1.527867
	ACF Fiorentina	1.193396	1.000000	1.522263
	Genoa CFC	1.113631	1.000000	1.452471
	FC Internazionale	1.000000	1.000000	1.450472
	Juventus FC	0.999539	1.000000	0.957571
	SS Lazio	1.053931	1.000000	1.552393
	AS Livorno Calcio	1.512552	1.000000	2.200000
	AC Milan	1.209863	1.000000	1.592457
	SSC Napoli	0.999761	0.999998	1.042906
	Parma Calcio 1913	0.999791	1.000000	0.999751
	AS Roma	0.997535	1.000000	1.167632
	UC Sampdoria	1.184238	1.000000	1.222214
	US Sassuolo Calcio	1.324924	1.000000	1.617653
	Torino FC	0.999998	1.000000	1.000000
	Udinese Calcio	1.258957	1.000000	1.925960
	Hellas Verona FC	0.992772	1.000000	1.018442
2014-2015	Atalanta BC	1.496836	1.000000	1.486441
	Cagliari Calcio	1.395098	1.114761	1.530024
	AC Cesena	1.000000	1.000000	2.291674
	AC Chievo Hellas Verona FC	1.162777	1.000000	1.279068
	Empoli FC	1.519091	1.000000	1.818294
	ACF Fiorentina	1.044159	1.000000	1.418973
	Genoa CFC	1.108234	1.000000	1.000000
	FC Internazionale	1.330221	1.000000	1.639909
	Juventus FC	1.095697	1.000000	1.024393
	SS Lazio	0.999824	1.000000	0.999817
	AC Milan	0.999827	1.000000	1.120735
	SSC Napoli	0.999789	1.380963	1.257386
	SSD Palermo	1.120143	1.000000	1.304210
	Parma Calcio 1913	1.303037	1.000000	1.000000
	AS Roma	1.178988	1.000000	1.000000
	UC Sampdoria	0.999998	1.000000	1.000000
	US Sassuolo Calcio	1.020405	1.000000	1.122460
	Torino FC	1.036899	1.000000	1.012506
	Udinese Calcio	1.000000	1.000000	1.341463
	Hellas Verona FC	1.021741	1.000000	1.195651

Table A2: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Italian Serie A Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	Atalanta BC	1.240490	1.000000	1.222214
	Bologna FC 1909	1.060610	1.125009	1.476170
	Carpi FC 1909	1.324208	1.000000	1.000000
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.099998
	Empoli FC	1.000000	1.000000	1.282591
	ACF Fiorentina	1.176428	1.000000	1.437358
	Frosinone	1.628565	1.000000	1.774218
	Genoa CFC	1.301030	1.000000	1.347498
	FC Internazionale	1.257702	1.000000	0.999274
	Juventus FC	1.031034	1.000000	0.992896
	SS Lazio	1.307269	1.000000	1.166401
	AC Milan	1.354257	1.000000	1.105212
	SSC Napoli	0.998341	1.000000	1.206087
	SSD Palermo	1.131572	1.000000	1.410243
	AS Roma	0.999389	1.000000	1.126382
	UC Sampdoria	1.062482	1.000000	1.000000
	US Sassuolo Calcio	0.997730	1.000000	1.026227
	Torino FC	1.074716	1.000000	1.000000
	Udinese Calcio	1.399599	1.000000	1.410243
	Hellas Verona FC	1.949083	1.000000	1.964299
2016-2017	Juventus FC	0.979532	1.000000	1.005142
	AS Roma	0.978434	1.000000	1.030021
	SSC Napoli	0.999660	1.000000	1.156782
	Atalanta BC	1.097124	1.000000	1.096705
	SS Lazio	0.998487	1.000000	0.994227
	AC Milan	1.169279	1.000000	1.262076
	FC Internazionale	1.120568	1.000000	1.228913
	ACF Fiorentina	1.229833	1.000000	1.533334
	Torino FC	0.999822	1.000000	1.508416
	US Sassuolo Calcio	1.031245	1.000000	1.347834
	UC Sampdoria	1.160762	1.125009	1.665635
	Cagliari Calcio	1.000000	1.000000	1.170225
	Udinese Calcio	1.042548	1.000000	1.222214
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.486026
	Bologna FC 1909	1.000000	1.000000	1.341463
	Genoa CFC	1.026380	1.000000	1.777798
	FC Crotone	1.147059	1.000000	1.000000
	Empoli FC	1.689624	1.000000	1.718729
	SSD Palermo	1.060610	1.000000	2.115395
	Delfino Pescara 1936	1.285714	1.000000	2.319035
2017-2018	Juventus FC	0.997460	1.000000	0.979820
	SSC Napoli	1.000000	1.000000	1.094602
	AS Roma	0.999833	1.000000	1.185158
	FC Internazionale	0.999997	1.000000	1.267050
	SS Lazio	1.000000	1.000000	0.997091
	AC Milan	1.231713	1.000000	1.280841
	Atalanta BC	1.207740	1.000000	1.336957
	ACF Fiorentina	0.999662	1.315789	1.399828
	UC Sampdoria	1.016873	1.000000	1.510948
	Torino FC	1.000000	1.000000	1.581002
	US Sassuolo Calcio	1.481648	1.000000	1.279068
	Genoa CFC	1.333330	1.000000	1.511212
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.375000
	Udinese Calcio	1.000000	1.000000	1.374988
	Cagliari Calcio	1.090909	1.000000	1.410243
	Bologna FC 1909	1.000000	1.000000	1.633743
	SPAL 2013	1.128192	1.000000	1.447360
	FC Crotone	1.000000	1.285714	1.571429
	Hellas Verona FC	1.000000	1.000000	2.200000
	Benevento Calcio	1.060610	1.000000	2.428566

Table A3: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Spanish La Liga Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	FC Barcelona	0.937994	0.999998	1.000000
	Real Madrid CF	0.897546	0.999960	0.999977
	RCD Mallorca	0.993924	1.000000	1.000000
	Valencia CF	0.998808	1.000000	1.000000
	Athletic Club de Bilbao	1.304402	1.000000	1.018442
	Villarreal CF	1.000000	1.388362	1.000000
	Sevilla FC	1.056241	1.000000	1.000000
	Club Atlético de Madrid	1.118711	1.000000	1.000000
	CD Tenerife	1.474791	1.305545	1.527867
	Real Zaragoza SAD	1.238710	1.146356	1.000000
	UD Almería	1.092948	1.142857	1.000000
	Getafe CF	1.182477	1.000000	1.000000
	RCD Espanyol	1.227284	1.000000	1.000000
	Real Sporting de Gijón	1.083323	1.074999	1.000000
	CA Osasuna	1.000000	1.000000	1.000000
	RC Deportivo de La Coruña	1.000000	1.000000	1.000000
	Málaga CF	1.000000	1.000000	1.000000
	Real Valladolid CF	1.277773	1.305545	1.527867
	Xerez CD	1.000000	1.000000	1.088249
	Real Racing Club de Santander	1.000000	1.000000	1.000000
2010-2011	Real Madrid CF	0.951831	1.000000	1.000000
	FC Barcelona	1.038866	0.999993	1.000000
	Villarreal CF	1.000000	1.080620	1.000000
	Valencia CF	1.000000	1.000000	1.000000
	Club Atlético de Madrid	0.999920	0.999924	1.000000
	Sevilla FC	1.064323	1.000000	1.086188
	RCD Mallorca	1.000000	1.363649	1.409069
	CA Osasuna	1.000000	1.000000	1.170225
	Athletic Club de Bilbao	0.999966	1.000000	1.000000
	Real Sporting de Gijón	1.042552	1.235303	1.170225
	Real Sociedad de Football SAD	1.000000	1.000000	1.222214
	Real Zaragoza SAD	1.244407	1.044444	1.000000
	Getafe CF	1.183630	1.227188	1.000000
	Real Racing Club de Santander	1.000000	1.302314	1.347835
	RC Deportivo de La Coruña	1.000000	1.174828	1.279068
	Hércules CF	1.249999	1.395343	1.571422
	RCD Espanyol	1.020406	1.244790	1.000000
	Málaga CF	0.999980	1.000000	1.000000
	Levante UD	1.000000	1.061229	1.000000
	UD Almería	1.000000	1.599996	1.833332
2011-2012	FC Barcelona	1.002068	1.043959	1.000000
	Real Madrid CF	0.884078	1.000000	1.000000
	Real Sociedad de Football SAD	1.000000	1.402693	1.319150
	Málaga CF	0.999841	1.464932	1.189417
	Club Atlético de Madrid	1.295282	1.000000	1.000000
	Villarreal CF	1.195097	1.358733	1.414632
	CA Osasuna	1.000000	1.000000	1.018442
	Levante UD	1.000000	1.163559	1.000000
	Sevilla FC	1.000000	1.338584	1.099998
	Valencia CF	1.000000	1.000000	1.000000
	Athletic Club de Bilbao	1.000000	1.081466	1.448997
	Real Betis Balompié SAD	1.000000	1.148805	1.234037
	Real Sporting de Gijón	1.357156	1.061526	1.000000
	RCD Espanyol	1.000000	1.065205	1.000000
	Real Zaragoza SAD	1.000000	1.302336	1.000000
	Rayo Vallecano de Madrid	1.000000	1.907003	1.000000
	RCD Mallorca	1.000000	1.000000	1.057685
	Getafe CF	1.000000	1.042553	1.000000
	Granada CF	1.333320	1.571428	1.000000
	Real Racing Club de Santander	1.000000	1.000000	1.000000

Table A3: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Spanish La Liga Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	FC Barcelona	1.000000	1.000000	0.999987
	Real Madrid CF	0.949235	1.000000	0.988304
	Club Atlético de Madrid	0.983127	1.000000	0.994903
	Real Sociedad de Football SAD	0.995692	1.000000	0.996618
	Sevilla FC	1.183924	1.000000	1.234757
	Valencia CF	1.028713	1.000000	1.000000
	Málaga CF	0.999986	1.052641	1.139310
	CA Osasuna	1.333337	1.282037	1.410243
	Real Betis Balompié SAD	1.000000	1.000000	1.000000
	Athletic Club de Bilbao	1.000000	1.066644	1.244437
	RC Celta de Vigo	1.216225	1.333337	1.486430
	Real Valladolid CF	1.000000	1.046514	1.530290
	Rayo Vallecano de Madrid	1.329451	1.000000	1.000000
	RC Deportivo de La Coruña	1.466594	1.206897	1.571428
	Levante UD	1.000000	1.000000	1.000000
	Granada CF	1.189184	1.000000	1.309529
	Getafe CF	1.042553	1.325532	1.170225
	RCD Mallorca	1.000000	1.000000	1.527867
	RCD Espanyol	1.000000	1.000000	1.000000
	Real Zaragoza SAD	1.540487	1.000000	1.617653
2013-2014	FC Barcelona	1.083059	1.172327	1.127317
	Real Madrid CF	0.962480	1.000000	1.048357
	Club Atlético de Madrid	0.961137	1.000000	0.981749
	Athletic Club de Bilbao	0.985427	1.000000	1.231810
	Sevilla FC	1.000000	1.000000	1.000000
	Real Sociedad de Football SAD	0.999934	1.000000	1.505690
	Villarreal CF	0.998942	1.000000	0.999842
	Valencia CF	1.199146	1.142857	1.425074
	RCD Espanyol	1.095233	1.119033	1.309529
	CA Osasuna	1.125009	1.000000	1.588589
	Málaga CF	1.000000	1.243196	1.222214
	Granada CF	1.375000	1.000000	1.414532
	Levante UD	1.000000	1.000000	1.000000
	RC Celta de Vigo	1.000000	1.000000	1.373147
	Real Valladolid CF	1.000000	1.071495	1.527867
	UD Almería	1.023263	1.000000	1.375002
	Getafe CF	1.166677	1.000000	1.309529
	Real Betis Balompié SAD	1.277774	1.902441	2.205455
	Elche CF	1.224985	1.000000	1.375002
	Rayo Vallecano de Madrid	1.476053	1.000000	1.646536
2014-2015	FC Barcelona	1.012918	1.000000	0.991168
	Real Madrid CF	0.951388	1.000000	0.999451
	Valencia CF	0.991311	1.000000	0.998986
	Club Atlético de Madrid	0.994492	1.000000	0.999839
	Sevilla FC	0.995331	1.000000	0.999999
	Villarreal CF	1.000000	1.000000	1.033200
	Real Sociedad de Football SAD	1.022719	1.243897	1.347586
	RC Celta de Vigo	1.193938	1.189190	1.196076
	Athletic Club de Bilbao	1.047241	1.254541	1.000000
	Málaga CF	1.047401	1.454548	1.099998
	RCD Espanyol	1.000000	1.000000	1.122460
	Rayo Vallecano de Madrid	0.999995	1.244892	1.550251
	RC Deportivo de La Coruña	1.314286	1.760296	1.657133
	Granada CF	1.599910	1.000000	1.571429
	Getafe CF	1.090909	1.000000	1.486441
	UD Almería	1.343748	1.000000	1.718729
	SD Eibar	1.000000	1.000000	1.571429
	Levante UD	1.294097	1.000000	1.486441
	Córdoba CF	2.227262	1.214286	2.750000
	Elche CF	1.121959	1.000000	1.341463

