



Optimization of the Number of Teams and Format of the Portuguese Football Primeira Liga

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Dissertation to obtain the Master of Science Degree in
Industrial Engineering and Management

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January 2021

Declaração

Declaro que o presente documento é um trabalho original da minha autoria e que cumpre todos os requisitos do Código de Conduta e Boas Práticas da Universidade de Lisboa.

Declaration

I declare that this document is an original work of my own authorship and that it fulfills all the requirements of the Code of Conduct and Good Practices of the Universidade de Lisboa.

Acknowledgments

At the end of this journey, I must start my acknowledgments by expressing my gratitude to my parents Graziela and Carlos and sister Catarina. Their love, support, belief and always being by my side are crucial for me to be able to achieve every important milestone in my life.

I would also like to thank my girlfriend Filipa for the love and strength and for always challenging me to accomplish more never allowing me to give up on my dreams.

Last, but not the least, I am extremely thankful to Professor António Sérgio Ribeiro and Professor José Rui Figueira for their constant support and guidance and for allowing me to study a subject I admire so much.

Without all of you, this would not have been possible.

Abstract

This dissertation seeks to find alternative structures (format and membership) for the major Portuguese football league – Primeira Liga – so that they can provide better results in terms of competitive balance and attendances in stadiums than the current structure of the league. This objective is achieved through studying and afterwards applying the same methods for assessing competitive balance and attendances to new structures (each with different possible combinations) created based on European leagues and the league as is. Two major analyses are developed: the first combined all measures considered relevant while the second sees analyses being performed and compared by groups of methods related to their framework (attendances, goal gap and point gap). While the former offered limited positive results, the latter sees structures with several combinations that beat Primeira Liga as is and even one of them stands out from the rest and is considered a plausible alternative. It merges unpredictability throughout the season whether it be in finding the champion or the relegated teams, more matches between teams with the same financial and sport strength, a shorter season and even more opportunities for weaker teams in terms of European football competitions. However, the application of these methods to find leagues where new champions, other than the usual ones, emerge is not successful which demonstrates the excessive power of the strongest teams.

Key-words: football, competitive balance, attendances, optimization, Portuguese league, professional sports league

Resumo

Esta dissertação procura encontrar estruturas alternativas (formato e número de equipas) para a principal liga de futebol em Portugal - Primeira Liga – para que estas possam proporcionar melhores resultados, relativamente ao equilíbrio competitivo e mais espectadores em estádios do que a atual estrutura. Este objetivo será alcançado através do estudo e aplicação dos mesmos métodos de avaliação de competitividade e espectadores a novas estruturas (cada uma com diversas combinações possíveis) criadas com base em ligas Europeias e à liga atual. Duas análises foram desenvolvidas: a primeira combina todos os métodos, enquanto que a segunda divide as análises realizadas e as comparações entre a liga atual e as criadas são feitas tendo em conta grupos de métodos (assistências, golos marcados e pontos obtidos). A primeira oferece alguns resultados positivos, mas muito limitados, ao passo que a segunda gera estruturas com diversas combinações com melhores resultados que a Primeira Liga atual sendo que uma delas destaca-se. Esta estrutura combina imprevisibilidade, seja para encontrar o campeão ou as equipas que descem de divisão, mais jogos entre equipas com o mesmo poder financeiro e desportivo, uma temporada mais curta e ainda mais oportunidades para equipas mais fracas alcançarem as competições europeias. Contudo, a aplicação destes métodos com o objetivo de encontrar ligas onde novos campeões, que não sejam os habituais, surjam não tem sucesso, o que demonstra o poder excessivo das maiores equipas.

Palavras-chave: futebol, competitividade, espectadores, otimização, Primeira Liga, liga de futebol profissional

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List of Abbreviations

FIFA – Fédération Internationale de Football Association (International Federation of Association Football)

FPF – Federação Portuguesa de Futebol (Portuguese Football Federation)

GDP – Gross Domestic Product

LPFP – Liga Portuguesa de Futebol Profissional (Portuguese Professional Football League)

MLB – Major League Baseball

NBA – National Basketball Association

NFL – National Football League

NHL – National Hockey League

UEFA – Union of European Football Associations

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1. Introduction

1.1. Motivation and context

Football has emerged into a billion-dollar business and the most recent statistics by FIFA (2016) demonstrate that there are 265 million football players worldwide strengthening the position of this sport as the world number one. FIFA, football's governing body, has even more members (211) than the United Nations (193). Portugal is today seen as an extremely football-oriented nation being it a phenomenon that mobilizes almost the entire society and its institutions. In Portugal, football is undoubtedly the most economically important sport regarding active and passive participants. According to Pordata (2018), in 2016, there were more than 590 thousand registered athletes considering all sports in Portugal. The Portuguese Football Federation gathers around 168 thousand registered football players, who represent around 29% of the whole universe of federated sportsmen and sportswomen.

Nowadays it is not uncertain to say that football is the most popular sport on Earth and is perceived not only as a sport but as a business. It gathers great attention from supporters worldwide despite gender, nationality or social status. Media is also highly concerned about football as it brings spectators/customers that will generate valuable advertising. The Portuguese Football League fits in this as there are enormous financial interests associated with it. Large investments are made year after year inside Primeira Liga not only in players or infrastructures but also in TV rights that are worth millions of Euros. This trend is also seen all over Europe especially in the major European Leagues like the English Premier League that values its live TV rights around 5.14 billion dollars from 2016 to 2019 (Statistica, 2020) or the German Bundesliga deal that is worth 4.64 billion Euros (Bundesliga, 2016) in a four-year deal that started in the 2017/2018 season. Without these TV rights deals, it would be impossible to pay the players the overwhelming million-dollar salaries or the massive transfer fees. In Portugal, TV rights have become the single highest income for the teams. Major telecommunications companies like NOS or Altice (formerly MEO) have been at the forefront of owning these rights since sporting events and mostly football is currently in the center of our culture. Football matches are commonly seen live which draws audience for several hours straight meaning these are understood to be one the best moments to deliver ad contents.

According to the European Club Footballing Landscape elaborated by UEFA (2018a) for the financial year of 2016, there is no Portuguese side in the Top 30 European clubs in terms of revenues. Manchester United tops the ranking with 689 million Euros while FC Barcelona and Real Madrid share de the second place with an equal 620 million Euros. All 30 teams have averaged a 13% growth comparing to the previous year. In Europe, 34% of club revenues are supported by domestic broadcast revenues. This huge percentage has led the European leagues to apply different business distribution models. Portugal is nowadays the only major league in Europe to sell its broadcasting rights separately (club by club). All other major leagues negotiate their rights as one and the distribution is made according to the performance of each team

generating a similar share for each member of the league. The Portuguese model echoes a huge gap between TV profits of the top three teams/Big 3 (SL Benfica, FC Porto and Sporting CP) and the rest of the teams. At the same time, participating in European club competitions such as the UEFA Champions League or UEFA Europa League has a positive influence on the financial position of the Portuguese clubs as they generate revenues like no other source according to UEFA (2018a). This unevenly distribution of broadcasting rights and UEFA revenue always benefiting the same clubs in Portugal has a direct impact on the competitive balance of the league which ultimately decreases the uncertainty of the matches' outcome that at the end of the day is considered one of the main reasons for fans engagement. As a direct result of this, attendances in stadiums may tend to decrease. The current league structure (number of teams and format) of Primeira Liga may ultimately have an impact on this as it is the way of accessing UEFA competitions and where teams compete consistently throughout the season.

1.2. Objectives

Over the course of this dissertation, two major types of decisions while designing a new league structure for the Portuguese Primeira Liga will be addressed. League structure in terms of format (method for planning matches to determine the winner) and size (ideal number of teams in a league). To perform this, it will be necessary to build a computational tool able to generate results that include data from previous seasons and information about league structures across Europe so that a better league in terms of competitive balance and attendance is possible to be achieved. To obtain these results several leagues across Europe will be studied and competitive balance methods will be applied to them. These methods include game and season statistics that will help understand trends in matchdays but also give a big picture of the seasons in past few years. The country leagues measured are expected to be not only those considered to belong to the Big 5 (England, Spain, Italy, Germany and France) but mainly leagues from nations that have resemblances to Portugal in terms of population or where football is one of the main sports but also UEFA Ranking, football economy or GDP.

Afterwards, the objective is to gather techniques where data from Portuguese Primeira Liga's previous seasons including attendances and results on all matchdays are used. Additionally, alternative league formats from European Leagues are simulated for Primeira Liga including different league sizes. The main objective is to increase attendances considering all the current regulations (FPF, UEFA and FIFA). Additional features are also considered such as making results of matches more unanticipated by trying to avoid teams being smashed by others and thus resulting in closer final league standings across the entire board.

To conclude, and after applying again the previous competitive balance methods it is expected that changes in the League would help increase attendances in stadiums and create an unpredictable championship. Having a balanced competition backed by sold out stadiums would allow every team, and not only the Big 3, to envision achieving higher table positions giving them access to European competitions and better broadcasting contracts. Mixing both conditions may

grow revenues for Portuguese teams allowing them to invest in better infrastructures and upscale players - increasing sports quality.

1.3. Research questions to be addressed

After defining the objectives of this dissertation, it is necessary to find answers for the following connected questions:

Q1) How can the Portuguese Primeira Liga be maximized in terms of both attendance and competitive balance?

Q2) What is the best structure in terms of format and membership for Primeira Liga so that attendance and competitive balance can be maximized taking into consideration other European leagues?

