

European Major Football Leagues

A comprehensive analysis

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September 2024

1 Introduction

Football has evolved into a global spectacle, captivating millions of fans and bettors alike. Beyond the entertainment, analyzing football team performances offers critical insights into tactical patterns, efficiency, and overall league dynamics. This case study aims to provide a comprehensive analysis of team and league performances across three of the most prominent football leagues: the English Premier League (EPL), La Liga (Spain), and Ligue 1 (France). By examining offensive and defensive metrics, we sought to understand the factors that differentiate top-performing teams, identify trends in league competitiveness, and explore patterns in football outcomes. Additionally, we evaluated these performances through the lens of betting-related metrics to bridge the gap between statistical performance analysis and sports betting insights.

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Purpose and Scope

The main objective of this study was to dissect football performance by evaluating a series of key metrics, such as total goals scored, goals conceded, shots on target, shots off target, and corner goals. These variables were selected for their ability to reflect a team's offensive and defensive strength. The analysis focused on two levels: a team-level performance analysis, where we scrutinized individual team dynamics within each league, and a league-level performance comparison, where we compared aggregate data across leagues.

In addition to standard performance metrics, we incorporated betting-specific indicators such as:

- **Goals Over/Under (O/U):** Analyzes the frequency of high- and low-scoring matches based on the total goals scored in a game. Specifically, "Over" refers to matches where the total goals scored by both teams combined are three or more (i.e., Over 2.5 goals), while "Under" refers to matches where the total goals are fewer than three (i.e., Under 2.5 goals). This metric helps assess the attacking or defensive nature of teams or leagues, providing insights into which teams are likely to be involved in high- or low-scoring matches.
- **GG/NG (Both Teams to Score/Not Score):** Evaluates how often both teams score (GG) or do not score (NG) in a match. "GG" stands for "Goal-Goal" and occurs when both teams manage to score at least once in the match. Conversely, "NG" refers to matches where either one or both teams fail to score. By analyzing the frequency of GG/NG outcomes, we can identify teams or leagues prone to high engagement matches where both teams contribute offensively, as well as those more likely to feature dominant defensive performances or one-sided games..
- **Set-pieces (Corner Goals):** Focuses on the success rate of converting corner kicks into goals. By comparing the dataset for instances where a corner kick occurred followed by a goal in the same minute, we can estimate how effective teams are at exploiting set-piece opportunities. Evaluating the number of goals directly attributed to corners provides insights into

team strategies, particularly in terms of how reliant they are on set-pieces for scoring. (See Figure 41 for more details)

- **Total Goals per Match:** In addition to Over/Under, we categorized matches based on the total number of goals scored into four groups: 0–1 goals, 2–3 goals, 4–6 goals, and 7+ goals. This allows for a deeper understanding of scoring distribution across matches, helping to identify leagues or teams more frequently involved in tightly contested low-scoring matches or goal-heavy encounters.

These metrics provided a more detailed understanding of football outcomes and offered valuable insights for both analysts and bettors.

Purpose and Structure

Our study was structured around the following key focus areas:

- **Team Performance Analysis:** Investigating individual team performances within each league, with particular attention to goal-scoring tendencies, home/away differences, time-based scoring patterns, and efficiency in set-pieces like corner goals.
- **League-Level Comparisons:** Comparing leagues based on average goals, goal-scoring efficiency, and team competitiveness. We aimed to uncover whether certain leagues exhibited more open play, tighter defenses, or a higher frequency of high-scoring matches.
- **Betting-Oriented Metrics:** Integrating betting-relevant metrics such as over/under frequencies, GG/NG, and corner conversions into the analysis to provide real-world betting insights.
- **Exploration of Interesting Trends:** Exploring thought-provoking topics, such as whether top teams across different leagues exhibit similar performance patterns ("Do Big Teams Look Alike?") and whether scoring efficiency is a defining factor for winning leagues ("Does Efficiency Win Leagues?"). Additionally, we examined the entertainment value of the Premier League, which is often touted as the most exciting football league in the world.

Data Evaluated

In order to thoroughly evaluate team performance across different leagues, we selected a set of key match statistics that serve as comprehensive indicators of both offensive and defensive capabilities. For the periods of 2017-18, 2018-19 and 2019-2020 we selected these variables, including total goals, shots on target, shots off target, and corners, because they capture the most critical aspects of a football team's overall performance. The analysis of these variables allows for a deeper understanding of how well teams perform offensively by measuring

their goal-scoring abilities, accuracy in front of goal, and the pressure they exert through corner kicks. Additionally, defensive strengths are inferred through metrics such as the number of shots they allow, both on and off target, and how often their defense is forced into conceding corners.

By combining these statistics, we can derive a balanced and holistic view of team dynamics, evaluating both their attacking and defending effectiveness. The selected data thus provides a meaningful representation of team strategies, match outcomes, and overall trends within and across the leagues analyzed.

- **Total Goals:** Represents the total number of goals scored by both teams in a match and is perhaps the most direct indicator of match outcomes and overall team performance.
- **Shots on Target:** Accurate attempts directed toward the goal are a strong indicator of offensive effectiveness.
- **Shots off Target:** While not as immediately impactful as shots on target, this metric is also indicative of a team's offensive mindset, they suggest the frequency of attempts being created, even if they do not always result in accurate effort
- **Corners:** The number of corners awarded to a team gives insight into their attacking pressure, especially in matches where a team frequently forces the opposing defense to concede corners through sustained offensive play.

Key Findings

- **Similarities Across Top Teams:** Top teams across leagues—such as Manchester City and Liverpool in the EPL, Paris Saint-Germain (PSG) in Ligue 1, and FC Barcelona and Real Madrid in La Liga—displayed similar performance patterns, particularly in goal-scoring, shots on target, and corner efficiency. This suggests that elite football clubs, despite operating in different leagues, adopt comparable tactics and maintain consistent levels of dominance.
- **Betting Insights:** Certain teams were consistently involved in high-scoring matches (frequent over 2.5 goals), while others exhibited trends of both teams scoring in most matches (GG). These findings offer actionable insights for bettors aiming to capitalize on these patterns.
- **Efficiency as a Key to Success:** Our analysis of goal conversion rates, shot accuracy, and overall efficiency revealed that while efficiency contributes to success, it is not always the defining factor in winning leagues. Some teams displayed high efficiency in goal-scoring but failed to convert it into league dominance due to defensive lapses or inconsistencies.

- **Leagues Differ in Entertainment Value:** The Premier League stood out as the most "entertaining" league, with the highest number of lead changes (turnarounds), goals scored in dead time (beyond the 90th minute), and early goals (within the first 10 minutes). Despite being followed closely by the other Leagues, this aligns with the widespread perception of the EPL as a high-paced, unpredictable competition.

2 Performance Throughout Teams

In this section, we explore team-based performance across leagues, focusing on goals scored, goals conceded, home and away performance, and betting insights related to specific metrics. The evaluation includes an analysis of scoring and conceding patterns, the distribution of goals over match times, and teams' proclivity towards high-scoring matches (Over frequency). For supplementary analysis and figures on Ligue 1 and La Liga teams, see Appendix.

2.1 Goal-Scoring and Conceding Patterns

We begin our analysis by evaluating the goal-scoring and goal-conceding tendencies of teams across the Premier League, Ligue 1, and La Liga.

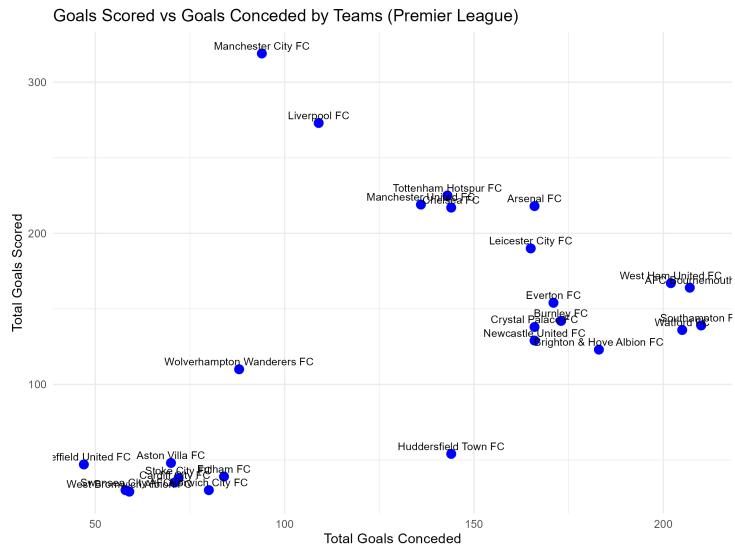


Figure 1: Goals Scored vs Conceded (Premier League)

From the goal-scored and goal-conceded scatterplot (Figure 1), it becomes evident that top teams, such as Manchester City, dominate both offensively and defensively. They not only score significantly more goals but also concede fewer, indicating their strength in both attack and defense. These trends are similarly

observed in Ligue 1 and La Liga (see Figures 23 and 24 in the Appendix), where teams like PSG, Barcelona and Real Madrid stand out for their superior goal-scoring and defensive abilities. Notably, defensive vulnerabilities are visible in teams like Levante and Toulouse across both leagues, leading to frequent GG (Both Teams to Score) scenarios.

2.2 Home vs. Away Performance

This section compares team performance between home and away games across leagues.

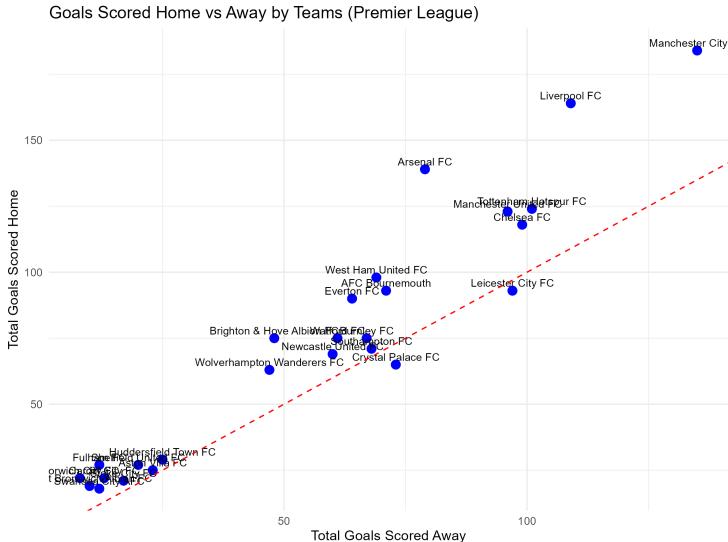


Figure 2: Goals Scored Home vs Away by Teams (Premier League)

For the Premier League (Figure 2), teams like Manchester City and Liverpool perform equally well both at home and away, making them strong candidates for betting on away wins or draws. However, more balanced performances between home and away, such as that of Brighton and , can indicate strategic vulnerabilities or strengths. Similar trends are evident in Ligue 1 and La Liga (see Figures 22, 25 and 26 in the Appendix), where teams like PSG dominate both home and away, while mid-table teams show stark differences in performance depending on the venue.

2.3 Distribution of Goals Across the Match Timespan

The distribution of goals across different match minutes helps identify whether teams are more likely to score early, late, or consistently throughout the match.