Table A3: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Spanish La Liga Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	Real Madrid CF	0.943570	0.999986	0.996416
	FC Barcelona	0.999954	1.000000	0.999231
	Club Atlético de Madrid	1.000000	1.000000	0.979420
	Sevilla FC	1.136074	1.000000	1.057685
	Athletic Club de Bilbao	1.000000	1.129032	0.999912
	Villarreal CF	1.000000	1.000000	1.000000
	Málaga CF	1.020832	1.060610	1.145835
	UD Las Palmas	1.113632	1.152179	1.454159
	Real Sociedad de Football SAD	1.000000	1.249994	1.580690
	RC Celta de Vigo	1.000000	1.000000	1.016654
	Valencia CF	1.065083	1.021266	1.249991
	Real Sporting de Gijón	1.000000	1.076934	1.410243
	SD Eibar	1.000000	1.564083	1.279068
	Getafe CF	1.000000	1.456529	1.027769
	Rayo Vallecano de Madrid	1.000000	1.473674	1.999992
	Real Betis Balompié SAD	1.244437	1.022223	1.222214
	RCD Espanyol	1.000000	1.000000	1.279068
	RC Deportivo de La Coruña	1.000000	2.023811	1.476021
	Levante UD	1.324315	1.000000	1.468753
	Granada CF	1.195651	1.256411	1.000000
2016-2017	Real Madrid CF	0.909348	1.000000	0.983501
	FC Barcelona	0.999665	1.033322	1.111090
	Club Atlético de Madrid	1.000000	1.000000	0.959801
	Sevilla FC	0.999998	1.000000	0.999985
	Villarreal CF	1.000000	1.000000	0.999853
	Real Sociedad de Football SAD	0.993005	1.249999	1.232309
	Athletic Club de Bilbao	1.170962	1.000000	0.998625
	RCD Espanyol	1.000000	1.000000	1.000000
	Deportivo Alavés SAD	1.000000	1.048721	1.000000
	SD Eibar	1.000000	1.388798	1.018442
	Málaga CF	1.162970	1.375002	1.195651
	Valencia CF	0.999810	1.000000	1.195651
	RC Celta de Vigo	1.000000	1.355546	1.399908
	UD Las Palmas	1.188675	1.000000	1.820499
	Real Betis Balompié SAD	1.000000	1.163633	1.410243
	RC Deportivo de La Coruña	1.325402	1.000000	1.777650
	CD Leganés	1.000000	1.375002	1.571429
	Real Sporting de Gijón	1.047648	1.000000	1.774218
	CA Osasuna	1.000000	1.000000	1.649137
	Granada CF	1.166677	1.000000	2.750000
2017-2018	FC Barcelona	1.000000	1.000000	1.075079
	Club Atlético de Madrid	1.000000	1.000000	0.995408
	Real Madrid CF	1.142175	1.000000	1.310457
	Valencia CF	0.999741	1.000000	0.999606
	Villarreal CF	1.000000	1.000000	1.000000
	Real Betis Balompié SAD	1.000000	1.000000	1.530459
	Sevilla FC	1.051730	1.000000	1.254123
	Getafe CF	1.047648	1.000000	1.000000
	SD Eibar	1.000000	1.000000	1.212490
	Girona FC	1.118058	1.000000	1.078436
	RCD Espanyol	1.142857	1.000000	1.264714
	Real Sociedad de Football SAD	1.038341	1.306117	1.844826
	RC Celta de Vigo	1.000000	1.000000	1.610791
	Deportivo Alavés SAD	1.000000	1.000000	1.170225
	Levante UD	1.000000	1.000000	1.195651
	Athletic Club de Bilbao	1.363961	1.065206	2.059490
	CD Leganés	1.302336	1.000000	1.279068
	RC Deportivo de La Coruña	1.184214	1.000000	2.206756
	UD Las Palmas	2.416659	1.275858	3.616543
	Málaga CF	1.625049	1.000000	2.750000

Table A4: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in German Bundesliga Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	SV Werder Bremen	1.097583	1.000000	1.000000
	FC Bayern München	0.999079	1.000000	1.000000
	Bayer 04 Leverkusen	1.000000	1.000000	1.000000
	Borussia Dortmund	0.999984	1.000000	1.000000
	VfL Wolfsburg	0.999996	1.000000	1.000000
	FC Schalke 04	0.999634	1.000000	1.000000
	Hamburger SV	1.000000	1.000000	1.000000
	VfB Stuttgart	0.999928	1.000000	1.009179
	TSG 1899 Hoffenheim	1.165730	1.354841	1.000000
	1. FSV Mainz 05	1.000000	1.000000	1.000000
	Hertha BSC Berlin	1.147059	1.473523	1.793515
	Eintracht Frankfurt FAG	1.086064	1.000000	1.413065
	Borussia VfL Mönchengladbach	1.046514	1.000000	1.057769
	1. FC Nürnberg	1.406241	1.380963	1.064516
	1. FC Köln	1.131572	1.000000	1.000000
	Hannover 96	1.116272	1.000000	1.000000
	SC Freiburg	1.627043	1.000000	1.000000
	VfL Bochum	1.545123	1.000000	1.000000
2010-2011	FC Bayern München	0.954904	1.000000	1.000000
	Borussia Dortmund	1.021076	1.000000	1.000000
	1. FSV Mainz 05	1.000000	1.147059	1.000000
	Bayer 04 Leverkusen	0.999998	1.014714	0.999963
	Hamburger SV	1.298935	1.268288	1.111113
	VfB Stuttgart	0.999999	1.047648	1.000000
	TSG 1899 Hoffenheim	1.266092	1.000000	1.000000
	1. FC Kaiserslautern	1.179443	1.000000	1.000000
	SV Werder Bremen	1.489105	1.121959	1.000000
	FC Schalke 04	1.289339	1.000000	1.074999
	VfL Wolfsburg	1.000000	1.000000	1.000000
	1. FC Nürnberg	1.190254	1.000000	1.000000
	Eintracht Frankfurt FAG	1.205872	1.113632	1.889063
	Borussia VfL Mönchengladbach	1.000000	1.048352	1.000000
	Hannover 96	1.000000	1.000000	1.000000
	1. FC Köln	1.135890	1.000000	1.000000
	SC Freiburg	1.113632	1.000000	1.000000
	FC St. Pauli	1.114292	1.413794	1.000000
2011-2012	Borussia Dortmund	0.992518	1.041662	0.973015
	FC Bayern München	1.000000	1.000000	1.070424
	FC Schalke 04	0.976005	1.000000	0.990569
	Borussia VfL Mönchengladbach	1.000000	0.999709	0.963741
	SV Werder Bremen	1.047648	1.260876	1.485955
	Bayer 04 Leverkusen	1.000000	1.037142	1.223102
	VfB Stuttgart	1.088641	1.000000	0.997824
	1. FSV Mainz 05	1.272868	1.205121	1.571520
	SC Freiburg	1.333284	1.000000	1.624943
	Hamburger SV	1.500000	1.117647	1.911762
	VfL Wolfsburg	1.468102	1.000000	1.249999
	TSG 1899 Hoffenheim	1.317069	1.000000	1.438986
	FC Augsburg	1.578554	1.078949	1.157886
	Hannover 96	1.245960	1.071495	1.291664
	1. FC Nürnberg	1.618740	1.000000	1.476176
	Hertha BSC Berlin	1.572747	1.422219	1.419358
	1. FC Köln	1.000000	1.666667	1.457814
	1. FC Kaiserslautern	2.499248	1.000000	2.695447

Table A4: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in German Bundesliga Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	FC Bayern München	1.000000	1.000000	0.831596
	Bayer 04 Leverkusen	1.215906	1.000000	1.331847
	Borussia Dortmund	0.943921	1.318171	1.226310
	SC Freiburg	1.405265	1.000000	1.243732
	FC Schalke 04	1.034434	1.000000	1.495943
	VfL Wolfsburg	1.267020	1.130385	1.945686
	Hamburger SV	1.249998	1.000000	1.761513
	Eintracht Frankfurt FAG	1.180549	1.095231	1.699778
	1. FSV Mainz 05	1.000000	1.292980	1.981077
	Borussia VfL Mönchengladbach	1.088877	1.000000	1.847889
	SV Werder Bremen	1.964992	1.000000	2.014277
	1. FC Nürnberg	1.487546	1.000000	1.408496
	VfB Stuttgart	1.395288	1.000000	1.556412
	Hannover 96	1.000000	1.000000	1.377146
	FC Augsburg	1.513749	1.000000	1.851858
	TSG 1899 Hoffenheim	1.166677	1.218193	1.998679
	Fortuna Düsseldorf	1.000000	1.366660	1.578456
	SpVgg Greuther Fürth	1.961584	1.000000	2.492309
2013-2014	FC Bayern München	0.998115	1.000000	0.979214
	Borussia Dortmund	1.061695	1.225347	1.126877
	Borussia VfL Mönchengladbach	0.999999	1.000000	1.622293
	Bayer 04 Leverkusen	0.999999	1.000000	1.420549
	FC Schalke 04	1.000000	1.000000	1.325101
	VfL Wolfsburg	1.000000	1.000000	1.421265
	1. FSV Mainz 05	1.000000	1.000000	1.184270
	TSG 1899 Hoffenheim	1.000000	1.000000	1.289747
	Hamburger SV	1.347981	1.000000	2.255347
	SV Werder Bremen	1.214244	1.000000	1.410243
	Hertha BSC Berlin	1.463423	1.000000	1.472886
	1. FC Nürnberg	1.621615	1.000000	2.379678
	Eintracht Frankfurt FAG	1.274984	1.000000	2.395640
	FC Augsburg	1.486737	1.000000	1.380570
	Hannover 96	1.309529	1.000000	1.463795
	VfB Stuttgart	1.224500	1.319151	1.671142
	SC Freiburg	1.395354	1.000000	1.700586
	Eintracht Braunschweig	2.068817	1.000000	2.200000
2014-2015	FC Bayern München	1.265474	1.000000	0.914415
	VfL Wolfsburg	1.000000	1.000000	1.209064
	Bayer 04 Leverkusen	1.274615	1.000000	0.999998
	Borussia VfL Mönchengladbach	1.000000	1.000000	1.290520
	TSG 1899 Hoffenheim	1.000000	1.000000	1.392259
	FC Schalke 04	1.249999	1.000000	1.759131
	Borussia Dortmund	1.000000	1.978213	1.565103
	FC Augsburg	1.465114	1.000000	1.259303
	Eintracht Frankfurt FAG	1.000000	1.319151	1.439238
	1. FSV Mainz 05	1.333337	1.000000	1.485871
	1. FC Köln	1.000000	1.000000	1.374748
	SV Werder Bremen	1.019997	1.000000	1.279068
	Hamburger SV	1.400000	1.000000	1.571429
	SC Paderborn 07	1.741944	1.000000	1.774217
	SC Freiburg	1.000000	1.000000	1.730716
	Hannover 96	1.000000	1.000000	1.662980
	VfB Stuttgart	1.214286	1.034434	1.698353
	Hertha BSC Berlin	1.000000	1.000000	1.571429

Table A4: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in German Bundesliga Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	FC Bayern München	1.000000	1.000000	0.897667
	Borussia Dortmund	1.000000	1.166677	1.181323
	Bayer 04 Leverkusen	1.247977	1.176342	0.989927
	Borussia VfL Mönchengladbach	1.000000	1.000000	1.577555
	FC Schalke 04	1.000000	1.000000	1.654998
	VfL Wolfsburg	1.000000	1.000000	1.992283
	1. FSV Mainz 05	1.000000	1.000000	1.213867
	SV Werder Bremen	1.019997	1.226418	1.447360
	1. FC Köln	1.000000	1.000000	1.270283
	FC Augsburg	1.000000	1.000000	1.625497
	FC Ingolstadt 04	1.000000	1.050027	1.000000
	Hamburger SV	1.000000	1.000000	1.507468
	Hertha BSC Berlin	1.000000	1.000000	1.733583
	TSG 1899 Hoffenheim	1.000000	1.000000	1.670214
	SV Darmstadt 98	1.000000	1.000000	1.000000
	VfB Stuttgart	1.378586	1.744213	1.870988
	Eintracht Frankfurt FAG	1.361115	1.130385	1.721665
	Hannover 96	1.580644	1.087690	2.458128
2016-2017	FC Bayern München	0.998315	1.000000	0.974842
	RB Leipzig	1.000000	1.000000	0.954327
	Borussia Dortmund	1.138880	1.000000	1.373909
	TSG 1899 Hoffenheim	1.000000	1.000000	1.316504
	1. FC Köln	1.000000	1.000000	1.048004
	Hertha BSC Berlin	1.000000	1.000000	1.493154
	SC Freiburg	1.000000	1.000000	1.287516
	SV Werder Bremen	1.000000	1.000000	1.221151
	Borussia VfL Mönchengladbach	1.000000	1.195097	1.985959
	FC Schalke 04	1.000000	1.000000	2.022042
	Eintracht Frankfurt FAG	1.000000	1.000000	1.473497
	Bayer 04 Leverkusen	1.000000	1.374989	2.087706
	FC Augsburg	1.000000	1.000000	1.447360
	Hamburger SV	1.000000	1.000000	1.447360
	1. FSV Mainz 05	1.272728	1.324315	1.486439
	VfL Wolfsburg	1.513521	1.000000	2.358313
	FC Ingolstadt 04	1.055566	1.000000	1.718729
	SV Darmstadt 98	1.000000	1.000000	1.831394
2017-2018	FC Bayern München	0.998231	1.000000	1.103721
	FC Schalke 04	0.999963	1.000000	0.983912
	TSG 1899 Hoffenheim	1.000000	1.000000	1.214037
	Borussia Dortmund	1.000000	1.119033	1.643412
	Bayer 04 Leverkusen	0.999993	1.000000	1.522332
	RB Leipzig	1.000000	1.000000	1.613974
	VfB Stuttgart	1.000000	1.000000	1.240371
	Eintracht Frankfurt FAG	1.000000	1.000000	1.251470
	Borussia VfL Mönchengladbach	1.212755	1.000000	1.676219
	Hertha BSC Berlin	1.000000	1.000000	1.397008
	SV Werder Bremen	1.000000	1.000000	1.413394
	FC Augsburg	1.000000	1.000000	1.430997
	Hannover 96	1.205121	1.000000	1.567056
	1. FSV Mainz 05	1.052641	1.000000	1.526643
	SC Freiburg	1.000000	1.000000	1.527852
	VfL Wolfsburg	1.000000	1.000000	2.636484
	Hamburger SV	1.551727	1.000000	2.056172
	1. FC Köln	1.342809	1.000000	2.639943