2. Definition of the Problem

2.1. Socio-Economics vs Football Economy

Examining Portugal in a European level, the country sits 15th in terms of population according to the United Nations Department of Economic and Social Affairs' World Population Prospects 2019 (2019) and has the 18th highest GDP among its peers according to the World Economic Outlook (2018) as can be seen in Table 1. Looking at Portugal in terms of Football, it is clear that the country sits considerably ahead of its competitors considering population and GDP. Portugal is listed 7th in the UEFA Ranking (2018b) and 7th as well in terms of Enterprise Value which is the "sum of the market value of the owner's equity, plus total debt, less cash and cash equivalents" according to KPMG (2018) as can be understood in Table 2. The Enterprise Value allows comparing firms with different debt and equity structures. This metric gives us the chance to understand if the business is valuable despite the capital structure used to sponsor its operations. Only countries with higher GDP and more population have managed to accomplish a rank greater than Portugal.

**Table 1 - European Countries in terms of Population and GDP according to World Prospectus 2019
(2019)**

Rank	Population (2018)		GDP (billion USD)	
1	Russia	143 964 709	Germany	3,684.816
2	Germany	82 293 457	United Kingdom	2,624.529
3	Turkey	79 817 849	France	2,583.560
4	United Kingdom	66 573 504	Italy	1,937.894
5	France	65 233 271	Russia	1,527.469
6	Italy	59 290 969	Spain	1,313.951
7	Spain	46 397 452	Turkey	849 480
8	Ukraine	44 009 214	Netherlands	825 745
9	Poland	38 104 832	Switzerland	678 575
10	Romania	19 580 634	Sweden	538 575
11	Netherlands	17 084 459	Poland	524 886
12	Belgium	11 498 519	Belgium	494 733
13	Greece	11 142 161	Austria	416 845
14	Czech Republic	10 625 250	Norway	396 457
15	Portugal	10 291 196	Ireland	333 994
16	Sweden	9 982 709	Denmark	324 484
17	Hungary	9 688 847	Finland	253 244
18	Belarus	9 452 113	Portugal	218 064
19	Serbia	8 762 027	Czech Republic	213 189
20	Austria	8 751 820	Romania	211 315
21	Switzerland	8 544 034	Greece	200 690
22	Bulgaria	7 036 848	Hungary	152 284
23	Denmark	5 754 356	Ukraine	109 321
24	Finland	5 542 517	Slovakia	95 938
25	Slovakia	5 449 816	Luxembourg	62 393

**Table 2 - European Countries in terms of UEFA Ranking and Enterprise Value
by UEFA (2018b) and KPMG (2018)**

Rank	UEFA Country Ranking 17/18 (Points)		Enterprise Value (Million €)	
1	Spain	106,998	England	13 787
2	England	79,605	Spain	7 489
3	Italy	76,249	Germany	4 286
4	Germany	71,427	Italy	3 521
5	France	56,415	France	1 830
6	Russia	53,382	Turkey	981
7	Portugal	47,248	Portugal	328
8	Ukraine	41,133	Netherlands	283

2.2. Sports Financial Cycle

According to Beech and Chadwick (2004), the financial systems of all sports organizations can be separated into four issues: capital employed, assets, operating cash flows and return to capital employed:

1. Capital employed: All sports organizations need funds to ensure long-term sustainability to support the asset base of the organization. There are two extensive types of long-term financing: debt and equity. Debt comprises bank loans and other borrowings. Equity is the capital delivered by the owners of the organization and confers privileges to any residual revenue after all other financial duties have been fulfilled;
2. Assets: The capital of a sports team is used to purchase the assets required for their operations. The assets of an organization can include tangible assets such as buildings, training facilities or stadiums. Additionally, sports teams have intangible properties such as players' rights that give organizations the chance to use them in matches or sell those rights to teams interested;
3. Operating cash flows: Operating cash flows are the revenues and cash expenditures produced by a sports organization's operating activities. Revenues will be obtained by the sale of goods (including players) and services to the group's clients. Cash expenses are the costs of maintain the operations running, which include the purchase of goods as well as the costs with employees;
4. Return to capital employed: It is necessary to measure the efficiency of a sports organization regarding how profitable it can be comparing net operating profit to capital employed being this a long-term financial ratio.

A club's sporting strength is determined based on its results. By improving its sports strength not only does a team attract more supporters to stadiums but also rises the number of viewers on TV. This action leads the club to be more appealing in terms of sponsoring deals raising revenues. The growth in revenues allows the investment in players, stadiums or fans' engagement. The opposite action, decreasing sports strength will make a team play worse on all these dimensions.

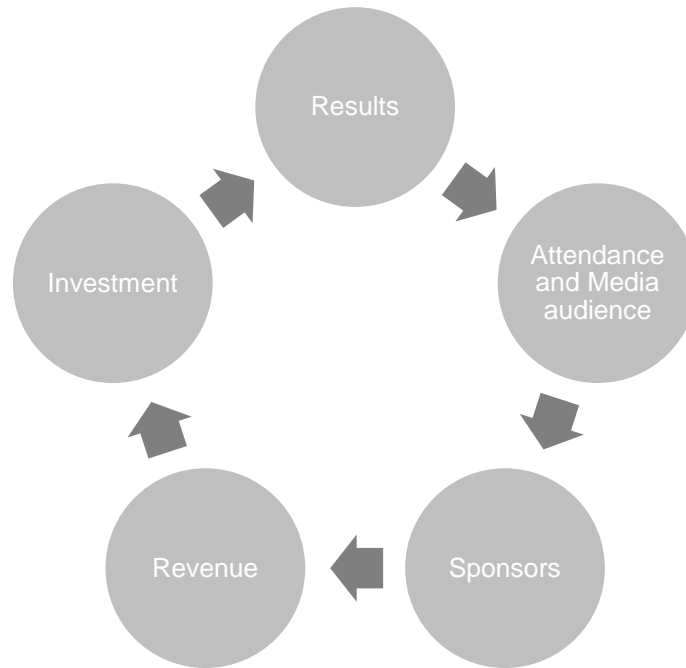


Figure 1 - Sports Financial Cycle

2.3. League Structure

Team sports are usually structured into leagues. The structure of sports leagues differs enormously around the world and the main driver while building and developing a league should be its financial result. A league usually follows one of two kinds of schedules: an elimination format or a round-robin. In a round-robin, the league generates a schedule of games for a season for each team. All teams play a prearranged number of games against other championship members. The champion is determined by accumulating the results of all matches. In Europe, even though the majority of the leagues adopt a round-robin format where all teams play all others an equal number of matches, there are few leagues where teams play some teams more than others. In other sports, especially in North America (NBA, for example), this usually happens mainly due to schedule or geographic limitations. On the other hand, in an elimination competition, teams are eliminated from the contest after losing a certain number of games, usually in one or two legs. In Football, this type of format is normally used in country cups where teams are drawn against each other in each round of the competition. Some competitions adopt free draws where there are no restrictions in terms of opponents to be faced or draws with seeded teams meaning the stronger or weaker designated teams cannot play against each other. There are advantages and disadvantages in both formats. In elimination competitions each game is of higher importance over the round-robin format since a loss can determine elimination and season ending as a result. This point is also seen as a disadvantage since most of the teams will have a shorter season and eventually less revenues.

2.4. Major differences between European and North American League

As previously stated, Europe and North America have different ideas on how to establish professional sports leagues. These ideas relate much to the way Competitive Balance is comprehended. In North America (NBA, NFL, MLB and NHL), at the beginning of a season, several teams are considered to have a real chance of winning the championship as it ensured that each team does not become too strong or too weak making supporters excited about the uncertainty of the result (Quirk and Fort, 1997) whereas in Europe, numerous top tier leagues have always the same title contenders and where competitive balance is experiencing a general continuous decline (Michie and Oughton, 2004).

One of the main differences observed is on how they control the entrance of new teams to leagues. In Europe all leagues are open meaning that the lowest ranked teams are relegated and replaced by the top ranked teams from the division below. Contrarily, in North America most of the leagues are closed. The same teams are gathered in the same league over time. Entrance by a new team in leagues is only allowed if other teams agree.

Other difference perceived is related to territorial exclusivity. While in Europe this is not a matter, North American leagues are extremely strict when it comes to allowing the existence of more than one team per metropolitan area. This subject is seen all over Europe since most rival football teams are from the same city (Manchester United and Manchester City in England or AC Milan and International in Italy among many others).

Competitive Balance has also contradictory perceptions in these regions. European teams mainly focus on win-intensification and minimum interest in the league and other teams' businesses. On the other hand, in North American leagues, competitive balance is one of the principal drivers for attaining successful leagues (increasing demand for matches and league's product). Economically balanced teams are the key to generate more income (Michie and Oughton, 2004). In terms of Revenue Sharing there is similar understanding on the importance of this to maximize profits. Nevertheless, most European teams (mainly powerful sides) are not willing to share a part of their income with less dominant teams. As in North America, broadcasting rights are usually sold together but are not shared equally. Other revenues such as gate receipts or sponsors are never shared in Europe. In North America these revenues are shared since not only broadcasting rights but also sponsoring deals are sold together.

As far as attracting and retaining young talents, the way this is managed is connected to how both continents develop these young athletes. In Europe, most of these start their careers in academies that belong to the clubs whereas in North America, before joining a team, athletes must be studying in high schools and universities at the same time they practice a sport. These differences have a huge impact when players sign their first contract. In Europe, since a player already belongs to a team, it is easier to maintain him/her and offer a contract. If there are several

teams interested, bids usually happen, and the richest teams collect the best athletes. In North American leagues, as a manner to avoid this, drafts are used to protect lower ranked sides. These teams are allowed to choose first the top talents they wish to add to their teams. By doing this, competitive balance is taken into consideration as it is expected these teams elevate their performance. According to Szymanski and Ross (2000), teams usually spend more on player talent in an open league than in a closed league.