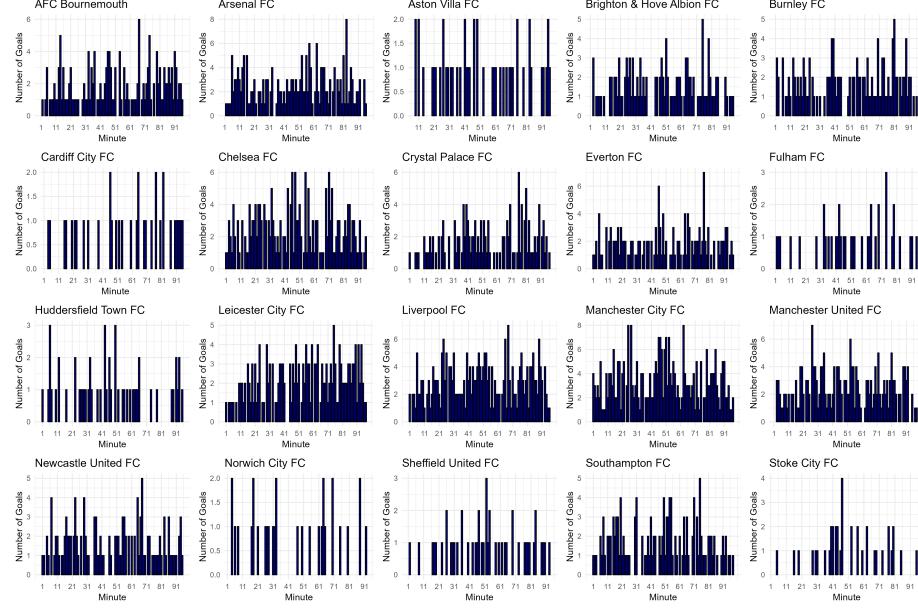


Figure 3: Team Goal Distribution by Match Minutes (Premier League)

In the Premier League (Figure 3), Manchester City and Liverpool exhibit a consistent scoring pattern throughout the match, with less goals occurring in the late minutes, indicating an early securitization of the matches . Meanwhile, teams like Crystal Palace and Stoke City have a tendency to score more in specific time periods, making in-play betting on late or early goals a potentially profitable strategy. A similar distribution pattern can be observed in Ligue 1 and La Liga (see Figures 29 and 30 in the Appendix), where top teams (Real Madrid-PSG) tend to score consistently, while mid- to low-table teams (Stade Brestois 29-Granada) show more sporadic patterns, offering opportunities for late-goal bets.

2.4 Team Points, Conversion Rate, and Efficiency

In this section, we evaluate teams' overall points in the Premier League and La Liga alongside key performance indicators such as goal conversion rate (GCR) and efficiency.

For Premier League teams, there is a strong relationship between GCR and points (Figure 18). Teams like Manchester City and Liverpool, which lead in GCR, also amass the highest points. In La Liga, the Efficiency metric (Figure 4) presents a slightly different picture. While top teams like Barcelona and Atletico Madrid perform as expected, outliers like Granada and Real Sociedad have a relatively high efficiency but fewer total points, indicating that while they capitalize on the chances they get, they may have fewer opportunities overall,

resulting in a lower league standing. Efficiency, thus, gives a nuanced view of teams' performance beyond simple goal counts.

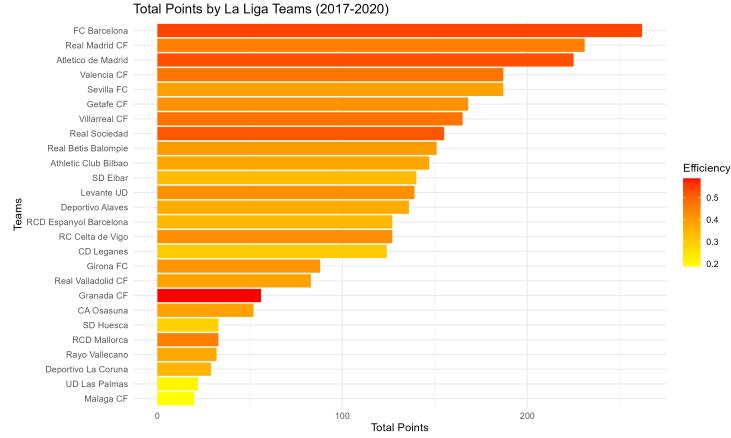


Figure 4: Total Points by LaLiga Teams (2017-2020) and Efficiency

2.5 Team-Specific Over Frequency (High-Scoring Games)

Finally, we assess the frequency with which teams engage in high-scoring matches (Over games) across the three leagues.

Top-performing teams in the Premier League, such as Manchester City and Liverpool (Figure 27), exhibit high Over frequency, largely due to their aggressive offensive play, frequently surpassing the 2.5 goal mark in matches. Ligue 1 and La Liga display similar patterns (Figures 28).

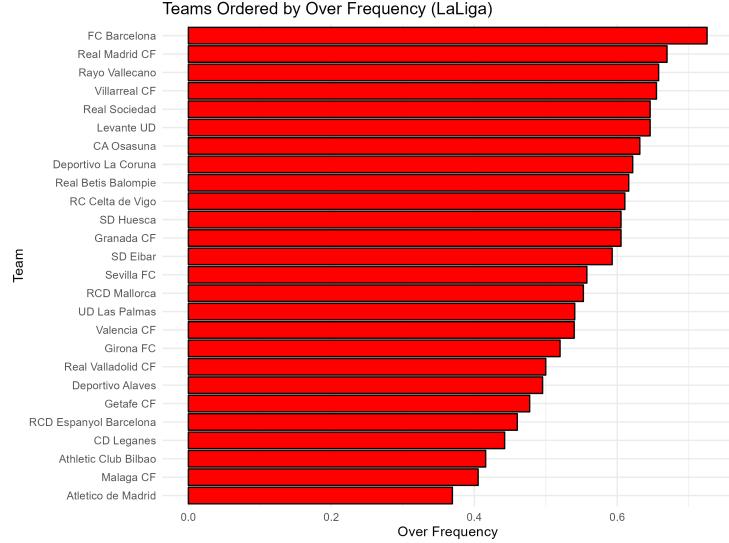


Figure 5: Frequency of Over matches in LaLiga teams

Interestingly, Atletico Madrid is a significant outlier, as they have one of the lowest Over frequencies in La Liga despite their high league position (Figure 6). Approximately 36% of their matches during these seasons ended with below three goals in total, reflecting their strong defense and conservative playstyle, making them a more challenging team for Over betting.

3 Performance Throughout Leagues

This section provides a comparative analysis of performance across three of Europe’s top football leagues: the Premier League, La Liga, and Ligue 1. The goal is to assess how league characteristics influence match outcomes, goal-scoring patterns, and key performance metrics such as shots on target, shots off target, and corners. We examine how these metrics evolve over the course of a season and how they are distributed throughout a typical match, offering insights into the distinctive playing styles and strategic approaches seen across different leagues. Additionally, we analyze correlation trends between match metrics to understand the statistical relationships that drive team success or failure across the leagues.

3.1 League Descriptive Statistics and Correlation

We start by exploring the descriptive statistics of teams across the three major leagues. In Table 1 we can observe that the Premier League exhibits slightly higher average goals per match (mean of 3.012) compared to Ligue 1 (2.88) and La Liga (2.94). Despite having less shots in total across all three leagues, the Premier League manages to convert these into more goals on average, indicating

a slightly higher shooting accuracy. This shows that Premier League teams may focus more on efficient finishing, while Ligue 1 and La Liga teams require slightly more opportunities to achieve a similar goal count. The other metrics present a quite similar result, with no significant changes.

Below we present some plots based on the descriptive statistics for the Premier League. These plots provide an overview of key match metrics such as goals, shots on target, shots off target, and corners. Figures 37 and 38 display similar plots for Ligue 1 and La Liga, with quite consistent trends across the leagues.

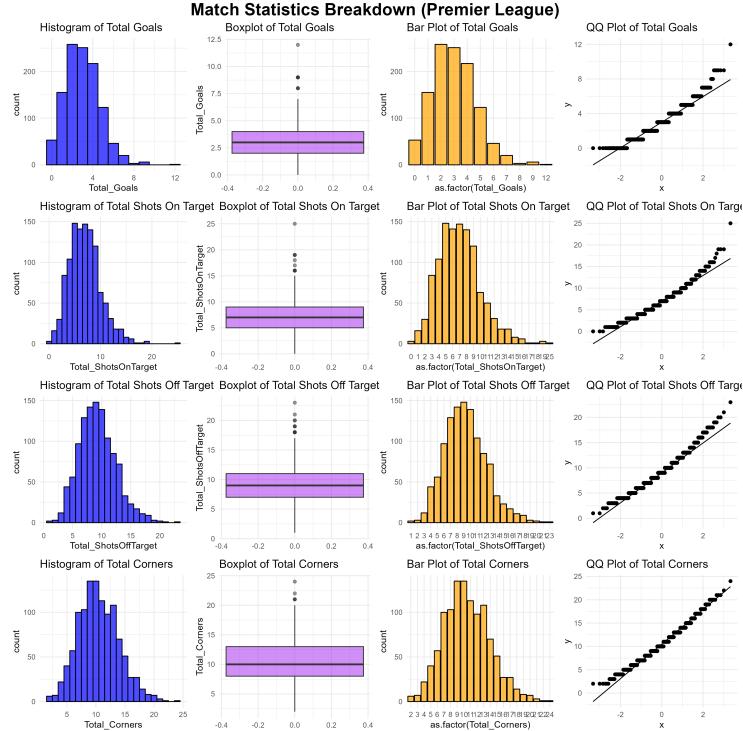


Figure 6: Distribution Plots (Premier League)

- **Goals Distribution:** The histogram shows that most matches in the Premier League feature between 1 to 4 goals, with a slight skew towards lower goal counts. Matches with more than 4 goals are relatively rare, with some outliers reaching as many as 8 to 10 goals, as indicated by the boxplot.
- **Shots on Target and Shots off Target:** The histograms for shots on target and off target display a normal distribution, with most matches having 3 to 10 shots on target and a slightly wider range for shots off target. This suggests that most teams maintain moderate shooting accuracy, with

very few matches having extreme values.

- **Corners:** The distribution of corners per match is more concentrated, with most matches seeing between 5 and 12 corners. The boxplot shows a tighter interquartile range compared to goals and shots, suggesting more consistent patterns in set-piece opportunities across matches.

The distributions across Ligue 1 and La Liga (Figures 37 and 38) show quite similar trends, with small variations. Both leagues exhibit a similar concentration of goals, shots on target/off target, and corners per match.

3.2 Correlation Analysis

In order to explore the relationships between key metrics, a correlation heatmap is generated for all the leagues. This helps to identify how strongly various match statistics correlate with each other.

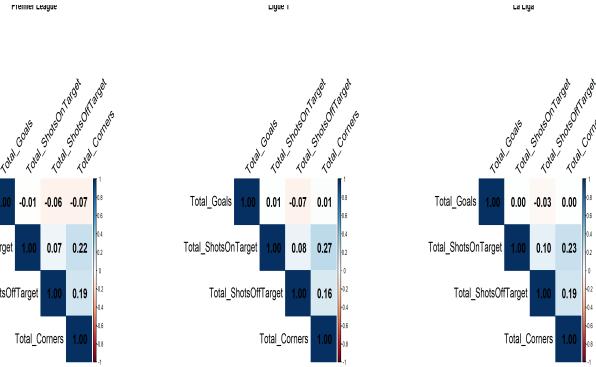


Figure 7: Correlation Heatmap

The correlation heatmap (Figure 7) yields several key insights:

- Total goals exhibit little to no correlation with the number of shots on target or off target. This suggests that the volume of attempts does not necessarily translate into goals, emphasizing the importance of shot quality and finishing efficiency.
- There is a moderate positive correlation (0.27) between corners and shots on target, indicating that teams which generate more corner kicks tend to have more opportunities to score.