Table A5: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in French Ligue 1 Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	Olympique de Marseille	0.997016	1.000000	0.995959
	Olympique Lyonnais	0.999999	1.000000	0.999186
	Lille OSC	1.015392	1.000000	0.999781
	FC Girondins de Bordeaux	1.000000	1.025631	1.139743
	FC Lorient	0.999992	1.000000	1.000000
	AJ Auxerre	1.000000	1.000000	1.000000
	Valenciennes FC	1.000000	1.000000	1.000000
	Stade Rennais FC	1.000000	1.000000	1.225388
	AS Monaco FC	1.018175	1.000000	1.000000
	AS Saint-Étienne	1.349984	1.000000	1.675007
	Paris Saint-Germain FC	1.139994	1.000000	1.382380
	RC Lens	1.049927	1.000000	1.000000
	Toulouse FC	1.000000	1.000000	1.000000
	Montpellier HSC	1.000000	1.000000	1.000000
	AS Nancy Lorraine	1.000000	1.000000	1.000000
	OGC Nice	1.000000	1.000000	1.000000
	FC Sochaux-Montbéliard	1.285712	1.000000	1.634157
	US Boulogne	1.000000	1.000000	1.000000
	Le Mans FC	1.000000	1.000000	1.718729
	Grenoble Foot 38	1.000000	1.694432	1.608695
2010-2011	Lille OSC	0.995192	1.000000	1.010499
	Olympique de Marseille	0.996305	1.000000	0.990371
	FC Sochaux-Montbéliard	0.999769	1.000000	1.115451
	Olympique Lyonnais	0.999922	1.000000	0.996249
	Paris Saint-Germain FC	1.050025	1.000000	0.998646
	AS Nancy Lorraine	1.023261	1.000000	1.291678
	Stade Rennais FC	1.000000	1.000000	1.155738
	Valenciennes FC	1.000000	1.000000	1.221568
	Stade Brestois 29	1.217211	1.021741	1.300669
	SM Caen	1.000000	1.000000	1.000000
	FC Lorient	1.136458	1.043470	1.632121
	Toulouse FC	1.000000	1.000000	1.023164
	AS Saint-Étienne	1.000000	1.000000	1.220975
	FC Girondins de Bordeaux	1.023222	1.000000	1.235233
	RC Lens	1.285714	1.035739	1.771860
	AJ Auxerre	1.000000	1.000000	1.000000
	Montpellier HSC	1.063827	1.074999	1.468089
	AS Monaco FC	1.000000	1.000000	1.409073
	OGC Nice	1.000000	1.170744	1.000000
	AC Arles-Avignon	1.000000	1.000000	2.750000
2011-2012	Montpellier HSC	0.994135	1.000000	0.999904
	Paris Saint-Germain FC	0.997637	1.000000	0.996829
	Lille OSC	0.995261	1.000000	1.236639
	Stade Rennais FC	0.999746	1.099998	1.321864
	Toulouse FC	1.141636	1.000000	1.148650
	FC Girondins de Bordeaux	1.000000	1.000000	0.999422
	Olympique de Marseille	1.290268	1.000000	1.374596
	AS Saint-Étienne	1.000000	1.000000	1.140272
	Olympique Lyonnais	0.999999	1.000000	1.247764
	AS Nancy Lorraine	1.000000	1.000000	1.000000
	Stade Brestois 29	1.129022	1.000000	1.105630
	Evian Thonon Gaillard FC	1.000000	1.000000	1.000000
	FC Lorient	1.256411	1.113632	1.179491
	AJ Auxerre	1.000000	1.000000	1.338265
	OGC Nice	1.153846	1.000000	1.071495
	SM Caen	1.315789	1.000000	1.146802
	Valenciennes FC	1.139532	1.000000	1.127424
	FC Sochaux-Montbéliard	1.000000	1.000000	1.428546
	AC Ajaccio	1.000000	1.000000	1.000000
	Dijon FCO	1.184214	1.000000	1.000000

Table A5: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in French Ligue 1 Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	Paris Saint-Germain FC	1.000000	1.000000	0.972306
	AS Saint-Étienne	1.000000	1.333337	1.154578
	Olympique Lyonnais	0.998327	1.000000	1.199542
	Olympique de Marseille	0.999999	1.225347	1.141869
	Lille OSC	1.000000	1.000000	1.444935
	FC Girondins de Bordeaux	1.000000	1.000000	1.286132
	Montpellier HSC	1.054745	1.000000	1.265006
	Toulouse FC	1.000000	1.000000	1.508062
	FC Sochaux-Montbéliard	1.000000	1.000000	1.510802
	FC Lorient	1.017535	1.526119	1.226401
	Stade Rennais FC	1.000000	1.474988	1.515575
	AS Nancy Lorraine	1.131572	1.414632	1.681525
	Valenciennes FC	1.000000	1.000000	1.286217
	OGC Nice	1.000000	1.000000	1.012638
	Troyes AC	1.000000	1.089286	1.486440
	Stade de Reims	1.000000	1.000000	1.441108
	AC Ajaccio	1.153846	1.214286	1.549982
	Evian Thonon Gaillard FC	1.000000	1.000000	1.244331
	SC Bastia	1.063826	1.000000	1.170225
	Stade Brestois 29	1.000000	1.016405	1.551727
2013-2014	Paris Saint-Germain FC	0.992444	1.000000	1.024768
	AS Monaco FC	1.030652	1.000000	1.064034
	AS Saint-Étienne	1.000000	1.000000	1.245082
	Lille OSC	0.991346	1.000000	1.201259
	Olympique de Marseille	1.016379	1.000000	1.337651
	FC Girondins de Bordeaux	0.999964	1.303033	1.619056
	Olympique Lyonnais	1.000000	1.000000	1.488075
	Stade de Reims	1.000000	1.000000	1.382124
	Toulouse FC	1.065205	1.000000	1.620295
	Stade Rennais FC	1.000000	1.000000	1.382607
	Montpellier HSC	1.133331	1.292690	1.468027
	FC Nantes	1.000000	1.000000	1.195648
	FC Lorient	1.000000	1.000000	1.304954
	Evian Thonon Gaillard FC	1.000000	1.113632	1.408420
	En Avant de Guingamp	1.166677	1.024379	1.309529
	OGC Nice	1.200000	1.047648	1.863200
	FC Sochaux-Montbéliard	1.000000	1.000000	1.375002
	Valenciennes FC	1.270265	1.000000	2.137493
	SC Bastia	1.000000	1.000000	1.122457
	AC Ajaccio	1.000000	1.000000	2.391313
2014-2015	Paris Saint-Germain FC	0.988958	1.048176	1.180287
	Olympique de Marseille	0.989066	1.000000	1.301255
	Olympique Lyonnais	0.999842	1.000000	1.201759
	AS Monaco FC	1.100114	1.000000	1.161328
	AS Saint-Étienne	0.999846	1.000000	1.218330
	Montpellier HSC	1.000000	0.999997	1.105431
	SM Caen	1.037142	1.065205	1.195646
	Lille OSC	0.999913	1.000000	1.507104
	FC Lorient	1.000000	1.162777	1.610157
	FC Girondins de Bordeaux	1.062031	1.000000	1.345477
	FC Nantes	1.000000	1.000000	1.357818
	OGC Nice	1.112978	1.081664	1.576110
	Stade Rennais FC	1.000000	1.000000	1.676781
	SC Bastia	1.000000	1.000000	1.318273
	Toulouse FC	1.139498	1.000000	1.471606
	En Avant de Guingamp	1.000000	1.224336	1.122460
	Stade de Reims	1.000000	1.227284	1.520839
	FC Metz	1.000000	1.000000	1.833332
	RC Lens	1.375002	1.000000	2.135652
	Evian Thonon Gaillard FC	1.000000	1.324315	1.486441

Table A5: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in French Ligue 1 Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	Paris Saint-Germain FC	0.999990	0.997090	0.879899
	Olympique Lyonnais	0.999917	1.061526	1.432399
	OGC Nice	1.000000	1.000000	1.463551
	Lille OSC	1.059342	1.000000	1.459705
	FC Girondins de Bordeaux	1.000000	1.493649	1.779101
	AS Monaco FC	0.994342	1.000000	1.331304
	Montpellier HSC	1.000000	1.000000	1.788148
	Olympique de Marseille	1.309592	1.135126	1.579334
	Stade Rennais FC	1.000000	1.420013	1.616090
	SM Caen	1.128173	1.367558	1.018442
	En Avant de Guingamp	1.000000	1.113632	1.249999
	Toulouse FC	1.174311	1.375002	1.549638
	FC Nantes	1.000000	1.099998	1.835472
	FC Lorient	1.000000	1.000000	1.455010
	AS Saint-Étienne	1.000000	1.000000	1.282130
	Angers SCO	1.000000	1.000000	1.099998
	SC Bastia	1.000000	1.000000	1.099998
	Stade de Reims	1.113631	1.000000	1.626923
	AC Ajaccio	1.000000	1.450013	1.675384
	Troyes AC	1.571429	1.000000	3.055528
2016-2017	AS Monaco FC	0.969269	1.000000	0.877153
	Paris Saint-Germain FC	0.998713	1.000000	1.120025
	OGC Nice	1.000000	1.000000	1.274165
	Olympique Lyonnais	1.442127	1.000000	1.428085
	Olympique de Marseille	1.000000	1.000000	1.415572
	FC Girondins de Bordeaux	1.000000	1.000000	1.048137
	FC Nantes	1.000000	1.000000	1.212687
	AS Saint-Étienne	1.073180	1.000000	1.631347
	Stade Rennais FC	1.000000	1.000000	1.732271
	En Avant de Guingamp	1.065168	1.000000	1.456163
	Lille OSC	1.282262	1.000000	1.890680
	Angers SCO	1.000000	1.000000	1.316529
	Toulouse FC	1.113632	1.000000	1.249998
	FC Metz	1.000000	1.000000	1.279068
	Montpellier HSC	1.000000	1.081996	2.202094
	Dijon FCO	1.000000	1.000000	1.670705
	SM Caen	1.222214	1.000000	1.652247
	FC Lorient	1.000000	1.346154	1.860300
	AS Nancy Lorraine	1.206897	1.299997	1.571429
	SC Bastia	1.000000	1.000000	1.617653
2017-2018	Paris Saint-Germain FC	1.060924	1.000000	1.015087
	AS Monaco FC	0.974633	1.000000	1.065052
	Olympique Lyonnais	0.999990	1.000000	1.117072
	Olympique de Marseille	1.058918	1.000000	1.165760
	Stade Rennais FC	1.109525	1.000000	1.507148
	FC Girondins de Bordeaux	0.999960	1.000000	1.391760
	AS Saint-Étienne	1.000000	1.000000	1.558836
	OGC Nice	1.111113	1.000000	1.702390
	FC Nantes	1.000000	1.000000	1.057684
	Montpellier HSC	1.000000	1.000000	1.202964
	Dijon FCO	1.000000	1.000000	1.392252
	En Avant de Guingamp	1.164389	1.148955	1.782074
	Amiens SC	1.000000	1.000000	1.222214
	Angers SCO	1.000000	1.000000	1.341452
	RC Strasbourg Alsace	1.113596	1.367349	2.273399
	SM Caen	1.333336	1.000000	1.447344
	Lille OSC	1.000000	1.105263	2.294736
	Toulouse FC	1.471091	1.000000	1.675504
	Troyes AC	1.000000	1.000000	1.666667
	FC Metz	1.176458	1.000000	2.115396

Table A6: Conditional Order-M Scores of Offensive, Defensive and Team Performances in English Premier League Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	Chelsea FC	1.000000	1.000000	1.000000
	Manchester United FC	1.034613	1.000000	1.000000
	Tottenham Hotspur FC	1.005708	1.000000	1.000000
	Arsenal FC	1.000174	1.000000	1.039339
	Aston Villa FC	1.000000	1.000000	1.000000
	Manchester City FC	1.000000	1.000000	1.000000
	Liverpool FC	1.025384	1.000000	1.032775
	Everton FC	1.000000	1.000000	1.000000
	Birmingham City FC	1.099998	1.000000	1.003302
	Sunderland AFC	1.000000	1.000000	1.249125
	West Ham United FC	1.394786	1.000000	1.523347
	Fulham FC	1.000000	1.000000	1.000000
	Bolton Wanderers FC	1.000000	1.000000	1.000000
	Stoke City FC	1.000000	1.000000	1.000000
	Wigan Athletic FC	1.456600	1.000000	1.860472
	Blackburn Rovers FC	1.000000	1.000000	1.000000
	Portsmouth FC	1.000000	1.000000	1.092614
	Wolverhampton Wanderers FC	1.000000	1.000000	1.044807
	Burnley FC	1.000000	1.000000	1.000000
	Hull City AFC	1.000000	1.000000	1.433328
2010-2011	Chelsea FC	1.103447	1.000000	1.252080
	Manchester United FC	1.000000	1.000000	1.000200
	Arsenal FC	1.000000	1.000000	1.352932
	Manchester City FC	1.000000	1.128499	1.236167
	Tottenham Hotspur FC	1.254546	1.112906	1.114842
	Liverpool FC	1.000000	1.000000	1.000000
	Fulham FC	1.000000	1.000000	1.061477
	Bolton Wanderers FC	1.000000	1.000000	1.000000
	Sunderland AFC	1.000000	1.001574	1.070168
	Aston Villa FC	1.000000	1.000000	1.000000
	Everton FC	1.043615	1.000000	1.148207
	Wigan Athletic FC	1.007464	1.000000	1.309529
	Newcastle United FC	1.000000	1.000000	1.000000
	West Ham United FC	1.000000	1.000000	1.129590
	Stoke City FC	1.000000	1.000000	1.000000
	Blackburn Rovers FC	1.000000	1.000000	1.000000
	Blackpool FC	1.000000	1.000000	1.189545
	West Bromwich Albion FC	1.000000	1.000000	1.011395
	Birmingham City FC	1.000000	1.000000	1.326632
	Wolverhampton Wanderers FC	1.000000	1.000000	1.201014
2011-2012	Chelsea FC	1.000000	1.000000	1.117500
	Manchester United FC	1.000000	1.000000	1.000000
	Arsenal FC	1.000000	1.077716	1.312924
	Manchester City FC	1.000000	1.000000	1.000000
	Tottenham Hotspur FC	1.022396	1.000000	1.000000
	Liverpool FC	1.141099	1.212127	1.051366
	Fulham FC	1.000000	1.000000	1.002625
	Bolton Wanderers FC	1.000061	1.000000	1.229073
	Sunderland AFC	1.000000	1.000000	1.000000
	Aston Villa FC	1.289492	1.000000	1.483108
	Everton FC	1.000202	1.000000	1.001383
	Wigan Athletic FC	1.097558	1.000000	1.209642
	Newcastle United FC	1.000000	1.000000	1.008549
	Swansea City AFC	1.000000	1.000000	1.062427
	Stoke City FC	1.000000	1.000142	1.000142
	Blackburn Rovers FC	1.000009	1.000000	1.000000
	Queens Park Rangers FC	1.000000	1.000000	1.011924
	West Bromwich Albion FC	1.000000	1.000000	1.362950
	Norwich City FC	1.000000	1.000000	1.046846
	Wolverhampton Wanderers FC	1.000000	1.000000	1.452201