2.5. European Leagues

The structure of European football leagues has been analyzed by Manasis et al (2013) who categorize three levels in leagues in which teams compete at:

- The first level refers to the race for the competition title, which is branded as the most significant award in any tournament;
- The second level denotes the battle for qualifying places for European tournaments (Champions League and Europa League) for the following season;
- Lastly, the third level stands for the relegation places.

European football leagues work based on each team's performance and thus final ranking. The top placed teams are promoted from an assumed league division to its directly upper tier at the end of each season with the lowest classified teams downgraded to the inferior division. In first league divisions, the performance motivation is to reach one of the highest positions that offer the chance to participate in the Champions League and Europa League. The number of spots awarded each country is subject to its UEFA coefficient, which is calculated by the outcomes of the club's games in UEFA Club competitions over the past five seasons. The UEFA ranking defines the number of teams participating in UEFA competitions in the season after the next one and not in the next season (as it would be expected) after the final season rankings are generated. Therefore, as an example, the standings at the end of the 2017/2018 season determine the team allocation by country in the 2019/2020 UEFA season. Nonetheless, the actual teams that will be participating in the next season are determined at the end of the previous season when all competitions are concluded. The main purpose of a league is to have teams with positive results in UEFA competitions as it increases the league reputation and ultimately uplifts its UEFA country ranking.

2.6. Membership

An essential factor of league organization is the process of determining its members. Since the creation of the first football league in England in 1888 and the introduction of a Second Division in 1892 the process of promotion and relegation has always been part of European Leagues. Anyone interested could start a project to build a team and begin competing at lower leagues. It is also possible to purchase an existing team and start competing immediately as this process does not require an agreement from the teams in the league. Even though open leagues are common amongst Europe, in the United States most of sports leagues are closed. The only way

to enter a closed league is by obtaining an approval from the existing teams and paying a fee to the league. This decision means that its members are fixed (usually one team per metropolitan area) as a result of a great concern regarding local competition, territorial rights and therefore natural monopoly. Some consider this a manner of stability as a team is assured to be playing a league in the next season despite how good or bad they perform. Nevertheless, this does not occur in open leagues.

Noll (2002) considers that players tend to be paid higher values in leagues with promotion and relegation systems as well as attendance in stadiums tend to increase when using this system (teams have more to win with promotions than to lose with relegations). Another gain from promotion and relegation systems is that it reduces irrelevant games at a certain point in time. Mostly at the end of a season and especially in North American closed leagues, most of the teams know that they will not be able to compete for the championship. Adding to this, the bottom ranked teams are awarded the best draft picks so there are actually incentives for teams to consider start losing matches on purpose making those matches less attractive to fans. The effect of this on competitive balance is unclear as teams may not be able to afford to have a competitive team in a higher league and thus invest less. In contrast, these teams might spend higher values while trying to be promoted when competing in lower divisions.

2.7. Domestic Football Structures in Europe

The wide variety of League structures in Europe is more fluid than most would expect. Considering every European First League, differences in size and schedule mean that for the 2017/2018, 24 different structures were experienced.

From the 55 top-tier European leagues played under the jurisdiction of UEFA the great majority (38 leagues, 69%) adopt the traditional league format (round-robin) with each team playing each of the other teams twice (17), three times (10), four times (10) or six times (1, Armenia). The remaining 17 leagues use a different format, consisting of gathering teams into groups based on their standings in a certain point of the season being this a growing trend since there were only just 5 leagues using this format in 2005.

Another visible aspect concerning the teams is that nowadays the tendency is to reduce the number of top-tier clubs. From 2002 to 2007, it was concluded that there was an increase in the number of clubs in first Leagues (707 to 733 teams). Nine seasons forward a decrease in the number of clubs participating in domestic championships fell from 733 back to 706.

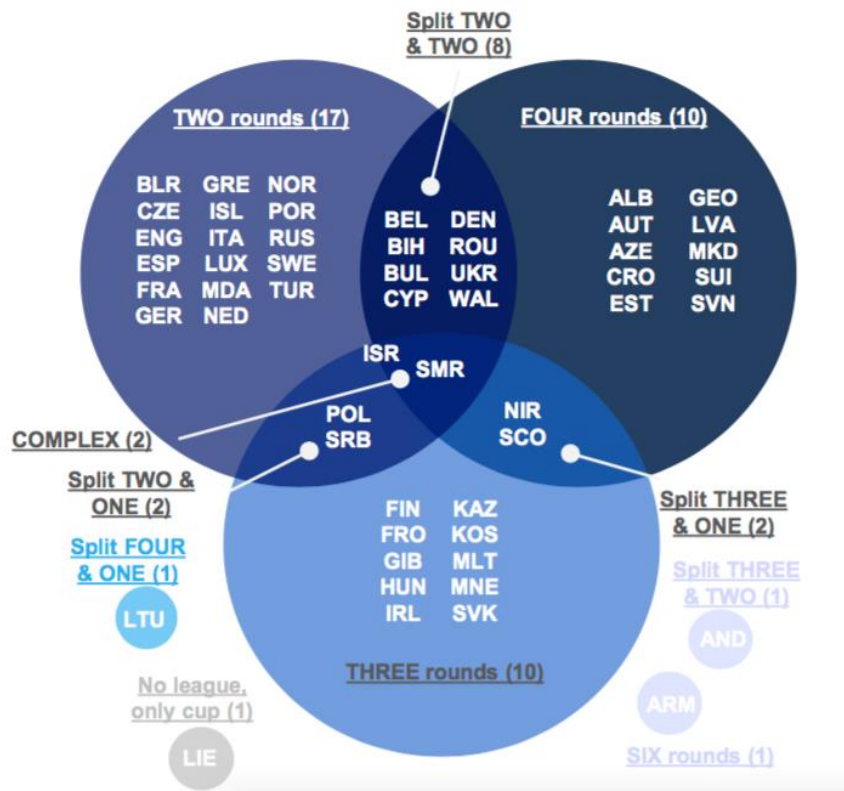


Figure 2 - UEFA's domestic football league structures according to UEFA (2018a)

The variation of the number of teams composing a league does not necessarily influence the competitive balance of the competition. For instance, a league comprised of only two teams can be widely uneven if one of teams is far superior to the other while a league with plenty of teams can be uniform with high levels of competitive balance. There are significant differences in the number of teams in the top divisions of European football, starting from 8 to 20 teams (England, Spain, France and Italy). In Table 3 the majority of the top 10 countries in the UEFA Ranking as of November 2018 (UEFA, 2018a) and few other relevant countries (similar to Portugal in terms of population) are measured in terms of teams, number of games per season, population and number of inhabitants per team for the 2018/2019 season.

Four countries (Spain, England, Italy and France) included in the big 5 have all the same number of teams and games as both are a maximum in Europe. These relates well with the high population in these regions. Moving to the countries with 18 teams, Turkey and Germany are similar in terms of population but this does not happen with Portugal that has around 8 times less population. Questions arise about the similarity of football markets in these countries and if Portugal can afford to have the same number of games and teams likewise Germany or Turkey. Considering these variables, Belgium may be a good comparison for Portugal as both countries have similar inhabitants. Belgian Pro League has recently suffered a transformation with decreasing of the number of teams from 18 to 16 and introduction of playoff starting in the middle of the season that is underway since the 2009/10 season. Since this modification attendances in stadiums have escalated from an average of 8 720 fans in 2009/2010 to 10 704 in 2016/2017.

Other countries in this table such as Sweden, Greece or Czech Republic that have a population alike Portugal are relevant to be examined. These three nations have a first league composed by 16 teams totaling 240 games in each season and the competition format is a double round robin. Austria and Switzerland, who have around less 2 million citizens that Portugal, adopt systems why less teams and thus fewer games. Although the Swiss Super League format is a double round robin, Austria has made a league reform by including playoffs in the middle of the season.

Table 3 - Comparison of European Leagues in terms of Number of teams, games, population and citizens per team

League	Nr of Teams	Nr of Games	Population	Citizens/Team
Spanish La Liga	20	380	46 397 452	2 319 873
English Premier League	20	380	66 573 504	3 328 675
Italian Serie A	20	380	59290 969	2 964 548
French Ligue 1	20	380	65 233 271	3 261 664
German Bundesliga	18	306	82 293 457	4 571 859
Portuguese Primeira Liga	18	306	10 291 196	571 733
Turkish Super Lig	18	306	79 817 849	4 434 325
Dutch Eredivisie	18	306	17 084 459	949 137
Belgian Pro League	16	250	11 498 519	718 657
Russian Premier League	16	240	143 964 709	8 997 794
Greek Super League	16	240	11 142 161	696 385
Czech First League	16	240	10 625 250	664 078
Swedish Allsvenskan	16	240	9 982 709	623 919
Austrian Bundesliga	12	222	8 751 820	729 318
Swiss Super League	10	180	8 544 034	854 403

2.8. League structure in Portugal

The Primeira Liga is the highest professional association of the Portuguese Football league system and is the 47th most attended global sport event on the planet. According to Sporting Intelligence (2018) the league is the 15th best in the world of football (9th in Europe) in terms of average salaries which is around 300 thousand Euros. The league is annually organized by LPFP. As for the 2018/2019 season, 18 teams take part in the competition. In the past 10 years there have been few changes in the number of teams. At the beginning of the 2006/2007, LPFP reduced the number of teams from 18 to 16 and this change lasted until the 2014/2015 season when the league was scaled up to 18 teams again, as a result of the Court's decision to bring back Boavista and reverse its relegation. From that season on the number of teams have been the same.

The competition usually starts in the beginning of August and lasts through mid-May so that the summer months can be kept for national teams' competitions. The format has always been the same since teams compete twice against each other with equal number of home and away matches totaling 306 games in 34 matchdays.