In this plot, only linear correlation was taken into account. To provide a better glimpse in the correlation between the goals and the other variables we also provide a scatterplot, where on y axis are depicted the goals and on x axis

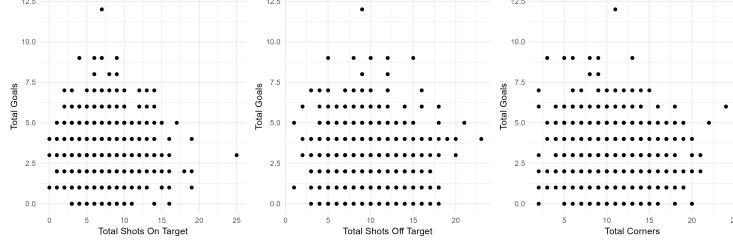


Figure 8: Goals vs Shots (Premier League)

the variables of our interest. As observed, no significant relationship is visible between the number of shots and the total goals scored, since the plots create a random mass. This reinforces the earlier observation that accuracy rates vary widely even among teams with high shot counts. The lack of a strong relationship between total goals and the number of shots on target suggests that other factors, such as defensive quality, player positioning, and set-piece effectiveness, play crucial roles. This finding has significant implications for predictive models and betting strategies, where focusing on expected goals (xG) may offer greater predictive power than shot totals alone.

3.3 Goal Trends Across Seasons

3.3.1 Goals Over Time

We now examine the trends in total goals per match over the course of three seasons. Figure 9 illustrates the distribution of total goals per match in the Premier League.

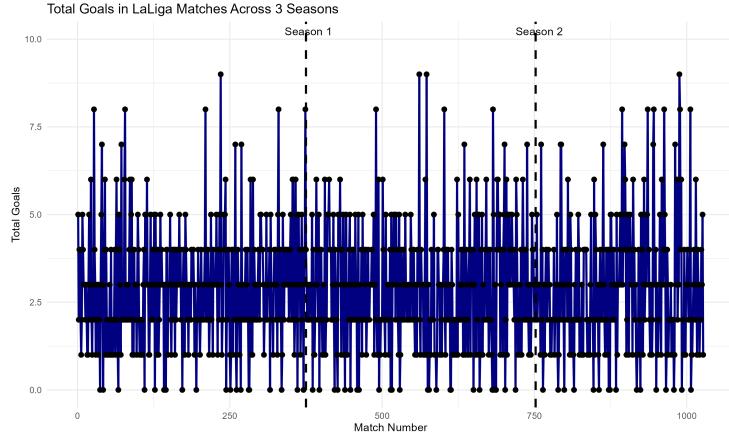


Figure 9: Total Goals per Match in Premier League Across Three Seasons

As can be seen in this Figure , Premier League exhibits a noticeable pattern of increased goal concentration towards the end of each season. Specifically, in season 2019-20 this occurrence is quite apparent, suggesting that teams tend to adopt more aggressive play as they approach the season's conclusion, whether to secure vital points, qualify for European competition, or avoid relegation. In Ligue 1, Figure 31, we observe a more standardized and a well balanced performance throughout the 3 seasons, with some peaks in variant times, without significant patterns along. Laliga (Figure 32) does not show any pattern, but shows a higher volatility in goals throughout all three seasons.

3.3.2 Total Goals by Match Minute

In order to understand how goals are distributed throughout the match, we analyze the total goals scored by match minute for each league.

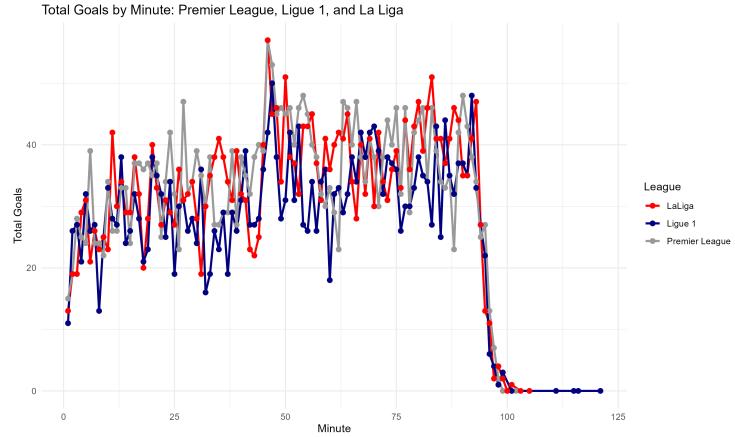


Figure 10: Total Goals by Match Minute: Premier League, Ligue 1, and La Liga

Figure 4 reveals some key insights regarding goal timing:

- Across all leagues, more goals are scored in the second half, with a notable peak between the 45th and 50th minute. This can be attributed increased intensity as teams seek to score before the end of the half, or even lack of defensive patience and consequence due to looseness.
- Premier League teams show relatively strong early-game performance, scoring more goals in the first half, especially in the mean time, compared to the other leagues.
- Ligue 1 and La Liga exhibit a tendency for more goals in the last 20 minutes, indicating that teams often push for results towards the end of matches.

Across all leagues, there is a notable peak in the time span of 45-50 minutes (extra time of the first half) for all key variables, including goals, shots on target, shots off target, and corners (see Figures 35 and 36), with this trend being particularly pronounced in the Premier League. This suggests a heightened level of pressure and urgency from teams during the closing minutes of the first half, as they strive to either secure a lead or level the score. The psychological significance of entering halftime with a favorable scoreline may drive teams to intensify their offensive efforts during this critical period. By scoring or creating chances in these final moments, teams can regain focus and enter the second half with greater confidence and tactical clarity.

Although a high peak is observed during the extra time of the first half (45-50 minutes), this intensity is not as prominent during the extra time of 90 minutes across leagues. This may be attributed to the physical and mental exhaustion of the teams by the end of the match, which reduces their ability to maintain the same level of offensive pressure. While teams continue to push for results in the final minutes, the diminished intensity compared to the first half highlights the toll that 90 minutes of play takes on players, leading to fewer decisive actions like goals, shots, and corners during stoppage time.

3.4 Home Advantage

We now try to evaluate the performance of each league's teams during home and away games to get a deeper insight into the home advantage and its influence on match outcomes. By comparing home and away performances, we aim to identify patterns such as goal-scoring proficiency, defensive stability, and overall win-loss ratios across the Premier League, La Liga, and Ligue 1. Understanding these patterns can provide valuable insights into how teams exploit home-field advantage, providing further clues into their adaptability and consistency in different match environments.

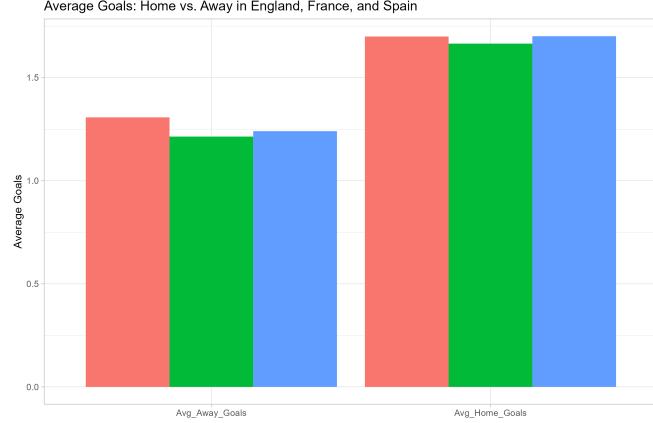


Figure 11: Average Goals in Home vs Away games in each League

In Figure 11, we observe that goal distribution across home and away games presents a consistent pattern across the Premier League, Ligue 1, and La Liga. In all three leagues, teams score significantly more goals at home compared to away games. This trend is expected as home teams benefit from factors such as home crowd support, familiar conditions, and reduced travel fatigue. Notably, the Premier League exhibits a slight edge in goals scored during away games compared to the other leagues, though the difference is relatively small.

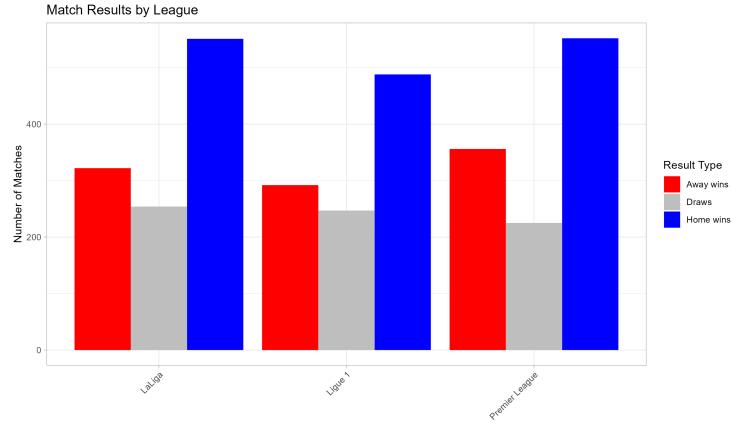


Figure 12: Home vs Away Results by League

In Figure 12, home wins dominate across all three leagues. Both La Liga and the Premier League show a high percentage of home wins, with Ligue 1 displaying more balanced results between home wins, draws, and away wins. Additionally, the total number of matches that end in draws appears to be quite

similar across all leagues, with the Premier League having slightly fewer draws. Moreover, the Premier League seems to have a slight edge on away wins as well, further suggesting a somewhat higher competitiveness in away games compared to Ligue 1 and La Liga.

This analysis suggests that home advantage plays a significant role in match outcomes, as evidenced by the dominance of home wins and the higher goal-scoring rates in home games across all leagues. The slightly more competitive nature of Premier League away games, reflected in both goals scored and away wins, may point to the relative strength of teams when playing on the road in England.

3.5 Crucial Betting Metrics

In this chapter, we transition to a detailed analysis of key betting metrics, focusing on the performance of teams across the Premier League, Ligue 1, and La Liga. We will examine critical indicators such as the Over/Under (O/U) goal totals, the frequency of high-scoring matches (7+ goals), and the occurrence of Both Teams to Score (GG) or Not to Score (NG). These metrics provide valuable insights into the offensive and defensive tendencies of teams, helping us understand how they align with common betting markets and offering useful trends for predictive analysis.

3.5.1 Over/ Under 2.5 Goals

Firstly, we compute the percentage of matches that exceed 2.5 goals (over) versus those that remain under 2.5 goals (under) across these leagues. The results, visualized in Figure 13, reveal that while Ligue 1 and La Liga exhibit quite similar distributions, with the majority of matches surpassing the 2.5 goal threshold (indicated by the blue section of the pie charts), the Premier League demonstrates a significantly higher percentage of over 2.5 goal matches.