Table A6: Conditional Order-M Scores of Offensive, Defensive and Team Performances in English Premier League Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	Manchester United FC	1.000000	1.000000	1.000000
	Arsenal	1.000000	1.000000	1.228374
	Liverpool FC	1.000000	1.000000	1.505820
	Tottenham Hotspur FC	1.000000	1.000000	1.236110
	Chelsea FC	1.000000	1.000000	1.000000
	Manchester City FC	1.000000	1.000000	1.002234
	Everton FC	1.000000	1.000000	1.013580
	Swansea City AFC	1.000000	1.000000	1.774911
	Fulham FC	1.000000	1.000000	1.340129
	Aston Villa FC	1.000000	1.000000	1.341488
	Southampton FC	1.000000	1.059226	1.143699
	West Ham United FC	1.000000	1.000000	1.195651
	Sunderland AFC	1.000000	1.000000	1.026858
	Queens Park Rangers FC	1.001245	1.200000	1.800001
	Newcastle United FC	1.000000	1.000000	1.483016
	Stoke City FC	1.000000	1.000000	1.309529
	West Bromwich Albion FC	1.000000	1.000000	1.105840
	Wigan Athletic FC	1.000133	1.000000	1.418053
	Norwich City FC	1.000000	1.000000	1.223862
	Reading FC	1.000000	1.000000	1.000000
2013-2014	Liverpool FC	1.000000	1.000000	1.004682
	Manchester City FC	1.000000	1.000000	1.041066
	Chelsea FC	1.000000	1.000000	1.093963
	Arsenal FC	1.000000	1.000000	1.164477
	Everton FC	1.114761	1.000001	1.138886
	Manchester United FC	1.000000	1.000000	1.210791
	Southampton FC	1.000000	1.232558	1.272131
	Crystal Palace FC	1.000000	1.000000	1.000000
	Tottenham Hotspur FC	1.000000	1.000000	1.000012
	Stoke City FC	1.000000	1.000000	1.240000
	Newcastle United FC	1.000000	1.000000	1.337666
	Swansea City AFC	1.000000	1.000000	1.812402
	West Ham United FC	1.000000	1.000000	1.018310
	West Bromwich Albion FC	1.000000	1.000000	1.035569
	Hull City AFC	1.000000	1.000000	1.332450
	Aston Villa FC	1.000000	1.105263	1.014179
	Sunderland AFC	1.000000	1.000000	1.000000
	Fulham FC	1.005317	1.000000	1.000017
	Norwich City FC	1.000000	1.000000	1.335778
	Cardiff City FC	1.000138	1.000000	1.732649
2014-2015	Arsenal FC	1.122091	1.000000	1.226666
	Manchester City FC	1.000000	1.000000	1.189420
	Chelsea FC	1.000000	1.000000	1.013108
	Manchester United FC	1.000000	1.000000	1.000035
	Southampton FC	1.000000	1.000000	1.000219
	Liverpool FC	1.000000	1.403226	1.435450
	Tottenham Hotspur FC	1.000000	1.000000	1.328068
	Stoke City FC	1.000000	1.000000	1.159989
	Swansea City AFC	1.000000	1.000000	1.253405
	West Ham United FC	1.000000	1.000000	1.236673
	Leicester City FC	1.000000	1.000000	1.341463
	Crystal Palace FC	1.000000	1.000000	1.000000
	Everton FC	1.000000	1.000000	1.648454
	Burnley FC	1.303037	1.000000	1.528239
	West Bromwich Albion FC	1.000000	1.000000	1.000547
	Queens Park Rangers FC	1.000000	1.000000	1.173810
	Hull City AFC	1.000367	1.000000	1.571428
	Sunderland AFC	1.000000	1.000000	1.114249
	Newcastle United FC	1.424975	1.097479	1.183493
	Aston Villa FC	1.000000	1.000000	1.000000

Table A6: Conditional Order-M Scores of Offensive, Defensive and Team Performances in English Premier League Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	Arsenal FC	1.334546	1.000000	1.253906
	Leicester City FC	1.000000	1.000000	1.000000
	Tottenham Hotspur FC	1.000024	1.000000	1.000000
	Manchester City FC	1.000000	1.000000	1.393935
	West Ham United FC	1.000087	1.000000	1.000301
	Southampton FC	1.000000	1.000000	1.000000
	Liverpool FC	1.000000	1.000000	1.000000
	Everton FC	1.000000	1.000000	1.025593
	Chelsea FC	1.084746	1.002479	1.532085
	Manchester United FC	1.000000	1.000000	1.148629
	Watford FC	1.000000	1.000000	1.222214
	Crystal Palace FC	1.047099	1.000000	1.327824
	Sunderland AFC	1.000000	1.000000	1.000000
	Swansea City AFC	1.000000	1.000000	1.000000
	Stoke City FC	1.000000	1.000000	1.221154
	Newcastle United FC	1.000000	1.000000	1.227377
	West Bromwich Albion FC	1.000000	1.000000	1.000000
	AFC Bournemouth	1.000000	1.000000	1.403725
	Aston Villa FC	1.000000	1.000000	1.139472
	Norwich City FC	1.000000	1.000000	1.618626
2016-2017	Chelsea FC	1.000000	1.000000	1.000000
	Tottenham Hotspur FC	1.000000	1.000000	1.000000
	Manchester City FC	1.230645	1.000000	1.176547
	Liverpool FC	1.000000	1.000000	1.006539
	Arsenal FC	1.000000	1.076284	1.226269
	Manchester United FC	1.000000	1.000000	1.304960
	Everton FC	1.000000	1.000000	1.039076
	Southampton FC	1.000000	1.000000	1.575736
	AFC Bournemouth	1.000000	1.000000	1.565199
	West Bromwich Albion FC	1.000000	1.000000	1.000000
	West Ham United FC	1.000000	1.000000	1.466656
	Leicester City FC	1.000000	1.000000	1.000000
	Stoke City FC	1.000000	1.000000	1.250006
	Crystal Palace FC	1.000000	1.000000	1.080005
	Swansea City AFC	1.000000	1.000000	1.000000
	Burnley FC	1.000000	1.000000	1.007083
	Watford FC	1.000000	1.000000	1.382467
	Hull City AFC	1.000000	1.000000	1.261608
	Middlesbrough FC	1.000000	1.000000	1.860205
	Sunderland AFC	1.000000	1.000000	1.438393
2017-2018	Manchester City FC	1.000000	1.000000	1.000000
	Manchester United FC	1.000000	1.000000	1.098739
	Tottenham Hotspur FC	1.000000	1.000000	1.156183
	Liverpool FC	1.000000	1.000000	1.191426
	Chelsea	1.000000	1.000000	1.271423
	Arsenal FC	1.000000	1.000000	1.460302
	Burnley FC	1.000000	1.000000	1.000620
	Everton FC	1.000000	1.000000	1.000004
	Leicester City FC	1.000000	1.000000	1.000000
	Newcastle United FC	1.000000	1.000000	1.249998
	Crystal Palace FC	1.266686	1.000000	1.047648
	AFC Bournemouth	1.000000	1.000000	1.608924
	West Ham United FC	1.000000	1.000000	1.090225
	Watford FC	1.000000	1.000000	1.242067
	Brighton & Hove Albion FC	1.000000	1.000000	1.361461
	Huddersfield Town AFC	1.000000	1.178992	1.356483
	Southampton FC	1.000000	1.000000	1.794010
	Swansea City AFC	1.000000	1.000000	1.346877
	Stoke City FC	1.000000	1.000000	1.454548
	West Bromwich Albion FC	1.000000	1.000000	1.000000

Table A7: Conditional Order-M Scores of Offensive, Defensive and Team Performances in Italian Serie A Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	Atalanta BC	1.000000	1.000000	1.000000
	FC Bari 1908	1.000000	1.000000	1.000000
	Bologna FC 1909	1.000000	1.000000	1.000000
	Cagliari Calcio	1.000000	1.000000	1.010359
	Calcio Catania	1.111113	1.000000	1.000000
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.000000
	ACF Fiorentina	1.000000	1.000000	1.000000
	Genoa CFC	1.000000	1.000000	1.000000
	FC Internazionale	1.000000	1.000000	1.000000
	Juventus FC	1.000000	1.000000	1.000000
	SS Lazio	1.000037	1.000000	1.000000
	AS Livorno Calcio	1.497543	1.000000	1.000000
	AC Milan	1.000010	1.000000	1.000007
	SSC Napoli	1.000000	1.000000	1.000000
	SSD Palermo	1.000000	1.000000	1.000000
	Parma Calcio 1913	1.000000	1.000000	1.000000
	AS Roma	1.000000	1.000000	1.000000
	UC Sampdoria	1.000000	1.000000	1.000000
	SS Robur Siena	1.000000	1.000000	1.000000
	Udinese Calcio	1.000035	1.000000	1.000000
2010-2011	FC Bari 1908	1.458340	1.000000	1.726305
	Bologna FC 1909	1.000000	1.000000	1.000000
	Brescia Calcio	1.558255	1.000000	1.000000
	Cagliari Calcio	1.000000	1.000000	1.001618
	Calcio Catania	1.000000	1.000000	1.000000
	AC Cesena	1.139525	1.000000	1.000000
	AC Chievo Hellas Verona FC	1.009613	1.000000	1.129090
	ACF Fiorentina	1.000000	1.000000	1.072909
	Genoa CFC	1.000000	1.000000	1.050856
	FC Internazionale	1.000000	1.000000	1.000000
	Juventus FC	1.000000	1.000000	1.000000
	SS Lazio	1.000010	1.000000	1.000000
	US Lecce	1.000000	1.000000	1.000000
	AC Milan	1.004126	1.000000	1.000000
	SSC Napoli	1.000047	1.000000	1.000000
	SSD Palermo	1.000000	1.000000	1.000000
	Parma Calcio 1913	1.000000	1.000000	1.000000
	AS Roma	1.000000	1.000000	1.269736
	UC Sampdoria	1.093012	1.000000	1.000000
	Udinese Calcio	1.000000	1.000000	1.000000
2011-2012	Atalanta BC	1.000000	1.000000	1.000000
	Bologna FC 1909	1.000000	1.000000	1.000000
	Cagliari Calcio	1.151655	1.000025	1.511631
	Calcio Catania	1.208324	1.000000	1.000000
	AC Cesena	1.000000	1.000000	1.521742
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.265169
	ACF Fiorentina	1.000000	1.000000	1.000000
	Genoa CFC	1.000000	1.000000	1.000000
	FC Internazionale	1.000000	1.000000	1.000000
	Juventus FC	1.000000	1.000000	1.000000
	SS Lazio	1.000000	1.000000	1.000000
	US Lecce	1.000000	1.000000	1.000000
	AC Milan	1.000000	1.000000	1.000000
	SSC Napoli	1.000053	1.000000	1.000000
	Novara Calcio	1.539716	1.000000	1.406244
	SSD Palermo	1.000000	1.000000	1.000000
	Parma Calcio 1913	1.000000	1.000000	1.000000
	AS Roma	1.000000	1.000000	1.062130
	SS Robur Siena	1.000000	1.000045	1.000000
	Udinese Calcio	1.000000	1.000000	1.000000

Table A7: Conditional Order-M Scores of Offensive, Defensive and Team Performances in Italian Serie A Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	Atalanta BC	1.080363	1.000000	1.309529
	Bologna FC 1909	1.210929	1.130385	1.249999
	Cagliari Calcio	1.061207	1.000000	1.000000
	Calcio Catania	1.000000	1.000000	1.000000
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.000039
	ACF Fiorentina	1.000000	1.000000	1.000000
	Genoa CFC	1.000000	1.000000	1.000296
	FC Internazionale	1.254663	1.000000	1.025905
	Juventus FC	1.126735	1.000000	1.000001
	SS Lazio	1.004938	1.000000	1.002314
	AC Milan	1.040896	1.000000	1.000000
	SSC Napoli	1.000000	1.000000	1.000000
	SSD Palermo	1.000000	1.000000	1.264118
	Parma Calcio 1913	1.235478	1.000000	1.122460
	Delfino Pescara 1936	1.000000	1.000000	1.410212
	AS Roma	1.000063	1.000000	1.000000
	UC Sampdoria	1.162415	1.000000	1.000000
	SS Robur Siena	1.000000	1.000000	1.027469
	Torino FC	1.030254	1.000000	1.421552
	Udinese Calcio	1.000000	1.000000	1.000000
2013-2014	Atalanta BC	1.000000	1.000000	1.122390
	Bologna FC 1909	1.723475	1.000000	1.054400
	Cagliari Calcio	1.262908	1.000000	1.179941
	Calcio Catania	1.157429	1.000000	1.156240
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.000000
	ACF Fiorentina	1.184608	1.000000	1.388885
	Genoa CFC	1.000000	1.000000	1.083029
	FC Internazionale	1.000000	1.000000	1.055704
	Juventus FC	1.000000	1.000000	1.000000
	SS Lazio	1.001220	1.000000	1.000000
	AS Livorno Calcio	1.025084	1.000000	1.000000
	AC Milan	1.000000	1.000000	1.228472
	SSC Napoli	1.000000	1.000000	1.006133
	Parma Calcio 1913	1.000000	1.000000	1.000000
	AS Roma	1.000000	1.000000	1.000030
	UC Sampdoria	1.000000	1.000000	1.000000
	US Sassuolo Calcio	1.023614	1.000000	1.228141
	Torino FC	1.000000	1.000000	1.000000
	Udinese Calcio	1.153847	1.000000	1.500000
	Hellas Verona FC	1.000000	1.000000	1.018416
2014-2015	Atalanta BC	1.108026	1.000000	1.000281
	Cagliari Calcio	1.166600	1.000000	1.000000
	AC Cesena	1.000000	1.000000	1.391761
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.000000
	Empoli FC	1.168199	1.000000	1.571427
	ACF Fiorentina	1.008965	1.000000	1.270183
	Genoa CFC	1.000000	1.000000	1.000000
	FC Internazionale	1.000000	1.000000	1.079212
	Juventus FC	1.111113	1.000000	1.000000
	SS Lazio	1.000000	1.000000	1.000000
	AC Milan	1.000000	1.000000	1.000000
	SSC Napoli	1.000000	1.380963	1.002155
	SSD Palermo	1.002018	1.000000	1.084081
	Parma Calcio 1913	1.000000	1.000000	1.000000
	AS Roma	1.185725	1.000000	1.000000
	UC Sampdoria	1.000000	1.000000	1.000000
	US Sassuolo Calcio	1.000000	1.000000	1.122194
	Torino FC	1.000000	1.000000	1.000001
	Udinese Calcio	1.000000	1.000000	1.322637
	Hellas Verona FC	1.000002	1.000000	1.195651