Considering the 2018/2019 season, the winner qualifies directly for the UEFA Champions' League group stage and the runner-up qualifies for the third qualifying round of the same competition. Third and fourth-placed teams will compete in third and second qualifying round of the UEFA Europa League, respectively. There is also another spot for the UEFA Europa League group stage for the winner of the Taça de Portugal (Portuguese Cup) which is organized by FPF. On the other hand, the two lower ranked teams of the Primeira Liga are relegated to LigaPro, LPFP second-tier league. The current pyramid structure for the most relevant Portuguese leagues for the 2018/2019 season to the nature of demand is seen in Table 4.

Table 4 - Portuguese pyramid structure for the top 3 tier leagues

Tier	Competition			
1	Primeira Liga 18 teams			
2	LigaPro 18 teams			
3	Campeonato de Portugal			
	Serie A	Serie B	Serie C	Serie D
	(Regional League)	(Regional League)	(Regional League)	(Regional League)
	18 teams	18 teams	18 teams	18 teams

It can be perceived that the current structure for Primeira Liga follows a pattern seen across Europe. It goes through a round robin system which is used by around 67% of major European Leagues and it is composed by 18 teams. As seen before, no country with the dimensions and population of Portugal has so many teams competing in its major league. This is quite important as Portugal has a limited number of citizens ready to consume a 18-team league. This is additionally impacted by most of the population, that is a fan of football, supporting mostly one of the Big 3 teams which have a huge market size. The other 15 teams have a low fan base compared to those teams. Market size plays a crucial role on attracting supporters. The bigger it is the easier it is to generate more supporters. A country with around 10 million citizens cannot compare itself to those who have 80 million inhabitants (Turkey or Germany).

Even though this structure can be considered one of the fairest as each team plays the same number of times against all other teams (home and away), some weak aspects can be identified. Using this structure, when the season approaches its final matchdays, some teams that are not fighting anymore for any objective might decrease competitiveness and some matches can even be considered of minor relevance attracting no viewers at home or at stadiums. This can damage

competitive balance between teams and affect how supporters perceive the strength of the league and be an enemy of the progress of the competition. At the same time, even considering the fairness presented before, this structure can be beneficial for stronger teams as they only have to face each other a reduced number of times compared to the number of times they face weaker teams. This aspect is more relevant as a league with 18 teams suffers more from this than a league with 12 or 14 teams.

Some aspects from the previous paragraph can help identify the problem:

- Several uninteresting matches may occur towards the end of the season reducing attendances especially in weaker teams' stadiums;
- Teams who usually fight for the championship face each other a limited number of times;
- Top placed teams are always the same which means the same teams access European competitions and its massive prize money year after year;

Other formats are being adopted in Europe and could help Primeira Liga increase its standards in terms of competitive balance or attendance.

2.9. Changes and pursuit of optimal league structures

Leagues across Europe are continuously studying methods to embrace more fans and sponsors while analyzing new formats for its major championships. One clear example is Belgium's Pro League. Over the past years, Belgian football has gone through a league format change aiming to attract home and stadium spectators as well as improving the competitiveness of the league. By concluding that its format was not fully potentiating the expectations of the league's administration, for the 2008/2009 season it was decided to switch from the widely seen 2 round robin format with 18 teams (equal to Primeira Liga) to a league with less teams (16) composed by a 2 round robin plus an additional playoff format that starts in middle of the season that separates the league in two equal halves. The goal to increase competitive balance and fans' experience and attendance has been a success as both aspects were improved. Other leagues such as the Austrian Bundesliga concluded that it had a competitive problem since the same team kept winning the championship year after year with a wide advantage in terms of points obtained comparing to other teams. It was as well decided to switch the competition format. The usual round robin format was maintained but an additional playoff was included. The top half and bottom half are divided, and a mini league is played in both halves. Even though RB Salzburg continues to win the league and to be main favorite year every year, the gap in terms of competitiveness has decreased.

This trend related to playoffs is an interesting way to offer additional matches between teams that are closer in terms of points. Each group of teams is fighting for their specific objectives whether it be winning the league, clinching a European place or avoiding relegation.

3. Literature Review

3.1. Competitive Balance

It is normally recognized that any extremely unbalanced competition will affect customer interest in attending a sports event. Competitive balance relates to the equilibrium in sport and amongst sport teams (Michie and Oughton, 2004) and is at its peak when clubs facing each other have exactly the same chances of winning a match. Quirk and Fort (1997) believe that one of the key elements of sports is the uncertainty of outcome of matches. In order to keep fan interest, a sports league has to guarantee that teams do not get too strong or too fragile relative to one another so that uncertainty of outcome is conserved. With this said, leagues should find and implement mechanisms to rise competitive balance in order to increase their attractiveness.

According to Szimanski (2003) sporting contests are one of the most noteworthy branches of the performing industry measured by the amount of time that consumers dedicate to following them. The US Census Bureau predicted the annual attendance at sports events in 1997 to be 110 million (equivalent to 41% of the population of USA). Couture (2016) considers that competition inside sports is radically different than competition in other businesses. In other markets competitors fight hostilely to become leaders and totally destroy their opponents. Rivals in sports must rely upon themselves to make an income as one of the key reason's fans appreciate watching sports is that any side can win. As a result, a single club cannot exist without "enemies". Spectators will not be interested in attending or watching a game if the level between the teams is excessively unbalanced. The competitive balance within sports is increasingly important and there is a wide variety of literature on this matter.

The uncertainty in sports results is studied through several methods. El-Hodiri and Quirk (1971) first found that attendance profits rely too much on the uncertainty of the outcome of a game and Forrest and Simmons (2002) discover that stadium attendance rises when the teams are more balanced. On the other hand, not only Lemke et al (2010) find that attendance rises when the home team is undoubtedly favorite while studying the 2007 MLB season but also other authors show that European football fans prefer to attend a match where the home club is likely to win by many goals as fans are more interested in matches with high scoring ranges (Buraimo et al, 2006) so there are opposite ideas on this subject.

Szymanski (2003) also considers that there are three types of competitive balance: match uncertainty which relates to uncertainty about a result of a given match, season uncertainty as the uncertainty about results in the course of a season and league uncertainty that tells the supremacy of reduced number of teams in a championship in numerous seasons. In competitions where there is a massive difference of wealth across teams, money is the key effect of dropping the distribution of player talent and successfully creating unequal teams (McMillan, 1997).

Peel and Thomas (1988) have also first discussed betting odds as a measure of assessing match uncertainty. The odds offered by bookmakers, reproducing chances of a home win, of a draw and of an away victory, deliver easy to use data with respect to the equilibrium of a match. The more identical these probabilities are, the more uncertain the result of a tie is. If the betting market is efficient, the bookmaker odds include all relevant information for the formation of expectations regarding the final result. Goossens (2005) assessed 11 European leagues (Germany, Spain, France, England, Italy, Portugal, Greece, the Netherlands, Belgium, Denmark and Sweden) and the results are reasonably distinctive since, for example, in Portugal, SL Benfica, FC Porto or Sporting are difficult to be defeated but competition between other league teams is feisty. This research also showed that Belgium decreased in terms of competitive balance. Goossens concluded that the competitive balanced did not change much in the last few decades despite rule changes or entrance by investment groups in the world of football. On the other hand, football is attracting even more media, sponsor or spectator attention.

However, Canes (1974) presented that if all the clubs have the same power, this will not result exactly in a benefit for the spectators, so some level of imbalance among teams is necessary. As a way to make the Portuguese Primeira Liga more appealing, in 2006/2007 the league undergone a reduction in two teams, from 18 to 16 clubs. The main reason behind this action was the chance that this decrease could elevate the league's competitive balance, since each of the contenders would have a better financial situation.

3.2. Salary Cap and Revenue Sharing

The idea of salary caps was introduced by Rottenberg (1956) who imagined it as way to impose a ceiling on salaries paid to professional athletes. The salary cap was created to certify that all teams are spending level amounts on player salaries, so that money cannot be used by wealthy teams to fill their teams with the all the best players. In a perfect situation, if all sides are spending below the salary cap and have the same resources regarding staff, competition should be equally balanced. It has been studied for several people both empirically and theoretically.

Vrooman (2009) uses a theoretical approach to analyze the impact of salary caps on competitive balance and the conclusion was that salary cap improves competitive balance. Vrooman also reports that revenue sharing improves competitive balance and that salary cap does not influence revenue sharing. There has been a considerable growth in revenue over last few decades on all major European leagues. Even though growth is seen and given that revenue in some leagues is not shared similarly, with some teams profiting more than others, the competitive balance is being affected.

Fort and Quirk (1995) consider that revenue sharing does not have any correlation with Competitive Balance whereas Vrooman (1995) believe that a sharing of revenues have a positive impact on Competitive Balance.

The key motivation for selling the TV rights together is to uplift the competitive balance. If the top teams become too strong, this can downgrade attention for the matches and as a result also the championship itself. Neale (1964) first came up with an explanation for this subject and called it the Louis-Schmelling paradox. Joe Louis and Max Schmelling were boxers who dominated the sport and that are considered an example to understand the economics of sports. Even though companies pursue monopolies to maximize profits this would be tragic in sports context. If any of the two boxers had a monopoly, there would be no competition which would reduce fans interest. Uncertainty is key here and doubts about results are what matters to supporters. Real Madrid needs a Barcelona to compete against. An import step towards this was seen in the Italian Serie A at the start of 2002/2003 season. The beginning of the league was postponed as most of the teams rejected offers from TV broadcasters due to the difference in values that were being paid to top teams. The wealthier teams then offered the remainder of what teams were willing to accept so that the season could start. Today we see this attempt from leagues and also teams to minimize differences between clubs by introducing salary caps, revenue sharing or even drafts especially in the United States.