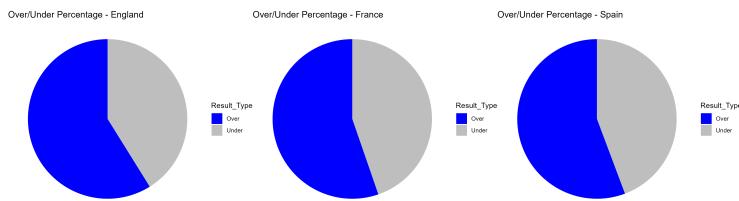


Figure 13: Over/Under 2.5 Goals Distribution by League

This suggests that Premier League matches are generally more goal-laden compared to the other two leagues. The fast-paced, attacking football often

associated with the Premier League could explain this trend, where the style of play allows for more frequent scoring opportunities. On the other hand, Ligue 1 and La Liga, although still featuring a majority of high-scoring games, display a slightly more balanced distribution between over and under 2.5 goals.

In summary, all leagues show that most matches exceed 2.5 goals, indicating that fans across these leagues are regularly treated to high-scoring games, enhancing the spectacle. The higher frequency of over 2.5 goals in the Premier League, however, reinforces its reputation as a more attack-focused, high-scoring competition compared to its French and Spanish counterparts.

3.5.2 Goal Category Distribution

In this analysis, we investigate the distribution of goals across different intervals (0-1, 2-3, 4-6, and 7+ goals) for all leagues. The bar plot below provides insights into how often different numbers of goals occur in these leagues.

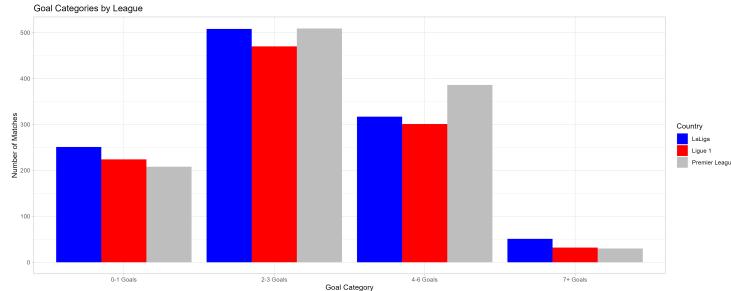


Figure 14: Goal Categories by League

In plot 14 we observe that Premier League stands out, with the majority of its matches clustered around the 2-3 and 4-6 goal intervals, especially in the latter. This distribution suggests that Premier League games often have moderate to high goal-scoring events, showcasing the league's attacking nature and frequent goal-scoring opportunities.

La Liga, on the other hand, reveals some interesting characteristics. While it has the highest number of matches with 0-1 goals, which aligns with its reputation for being a more defensively structured league, it also leads in matches with 7+ goals. This indicates that despite the prevalence of low-scoring games, there is a considerable number of high-scoring matches in La Liga. This divergence can be explained by the defensive approach of many teams, which occasionally breaks down, leading to lopsided results. Statistically, this pattern also aligns with the fat-tailed distribution we previously identified in La Liga's goal data, where extreme outcomes (either very few or very many goals) are more common.

Interestingly, despite the Premier League having the most overall goals, it has the fewest 7+ goal matches. This likely stems from the league's competitiveness and balanced matchups, where even high-scoring games rarely result in extreme goal differences.

Finally, Ligue 1 demonstrates a more balanced spread across the goal categories, without significant peaks in any specific interval. This suggests that Ligue 1 matches tend to have a more consistent goal-scoring pattern, neither overly defensive nor heavily goal-laden compared to the other leagues.

In summary, while all leagues show that 2-3 goals is the most common outcome, La Liga shows more extremes in goal distribution, the Premier League consistently has moderate-to-high scoring matches, and Ligue 1 exhibits a more evenly spread goal-scoring pattern.

3.5.3 GG/NG Analysis

We close this interesting section by exploring the distribution of GG (both teams scoring) versus NG (no goals from one team) match outcomes across the leagues. The bar plot below provides a comparative analysis of how frequently both teams score (GG) or one team fails to score (NG) across these leagues.

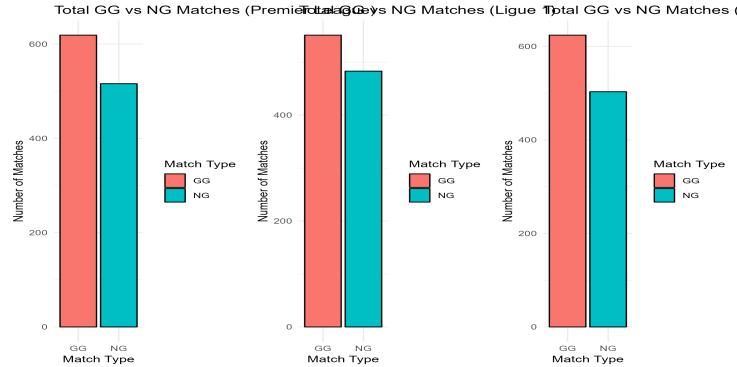


Figure 15: GG/NG Percentage of matches

The Premier League and La Liga display quite similar results, with both having a slightly higher number of GG matches compared to NG matches. This suggests that most matches in these leagues tend to be more competitive, with both teams managing to find the back of the net in a majority of games. The fact that GG matches slightly outnumber NG matches can be an indicator of an attacking approach from teams in both leagues, with games featuring open play and more frequent scoring opportunities for both sides.

On the other hand, Ligue 1 exhibits a more balanced spread between GG and NG matches, with the percentage of NG matches being slightly higher than the other leagues. This balance implies a somewhat more defensively oriented league, where clean sheets are more common, leading to a higher occurrence of games where one team fails to score.

In figures 39 and 40 we can also see the percentage of each league's GG games, across all different three seasons, to get a better view of each leagues performance through seasons.

Overall, the GG/NG ratio across all three leagues shows a general consistency, with a slight preference for GG matches across all leagues, particularly in the Premier League and La Liga. This consistency indicates that, regardless of the specific playing style of each league, teams tend to score goals in most matches, contributing to a competitive and dynamic football experience for fans. The slight edge of NG matches in Ligue 1 further emphasizes the importance of defensive strategies in the French league.

4 Exploring Key Hypothesis

In this chapter, we perform an in-depth comparative analysis across the three major European football leagues trying to tackle some interesting concerns. The analysis is structured into three subsections, each addressing a distinct question regarding the teams' playstyles, performance efficiency, and overall entertainment value of the leagues. The aim is to evaluate whether the top-performing teams in these leagues exhibit similar characteristics, assess the role of efficiency in winning leagues, and determine which league provides the most exciting football experience based on specific metrics.

4.1 Do 'Big Guys' Look Alike?

In this subsection, we delve into the question of whether top teams in different leagues share common performance traits. To accomplish this, we focus on four key performance variables: goals, shots on target, shots off target, and corners. Each of these variables is further split into two subcategories—offensive and defensive metrics (i.e., goals scored vs. goals received, shots on target made vs. shots on target received, etc.). This approach enables us to better understand both the attacking and defensive tendencies of teams. In total, we analyze eight variables to form a more holistic view of team behavior.

We perform a Principal Component Analysis (PCA) to reduce the dimensionality of the dataset, allowing us to focus on the first two principal components, which explain 81% and 14% of the total variance, respectively. This large cumulative variance explained (95%) suggests that these components capture a significant amount of the variability in the data, making it a valuable tool for comparing teams across leagues.

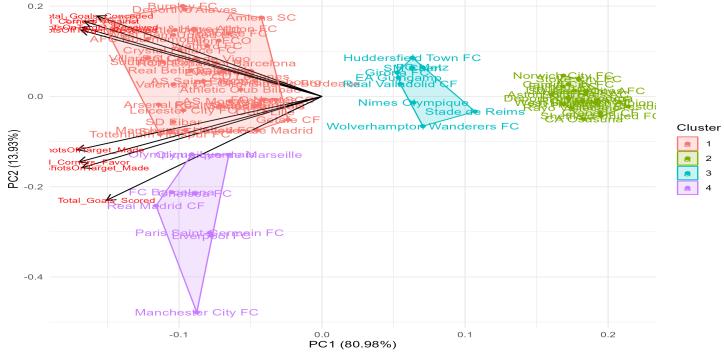


Figure 16: PCA and clusters

In Figure 16, we observe four distinct clusters that represent different groupings of teams based on their performances across the mentioned variables.

Interestingly, the PCA reveals that the top teams across the leagues exhibit remarkably similar traits. However, what stands out is that the underdog and mid-tier teams across all leagues show an even greater degree of resemblance. This may be explained by these teams often relying on similar tactical approaches, such as defensive resilience and opportunistic counterattacking, to compete against stronger opposition. As a result, these smaller and mid-tier teams might prioritize similar strategies, leading to a convergence in performance characteristics.

4.2 Does Efficiency Win Leagues?

Here, we aim to explore the relationship between a team’s ability to efficiently convert scoring opportunities into actual goals and their overall success in terms of points gained throughout the season. The focus is on the goal conversion metric, which reflects a team’s proficiency in turning critical chances into goals (Metric is designed as the ratio of shots on target to the goals of the team). A higher conversion rate is often indicative of clinical finishing, which is crucial in close matches. We calculate the correlation between the goal conversion rate and the total points earned by teams across all three seasons. This allows us to assess whether more efficient teams are also more successful in terms of league standings.

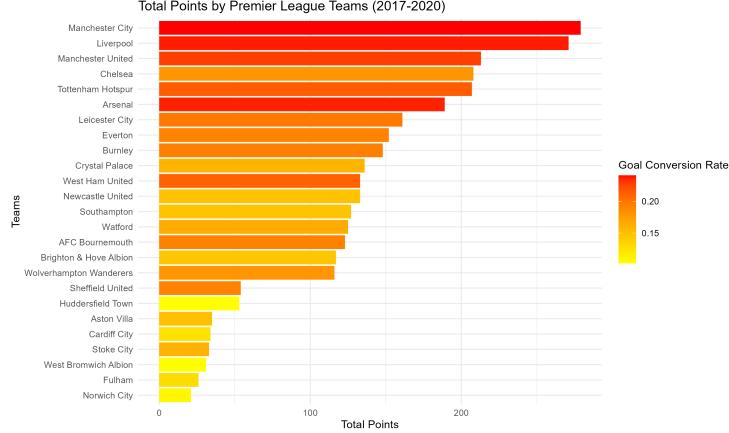


Figure 17: Total Points by Premier League Teams (2017-2020) and Efficiency

From Figure 17, it is evident that there is a strong positive correlation between goal conversion rate and total points earned by teams. Teams such as Manchester City, Liverpool, and Manchester United, which consistently accumulate the most points, also exhibit higher goal conversion rates, as indicated by the darker red shading. This demonstrates that these top-performing teams are highly efficient in converting their goal-scoring opportunities into actual goals, which directly contributes to their success in accumulating points.

However, there are some notable outliers in this trend. For instance, teams like Arsenal and Chelsea show relatively lower goal conversion rates compared to other top-performing teams, despite securing a significant number of points, while West Ham shows better goal conversion rate than its point yield. This could be attributed to other factors such as defensive strength, consistency in winning close matches, or tactical approaches that allow these teams to accumulate points even with lower goal conversion efficiency.

4.3 Is Premier the Most Interesting League?

The final question addresses a more subjective opinion—whether the Premier League can be considered the most entertaining league in Europe. To answer this, we evaluate three key metrics across all three leagues over the three seasons:

Lead Changes in Games: We assess which league experienced the most frequent lead changes within matches. Lead changes can be an indicator of competitive balance and unpredictability in games, factors that contribute to the entertainment value of a league.