Table A7: Conditional Order-M Scores of Offensive, Defensive and Team Performances in Italian Serie A Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	Atalanta BC	1.144483	1.000000	1.222214
	Bologna FC 1909	1.000000	1.000000	1.071495
	Carpi FC 1909	1.180616	1.000000	1.000000
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.007539
	Empoli FC	1.000000	1.000000	1.077136
	ACF Fiorentina	1.000458	1.000000	1.058955
	Frosinone	1.458487	1.000000	1.734822
	Genoa CFC	1.304082	1.000000	1.251886
	FC Internazionale	1.000000	1.000000	1.000000
	Juventus FC	1.044033	1.000000	1.000000
	SS Lazio	1.000009	1.000000	1.165542
	AC Milan	1.011171	1.000000	1.041378
	SSC Napoli	1.000000	1.000000	1.165716
	SSD Palermo	1.000000	1.000000	1.000000
	AS Roma	1.000000	1.000000	1.000000
	UC Sampdoria	1.000000	1.000000	1.000000
	US Sassuolo Calcio	1.000000	1.000000	1.009922
	Torino FC	1.017885	1.000000	1.000000
	Udinese Calcio	1.028140	1.000000	1.155361
	Hellas Verona FC	1.540485	1.000000	1.405441
2016-2017	Juventus FC	1.000000	1.000000	1.000000
	AS Roma	1.000000	1.000000	1.022663
	SSC Napoli	1.000000	1.000000	1.116273
	Atalanta BC	1.000000	1.000000	1.000000
	SS Lazio	1.000000	1.000000	1.000000
	AC Milan	1.000000	1.000000	1.000000
	FC Internazionale	1.000000	1.000000	1.000000
	ACF Fiorentina	1.036569	1.000000	1.000826
	Torino FC	1.000000	1.000000	1.339243
	US Sassuolo Calcio	1.000000	1.000000	1.003343
	UC Sampdoria	1.000000	1.000000	1.403059
	Cagliari Calcio	1.000000	1.000000	1.000000
	Udinese Calcio	1.000000	1.000000	1.000000
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.300559
	Bologna FC 1909	1.000000	1.000000	1.174061
	Genoa CFC	1.000000	1.000000	1.312062
	FC Crotone	1.147059	1.000000	1.000000
	Empoli FC	1.682674	1.000000	1.469645
	SSD Palermo	1.000000	1.000000	1.000000
	Delfino Pescara 1936	1.142857	1.000000	2.222955
2017-2018	Juventus FC	1.000000	1.000000	1.000000
	SSC Napoli	1.000000	1.000000	1.054940
	AS Roma	1.000000	1.000000	1.114510
	FC Internazionale	1.000000	1.000000	1.000059
	SS Lazio	1.000000	1.000000	1.000000
	AC Milan	1.000000	1.000000	1.002708
	Atalanta BC	1.001169	1.000000	1.167922
	ACF Fiorentina	1.000000	1.108715	1.187299
	UC Sampdoria	1.000000	1.000000	1.473545
	Torino FC	1.000000	1.000000	1.054240
	US Sassuolo Calcio	1.163193	1.000000	1.048956
	Genoa CFC	1.000000	1.000000	1.082704
	AC Chievo Hellas Verona FC	1.000000	1.000000	1.074999
	Udinese Calcio	1.000000	1.000000	1.000000
	Cagliari Calcio	1.000000	1.000000	1.263360
	Bologna FC 1909	1.000000	1.000000	1.410226
	SPAL 2013	1.101385	1.000000	1.329159
	FC Crotone	1.000000	1.000000	1.051016
	Hellas Verona FC	1.000000	1.000000	2.163915
	Benevento Calcio	1.000000	1.000000	1.201632

Table A8: Conditional Order-M Scores of Offensive, Defensive and Team Performances in Spanish La Liga Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	FC Barcelona	1.000000	1.000000	1.000000
	Real Madrid CF	1.000000	1.000000	1.000000
	RCD Mallorca	1.000000	1.000000	1.000000
	Valencia CF	1.000000	1.000000	1.000000
	Athletic Club de Bilbao	1.339986	1.000000	1.000000
	Villarreal CF	1.000000	1.370373	1.000000
	Sevilla FC	1.000000	1.000000	1.000000
	Club Atlético de Madrid	1.000000	1.000000	1.000000
	CD Tenerife	1.147823	1.010156	1.203704
	Real Zaragoza SAD	1.000000	1.007204	1.000000
	UD Almería	1.000000	1.000000	1.000000
	Getafe CF	1.001417	1.000000	1.000000
	RCD Espanyol	1.045497	1.000000	1.000000
	Real Sporting de Gijón	1.083323	1.000000	1.000000
	CA Osasuna	1.000000	1.000000	1.000000
	RC Deportivo de La Coruña	1.000000	1.000000	1.000000
	Málaga CF	1.000000	1.000000	1.000000
	Real Valladolid CF	1.000000	1.000000	1.000000
	Xerez CD	1.000000	1.000000	1.000000
	Real Racing Club de Santander	1.000000	1.000000	1.000000
2010-2011	Real Madrid CF	1.000000	1.000000	1.000000
	FC Barcelona	1.000000	1.000000	1.000000
	Villarreal CF	1.000000	1.000510	1.000000
	Valencia CF	1.000000	1.000000	1.000000
	Club Atlético de Madrid	1.000000	1.000000	1.000000
	Sevilla FC	1.000000	1.000000	1.085215
	RCD Mallorca	1.000000	1.113523	1.409073
	CA Osasuna	1.000000	1.000000	1.000000
	Athletic Club de Bilbao	1.000000	1.000000	1.000000
	Real Sporting de Gijón	1.026011	1.000000	1.000530
	Real Sociedad de Football SAD	1.000000	1.000000	1.000105
	Real Zaragoza SAD	1.090268	1.000000	1.000000
	Getafe CF	1.000196	1.018772	1.000000
	Real Racing Club de Santander	1.000000	1.018387	1.090092
	RC Deportivo de La Coruña	1.000000	1.174991	1.272753
	Hércules CF	1.000000	1.228561	1.457125
	RCD Espanyol	1.000000	1.069335	1.000000
	Málaga CF	1.000000	1.000000	1.000000
	Levante UD	1.000000	1.011186	1.000000
	UD Almería	1.000000	1.038693	1.004315
2011-2012	FC Barcelona	1.000000	1.000000	1.000000
	Real Madrid CF	1.000000	1.000000	1.000000
	Real Sociedad de Football SAD	1.000000	1.070802	1.309968
	Málaga CF	1.000000	1.465490	1.189582
	Club Atlético de Madrid	1.000000	1.000000	1.000000
	Villarreal CF	1.000000	1.143120	1.000000
	CA Osasuna	1.000000	1.000000	1.018442
	Levante UD	1.000000	1.000000	1.000000
	Sevilla FC	1.000000	1.021741	1.000000
	Valencia CF	1.000000	1.000000	1.000000
	Athletic Club de Bilbao	1.000000	1.000000	1.204714
	Real Betis Balompié SAD	1.000000	1.039428	1.000000
	Real Sporting de Gijón	1.000000	1.000000	1.000000
	RCD Espanyol	1.000000	1.055067	1.000000
	Real Zaragoza SAD	1.000000	1.061388	1.000000
	Rayo Vallecano de Madrid	1.000000	1.310271	1.000000
	RCD Mallorca	1.000000	1.000000	1.000000
	Getafe CF	1.000000	1.039680	1.000000
	Granada CF	1.094974	1.040222	1.000000
	Real Racing Club de Santander	1.000000	1.000000	1.000000

Table A8: Conditional Order-M Scores of Offensive, Defensive and Team Performances in Spanish La Liga Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	FC Barcelona	1.000000	1.000000	1.000000
	Real Madrid CF	1.000000	1.000000	1.000000
	Club Atlético de Madrid	1.000000	1.000000	1.000000
	Real Sociedad de Football SAD	1.000000	1.000000	1.000000
	Sevilla FC	1.000000	1.000000	1.000131
	Valencia CF	1.000000	1.000000	1.000000
	Málaga CF	1.000000	1.051482	1.108530
	CA Osasuna	1.333337	1.109168	1.409792
	Real Betis Balompié SAD	1.000000	1.000000	1.000000
	Athletic Club de Bilbao	1.000000	1.000000	1.000566
	RC Celta de Vigo	1.000000	1.130385	1.340036
	Real Valladolid CF	1.000000	1.000223	1.435868
	Rayo Vallecano de Madrid	1.032063	1.000000	1.000000
	RC Deportivo de La Coruña	1.000000	1.000000	1.009616
	Levante UD	1.000000	1.000000	1.000000
	Granada CF	1.000000	1.000000	1.000000
	Getafe CF	1.042553	1.050824	1.169756
	RCD Mallorca	1.000000	1.000000	1.055566
	RCD Espanyol	1.000000	1.000000	1.000000
	Real Zaragoza SAD	1.275739	1.000000	1.518091
2013-2014	FC Barcelona	1.019997	1.069809	1.075752
	Real Madrid CF	1.000000	1.000000	1.000017
	Club Atlético de Madrid	1.000000	1.000000	1.000000
	Athletic Club de Bilbao	1.000000	1.000000	1.000000
	Sevilla FC	1.000000	1.000000	1.000000
	Real Sociedad de Football SAD	1.000000	1.000000	1.495822
	Villarreal CF	1.000000	1.000000	1.000000
	Valencia CF	1.000000	1.000000	1.000000
	RCD Espanyol	1.010569	1.000000	1.003600
	CA Osasuna	1.000000	1.000000	1.282047
	Málaga CF	1.000000	1.028736	1.221675
	Granada CF	1.365605	1.000000	1.414614
	Levante UD	1.000000	1.000000	1.000000
	RC Celta de Vigo	1.000000	1.000000	1.377553
	Real Valladolid CF	1.000000	1.071495	1.284517
	UD Almería	1.000000	1.000000	1.375001
	Getafe CF	1.000001	1.000000	1.000000
	Real Betis Balompié SAD	1.000000	1.000000	1.000000
	Elche CF	1.224985	1.000000	1.374913
	Rayo Vallecano de Madrid	1.258226	1.000000	1.376399
2014-2015	FC Barcelona	1.000000	1.000000	1.000000
	Real Madrid CF	1.000000	1.000000	1.000000
	Valencia CF	1.000000	1.000000	1.000000
	Club Atlético de Madrid	1.000000	1.000000	1.000000
	Sevilla FC	1.000000	1.000000	1.000000
	Villarreal CF	1.000000	1.000000	1.000000
	Real Sociedad de Football SAD	1.000000	1.000000	1.055287
	RC Celta de Vigo	1.000021	1.189190	1.000000
	Athletic Club de Bilbao	1.047648	1.254534	1.000000
	Málaga CF	1.000000	1.399776	1.099997
	RCD Espanyol	1.000000	1.000000	1.007903
	Rayo Vallecano de Madrid	1.000000	1.142857	1.083426
	RC Deportivo de La Coruña	1.028525	1.367213	1.342809
	Granada CF	1.000000	1.000000	1.000000
	Getafe CF	1.000000	1.000000	1.000000
	UD Almería	1.000000	1.000000	1.113026
	SD Eibar	1.000000	1.000000	1.029098
	Levante UD	1.056646	1.000000	1.020309
	Córdoba CF	1.590907	1.000000	2.402780
	Elche CF	1.073180	1.000000	1.172115

Table A8: Conditional Order-M Scores of Offensive, Defensive and Team Performances in Spanish La Liga Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	Real Madrid CF	1.000000	1.000000	1.000000
	FC Barcelona	1.000000	1.000000	1.000000
	Club Atlético de Madrid	1.000000	1.000000	1.000000
	Sevilla FC	1.000371	1.000000	1.000000
	Athletic Club de Bilbao	1.000000	1.000109	1.000000
	Villarreal CF	1.000000	1.000000	1.000000
	Málaga CF	1.000000	1.000010	1.145837
	UD Las Palmas	1.000000	1.082651	1.234553
	Real Sociedad de Football SAD	1.000000	1.090699	1.000000
	RC Celta de Vigo	1.000000	1.000000	1.000000
	Valencia CF	1.000000	1.000000	1.000000
	Real Sporting de Gijón	1.000000	1.000000	1.069292
	SD Eibar	1.000000	1.526313	1.101182
	Getafe CF	1.000000	1.456529	1.000000
	Rayo Vallecano de Madrid	1.000000	1.293214	1.447360
	Real Betis Balompié SAD	1.058831	1.000000	1.000000
	RCD Espanyol	1.000000	1.000000	1.023654
	RC Deportivo de La Coruña	1.000000	2.023799	1.388012
	Levante UD	1.054934	1.000000	1.374999
	Granada CF	1.000000	1.000000	1.000000
2016-2017	Real Madrid CF	1.000000	1.000000	1.000000
	FC Barcelona	1.000000	1.033322	1.111113
	Club Atlético de Madrid	1.000000	1.000000	1.000000
	Sevilla FC	1.000000	1.000000	1.000000
	Villarreal CF	1.000000	1.000000	1.000000
	Real Sociedad de Football SAD	1.000000	1.000000	1.053742
	Athletic Club de Bilbao	1.056599	1.000000	1.000000
	RCD Espanyol	1.000000	1.000000	1.000000
	Deportivo Alavés SAD	1.000000	1.000000	1.000000
	SD Eibar	1.000000	1.388798	1.000024
	Málaga CF	1.000000	1.000000	1.000000
	Valencia CF	1.000000	1.000000	1.000000
	RC Celta de Vigo	1.000000	1.000000	1.000530
	UD Las Palmas	1.000008	1.000000	1.255102
	Real Betis Balompié SAD	1.000000	1.000000	1.137202
	RC Deportivo de La Coruña	1.093010	1.000000	1.352613
	CD Leganés	1.000000	1.000588	1.571428
	Real Sporting de Gijón	1.000000	1.000000	1.000000
	CA Osasuna	1.000000	1.000000	1.000000
	Granada CF	1.000000	1.000000	1.000000
2017-2018	FC Barcelona	1.000000	1.000000	1.075263
	Club Atlético de Madrid	1.000000	1.000000	1.000000
	Real Madrid CF	1.085040	1.000000	1.315789
	Valencia CF	1.000000	1.000000	1.000000
	Villarreal CF	1.000000	1.000000	1.000000
	Real Betis Balompié SAD	1.000000	1.000000	1.000000
	Sevilla FC	1.000000	1.000000	1.000000
	Getafe CF	1.000000	1.000000	1.000000
	SD Eibar	1.000000	1.000000	1.081789
	Girona FC	1.000000	1.000000	1.047179
	RCD Espanyol	1.000000	1.000000	1.040802
	Real Sociedad de Football SAD	1.000000	1.000021	1.612147
	RC Celta de Vigo	1.000000	1.000000	1.399955
	Deportivo Alavés SAD	1.000000	1.000000	1.000000
	Levante UD	1.000000	1.000000	1.000000
	Athletic Club de Bilbao	1.365864	1.000000	1.772548
	CD Leganés	1.007280	1.000000	1.279068
	RC Deportivo de La Coruña	1.000000	1.000000	1.215583
	UD Las Palmas	1.140173	1.000000	2.066322
	Málaga CF	1.000000	1.000000	1.928158