3.3. Sports broadcasting

Income from broadcasting rights has become a crucial revenue source for clubs in Europe. On the other hand, it can also be considered a barrier for attending live events. Baimbridge et al (1996) proved that attendance is lower when matches (especially on weekdays) are being televised. Forest and Simmons (2006) also found some audience reduction in lower English Football Leagues when Champions League matches were broadcasted.

Beech and Chadwick (2004) attest that the most important revolution in the sport business since early in the 90s has been the growing interest of broadcast demand for sport and football in specific. Before this revolution there is considered to have existed three phases. The first one occurred from the 1950s to the 1970s and there were almost no broadcast contracts resulting in low financial benefits to sports institutions. The second phase happened together with the origination of cable TV in the 1980s. This brought new opportunities as there were no regulations. The negotiation for rights escalated quickly to fees that were never seen before. Later in the 1980s came the liberalization of broadcasting in Europe and the beginning of gigantic rises in prices. Finally, in the 1990s the digital phase erupted and made broadcasting revenues the highest source of profits for football teams.

KPMG (2017) says that with the rising significance of broadcasting rights in the football business, media revenues are seen as a key reason for understanding the discrepancy in wealth between clubs across the major European leagues. Aside the quantity of income created from distribution rights, the system of distribution likewise appears to be extremely influential in defining a league's competitive balance. Several leagues have been reviewed and Portugal is seen as one of the few countries where the broadcasting rights are still being negotiated in a club-by-club (individual)

basis. This approach only benefits teams with larger fan bases such as FC Porto, SL Benfica and Sporting CP. As a result, this liberal market approach arguably decreases the competitiveness of the league and widens the gap between big and small clubs.

Looking at the major Football European Leagues (England, Spain, Germany, Italy and France), broadcasting rights have grown tremendously and nowadays represent more than 50% of the revenues produced in these leagues according to Deloitte (2018). These rights are sold worldwide for a 3-year period normally. This small time period usually benefits the leagues (who sell all the teams' rights together) since interest from fans is unceasingly growing. According to Statistica (2020) the value of the English Premier League TV Rights from 2016 to 2019 is almost 27 times higher than when the new format of the league was created in 1992. Comparing the last agreement to the previous one (2013 to 2016) the value almost doubled from 3 018 to 5 136 million Pounds.

3.4. Evaluation of Attendance in Stadiums

The attractiveness of a competition can be evaluated by its effectiveness to attract spectators to matches. Supporters build an energetic atmosphere at stadiums, but they are also seen as financial contributors through match day tickets. Nowadays, teams are engaging fans even more and enhancing the fan experience not only inside stadiums but also outside where new facilities are built to bring supporters to fan zones several hours before kickoff time.

There are several variables on the table when deciding about attending a match. Greenstein and Marcum (1981) divided these variables in the following groups:

- performance (in terms of individual skills of star players, team win/loss records and league standings);
- sociodemographics (in terms of population, age, gender, ethnicity, occupation, education, geography and economy conditions);
- audience preference (in terms of timetable, convenience, accommodation, weather and stadium quality).

Dawson et al (2000) consider that ticket prices and the number of spectators attending a sports event says much about the team's reputation for the fans. Top clubs can easily practice more elevated ticket prices than weaker teams as their demand will not change. Haugen and Hervik (2002) also consider that the higher the attendance, the higher the ranking of the team, the population of the region, the quality of the player roster and the history of the club. Humphreys and Zhou (2015) studied an enormous amount of baseball games to conclude that are mainly two important reasons to determine attendance. The first is related to home wins. Fans are always expected to attend matches where the probability of an home win is higher. The second is loss frustration as it is considered that a loss hurts more than the good feeling of a win. This feeling of defeat harms even more when a win was expected. This variable is an obstacle to competitive balance for team's administration that would only focus on winning home clashes.

Borland and Macdonald (2003) found five different categories that define demand for attending sports fixtures. The first relates to consumer preferences as it gathers consumer loyalty to a certain team or preferring attending a match rather than other activity. The second category is the economy factor associated: fee of a ticket, cost of travelling to the stadium or car parking actively influence a spectator. Opposing substitutes as possibility of watching the match at home also affect customer behavior. The quality of viewing such as reasonable seating with low influence of scarce weather conditions and the schedule of the event – time of the day as well as the weekday – is another fundamental aspect. Other important effect lies under certain characteristics of a match. Attendance will rise if successful and top ranked teams are competing. Connected to this, if there is a high unpredictability of outcome or relegation and promotion are on the line, fans interest in the clash may rise. Finally, the seating capacity of a stadium may be a restriction in case of high demand for attendance since not all those who are interested will be able to attend the match.

4. Methodology

4.1. Scenario planning

Scenario Planning is going to be used so that some fundamental steps are followed in the process of finding an optimal structure in terms of teams and format for Primeira Liga.

There are several methods to build scenarios that differ in terms of features. For Schoemaker (1995), scenario planning is a structured method to envision future outcomes by analyzing a wide variety of possibilities in detail while Porter (1996) states that scenarios are consistent futuristic visions based on plausible assumptions. From what the authors state in terms of scenarios, it is relevant to follow some key steps while developing a method to find a better a structure for the league. From all known methods to build scenarios, the following are the most used and thus deeply analyzed:

Porter (1985) uses the 5 Forces Framework to elaborate scenarios as they go through the following critical steps:

1. Identification of Uncertainties: the main aspects (both positive and negative) that can impact a company/organization should be listed. Using the 5 Forces Framework every element should be classified as constant, uncertain or predetermined;
2. Determining the Causal Factors: the principal causes of the uncertain elements should be determined;
3. Choosing of the scenario variables: in this step the variables that have higher impact are selected. Porter (1996) mentions that only independent variables are considered to be scenario variables;
4. Defining scenario variables' configuration: plausible assumptions should be defined for each scenario variable. Each configuration depends on how much the causal factors differ in its future evolution;
5. Building Scenarios: scenarios are generated from the steadiest configurations. Porter declares that scenario variables affect each other (even independent variables) which ease consistent combinations;
6. Scenario Analysis: this step is all about analyzing implications for each scenario using the 5 Forces Framework. The author recommends the most distinct scenarios to be studied before examining the most plausible ones. This allows a broader strategic vision;
7. Competitors' behaviour: Porter (1996) clarifies that competitors' behaviour affect the speed of evolution and structural changes in scenarios. This should be handled by introducing scenario variables for competition if behaviour is not certain or the entrance of new players is possible;
8. Competitive Strategies: in the last step the company's strategy is defined according to the scenarios previously evaluated.

Ghemawat (2009) draws a process of six sequential steps:

1. Gathering data: mapping business scenarios in detail results in a wide collection of information;
2. Setting Boundaries: deciding scope of the project is always important in an early stage even though it can be difficult there is not an accurate way to do it;
3. Identifying Players: identification of all relevant players interacting in the process of building scenarios as well as envision future participants;
4. Understanding the negotiation power of the Players: the necessary output in this step is to label the feistiest players and their behavior;
5. Thinking dynamically: the author recommends making perspectives only regarding the future and not past or present experiences. This way it is possible to anticipate changes easily;
6. Adapting and shaping the model: after performing the previous steps it is crucial to use all the work to execute strategically. Ghemawat (2009) declares that this strategy should contemplate the purpose of the scenario which can be anticipating future performances or testing investments in a given sector among others.

Schwartz (2012) believes it is necessary to create from three to five future scenarios for an organization to reflect about wide-ranging and assertive strategic decisions. For Schwartz there is an eight-step proposition for the process of elaborating scenarios:

1. Identifying the central question: the first step is to define clearly the question that originated the construction of scenarios;
2. Recognizing the main characteristics of the local environment: whether they are positive or negative the main characteristics that influence the local system should be listed;
3. Identifying the external driving forces: there should also be listed outside characteristics that impact the central question such as new technologies or political factors;
4. Ranking variables: two principles should be taken into account while raking. Firstly, the level of importance for the success of the central question and secondly the level of uncertainty of those factors;
5. Selecting scenario logic: after the previous two steps it is necessary to position variables in the axis according to the way the scenarios are being designed;
6. Describing scenarios: at this point scenarios are described narratively and in detail in terms of evolution;
7. Implications: After detailing each scenario it is described every possible implication for every decision as well as opportunities and vulnerabilities. This way we can evaluate the impact of a decision on every scenario;
8. Monitoring: Evaluating continuously facilitates gathering information about the organizational strategy and better positioning in the market (ahead of competitors).

Schoemaker (1995) says scenarios are beneficial in situations where the level of uncertainty for the future is high or there is a necessity to create new perspectives, so he created 10 guidelines to follow to build scenarios:

1. Define Scope and timeline;
2. Identify the major stakeholders in terms of roles, interests and power positions;
3. Identify the basic tendencies;
4. Identify the main uncertainties and if they can affect the objectives of the company;
5. Build scenarios using tendencies and uncertainties;
6. Verify consistency and plausibility unifying both;
7. Develop learning scenarios;
8. Identify searching needs as if it is required to enrich uncertainties and tendencies;
9. Develop quantitative models;
10. Evolve to decision scenarios as it is tested if the scenario is well developed.

Operations research has been essential helping managing in an efficient way resources in the world of football. Wright (2009) states it is not easy to define boundaries for OR as it merges with other areas such as economics or statistics and agrees that it relates directly or indirectly with decision-making as the results of it are not only recommendations for actions but also outlines of better decisions. In sports, the main areas studied are tactics, strategy, scheduling and forecasting.

For tactics and strategy, for example, Hirotsu and Wright (2002) use Dynamic Programming to decide the best moment for a coach to make a substitution in football or baseball whereas Boon and Sierksma (2003) created a system to help managers select the best players for each match, scouting or purchasing new players. Hope (2003) has used statistical models to determine the time for a head coach to be discharged demonstrating that managers in English football tend to stay longer than the model while the Dutch are on opposite side.