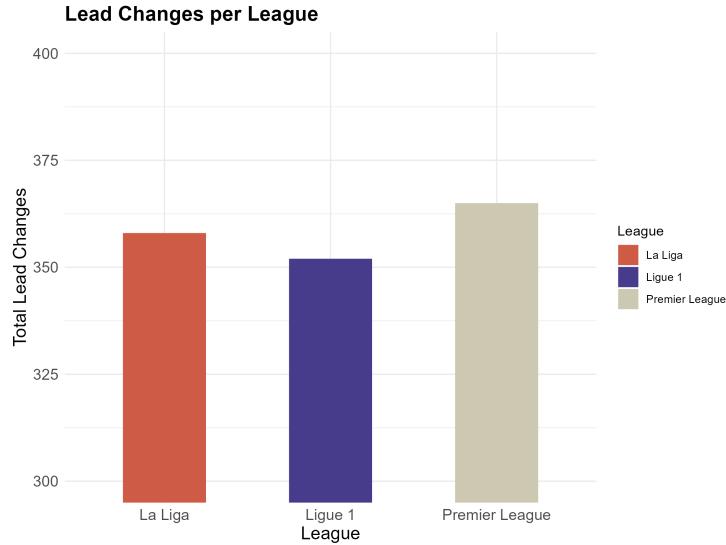


Figure 18: Total lead changes across all games in each league in all three seasons

As observed in Figure 18, the Premier League exhibits the highest number of lead changes, suggesting that it offers the most competitive and unpredictable matches among the three leagues. This indicates that Premier League matches frequently involve teams battling for the lead, creating an exciting and dynamic viewing experience.

Conversely, Ligue 1 has the fewest lead changes, although it still presents a notable amount of unpredictability and entertainment. La Liga falls somewhere in between, maintaining a relatively high level of lead changes compared to Ligue 1.

It is important to note that, despite the Premier League showcasing the highest number of lead changes, all three leagues have relatively high counts, which reinforces the notion that European football leagues are highly competitive. The frequent shifts in match dynamics highlight the entertainment value that these leagues offer, contributing to their global appeal and fan engagement.

Early Goals Impact: Similar to the late drama effect, this metric looks at which league had the most goals scored within the first 10 minutes of matches. Early goals can set the tone for an exciting, high-intensity game, as they often force the opposing team to respond quickly and change their tactics.

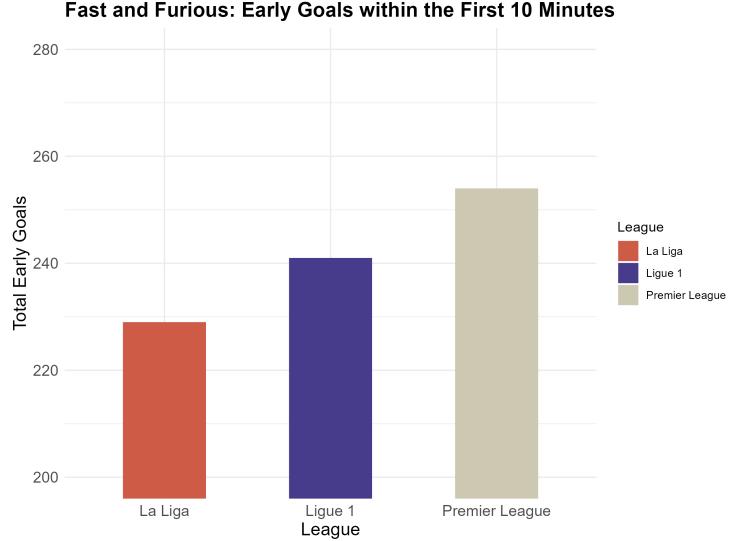


Figure 19: Total goals that were scored in the first ten minutes of the game

As shown in Figure 19, the Premier League once again leads in this metric, demonstrating the highest number of goals scored in the opening 10 minutes of matches. This suggests that Premier League teams tend to start games at a faster pace and engage in high-intensity play right from the start, contributing to the league’s reputation for dynamic and exciting football.

Ligue 1 follows closely behind with a similar number of early goals, indicating that teams in this league also aim to assert their dominance early on. La Liga, while slightly lower in comparison, still records a substantial number of early goals, showing that early goal scoring is prevalent across all three leagues.

This metric supports the view that early goals can increase the excitement and intensity of matches, as teams are immediately put on the back foot and must react to avoid falling behind further. In all three leagues, early goals help to set the stage for an exciting game.

Late Drama Effect: This metric examines which league saw the highest number of goals scored in extra time (after the 90th minute). The presence of late drama—goals scored in the dying moments of a match—adds excitement and unpredictability to games, creating memorable moments for fans.

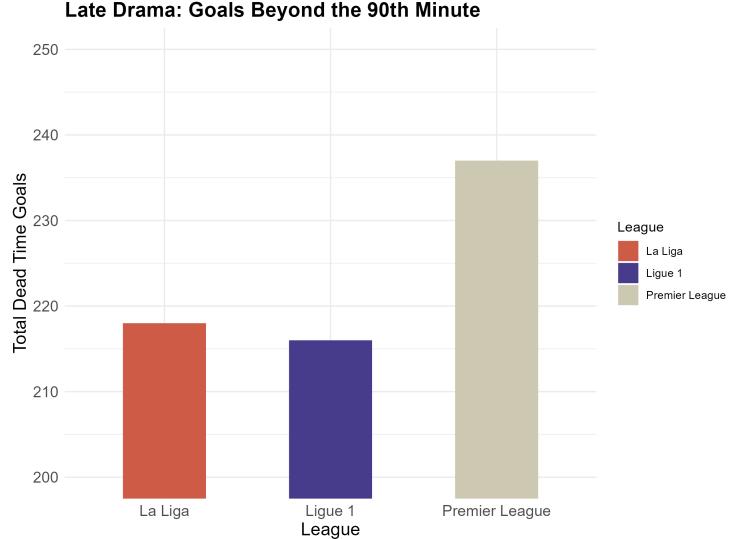


Figure 20: Total goals scored in dead time (after 90 minutes)

As shown in Figure 20, the Premier League leads with the highest number of goals scored beyond the 90th minute, emphasizing its reputation for providing thrilling, last-minute finishes. The presence of "dead time" goals adds to the unpredictability of matches, where results can dramatically change in the final moments.

La Liga and Ligue 1 show similar patterns but with fewer goals in the extra time period compared to the Premier League. However, all three leagues still maintain a substantial number of late goals, indicating that late drama is a common phenomenon across European football, enhancing the viewer experience.

This analysis supports the notion that late goals play a significant role in the perceived excitement of a league, with the Premier League slightly edging out its counterparts in terms of late-game drama.

Ultimately, numbers don't lie—the Premier League, with its dramatic turnarounds, early scoring, and late-game heroics, makes a strong case for being the most thrilling football competition in Europe.

Conclusion

This paper presents a comprehensive analysis of performance trends in three of Europe's top football leagues: the English Premier League (EPL), La Liga (Spain), and Ligue 1 (France). The study focuses on offensive and defensive metrics across multiple seasons and provides insights into team dynamics, league competitiveness, and trends within betting-related metrics. The paper is structured into three main sections: team performance analysis, league comparisons,

and a deeper exploration of specific hypotheses on football efficiency and entertainment.

Key Findings

- **Team Performance Across Leagues:** The analysis reveals that top-performing teams in all three leagues (such as Manchester City, PSG, and Barcelona) exhibit similar performance traits, particularly in scoring, shooting accuracy, and corner efficiency. This suggests that dominant teams tend to adopt comparable tactics, regardless of the league they play in. Mid- to lower-tier teams also demonstrate some shared characteristics, but underdogs tend to rely more on defensive resilience and counterattacking strategies.
- **Home vs. Away Performance:** Across all leagues, teams score significantly more goals at home compared to away matches, highlighting the importance of home-field advantage. Interestingly, the Premier League stands out slightly, with its away teams scoring more goals than those in other leagues, indicating higher competitiveness in English away matches.
- **Goal-Scoring Trends:** The analysis of goals over match time shows that the second half of games yields more goals across all leagues, with a significant peak occurring between the 45th and 50th minutes, consistent with halftime adjustments and urgency to secure results. Although there is a slight dip in intensity during extra time (after 90 minutes), the Premier League leads in late goals, contributing to its reputation for thrilling matches.
- **Betting-Oriented Metrics:** In terms of betting insights, the Premier League emerges as the most goal-heavy league, with a higher percentage of matches exceeding 2.5 goals. All leagues tend to have more matches where both teams score (GG) rather than one team failing to score (NG). In terms of over/under analysis, while all leagues lean towards over 2.5 goals, the Premier League is particularly attack-oriented.
- **Do Big Teams Look Alike?** Through a PCA (Principal Component Analysis), it becomes clear that top-performing teams across leagues exhibit a strong similarity in both offensive and defensive strategies. Interestingly, mid- and lower-tier teams show an even greater convergence in performance traits, perhaps due to reliance on similar tactical approaches when competing against stronger opposition.
- **Efficiency and Winning Leagues:** Goal conversion rate strongly correlates with total points accumulated by teams. Teams that are more efficient in converting scoring opportunities, such as Manchester City and Liverpool, are more successful in league standings. However, outliers such as Chelsea and Arsenal demonstrate that despite scoring many points, they are less efficient than other top teams.

- **Entertainment Value of the Premier League:** The paper evaluates three metrics—lead changes, early goals, and late goals—to assess which league provides the most entertaining football. The Premier League consistently ranks highest across all three metrics, with frequent lead changes, early goals in the first 10 minutes, and a significant number of late goals after the 90th minute. This reinforces the widespread perception that the Premier League is the most exciting league in European football.

Conclusion

The comprehensive analysis undertaken in this paper confirms the competitive nature of Europe’s top football leagues, with the Premier League standing out as the most dynamic and unpredictable. While top teams across leagues exhibit similar performance characteristics, it is the efficiency of teams in converting chances into goals that largely determines their success. The inclusion of betting-related metrics, such as over/under analysis and GG/NG frequency, provides further depth, offering actionable insights for bettors. Ultimately, the paper supports the idea that while all three leagues offer unique football experiences, the Premier League, with its high-octane, goal-heavy matches and unpredictable outcomes, leads as the most entertaining league in Europe.