Table A9: Conditional Order-M Scores of Offensive, Defensive and Team Performances in German Bundesliga Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	SV Werder Bremen	1.000000	1.000000	1.000000
	FC Bayern München	1.000000	1.000000	1.000000
	Bayer 04 Leverkusen	1.000000	1.000000	1.000000
	Borussia Dortmund	1.000000	1.000000	1.000000
	VfL Wolfsburg	1.000000	1.000000	1.000000
	FC Schalke 04	1.000000	1.000000	1.000000
	Hamburger SV	1.000000	1.000000	1.000000
	VfB Stuttgart	1.000000	1.000000	1.000046
	TSG 1899 Hoffenheim	1.035751	1.354841	1.000000
	1. FSV Mainz 05	1.000000	1.000000	1.000000
	Hertha BSC Berlin	1.002240	1.118773	1.000000
	Eintracht Frankfurt FAG	1.065206	1.000000	1.076528
	Borussia VfL Mönchengladbach	1.006191	1.000000	1.000000
	1. FC Nürnberg	1.281148	1.000000	1.000000
	1. FC Köln	1.117422	1.000000	1.000000
	Hannover 96	1.000000	1.000000	1.000000
	SC Freiburg	1.400001	1.000000	1.000000
	VfL Bochum	1.000000	1.000000	1.000000
2010-2011	FC Bayern München	1.000000	1.000000	1.000000
	Borussia Dortmund	1.000000	1.000000	1.000000
	1. FSV Mainz 05	1.000000	1.000000	1.000000
	Bayer 04 Leverkusen	1.000000	1.000000	1.000000
	Hamburger SV	1.000026	1.000019	1.000000
	VfB Stuttgart	1.000000	1.000000	1.000000
	TSG 1899 Hoffenheim	1.001933	1.000000	1.000000
	1. FC Kaiserslautern	1.007289	1.000000	1.000000
	SV Werder Bremen	1.276418	1.000146	1.000000
	FC Schalke 04	1.147935	1.000000	1.000000
	VfL Wolfsburg	1.000000	1.000000	1.000000
	1. FC Nürnberg	1.041186	1.000000	1.000000
	Eintracht Frankfurt FAG	1.025870	1.000000	1.129623
	Borussia VfL Mönchengladbach	1.000000	1.000000	1.000000
	Hannover 96	1.000000	1.000000	1.000000
	1. FC Köln	1.000000	1.000000	1.000000
	SC Freiburg	1.113631	1.000000	1.000000
	FC St. Pauli	1.000010	1.000000	1.000000
2011-2012	Borussia Dortmund	1.000000	1.000000	1.000000
	FC Bayern München	1.000000	1.000000	1.000001
	FC Schalke 04	1.000000	1.000000	1.000000
	Borussia VfL Mönchengladbach	1.000000	1.000000	1.000000
	SV Werder Bremen	1.000003	1.000348	1.000000
	Bayer 04 Leverkusen	1.000000	1.000000	1.010957
	VfB Stuttgart	1.000000	1.000000	1.000000
	1. FSV Mainz 05	1.276323	1.033968	1.145369
	SC Freiburg	1.000000	1.000000	1.160808
	Hamburger SV	1.000000	1.000000	1.000000
	VfL Wolfsburg	1.004426	1.000000	1.000000
	TSG 1899 Hoffenheim	1.016753	1.000000	1.003965
	FC Augsburg	1.514617	1.000000	1.000227
	Hannover 96	1.020663	1.000000	1.059022
	1. FC Nürnberg	1.208721	1.000000	1.010384
	Hertha BSC Berlin	1.000000	1.000000	1.000000
	1. FC Köln	1.000000	1.000000	1.000000
	1. FC Kaiserslautern	1.521633	1.000000	1.650615

Table A9: Conditional Order-M Scores of Offensive, Defensive and Team Performances in German Bundesliga Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	FC Bayern München	1.000000	1.000000	1.000000
	Bayer 04 Leverkusen	1.000000	1.000000	1.000000
	Borussia Dortmund	1.000000	1.011338	1.015513
	SC Freiburg	1.122308	1.000000	1.274499
	FC Schalke 04	1.000000	1.000000	1.038518
	VfL Wolfsburg	1.042553	1.000000	1.000000
	Hamburger SV	1.000097	1.000000	1.029109
	Eintracht Frankfurt FAG	1.000000	1.022838	1.009170
	1. FSV Mainz 05	1.000000	1.062151	1.303041
	Borussia VfL Mönchengladbach	1.000001	1.000000	1.303210
	SV Werder Bremen	1.220002	1.000000	1.190961
	1. FC Nürnberg	1.000000	1.000000	1.000000
	VfB Stuttgart	1.095889	1.000000	1.515900
	Hannover 96	1.000000	1.000000	1.257893
	FC Augsburg	1.483659	1.000000	1.509342
	TSG 1899 Hoffenheim	1.000000	1.000000	1.000000
	Fortuna Düsseldorf	1.000000	1.022627	1.008279
	SpVgg Greuther Fürth	1.012826	1.000000	1.000002
2013-2014	FC Bayern München	1.000000	1.000000	1.012348
	Borussia Dortmund	1.062409	1.000002	1.018039
	Borussia VfL Mönchengladbach	1.000000	1.000000	1.072547
	Bayer 04 Leverkusen	1.000000	1.000000	1.000000
	FC Schalke 04	1.000000	1.000000	1.078088
	VfL Wolfsburg	1.000000	1.000000	1.098327
	1. FSV Mainz 05	1.000000	1.000000	1.052415
	TSG 1899 Hoffenheim	1.000000	1.000000	1.071868
	Hamburger SV	1.000000	1.000000	1.000000
	SV Werder Bremen	1.214286	1.000000	1.000009
	Hertha BSC Berlin	1.199228	1.000000	1.301448
	1. FC Nürnberg	1.054047	1.000000	1.434156
	Eintracht Frankfurt FAG	1.000000	1.000000	1.835878
	FC Augsburg	1.036832	1.000000	1.057445
	Hannover 96	1.000042	1.000000	1.057233
	VfB Stuttgart	1.000000	1.000000	1.083071
	SC Freiburg	1.274102	1.000000	1.521893
	Eintracht Braunschweig	1.758743	1.000000	1.118642
2014-2015	FC Bayern München	1.000000	1.000000	1.000000
	VfL Wolfsburg	1.000000	1.000000	1.174911
	Bayer 04 Leverkusen	1.043856	1.000000	1.000000
	Borussia VfL Mönchengladbach	1.000000	1.000000	1.000017
	TSG 1899 Hoffenheim	1.000000	1.000000	1.003034
	FC Schalke 04	1.000000	1.000000	1.000000
	Borussia Dortmund	1.000000	1.935998	1.484812
	FC Augsburg	1.000000	1.000000	1.002563
	Eintracht Frankfurt FAG	1.000000	1.071323	1.003040
	1. FSV Mainz 05	1.000000	1.000000	1.000043
	1. FC Köln	1.000000	1.000000	1.000000
	SV Werder Bremen	1.000000	1.000000	1.000000
	Hamburger SV	1.000000	1.000000	1.000000
	SC Paderborn 07	1.022140	1.000000	1.212968
	SC Freiburg	1.000000	1.000000	1.242045
	Hannover 96	1.000000	1.000000	1.126084
	VfB Stuttgart	1.000000	1.000000	1.001210
	Hertha BSC Berlin	1.000000	1.000000	1.000000

Table A9: Conditional Order-M Scores of Offensive, Defensive and Team Performances in German Bundesliga Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	FC Bayern München	1.000000	1.000000	1.000000
	Borussia Dortmund	1.000000	1.067154	1.148321
	Bayer 04 Leverkusen	1.000919	1.166133	1.000000
	Borussia VfL Mönchengladbach	1.000000	1.000000	1.004919
	FC Schalke 04	1.000000	1.000000	1.401382
	VfL Wolfsburg	1.000000	1.000000	1.787877
	1. FSV Mainz 05	1.000000	1.000000	1.000018
	SV Werder Bremen	1.019997	1.226418	1.378549
	1. FC Köln	1.000000	1.000000	1.139532
	FC Augsburg	1.000000	1.000000	1.621957
	FC Ingolstadt 04	1.000000	1.004044	1.000000
	Hamburger SV	1.000000	1.000000	1.024793
	Hertha BSC Berlin	1.000000	1.000000	1.319274
	TSG 1899 Hoffenheim	1.000000	1.000000	1.035338
	SV Darmstadt 98	1.000000	1.000000	1.000000
	VfB Stuttgart	1.003898	1.289003	1.210858
	Eintracht Frankfurt FAG	1.000000	1.000000	1.162240
	Hannover 96	1.000919	1.000000	1.516181
2016-2017	FC Bayern München	1.000000	1.000000	1.000000
	RB Leipzig	1.000000	1.000000	1.000000
	Borussia Dortmund	1.126016	1.000000	1.385971
	TSG 1899 Hoffenheim	1.000000	1.000000	1.000000
	1. FC Köln	1.000000	1.000000	1.000047
	Hertha BSC Berlin	1.000000	1.000000	1.179114
	SC Freiburg	1.000000	1.000000	1.249603
	SV Werder Bremen	1.000000	1.000000	1.000000
	Borussia VfL Mönchengladbach	1.000000	1.123040	1.353386
	FC Schalke 04	1.000000	1.000000	1.262970
	Eintracht Frankfurt FAG	1.000000	1.000000	1.334491
	Bayer 04 Leverkusen	1.000000	1.195651	1.301905
	FC Augsburg	1.000000	1.000000	1.000618
	Hamburger SV	1.000000	1.000000	1.000047
	1. FSV Mainz 05	1.008301	1.232936	1.007971
	VfL Wolfsburg	1.000000	1.000000	1.234968
	FC Ingolstadt 04	1.000000	1.000000	1.000000
	SV Darmstadt 98	1.000000	1.000000	1.000000
2017-2018	FC Bayern München	1.000000	1.000000	1.000000
	FC Schalke 04	1.000000	1.000000	1.000000
	TSG 1899 Hoffenheim	1.000000	1.000000	1.023138
	Borussia Dortmund	1.000000	1.000024	1.191949
	Bayer 04 Leverkusen	1.000000	1.000000	1.180932
	RB Leipzig	1.000000	1.000000	1.180048
	VfB Stuttgart	1.000000	1.000000	1.000000
	Eintracht Frankfurt FAG	1.000000	1.000000	1.196021
	Borussia VfL Mönchengladbach	1.000000	1.000000	1.384182
	Hertha BSC Berlin	1.000000	1.000000	1.195127
	SV Werder Bremen	1.000000	1.000000	1.029317
	FC Augsburg	1.000000	1.000000	1.000042
	Hannover 96	1.000006	1.000000	1.053859
	1. FSV Mainz 05	1.011396	1.000000	1.163800
	SC Freiburg	1.000000	1.000000	1.417494
	VfL Wolfsburg	1.000000	1.000000	1.202518
	Hamburger SV	1.000000	1.000000	1.385431
	1. FC Köln	1.142856	1.000000	1.810807

Table A10: Conditional Order-M Scores of Offensive, Defensive and Team Performances in French Ligue 1 Clubs – 2009/10 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2009-2010	Olympique de Marseille	1.000000	1.000000	1.000000
	Olympique Lyonnais	1.000000	1.000000	1.000000
	Lille OSC	1.000000	1.000000	1.000000
	FC Girondins de Bordeaux	1.000000	1.025631	1.040484
	FC Lorient	1.000000	1.000000	1.000000
	AJ Auxerre	1.000000	1.000000	1.000000
	Valenciennes FC	1.000000	1.000000	1.000000
	Stade Rennais FC	1.000000	1.000000	1.147643
	AS Monaco FC	1.014665	1.000000	1.000000
	AS Saint-Étienne	1.094014	1.000000	1.196835
	Paris Saint-Germain FC	1.000483	1.000000	1.002996
	RC Lens	1.050027	1.000000	1.000000
	Toulouse FC	1.000000	1.000000	1.000000
	Montpellier HSC	1.000000	1.000000	1.000000
	AS Nancy Lorraine	1.000000	1.000000	1.000000
	OGC Nice	1.000000	1.000000	1.000000
	FC Sochaux-Montbéliard	1.129163	1.000000	1.498030
	US Boulogne	1.000000	1.000000	1.000000
	Le Mans FC	1.000000	1.000000	1.025976
	Grenoble Foot 38	1.000000	1.159975	1.608695
2010-2011	Lille OSC	1.000000	1.000000	1.010697
	Olympique de Marseille	1.000000	1.000000	1.000000
	FC Sochaux-Montbéliard	1.000000	1.000000	1.120318
	Olympique Lyonnais	1.000000	1.000000	1.000000
	Paris Saint-Germain FC	1.000000	1.000000	1.000000
	AS Nancy Lorraine	1.023257	1.000000	1.245617
	Stade Rennais FC	1.000000	1.000000	1.112751
	Valenciennes FC	1.000000	1.000000	1.012174
	Stade Brestois 29	1.065924	1.000000	1.038847
	SM Caen	1.000000	1.000000	1.000000
	FC Lorient	1.072208	1.000000	1.214050
	Toulouse FC	1.000000	1.000000	1.000000
	AS Saint-Étienne	1.000000	1.000000	1.194965
	FC Girondins de Bordeaux	1.000000	1.000000	1.000000
	RC Lens	1.017463	1.003301	1.255960
	AJ Auxerre	1.000000	1.000000	1.000000
	Montpellier HSC	1.063827	1.024403	1.318044
	AS Monaco FC	1.000000	1.000000	1.000000
	OGC Nice	1.000000	1.000000	1.000000
	AC Arles-Avignon	1.000000	1.000000	1.873002
2011-2012	Montpellier HSC	1.000000	1.000000	1.000000
	Paris Saint-Germain FC	1.000000	1.000000	1.000000
	Lille OSC	1.000000	1.000000	1.007449
	Stade Rennais FC	1.000000	1.000000	1.006092
	Toulouse FC	1.000000	1.000000	1.000644
	FC Girondins de Bordeaux	1.000000	1.000000	1.000000
	Olympique de Marseille	1.288108	1.000000	1.343891
	AS Saint-Étienne	1.000000	1.000000	1.002765
	Olympique Lyonnais	1.000000	1.000000	1.000000
	AS Nancy Lorraine	1.000000	1.000000	1.000000
	Stade Brestois 29	1.000000	1.000000	1.097607
	Evian Thonon Gaillard FC	1.000000	1.000000	1.000000
	FC Lorient	1.202503	1.000000	1.000000
	AJ Auxerre	1.000000	1.000000	1.000000
	OGC Nice	1.043700	1.000000	1.067183
	SM Caen	1.153292	1.000000	1.000000
	Valenciennes FC	1.139532	1.000000	1.084609
	FC Sochaux-Montbéliard	1.000000	1.000000	1.047299
	AC Ajaccio	1.000000	1.000000	1.000000
	Dijon FCO	1.091681	1.000000	1.000000