Scheduling can happen in terms of fixture scheduling. Several authors have used exact approximation approaches such as Della Croce and Oliveri (2006) which analyzed the Italian Serie A or Bartsch et al (2006) for the German and Austrian Bundesliga using heuristics.

Forecasting has always been part of most sports (Wright, 2009). Dixon and Robinson (1998) described on a statistical model to forecast the outcomes of football matches and to update those guesses during the progression of a match.

4.2. Measures of competitive balance

According to the CIES Football Observatory (2018), there is a wide-ranging decline as far as competitive balance is concerned in the European football leagues (including the Champions League and Europa League) while comparing 2016/2017 and 2017/2018 seasons. The measures

used consist of analysing the percentage of matches with a gap of three or more goals and the average goal difference in 29 European competitions.

For the first measure, Champions League has seen the highest percentage (29,5%) and almost twice as high as the Europa League (16,1%) with an increase of 8,5% from the former to the latter season. The English Premier League sits third with 21,9% in terms of country leagues for the 2017/2018 season. Portugal has one of the highest growths from the first to second season (6,6%) and ends up having 18,5% of its League matches with a three or more-goal difference. On the other hand, the German Bundesliga has the lowest percentage while evaluating the big-5 European Leagues with only 11% (-6% than in the previous season). The lowest fraction belongs to the Russian Premier League: only 10%. Overall, out of the 29 championships, this percentage increased in 20 leagues meaning this is a trend European wide. For the second measure the goal gap per game grew from 1,37 to 1,40 goals. Champions League tops once more the raking (1,87) whereas the Portuguese Primeira Liga has a 1,55-goal difference per match (third overall).

Apart from these, there are several methods to assess the competitiveness of a league. In order to analyze a league, it is first necessary to categorize the measurement. Zimbalist (2002) clarifies that it is possible to classify a league taking in consideration the closeness between its members in a given year which is perceived as the level of concentration. On the other hand, seeing a league in a big picture and evaluating if a certain group of teams are winning the league in consecutive seasons is also a measure of how competitive a league is which is catalogued as the level of dominance. It is also conceivable to mix both concepts and combine concentration and dominance. For each of these categories there are measures applicable not only to football but also to several United States sports.

Starting with measures that relate to the proximity of a league in a given season:

The **Range** is a method that compares the winning percentage of the best and worst positioned teams in a league. A perfect competitive balance occurs when both teams have the same league results.

The **Standard Deviation of League Points (SDLP)** is measured using the points each team achieves in a season and the average points in that league. The smaller the standard deviation, the higher the competitive balance. It was developed by Scully (1989) and Quirk and Fort (1997):

$$SDLP = \sqrt{\frac{\sum_{k=1}^n (P_k - TP)^2}{N}} \quad (1)$$

Where:

P_k = Individual team points in the season

TP = Average points in the season

N = Number of teams

The **Relative Entropy** proposed by Horowitz (1997) is used in leagues where a team plays the all other teams the same amount of times. The maximum value is 1 which corresponds to the most possible balanced league. It is calculated as follows:

$$R = \frac{E}{E_{max}} \quad (2)$$

$$E = -\sum_i p_i \log_2 p_i$$

p_i = Proportion of the total win of team i

$$E_{max} = -\log_2 \frac{1}{N}$$

N= Number of teams in the league

Concentration ratios weigh the competitive balance based on gathering a subgroup of markets. It is defined as the amount of market shares of the k first companies in a market, with the N companies contending ordered by decreasing market shares. In championship rankings, the teams are positioned in decreasing order of points achieved. The index varies from k/N, where N is the total number of teams, and all have exactly the same points in the league and 1, where there is only one team gathering all the possible points. The 5-club concentration ratio (C5 ratio) suggested by Michie and Oughton (2004) is one of the concentration ratios and can be conveyed as:

$$C5 \text{ ratio} = \frac{\text{Total points earned by the top 5 teams}}{\text{Total number of points earned by all teams}} \quad (3)$$

For the 18-team Portuguese Primeira Liga, this method as a minimum value of 0,27(7). The highest possible rate arises when all top 5 teams win their games and the other 13 teams draw their matches. Michie and Oughton (2004) brought a new version that allows a better interpretation of the C5 ratio. It is called the C5 Index of Competitive Balance (C5ICB):

$$C5ICB = \frac{C5 \text{ ratio}}{5/N} \times 100 \quad (4)$$

N= Number of teams in the league

In this index a 100 value is only obtained when a league is perfectly balanced.

The **Herfindahl-Hirschman Index (HHI)**, first planned by Hirschman and brought to sports analysis by Michie and Oughton (2004) and Depken (1999), uses the same pattern of the Concentration ratios but is used for all the teams composing a league.

The **Index of Dissimilarity (ID)** is used in other fields such as demographics but was taken to measure competitive balance by Mizak and Stair (2004):

$$ID = 0,5 \sum_{i=1}^N |X_i - Y_i| \quad (5)$$

Where:

$$X_i = \frac{1}{N}$$

Y_i = Team i's share of total win the league

N = Number of teams (i) in the league

This Index allows understanding the exact number of wins that need to be addressed in order to result in an equality of results in a league. The higher the value, the lower the competitive balance. If the result is zero which is the lowest possible then a perfect balance is evaluated. For example, in a league composed by 20 teams that play against each other the same amount of times, the maximum ID result is 0.26 meaning that it would be necessary to change 26% of the outcomes to achieve a perfect league in terms of competitiveness.

The **Surprise Index** is studied by Groot and Groot (2003). As the name indicates, this index is based on a surprise result (usually a win or a draw) from a team that is considered to be weaker than its opponent (a team that was better ranked in the previous season). The weaker team is allocated a score of two points in case of a win or a score of one point should a draw happen. If the top teams always win there are no surprises. This ratio varies between 0 and 1 and is formed by articulating the total amount of surprise points to the number of points of a perfect balanced league:

$$S = \frac{P}{B} \quad (6)$$

Where:

$$P = \text{Total of surprise points in the league} = \sum_{i=1}^{N-1} \sum_{j=1+1}^N (R_{ij} + R_{ji})(j - i)$$

N = Number of teams (i) in the league

$$B = \text{Number of surprise points with a perfect balanced league} = \frac{N(N+1)(N-1)}{3}$$

Team i finishes season in a higher position than team j

R_{ij} = Result of the match between home team i against team j (and vice versa)

A bigger value for S means that there is a higher level of competitiveness in the league. For the minimum value of S to happen, which is zero, it would be necessary that no surprise result occurs. On the other hand, if S =1 then each team won one and lost the other match against every team in the league.

Now moving to cataloguing a league in terms of level of dominance and relative performance of certain teams, it is possible to use the following measures of competitive balance:

The **Total of Titles Won by Team** measure was first introduced by Rottenberg (1956) as the author considers this a simple test to assess the dominance of certain teams. For the 84 editions of the Portuguese Primeira Liga only 5 teams have been crowned champions. SL Benfica, FC Porto and Sporting CP gathered 82 titles while Boavista and Belenenses were each underdog champions only one time. In the United Kingdom, since the creation of the Premier League in 1888, 119 editions have been played and 24 different teams have lifted the trophy. Manchester United tops the list with 20 titles won.

The **Repeated Title Wins** is a measure that indicates a level of dominance in a league. Szymanski and Kuypers (1999) enlighten that this measure can easily be used for the Scottish Premier League as Celtic FC and Glasgow Rangers have been the only winners and dominating the league for decades.

The **Number of Different Title Winners** measure identifies title winner variation over the years meaning that the more different winners the more balanced the league is.

All these methods have been previously used to measure different teams and competitions. For this dissertation, using only one of them may not be enough as a strong analysis requires using and combining those who are more relevant. The objective of this dissertation is to maximize attendance and competitive balance so both aspects must be supported by the methods presented above.

Regarding attendance it is relevant to measure differences encountered and that are impacted by changing the number of teams and format of Primeira Liga whether in terms of total number of supporters whether in terms of percentage of seats sold. When it comes to competitive balance it is possible to combine methods to sustain the study. The method by CIES Football Observatory (2018) is clearly necessary to be used meaning that more competitive leagues have closer matches meaning lower goal gaps. This method is only used to assess a 3-goal gap, but it requires deepen analysis, so an adaptation is needed in order to measure all goal gap that has occurred. Additionally, the Herfindahl-Hirschman Index (HHI) and Concentration ratios will be merged. So apart from goal gap, it is also beneficial to measure point gap in all sections of the league. Lower point gaps also mean a more competitive league. To sum up, it is also necessary to see if different title winners emerge or if the chronical top placed teams maintain their dominance. The podium of the league rarely changes nowadays so methods such as Number of Different Title Winners and Repeated Tittle Wins are going to be brought into this study.

4.3. Competitive Balance and Attendance Measures applied to Primeira Liga

As mentioned previously the league structure of the Portuguese Football League has been the same for several years both in terms of teams and format making it an 18-team competition where squads compete twice against each other. At the end of each season, 306 matches have been played and a new champion is found.

The main objective of this dissertation is to find the most adequate structure in terms of size and format so it necessary to combine and maximize the following features for Primeira Liga:

- Competitiveness;
- Attendance.

So that some of the measures of competitive balance studied and presented before can be applied to Primeira Liga it is better to review literature behind them. Data regarding Primeira Liga is not expected to be used and applied in a single measure but by a combination of measures so that the results encountered can be more sustained and trustworthy. At the same time the introduced measures must be able to cover different aspects related to competitive balance and attendance.