A Appendix

Metric	Premier League	Ligue 1	La Liga
Goals (Mean)	3.012	2.88	2.94
Goals (Std)	1.67	1.71	1.79
Goals (Max)	12	9	10
Shots on Target (Mean)	7.00	7.16	7.11
Shots on Target (Std)	3.08	3.09	3.09
Shots on Target (Max)	25	18	19
Shots off Target (Mean)	9.28	9.96	9.75
Shots off Target (Std)	3.18	3.28	3.63
Shots off Target (Max)	23	21	28
Corners (Mean)	10.47	9.73	9.57
Corners (Std)	3.48	3.35	3.24
Corners (Max)	24	23	20

Table 1: Descriptive Statistics of Premier League, Ligue 1, and La Liga (Goals, Shots, Corners)

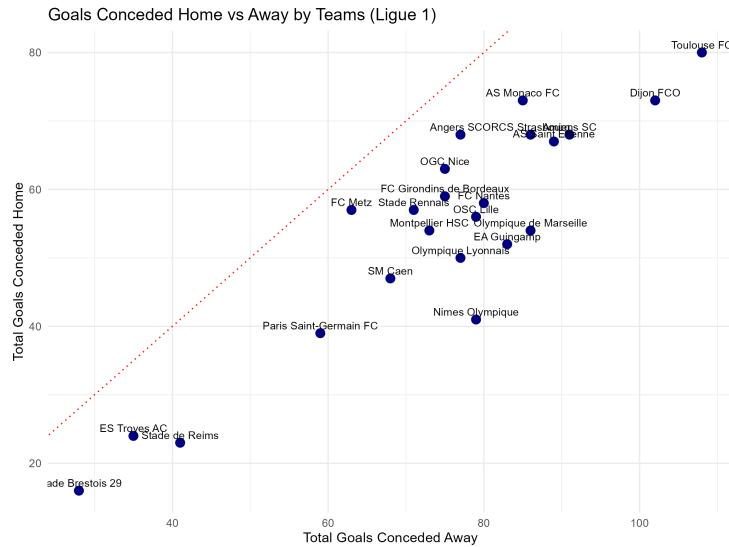
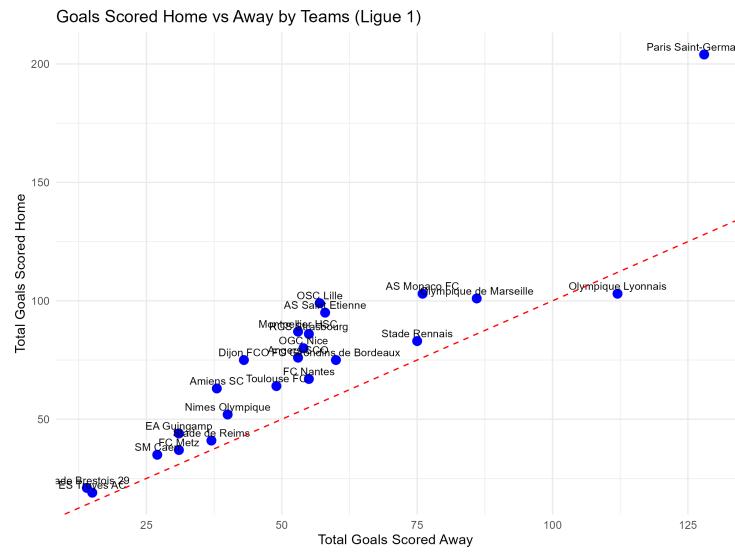


Figure 21: Goals Conceded Home vs Away by Teams (Ligue 1)



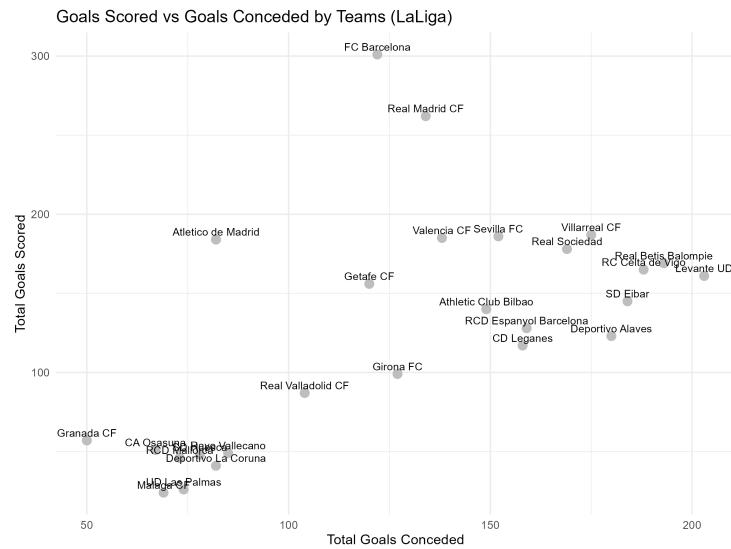


Figure 24: Goals scored vs conceded (LaLiga)

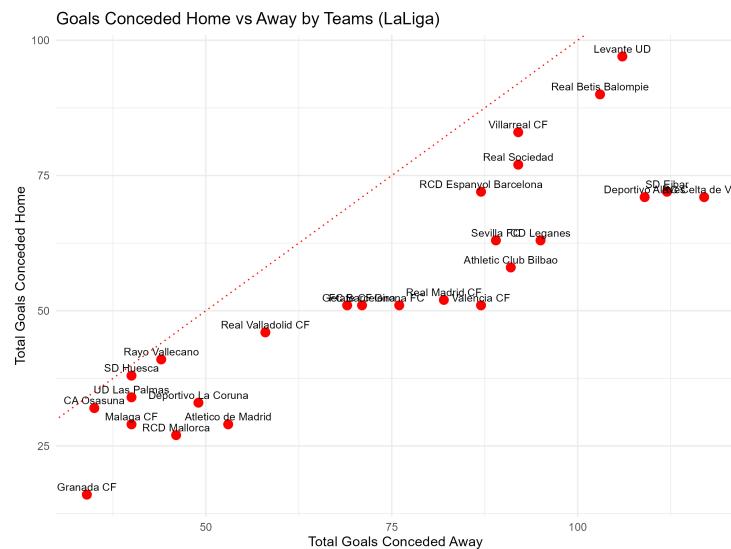


Figure 25: Goals Conceded Home vs Away by Teams (La Liga)

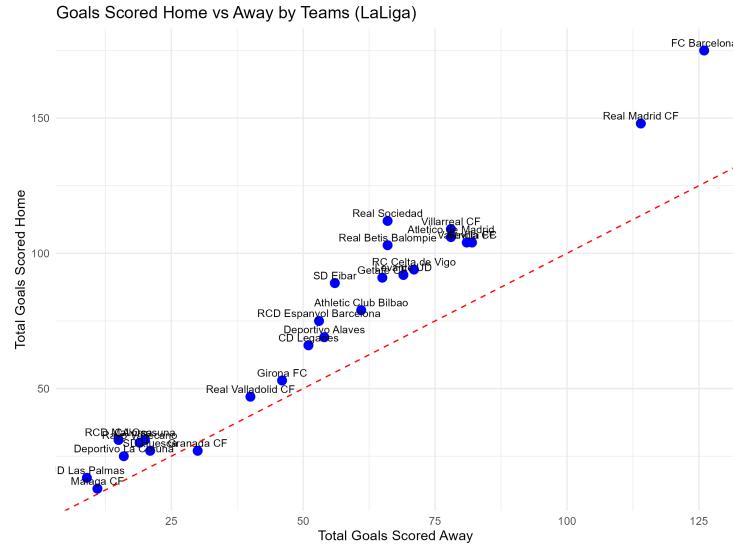


Figure 26: Goals Scored Home vs Away by Teams (La Liga)

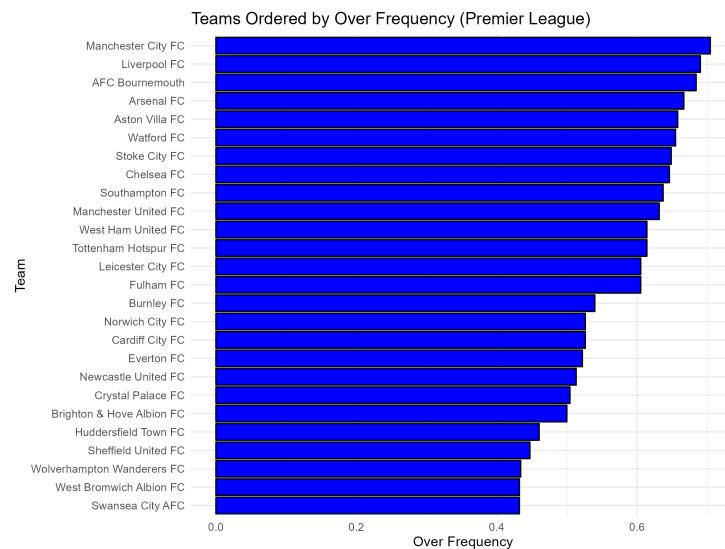


Figure 27: Teams Ordered by Over Frequency (Premier League)

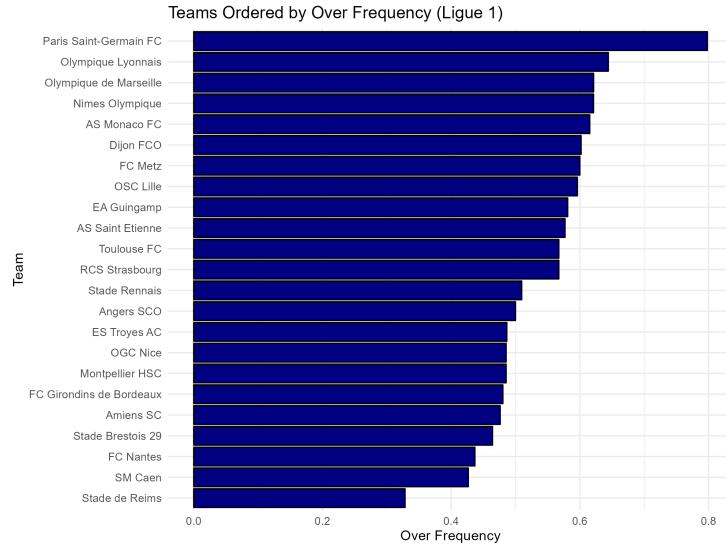


Figure 28: Teams Ordered by Over Frequency (Ligue 1)

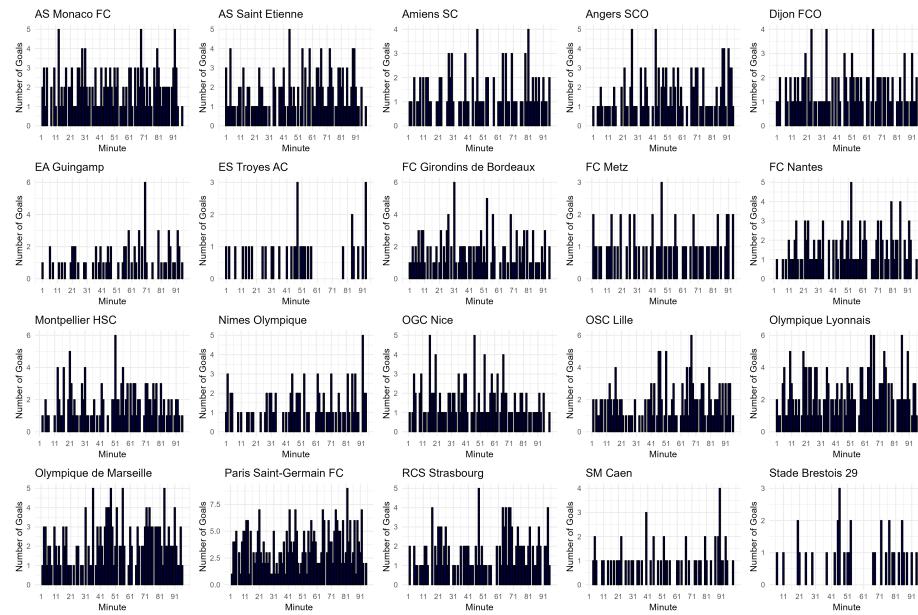


Figure 29: Team Goal Distribution by Match Minutes (Ligue 1)