Table A10: Conditional Order-M Scores of Offensive, Defensive and Team Performances in French Ligue 1 Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	Paris Saint-Germain FC	1.000000	1.000000	1.000000
	AS Saint-Étienne	1.000000	1.009636	1.000000
	Olympique Lyonnais	1.000000	1.000000	1.000012
	Olympique de Marseille	1.000000	1.000002	1.000000
	Lille OSC	1.000000	1.000000	1.406846
	FC Girondins de Bordeaux	1.000000	1.000000	1.341159
	Montpellier HSC	1.000987	1.000000	1.230681
	Toulouse FC	1.000000	1.000000	1.293250
	FC Sochaux-Montbéliard	1.000000	1.000000	1.143027
	FC Lorient	1.000000	1.148544	1.004559
	Stade Rennais FC	1.000000	1.010974	1.284950
	AS Nancy Lorraine	1.000000	1.086603	1.157898
	Valenciennes FC	1.000000	1.000000	1.162157
	OGC Nice	1.000000	1.000000	1.000004
	Troyes AC	1.000000	1.009699	1.327043
	Stade de Reims	1.000000	1.000000	1.138571
	AC Ajaccio	1.000000	1.000000	1.246859
	Evian Thonon Gaillard FC	1.000000	1.000000	1.000000
	SC Bastia	1.000000	1.000000	1.169404
	Stade Brestois 29	1.000000	1.016401	1.551678
2013-2014	Paris Saint-Germain FC	1.000000	1.000000	1.015492
	AS Monaco FC	1.000000	1.000000	1.000000
	AS Saint-Étienne	1.000000	1.000000	1.000000
	Lille OSC	1.000000	1.000000	1.071986
	Olympique de Marseille	1.000000	1.000000	1.000001
	FC Girondins de Bordeaux	1.000000	1.001508	1.158773
	Olympique Lyonnais	1.000000	1.000000	1.425104
	Stade de Reims	1.000000	1.000000	1.395830
	Toulouse FC	1.000037	1.000000	1.226845
	Stade Rennais FC	1.000000	1.000000	1.002335
	Montpellier HSC	1.000000	1.113617	1.123013
	FC Nantes	1.000000	1.000000	1.028344
	FC Lorient	1.000000	1.000000	1.000000
	Evian Thonon Gaillard FC	1.000000	1.000007	1.249311
	En Avant de Guingamp	1.166548	1.000453	1.306977
	OGC Nice	1.000055	1.000000	1.523934
	FC Sochaux-Montbéliard	1.000000	1.000000	1.298109
	Valenciennes FC	1.079637	1.000000	1.549970
	SC Bastia	1.000000	1.000000	1.122230
	AC Ajaccio	1.000000	1.000000	1.478258
2014-2015	Paris Saint-Germain FC	1.000000	1.014845	1.175751
	Olympique de Marseille	1.000000	1.000000	1.000027
	Olympique Lyonnais	1.000000	1.000000	1.000000
	AS Monaco FC	1.052140	1.000000	1.186316
	AS Saint-Étienne	1.000000	1.000000	1.095493
	Montpellier HSC	1.000000	1.000000	1.000510
	SM Caen	1.032074	1.027597	1.050235
	Lille OSC	1.000000	1.000000	1.277451
	FC Lorient	1.000000	1.000373	1.268264
	FC Girondins de Bordeaux	1.015883	1.000000	1.111182
	FC Nantes	1.000000	1.000000	1.122603
	OGC Nice	1.000380	1.000000	1.205025
	Stade Rennais FC	1.000000	1.000000	1.420020
	SC Bastia	1.000000	1.000000	1.000002
	Toulouse FC	1.000000	1.000000	1.033767
	En Avant de Guingamp	1.000000	1.142040	1.000000
	Stade de Reims	1.000000	1.227284	1.200091
	FC Metz	1.000000	1.000000	1.668687
	RC Lens	1.014121	1.000000	1.568457
	Evian Thonon Gaillard FC	1.000000	1.273033	1.486441

Table A10: Conditional Order-M Scores of Offensive, Defensive and Team Performances in French Ligue 1 Clubs – 2009/10 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2015-2016	Paris Saint-Germain FC	1.000000	1.000000	1.000000
	Olympique Lyonnais	1.000000	1.000000	1.150904
	OGC Nice	1.000000	1.000000	1.015365
	Lille OSC	1.000000	1.000000	1.000000
	FC Girondins de Bordeaux	1.000000	1.091388	1.002384
	AS Monaco FC	1.000000	1.000000	1.027167
	Montpellier HSC	1.000000	1.000000	1.000000
	Olympique de Marseille	1.000000	1.000000	1.000000
	Stade Rennais FC	1.000000	1.047556	1.004003
	SM Caen	1.000000	1.219208	1.000163
	En Avant de Guingamp	1.000000	1.000007	1.249999
	Toulouse FC	1.000000	1.000000	1.000456
	FC Nantes	1.000000	1.068514	1.296263
	FC Lorient	1.000000	1.000000	1.070908
	AS Saint-Étienne	1.000000	1.000000	1.035722
	Angers SCO	1.000000	1.000000	1.099982
	SC Bastia	1.000000	1.000000	1.000000
	Stade de Reims	1.000000	1.000000	1.170477
	AC Ajaccio	1.000000	1.337792	1.331436
	Troyes AC	1.249999	1.000000	2.388858
2016-2017	AS Monaco FC	1.000000	1.000000	1.000000
	Paris Saint-Germain FC	1.000000	1.000000	1.149411
	OGC Nice	1.000000	1.000000	1.000121
	Olympique Lyonnais	1.000000	1.000000	1.390106
	Olympique de Marseille	1.000000	1.000000	1.000000
	FC Girondins de Bordeaux	1.000000	1.000000	1.001026
	FC Nantes	1.000000	1.000000	1.000000
	AS Saint-Étienne	1.040096	1.000000	1.238084
	Stade Rennais FC	1.000000	1.000000	1.203419
	En Avant de Guingamp	1.001127	1.000000	1.319589
	Lille OSC	1.001342	1.000000	1.304353
	Angers SCO	1.000000	1.000000	1.271280
	Toulouse FC	1.000000	1.000000	1.002224
	FC Metz	1.000000	1.000000	1.233814
	Montpellier HSC	1.000000	1.000000	1.204143
	Dijon FCO	1.000000	1.000000	1.558662
	SM Caen	1.221739	1.000000	1.484351
	FC Lorient	1.000000	1.000000	1.263366
	AS Nancy Lorraine	1.200524	1.289809	1.571302
	SC Bastia	1.000000	1.000000	1.239751
2017-2018	Paris Saint-Germain FC	1.000000	1.000000	1.015338
	AS Monaco FC	1.000000	1.000000	1.000003
	Olympique Lyonnais	1.000000	1.000000	1.059639
	Olympique de Marseille	1.000000	1.000000	1.057124
	Stade Rennais FC	1.000000	1.000000	1.042995
	FC Girondins de Bordeaux	1.000000	1.000000	1.000000
	AS Saint-Étienne	1.000000	1.000000	1.000000
	OGC Nice	1.000037	1.000000	1.271718
	FC Nantes	1.000000	1.000000	1.031352
	Montpellier HSC	1.000000	1.000000	1.215685
	Dijon FCO	1.000000	1.000000	1.395830
	En Avant de Guingamp	1.020850	1.000000	1.425522
	Amiens SC	1.000000	1.000000	1.222214
	Angers SCO	1.000000	1.000000	1.304670
	RC Strasbourg Alsace	1.073641	1.000000	1.681914
	SM Caen	1.296100	1.000000	1.288791
	Lille OSC	1.000000	1.000000	1.100574
	Toulouse FC	1.000000	1.000000	1.007314
	Troyes AC	1.000000	1.000000	1.644842
	FC Metz	1.020958	1.000000	1.005969

Table A11. Summary Statistics of Offensive Efficiency (without country dummies)

		Unconditional Order-M	Conditional Order-M
EQUATION 1	**Minimum**	0.8841	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.1059	1.030
	3rd Quarter	1.1625	1.000
	Maximum	2.4992	1.759
	Eff. Score < 1	221	2
EQUATION 2	**Minimum**	0.8841	0.9998
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.1059	1.0342
	3rd Quarter	1.1625	1.0000
	Maximum	2.4992	2.2403
	Eff. Score < 1	221	20
EQUATION 3	**Minimum**	0.8841	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.1059	1.034
	3rd Quarter	1.1625	1.000
	Maximum	2.4992	1.799
	Eff. Score < 1	221	15
EQUATION 4	**Minimum**	0.8841	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.1059	1.036
	3rd Quarter	1.1625	1.000
	Maximum	2.4992	2.064
	Eff. Score < 1	221	0
EQUATION 5	**Minimum**	0.8841	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.1059	1.033
	3rd Quarter	1.1625	1.000
	Maximum	2.4992	2.300
	Eff. Score < 1	221	7
EQUATION 6	**Minimum**	0.8841	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.1059	1.035
	3rd Quarter	1.1625	1.000
	Maximum	2.4992	2.293
	Eff. Score < 1	221	7
EQUATION 7	**Minimum**	0.8841	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.1059	1.033
	3rd Quarter	1.1625	1.000
	Maximum	2.4992	1.611
	Eff. Score < 1	221	0

Table A12. Summary Statistics of Defensive Efficiency (without country dummies)

		Unconditional Order-M	Conditional Order-M
EQUATION 1	**Minimum**	0.9934	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.0566	1.017
	3rd Quarter	1.0000	1.000
	Maximum	2.0238	2.024
	Eff. Score < 1	56	0
EQUATION 2	**Minimum**	0.9934	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.0566	1.020
	3rd Quarter	1.0000	1.000
	Maximum	2.0238	2.023
	Eff. Score < 1	56	1
EQUATION 3	**Minimum**	0.9934	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.0566	1.016
	3rd Quarter	1.0000	1.000
	Maximum	2.0238	2.020
	Eff. Score < 1	56	0
EQUATION 4	**Minimum**	0.9934	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.0566	1.016
	3rd Quarter	1.0000	1.000
	Maximum	2.0238	1.974
	Eff. Score < 1	56	0
EQUATION 5	**Minimum**	0.9934	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.0566	1.015
	3rd Quarter	1.0000	1.000
	Maximum	2.0238	1.971
	Eff. Score < 1	56	0
EQUATION 6	**Minimum**	0.9934	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.0566	1.016
	3rd Quarter	1.0000	1.000
	Maximum	2.0238	1.757
	Eff. Score < 1	56	0
EQUATION 7	**Minimum**	0.9934	1.000
	1st Quarter	1.0000	1.000
	Median	1.0000	1.000
	Mean	1.0566	1.014
	3rd Quarter	1.0000	1.000
	Maximum	2.0238	1.963
	Eff. Score < 1	56	0

Table A13. Summary Statistics of Team Efficiency (without country dummies)

		Unconditional Order-M	Conditional Order-M
EQUATION 1	**Minimum**	0.8316	1.000
	1st Quarter	1.0125	1.000
	Median	1.2696	1.007
	Mean	1.3539	1.129
	3rd Quarter	1.5279	1.216
	Maximum	3.6351	2.403
	Eff. Score < 1	103	2
EQUATION 2	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0194
	Mean	1.3539	1.1493
	3rd Quarter	1.5279	1.2489
	Maximum	3.6351	2.4997
	Eff. Score < 1	103	19
EQUATION 3	**Minimum**	0.8316	1.000
	1st Quarter	1.0125	1.000
	Median	1.2696	1.015
	Mean	1.3539	1.135
	3rd Quarter	1.5279	1.222
	Maximum	3.6351	2.600
	Eff. Score < 1	103	16
EQUATION 4	**Minimum**	0.8316	1.000
	1st Quarter	1.0125	1.000
	Median	1.2696	1.017
	Mean	1.3539	1.144
	3rd Quarter	1.5279	1.234
	Maximum	3.6351	2.600
	Eff. Score < 1	103	2
EQUATION 5	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0117
	Mean	1.3539	1.1432
	3rd Quarter	1.5279	1.2335
	Maximum	3.6351	2.5000
	Eff. Score < 1	103	5
EQUATION 6	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0138
	Mean	1.3539	1.1455
	3rd Quarter	1.5279	1.2342
	Maximum	3.6351	2.6000
	Eff. Score < 1	103	5
EQUATION 7	**Minimum**	0.8316	1.000
	1st Quarter	1.0125	1.000
	Median	1.2696	1.021
	Mean	1.3539	1.141
	3rd Quarter	1.5279	1.233
	Maximum	3.6351	2.569
	Eff. Score < 1	103	1

Table A14. Summary Statistics of Offensive Efficiency (country dummies included)