Quirk and Fort (1997) state that one of the fundamentals of sports is the uncertainty of outcome of matches perceived by supporters. This must be connected directly with the difference in number of goals by each team in a match. The lower the goal gap the more competitive a match and normally a league is. Added to this idea, Forrest and Simmons (2002) discover that stadium attendance rises when the teams are more balanced. Following these ideas, attendance must be examined in different aspects such as in absolute number of supporters and percentage of attendance in each match/stadium. Szymanski (2003) also looks at competitive balance in a season point of view as final results and standings of a season tells the supremacy of a number of team or teams over the others so it is important to compare first placed teams as well as middle and bottom teams in terms of points obtained.

All previous literature connects with the measures of evaluating competitive balance and attendance discussed before. Starting with the measure used by CIES Football Observatory (2018) to evaluate the evolution in the number of matches where the goal difference was three or more goals: this measure gives us a good outlook on how unbalanced a league can be in extreme circumstances but does not provide a wider picture on the other results and difference in terms of goals scored by each team in a match so an adaptation of this measure seems necessary. With this said, it is more useful to look, evaluate and compare all goal differences from every match in different formats. It is also beneficial to get insights and combine other measures such as range (that relates the winning percentage of the best and worst performed teams), concentration ratios or the Herfindahl-Hirschman index (that weigh the competitive balance based on gathering a subgroup of teams) and even the number of different title winners to find the most adequate measure that enables comparing performances from different placed teams across the final standings. An appropriate way to perform this would be to compare points obtained at the end of a season by the first, second, fifth, middle and bottom team across the recent editions of Primeira Liga providing a broader viewpoint on the success of different teams. When it comes to Attendance and following Forrest and Simmons (2002) it is important to evaluate attendance and stadium occupation in every match. Competitive balance can be achieved because of a lower goal difference in each match which ultimately would result in a reduction of the point gap in the league making it unpredictable and more remarkable.

All things considered, as far as Attendance is concerned not only is it necessary to evaluate the average number of supporters at stadiums but also percentage of seats sold. When it comes to Competitiveness, the objective is to have the most unpredictable league in terms of results, so it is necessary to measure gaps in terms of points at the end of the season between different positioned teams and also look at the goal difference in each match played.

Summing up we are going to measure the following aspects in a match/season:

- Attendance;
- Stadium occupation;
- Goal difference;
- Point gap ratio in final standings between:
 - 1st and last team;
 - 1st and team in middle of the table;
 - 1st and 5th team;
 - 1st and 2nd team.

This examination will be first made for Primeira Liga. It will then be performed equally for different selected structures in terms of size and format. Both examinations will be conducted for 5 completed seasons. To do this it is first necessary to collect data from every match played in the last 5 seasons of Primeira Liga that will afterwards be used as inputs:

- Identification of every team;
- Matchday;
- Result including goals from both teams;
- Goal difference between teams;
- Attendance;
- Stadium capacity of every team.

Liga Portugal (2019) and Football-data.co.uk (2019) websites have been accessed to extract all the necessary data and to double check its accuracy. These data are extracted from past five seasons of Primeira Liga which have all had the same format and number of participants (18 teams and 2 rounds), which are:

- 2014/2015 season;
- 2015/2016 season;
- 2016/2017 season;
- 2017/2018 season;
- 2018/2019 season.

The next step is to look at other leagues' format and membership and find possible alternatives so that the previous inputs can be measured and compared to the current format of Primeira Liga. As mentioned previously, major leagues across Europe vary in terms of members starting in 8

and go up to 20 teams. On the other hand, the wide majority of European leagues have a 2, 3 or 4-round structure.

Even though the major leagues of England, Germany, Italy, Spain or France, usually referred as the Big 5, are seen as example to follow in several aspects such as broadcasting contracts or management policies, and despite all these leagues offer a 2 round structure, when it comes to membership they rely on a league composed by 20 teams (excluding Germany that has 18 teams). For this aspect they are not considered to be top-notch examples to be followed. The German Bundesliga, for example, currently has the same number of teams seen in Primeira Liga. A fact hard to understand given the disparity in terms of population between the two countries. On the other hand, its 2-round structure may be tested as it is the most used format across Europe.

The major country leagues that are going to be tested will be mainly selected based on the ones seen in countries similar to Portugal in terms of population (10 291 196 inhabitants) and where football is one the main sports taking in consideration the 2018/2019 season, such as:

- Belgium (11 498 519 inhabitants);
- Greece (11 142 161 inhabitants);
- Czech Republic (10 625 250 inhabitants);
- Sweden (9 982 709 inhabitants);
- Austria (8 751 820 inhabitants);
- Switzerland (8 544 034 inhabitants).

All these countries have different combined league format and membership and may deliver an extremely diversified and complete comparison for Primeira Liga. After having selected alternative formats, we are in condition to perform a comparison between the league as is and all other systems for the 5 seasons studied. Every season will be assessed independently, and the data extracted from every real championship will be used to generate all possible combinations for every format chosen. Every combination inside each format will be compared to the results of the actual league in each season.

So that all combinations and its results can be generated, Matlab software will be used. The results will be exported to Excel, examined and discussed afterwards. Before simulating the possibilities for every format chosen, some rules are essential be created. Firstly, and taking into consideration that all formats chosen will have less than 18 teams, a decision has been made to always consider the 5 most successful teams when we look at the last five seasons altogether. This means that SL Benfica, FC Porto, Sporting CP, SC Braga and Vitoria SC will always be considered when simulating. The first 4 have always been placed in top 5 last five seasons while the last one has stayed in those position 3 times. The reason not to consider any other team is because all of them experienced high volatility in the final league standings for the past 5 seasons.

Additionally, every format must comply with either UEFA and FIFA calendars, meaning there is a limit for the number of matchdays and games played so the upper boundary that is going to be considered will be the one used in England's Football League Championship which is composed by 46 matchdays. There will be a tentative not to match this number as some teams will play additional national and international competitions which mostly do not occur with Championship's sides.

Just as an example, if one of the chosen structure has 16 teams and a 2 round structure (teams play each other twice), we are going to examine all 78 possible combinations, i.e. there are 78 combinations of 16 teams using the 18 teams that compose each season of the league (take into consideration again that 5 teams will never be removed from the analysis; in this case 2 teams from the other 13 rotating teams are being left in and out which results in 78 combinations) and compare each of them against the existing 18 team and 2 round Primeira Liga in all measures described before.

Two different sorts of comparisons are going to be performed:

- 1) For one combination of a format to be considered better than the current league structure it has to be better (better is explained in brackets) in all seven measures:
 - attendance (higher attendance);
 - stadium occupation (higher percentage);
 - goal gap per match (lower goal gap);
 - final standings point gap between:
 - champion and second placed team (lower point gap);
 - champion and fifth placed team (lower point gap);
 - champion and team in the middle of table (lower point gap);
 - champion and team who sat bottom of the league (lower point gap).

- 2) Instead of combining and comparing measures as one, 3 different groups of measures will be formed (each comprising measures from the same category) and one format will be considered better (better is explained in brackets) if surpasses the current league structure in at least one the group measures created. The groups are the following:
 - Attendance: attendance and stadium occupation (higher attendance and higher percentage);
 - Goals: average goal gap per game (lower goal gap);
 - Standings: final standings point gap between champion and second placed team, champion and fifth placed team, champion and team in the middle of table and finally champion and team who sat bottom of the league (lower point gap).

A wide range of statistics regarding goals scored, attendance and points obtained in previous leagues are being mixed in different ways in both comparisons. The objective is not only to study

one measure alone but to contemplate seven measures and how they can boost competitive balance and attendance. Doing this, it strengthens each comparison and provides much more reliable conclusions and acceptance from possible stakeholders that consider studying this dissertation in future studies or even by the League should it reflects on changing the current structure and format used.

5. Application and Results

5.1. Application and Results for Primeira Liga

This chapter will reproduce the application of the methodology used to generate alternative formats and membership for Primeira Liga and perform comparisons between them and the current state of the league. The analysis will only be focused on seasons 2014/2015, 2015/2016, 2016/2017, 2017/2018 and 2018/2019. Even though, at the time being, it is possible to include data extracted from the 2019/2020 season, it would be misleading and could jeopardize results and conclusions because of the COVID-19 pandemic that interrupted championships not only in Europe but around the World. 2019/2020 season would eventually be concluded but all matches for the leagues analyzed have been conducted without supporters. The desired results must come from lookalike seasons and the 2019/2020 season was full of uncertainty, so I decided not to include it in this dissertation.

The process of selecting league formats to be compared starts by looking at what is currently being performed in other leagues. As it was mentioned before, by analyzing European countries similar to Portugal in terms of inhabitants while at the same time provide competitive leagues (top half of the UEFA ranking) it is possible to conclude that all of them have less than 18 teams competing in their major competition as seen in Table 5:

Table 5 - European countries like Portugal in terms of inhabitants and major league members

Country	Inhabitants	Membership in 2018/2019 season
Belgium	11 498 519	16
Greece	11 142 161	16
Czech Republic	10 625 250	16
Sweden	9 982 709	16
Austria	8 751 820	12
Switzerland	8 544 034	10

This depicted trend is not only seen in European countries like Portugal in terms of inhabitants but also the majority of European countries, so it must be translated into our model as an at least 18-team league is only seen in the Big 5 leagues (Spain, England, Germany, Italy and France) and in countries with far more inhabitants than Portugal (Netherlands or Turkey). At the same time, the model has also to contemplate a minimum number of teams to compose a league. No major league across Europe has less than 8 teams so none of the alternative formats will comprise a lower number of participants than these.