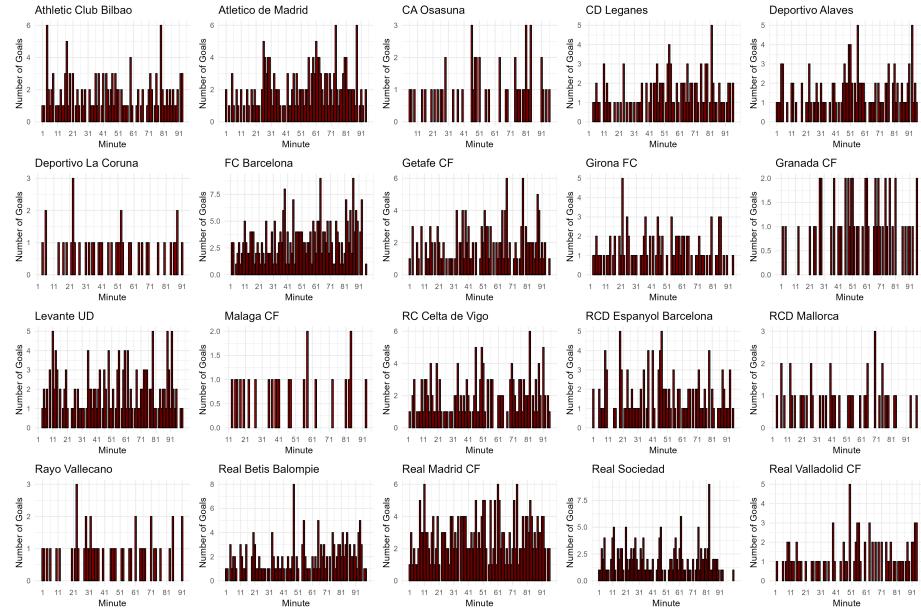


Figure 30: Team Goal Distribution by Match Minutes (La Liga)

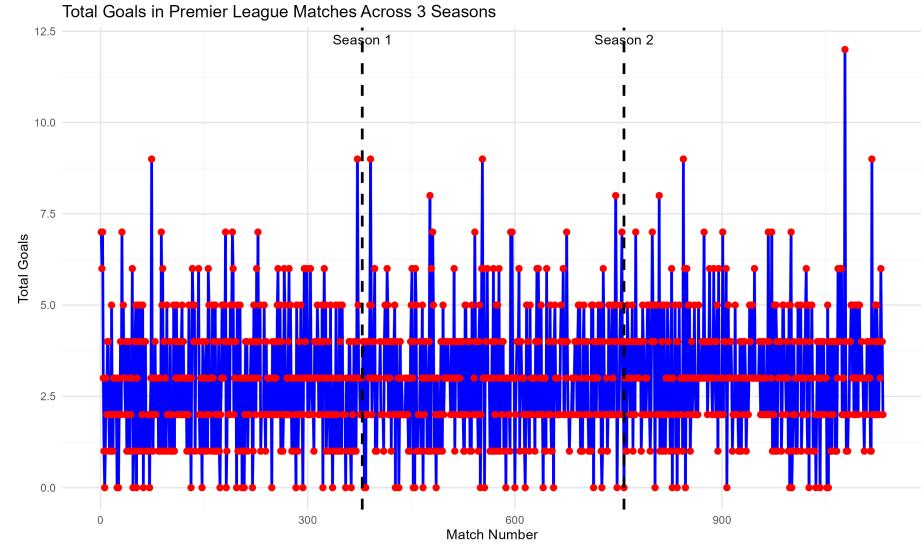


Figure 31: Team Goal Distribution by Match Minutes (Ligue 1)

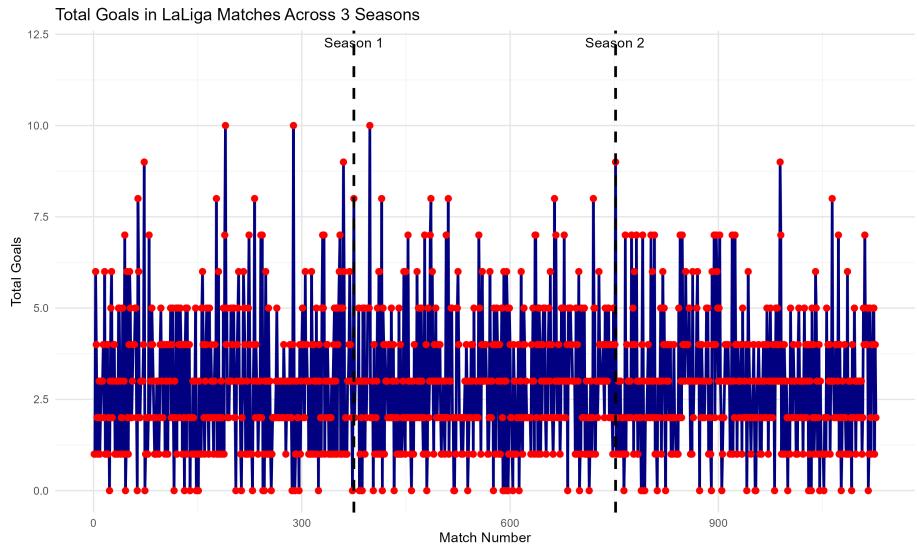


Figure 32: Team Goal Distribution by Match Minutes (La Liga)