		Unconditional Order-M	Conditional Order-M
EQUATION 1	**Minimum**	0.8841	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.1059	1.0000
	3rd Quarter	1.1625	1.0000
	Maximum	2.4992	1.0000
	Eff. Score < 1	221	0
EQUATION 2	**Minimum**	0.8841	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.1059	1.0000
	3rd Quarter	1.1625	1.0000
	Maximum	2.4992	1.2850
	Eff. Score < 1	221	0
EQUATION 3	**Minimum**	0.8841	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.1059	1.0000
	3rd Quarter	1.1625	1.0000
	Maximum	2.4992	1.0590
	Eff. Score < 1	221	0
EQUATION 4	**Minimum**	0.8841	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.1059	1.0000
	3rd Quarter	1.1625	1.0000
	Maximum	2.4992	1.0000
	Eff. Score < 1	221	0
EQUATION 5	**Minimum**	0.8841	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.1059	1.0000
	3rd Quarter	1.1625	1.0000
	Maximum	2.4992	1.0000
	Eff. Score < 1	221	0
EQUATION 6	**Minimum**	0.8841	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.1059	1.0000
	3rd Quarter	1.1625	1.0000
	Maximum	2.4992	1.0000
	Eff. Score < 1	221	0
EQUATION 7	**Minimum**	0.8841	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.1059	1.0000
	3rd Quarter	1.1625	1.0000
	Maximum	2.4992	1.0000
	Eff. Score < 1	221	0

Table A15. Summary Statistics of Defensive Efficiency (country dummies included)

		Unconditional Order-M	Conditional Order-M
EQUATION 1	**Minimum**	0.9934	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.0566	1.0000
	3rd Quarter	1.0000	1.0000
	Maximum	2.0238	1.0000
	Eff. Score < 1	56	0
EQUATION 2	**Minimum**	0.9934	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.0566	1.0000
	3rd Quarter	1.0000	1.0000
	Maximum	2.0238	1.1750
	Eff. Score < 1	56	0
EQUATION 3	**Minimum**	0.9934	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.0566	1.0000
	3rd Quarter	1.0000	1.0000
	Maximum	2.0238	1.1750
	Eff. Score < 1	56	0
EQUATION 4	**Minimum**	0.9934	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.0566	1.0000
	3rd Quarter	1.0000	1.0000
	Maximum	2.0238	1.0220
	Eff. Score < 1	56	0
EQUATION 5	**Minimum**	0.9934	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.0566	1.0000
	3rd Quarter	1.0000	1.0000
	Maximum	2.0238	1.0000
	Eff. Score < 1	56	0
EQUATION 6	**Minimum**	0.9934	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.0566	1.0000
	3rd Quarter	1.0000	1.0000
	Maximum	2.0238	1.0000
	Eff. Score < 1	56	0
EQUATION 7	**Minimum**	0.9934	1.0000
	1st Quarter	1.0000	1.0000
	Median	1.0000	1.0000
	Mean	1.0566	1.0000
	3rd Quarter	1.0000	1.0000
	Maximum	2.0238	1.0000
	Eff. Score < 1	56	0

Table A16. Summary Statistics of Team Efficiency (country dummies included)

		Unconditional Order-M	Conditional Order-M
EQUATION 1	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0000
	Mean	1.3539	1.0000
	3rd Quarter	1.5279	1.0000
	Maximum	3.6351	1.3040
	Eff. Score < 1	103	0
EQUATION 2	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0000
	Mean	1.3539	1.0002
	3rd Quarter	1.5279	1.0000
	Maximum	3.6351	1.3750
	Eff. Score < 1	103	0
EQUATION 3	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0000
	Mean	1.3539	1.0003
	3rd Quarter	1.5279	1.0000
	Maximum	3.6351	1.6400
	Eff. Score < 1	103	0
EQUATION 4	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0000
	Mean	1.3539	1.0000
	3rd Quarter	1.5279	1.0000
	Maximum	3.6351	1.0220
	Eff. Score < 1	103	0
EQUATION 5	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0000
	Mean	1.3539	1.0000
	3rd Quarter	1.5279	1.0000
	Maximum	3.6351	1.0980
	Eff. Score < 1	103	0
EQUATION 6	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0000
	Mean	1.3539	1.0000
	3rd Quarter	1.5279	1.0000
	Maximum	3.6351	1.0000
	Eff. Score < 1	103	0
EQUATION 7	**Minimum**	0.8316	1.0000
	1st Quarter	1.0125	1.0000
	Median	1.2696	1.0000
	Mean	1.3539	1.0000
	3rd Quarter	1.5279	1.0000
	Maximum	3.6351	1.0000
	Eff. Score < 1	103	0

Table A17: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Turkish Süper Lig Clubs– 2010/11 to 2017/18

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2010-2011	Fenerbahçe SK	1.000000	1.000000	1.000000
	Trabzonspor SK	1.000000	1.000000	1.000000
	Bursaspor SK	1.000000	1.180000	1.308000
	Gaziantepspor SK	1.000000	1.000000	1.241000
	Beşiktaş JK	1.425000	1.257000	1.519000
	Kayserispor SK	1.000000	1.020000	1.023000
	Eskişehirspor SK	1.219000	1.314000	1.390000
	Galatasaray SK	1.666000	1.000000	1.553000
	Kardemir Karabükspor SK	1.000000	1.109000	1.000000
	Manisaspor SK	1.000000	1.000000	1.238000
	Antalyaspor SK	1.120000	1.000000	1.080000
	İstanbul Başakşehir SK	1.000000	1.217000	1.344000
	MKE Ankaragücü	1.000000	1.000000	1.000000
	Gençlerbirliği SK	1.000000	1.000000	1.329000
	Sivasspor SK	1.000000	1.171000	1.599000
	Bucaspor SK	1.206000	1.000000	1.000000
	Konyaspor SK	1.806000	1.712000	2.361000
	Kasımpaşa SK	1.000000	1.231000	2.052000
2011-2012	Galatasaray SK	1.047000	1.000000	1.043000
	Fenerbahçe SK	1.000000	1.000000	1.206000
	Trabzonspor SK	1.275000	1.000000	1.318000
	Beşiktaş JK	1.426000	1.000000	1.465000
	Eskişehirspor SK	1.287000	1.171000	1.272000
	İstanbul Başakşehir SK	1.121000	1.147000	1.061000
	Sivasspor SK	1.064000	1.000000	1.176000
	Bursaspor SK	1.166000	1.469000	1.312000
	Gençlerbirliği SK	1.129000	1.264000	1.109000
	Gaziantepspor SK	1.221000	1.382000	1.426000
	Kayserispor SK	1.233000	1.389000	1.722000
	Kardemir Karabükspor SK	1.269000	1.080000	1.417000
	Mersin Idman Yurdu SK	1.500000	1.379000	1.000000
	Orduspor SK	1.462000	1.470000	1.554000
	Antalyaspor SK	1.572000	1.578000	1.630000
	Samsunspor SK	1.527000	1.181000	1.413000
	Manisaspor SK	1.680000	1.883000	1.806000
	MKE Ankaragücü	1.789000	1.000000	1.000000

Table A17: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Turkish Süper Lig Clubs– 2010/11 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2012-2013	Fenerbahçe SK	1.151000	1.079000	1.344000
	Galatasaray SK	1.016000	1.000000	1.155000
	Beşiktaş JK	1.026000	1.000000	1.136000
	Trabzonspor SK	1.282000	1.458000	1.590000
	Bursaspor SK	1.146000	1.068000	1.057000
	Kasımpaşa SK	1.127000	1.000000	1.134000
	İstanbul Başakşehir SK	1.410000	1.000000	1.705000
	Gaziantepspor SK	1.269000	1.000000	1.217000
	Eskişehirspor SK	1.176000	1.000000	1.783000
	Sivasspor SK	1.000000	1.248000	1.325000
	Mersin Idman Yurdu SK	1.909000	1.000000	2.751000
	Gençlerbirliği SK	1.208000	1.134000	1.000000
	Kayserispor SK	1.012000	1.000000	1.134000
	Orduspor SK	1.638000	1.407000	1.939000
	Kardemir Karabükspor SK	1.384000	1.000000	1.209000
	Antalyaspor SK	1.113000	1.000000	1.477000
	Elazığspor SK	1.447000	1.280000	1.367000
	Akhisar Belediyespor SK	1.422000	1.305000	1.284000
2013-2014	Galatasaray SK	1.142000	1.044000	1.262000
	Fenerbahçe SK	1.000000	1.000000	1.108000
	Beşiktaş JK	1.076000	1.205000	1.323000
	Trabzonspor SK	1.187000	1.184000	1.139000
	Bursaspor SK	1.719000	1.000000	1.453000
	Antalyaspor SK	1.884000	1.680000	2.385000
	Eskişehirspor SK	1.952000	1.317000	1.952000
	Kayserispor SK	2.383000	1.000000	2.429000
	Kasımpaşa SK	1.277000	1.000000	1.472000
	Gençlerbirliği SK	1.637000	1.000000	1.253000
	Kardemir Karabükspor SK	1.560000	1.008000	1.240000
	Sivasspor SK	1.043000	1.000000	1.401000
	Gaziantepspor SK	1.855000	1.000000	1.807000
	Kayseri Erciyesspor SK	2.103000	1.000000	1.808000
	Konyaspor SK	1.042000	1.000000	1.704000
	Çaykur Rizespor SK	1.721000	1.447000	1.669000
	Elazığspor SK	2.079000	1.000000	1.891000
	Akhisar Belediyespor SK	1.307000	1.000000	1.413000

Table A17: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Turkish Süper Lig Clubs– 2010/11 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2014-2015	Galatasaray SK	1.000000	1.000000	1.065000
	Fenerbahçe SK	1.074000	1.107000	1.057000
	Beşiktaş JK	1.188000	1.018000	1.188000
	Trabzonspor SK	1.190000	1.168000	1.000000
	Kasımpaşa SK	1.229000	1.000000	1.883000
	Bursaspor SK	1.181000	1.000000	1.331000
	Eskişehirspor SK	1.441000	2.103000	1.706000
	Sivasspor SK	1.652000	1.935000	2.233000
	Gençlerbirliği SK	1.000000	1.379000	1.458000
	Çaykur Rizespor SK	1.497000	1.873000	1.768000
	Kardemir Karabükspor SK	1.776000	1.000000	2.646000
	Kayseri Erciyesspor SK	1.384000	2.325000	2.366000
	Konyaspor SK	1.593000	1.000000	1.536000
	İstanbul Başakşehir SK	1.329000	1.225000	1.046000
	Akhisar Belediyespor SK	1.323000	1.792000	1.497000
	Balıkesirspor SK	1.052000	1.000000	1.962000
	Gaziantepspor SK	1.000000	1.302000	1.684000
	Mersin İdman Yurdu SK	1.402000	1.477000	1.487000
2015-2016	Fenerbahçe SK	1.057000	1.000000	1.000000
	Galatasaray SK	1.064000	1.000000	1.273000
	Beşiktaş JK	1.000000	1.000000	1.000000
	Trabzonspor SK	1.488000	1.115000	1.000000
	Bursaspor SK	1.248000	1.000000	1.144000
	Antalyaspor SK	1.102000	1.155000	1.387000
	Kasımpaşa SK	1.000000	1.000000	1.346000
	Eskişehirspor SK	1.454000	1.906000	1.241000
	İstanbul Başakşehir SK	1.166000	1.168000	1.078000
	Osmanlıspor SK	1.192000	1.000000	1.000000
	Gençlerbirliği SK	1.302000	1.000000	1.214000
	Sivasspor SK	1.947000	1.000000	1.943000
	Gaziantepspor SK	1.000000	1.000000	1.652000
	Akhisar Belediyespor SK	1.000000	1.053000	1.263000
	Kayserispor SK	2.175000	1.974000	1.481000
	Konyaspor SK	1.000000	1.000000	1.000000
	Çaykur Rizespor SK	1.279000	1.000000	1.241000
	Mersin İdman Yurdu SK	1.630000	1.000000	2.634000

Table A17: Unconditional Order-M Scores of Offensive, Defensive and Team Performances in Turkish Süper Lig Clubs– 2010/11 to 2017/18 (Cont'ed)

Seasons	Football Clubs	Offensive Efficiency	Defensive Efficiency	Team Efficiency
2017-2018	Beşiktaş JK	1.000000	1.000000	1.000000
	Fenerbahçe SK	1.000000	1.000000	1.000000
	Galatasaray SK	1.111000	1.000000	1.234000
	Trabzonspor SK	1.363000	1.000000	1.000000
	İstanbul Başakşehir SK	1.000000	1.000000	1.000000
	Osmanlıspor SK	2.001000	1.389000	1.768000
	Akhisar Belediyespor SK	1.000000	1.138000	1.000000
	Bursaspor SK	1.251000	1.360000	1.227000
	Kayserispor SK	1.090000	1.000000	1.000000
	Antalyaspor SK	1.121000	1.000000	1.000000
	Gaziantepspor SK	1.657000	2.081000	1.650000
	Kasımpaşa SK	1.189000	1.356000	1.407000
	Alanyaspor SK	1.108000	1.155000	1.230000
	Gençlerbirliği SK	1.344000	1.291000	1.221000
	Kardemir Karabükspor SK	1.642000	1.417000	1.284000
	Çaykur Rizespor SK	1.277000	1.000000	1.366000
	Konyaspor SK	1.000000	1.322000	1.570000
	Adanaspor SK	1.000000	2.293000	1.855000
2016-2017	Beşiktaş JK	1.060000	1.000000	1.000000
	Galatasaray SK	1.000000	1.000000	1.003000
	Fenerbahçe SK	1.000000	1.000000	1.036000
	İstanbul Başakşehir SK	1.000000	1.000000	1.072000
	Trabzonspor SK	1.000000	1.000000	1.138000
	Antalyaspor SK	1.475000	1.472000	1.511000
	Bursaspor SK	1.071000	1.000000	1.410000
	Osmanlıspor SK	1.275000	1.619000	1.462000
	Konyaspor SK	1.531000	1.400000	1.598000
	Göztepe İzmir SK	1.149000	1.000000	1.199000
	Alanyaspor SK	1.239000	1.699000	1.047000
	Kayserispor SK	1.178000	1.000000	1.593000
	Sivasspor SK	1.118000	1.169000	1.305000
	Gençlerbirliği SK	1.301000	1.770000	1.000000
	Yeni Malatyaspor SK	1.368000	1.232000	1.259000
	Akhisar Belediyespor SK	1.000000	1.385000	1.251000
	Kasımpaşa SK	1.000000	1.000000	1.124000
	Kardemir Karabükspor SK	2.641000	1.000000	1.000000