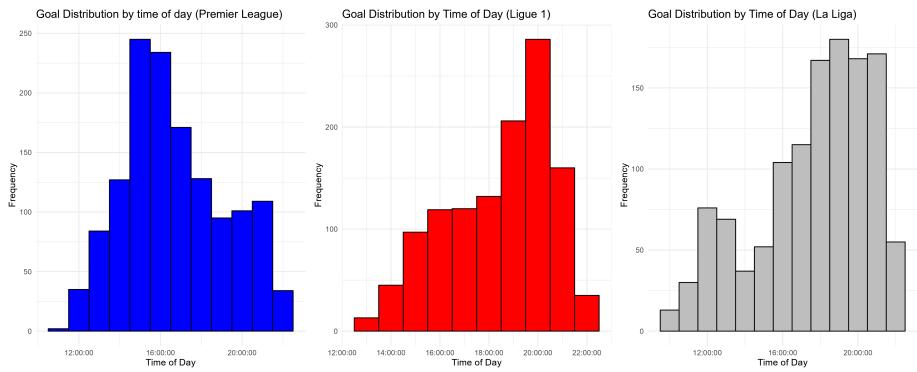


Figure 33: Team Goal Distribution by Match Minutes

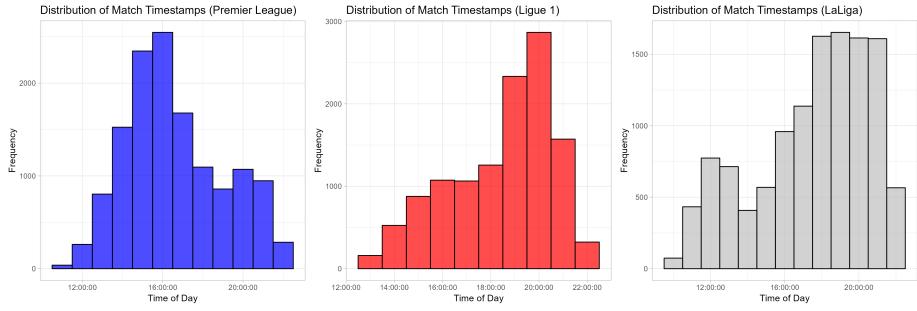


Figure 34: Matches distributions across Day Time

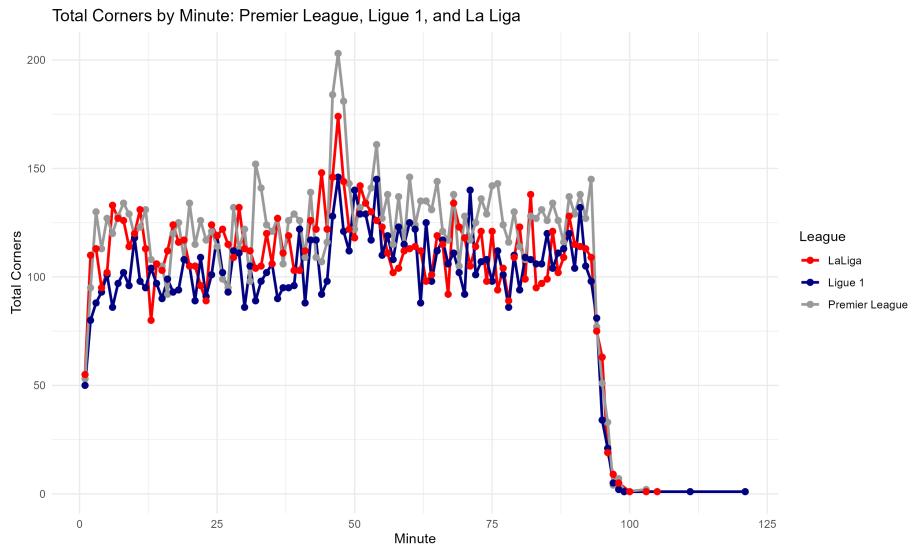


Figure 35: Team Corners Distribution by Match Minutes

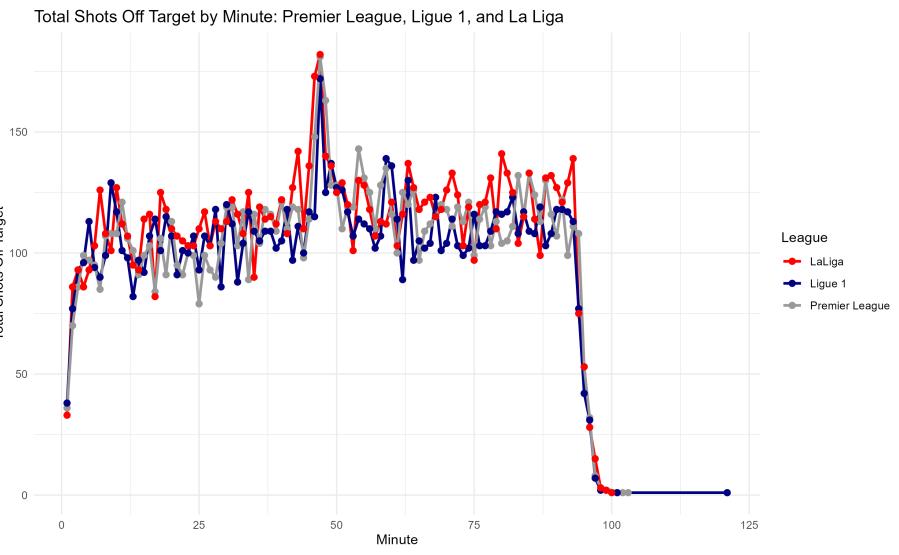


Figure 36: Team Shots off target Distribution by Match Minutes

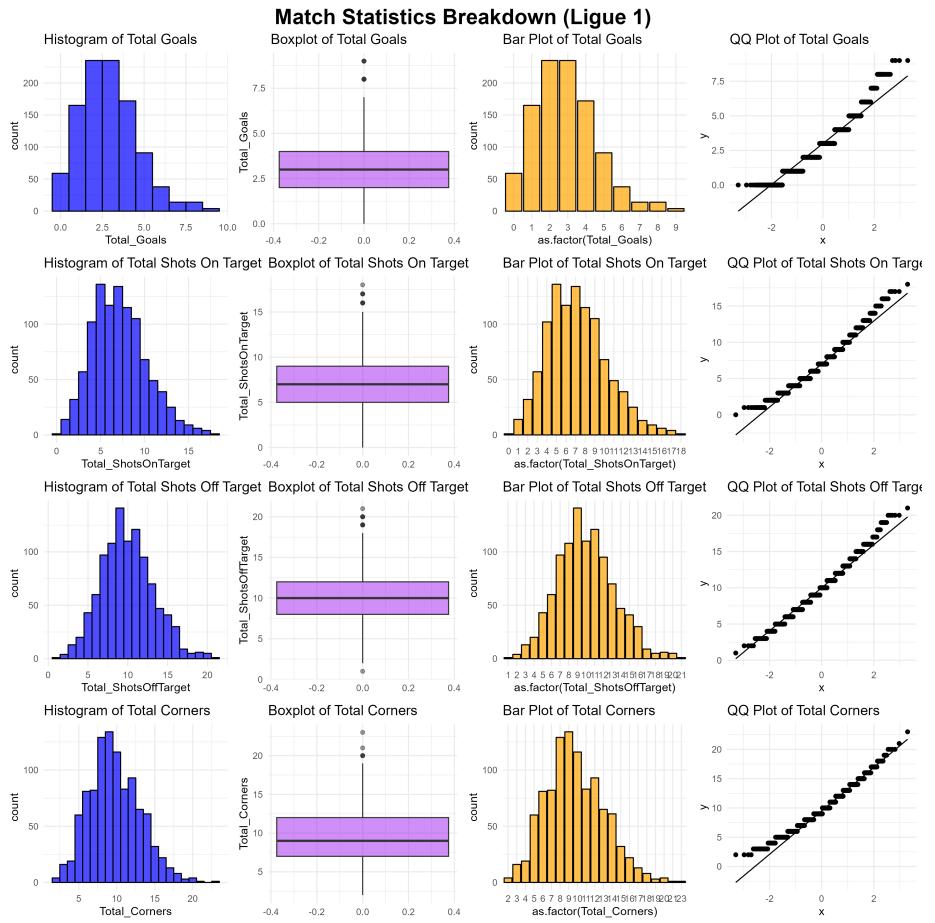


Figure 37: Distrbutions Plots for Ligue 1

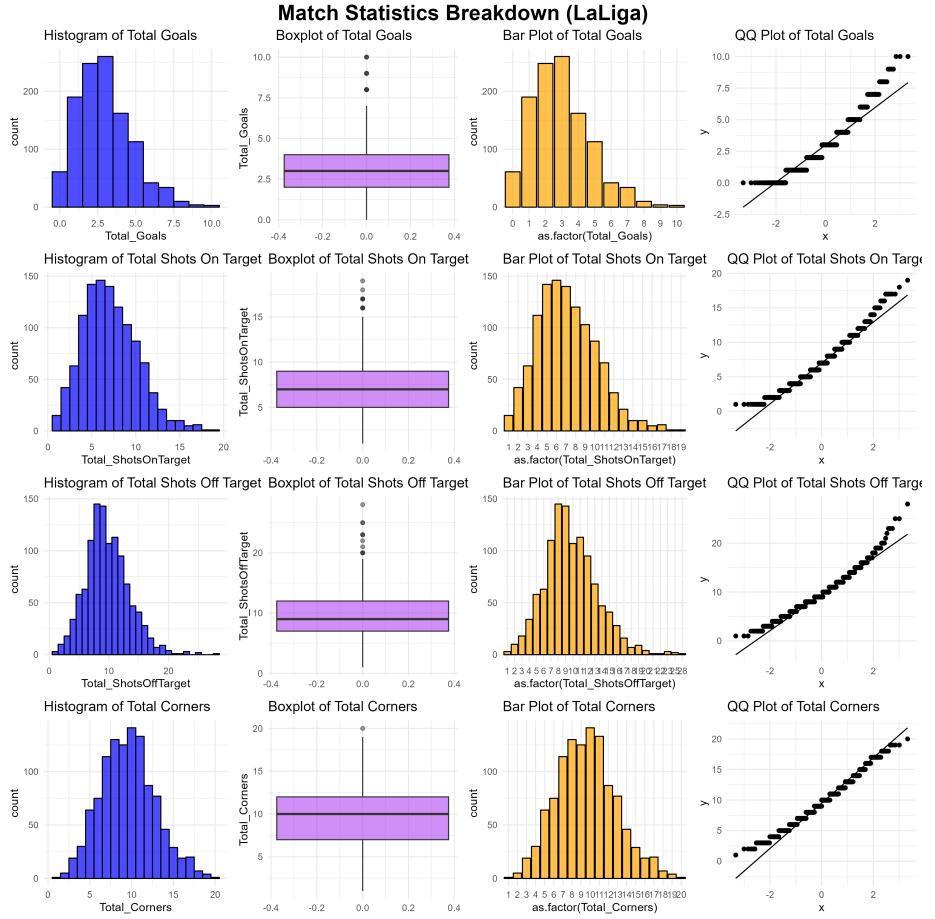


Figure 38: Distribution Plots for LaLiga

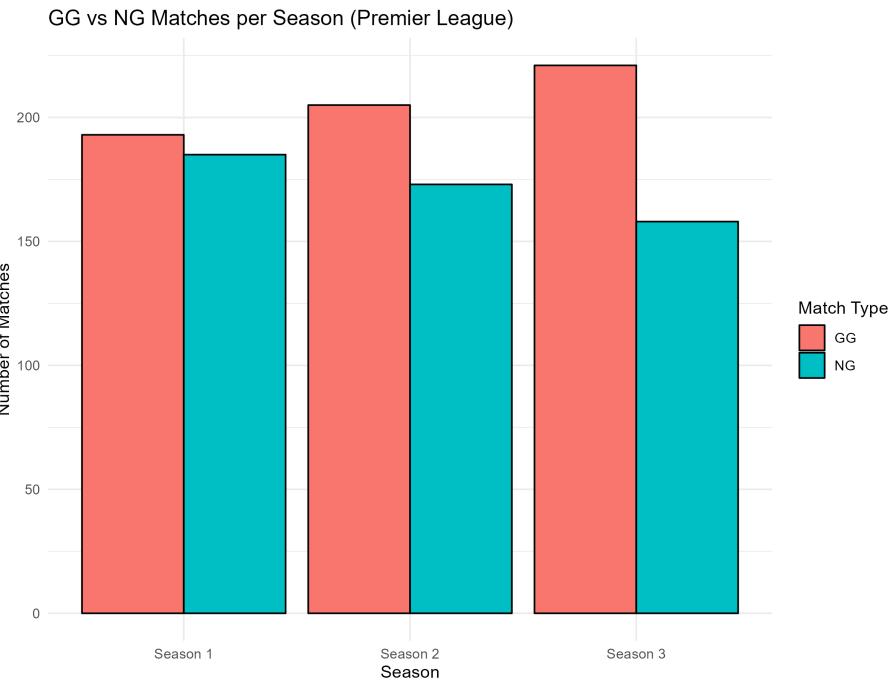


Figure 39: GG/NG games throughout seasons (Premier League)

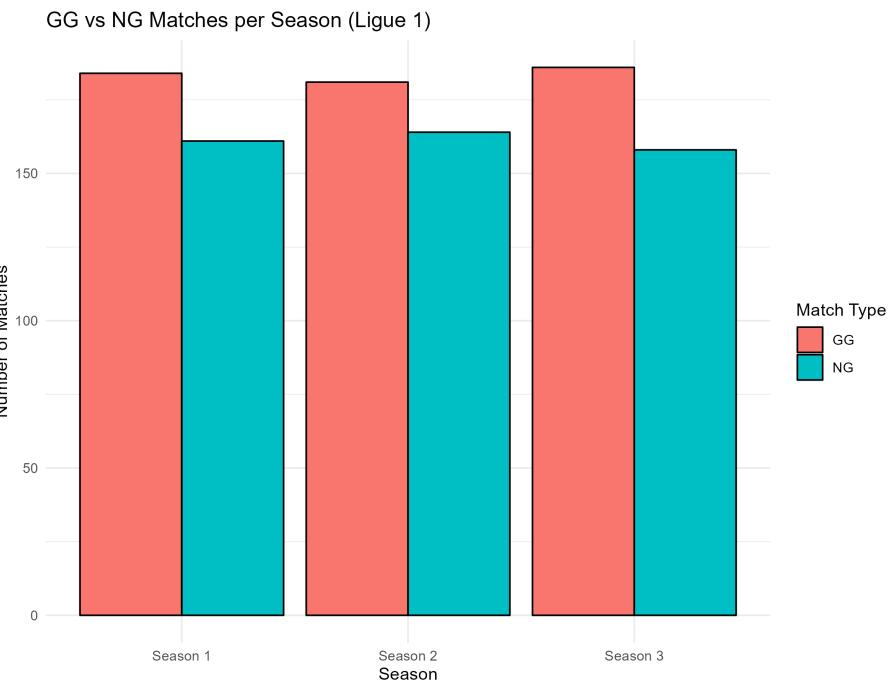


Figure 40: GG/NG games throughout seasons (LIGUE 1)

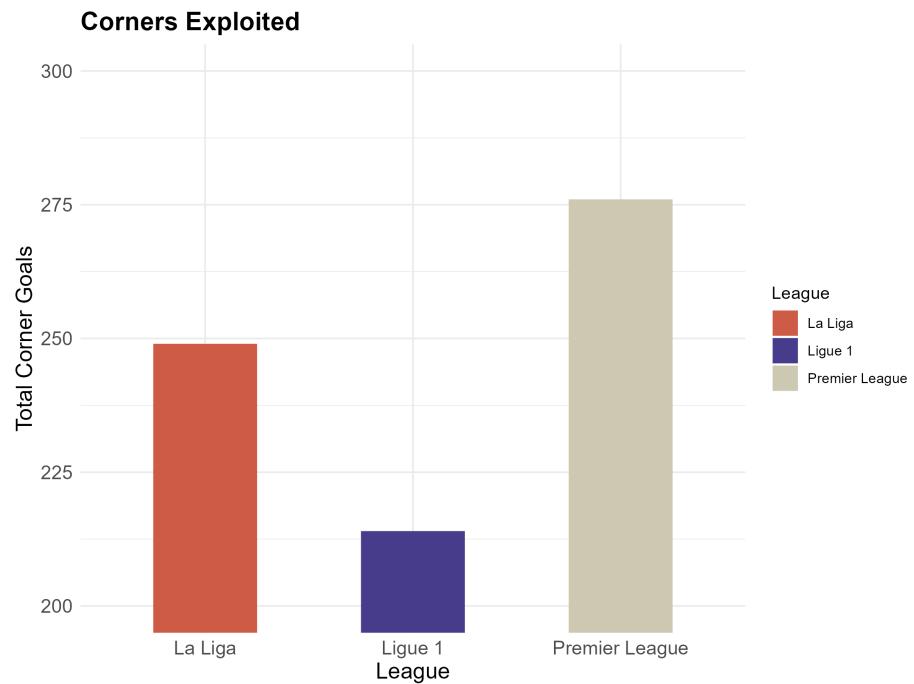


Figure 41: Corners that lead to goals