At the same time, when considering existing formats across Europe, not only do most of the previous mentioned countries like Portugal but also the majority of the other countries adopt a round robin format (which can be a 2, 3, 4 or 6 round format). In fact, 69% of Europe's first division

leagues rely of this format (UEFA, 2018a). Considering the additional 31% of cases, around half of these leagues (8 leagues and 14,5%) adopt a trending structure which UEFA calls Spit Two & Two, meaning that after a 2-round robin format is played, the league is spit in two halves considering the standings at that time and each half typically plays a supplementary 2 round robin format. This structure is, for example, encountered in Austria or in Belgium for the 2018/2019 season.

Taking the previous two paragraphs into account, on the one hand the upper and lower tier in terms of members have been defined meaning that the Portuguese league as is will be compared to leagues with a minimum of 8 teams as well as less than 18 teams. On the other hand, all 4 possible simple round robin (2, 3, 4 or 6-round format) and Spit Two & Two formats will be tested and combined with different number of teams according to the preceding rule.

All in all, 15 different leagues to be studied afterwards have been encountered at this stage. These leagues follow all the instructions mentioned across this chapter in terms of number of sides, formats and matchdays. Table 6 summarizes these leagues and provides information in terms of membership, format, total number of matches, matchdays and possible combinations mixing these different aspects. Explaining it, we can see that Primeira Liga's current membership and format results for the measures of competitive balance and attendance defined before will be compared to every possible combination result for each of the 15 formats. For example, a format that has 10 teams and 4 rounds presents 1 287 possible combinations to be considered.

Table 6 - Alternative league structures and its features

Membership	Format	Matches	Matchdays	Combinations	Format seen / partially seen in:
16	2 rounds	240	30	78	Swedish Allsvenskan; Greek Super League
16	3 rounds (3rd round = 1st round)	360	45	78	The majority of country leagues similar to the Portuguese league use 16 team members while 10 out of 55 major leagues in Europe use a 3-round format
16	3 rounds (3rd round = 2nd round)	360	45	78	
14	2 rounds	182	26	715	Romanian Liga 1 has 14 teams while 17 out of 55 major leagues in Europe use a 2-round format
14	3 rounds (3rd round = 1st round)	273	39	715	Romanian Liga 1 has 14 teams (and a Split Two & Two format) while 10 out of 55 major leagues in Europe use a 3-round format
14	3 rounds (3rd round = 2nd round)	273	39	715	
12	2 rounds	132	22	1 716	Austrian Bundesliga has 12 teams (and a Split Two & Two format) while 17 out of 55 major leagues in Europe use a 2-round format
12	3 rounds (3rd round = 1st round)	198	33	1 716	Finnish Veikkausliiga
12	3 rounds (3rd round = 2nd round)	198	33	1 716	
12	Split Two & Two	192	32	1 716	Austrian Bundesliga; Belgian Pro League
10	3 rounds (3rd round = 1st round)	135	27	1 287	Swiss Super League has 10 teams (and 4 rounds) while 10 out of 55 major leagues in Europe use a 3-round format
10	3 rounds (3rd round = 2nd round)	135	27	1 287	
10	4 rounds	180	36	1 287	Swiss Super League
8	4 rounds	224	28	286	Lowest number of teams seen in a major European league and 4-round format seen in 10 out of 55 major leagues in Europe (including the Swiss Super League)
8	6 rounds	336	42	286	Extreme case: lowest number of teams and maximum number of rounds seen in major leagues in Europe

It is important to state that leagues with 3 rounds have been duplicated so that it can also be seen if major differences are encountered in replicating the first or the second round for the third additional round. After defining suitable leagues, it is now time to start simulating every combination for each league and afterwards compare it to the results obtained for the existing league in the past 5 seasons. As mentioned before, two sorts of analysis are going to be performed.

For the first analysis, where one combination must be superior in all measures (attendance, stadium occupation, goal and point gap) to be considered better than the current league structure the results (number of combinations out of the possible combinations that surpass Primeira Liga's structure) are seen in Table 7:

Table 7 - Combinations of each format that are better than the current league structure in all 7 measures

Membership	Format	14/15	15/16	16/17	17/18	18/19	Avg % Better combinations per season
16	2 rounds	1	-	8	-	-	2,3%
16	3 rounds (3rd round replicates 1st round)	-	-	2	-	12	3,6%
16	3 rounds (3rd round replicates 2nd round)	3	-	10	-	-	3,3%
14	2 rounds	9	13	66	2	3	2,6%
14	3 rounds (3rd round replicates 1st round)	-	9	54	2	82	4,1%
14	3 rounds (3rd round replicates 2nd round)	12	-	64	2	-	2,2%
12	2 rounds	8	13	109	2	5	1,6%
12	3 rounds (3rd round replicates 1st round)	9	-	98	2	96	2,4%
12	3 rounds (3rd round replicates 2nd round)	15	-	100	8	-	1,4%
12	Split Two & Two	329	39	433	71	1	10,2%
10	3 rounds (3rd round replicates 1st round)	7	-	61	-	21	1,4%
10	3 rounds (3rd round replicates 2nd round)	5	1	58	-	-	1,0%
10	4 rounds	2	1	56	1	1	0,9%
8	4 rounds	3	-	11	-	-	1,0%
8	6 rounds	3	-	11	-	-	1,0%

The first eyesight goes to the 16/17 season. In this season, we can see that all leagues have at least 2 combinations that outperform Primeira Liga and four leagues have at least 98 combinations with better results overall. The league with the best results in terms of combinations

is the one with 12 teams and a Split Two & Two format. 433 out of 1 716 combinations beat the structure that is currently used. These 433 combinations connect better attendances and significant lower gaps in terms of goals scored by each team in every match and points obtained at the end of the season between different placed teams across the board making it a decent candidate to be suggested as an alternative.

These are however small numbers if compared to the total combinations for every encountered and simulated structure. When analyzing in terms of percentage, the highest listed league is the same and demonstrates around 25% (433 out of 1 716) of its combinations with better results. The second and third simulated leagues with the best results have only around 13% (10 out of 78) and 10% (8 out of 78) positive combinations (16 teams and 3 rounds where the 3rd round replicates 2nd round and 16 teams and a 2-round format, respectively). Even though other simulated leagues present more positive combinations than these two leagues in the table above, the total number of combinations simulated is far greater diminishing their positive percentage.

All other seasons present even poorer results (excluding the structure with 12 teams and a Split Two & Two format). Several structures present zero better combinations and, those who do not, show extremely small figures. Across all seasons (apart from 16/17) and structures (excluding 12 teams and Split Two & Two), only two numbers (out of 56) seem to be slightly relevant: 96 and 82. Both occur in the 18/19 season and in formats with 3 rounds where the 3rd round replicates 1st round. The first numbers derives from 12-team membership while the latter results from a 14-team league.

Overall, taking into consideration the average percentage of better combinations per season, a top 3 in terms of structure is encountered:

- 12 teams and Split Two & Two format (10,2%);
- 14 teams and 3 rounds (3rd round replicates 1st round) format (4,1%);
- 16 teams and 3 rounds (3rd round replicates 1st round) format (3,6%).

These low percentages and statistics seen above may seem an indicator that combining all seven measures could represent too big of a step to take to categorize an alternative league, so it is clearly necessary to perform additional analyses that do not aggregate so many methods making it possible to understand the results of each method.

For the second analysis, where all 7 measures have been divided into 3 categories, at least one of the subsequent must be superior to be considered better than the current league structure. These 3 categories are the following:

- Attendance: both average attendance and stadium occupation (higher attendance and higher percentage);
- Goals: average goal gap per game (lower goal gap);

- Standings: final standings point gap between champion and second placed team, champion and fifth placed team, champion and team in the middle of table and finally champion and team who sat bottom of the league (lower point gap).

When looking at the results all together it is clear that no matter which season, alternative league or combination is chosen, the group measure Attendance is improved above 99% of the times. This result is not surprising given the gap in terms of seats sold and stadium occupation between teams such as SL Benfica, FC Porto, Sporting CP, SC Braga or Vitoria SC – teams that are always part of the simulations – and all other teams in the league, that mostly fill their seats when one of the previous teams visits their grounds, especially SL Benfica, FC Porto or Sporting CP. This means that when reducing league members, attendance and stadium occupation are always better no matter the format of the league. This is reinforced by Haugen and Hervik (2002) who consider that the higher the attendance, the higher the ranking and historical success of the team. Borland and Macdonald (2003) also support this idea of greater teams generating more stadium visitors as the quality of viewing in terms of seating and facilities are generally offered in better conditions so these are also important when deciding to attend a match apart from the loyalty to the club.

The other categories, Standings and Goals, show that alternative leagues demonstrate better results than those seen in the first analysis. The 16/17 season provides again the most positive global outputs as it was seen while conducting the first analysis. For Standings, the 16/17 season goes from at least 7% (for 8 teams and 4 rounds and 8 teams and 6 rounds) to 41% (Split Two & Two and 12 teams) better encountered combinations. For the same season, when it comes to Goals, the worst results are seen in the league with 10 teams and 4 rounds (17%) while the best results are gotten again in the Split Two & Two league (a whopping 49% of better combinations). All other seasons provide not so good but relevant results. After seeing that Attendance is bettered in almost 100% of the combinations, Goals is second most improved category. At least around 10% (10 members and 4 rounds) combinations are improved in each league and this value escalates to 40% in the 12 teams and Split Two & Two league. Finally, considering Standings which is the category that creates the lowest number of combinations that beat Primeira Liga, the league with 8 teams and 4 rounds as well as the one with the same 8 teams but 6 rounds have only 3% of positive combinations. On the other hand, the trend continues as the 12-team Split Two & Two structure continues to deliver the best results with 25% better combinations.

Overall, taking into consideration the average percentage of better combinations per season for the 3 gathered categories, a top 3 in terms of structure is encountered:

- 12 teams and Split Two & Two format;
- 16 teams and 3 rounds (3rd round replicates 1st round) format;
- 14 teams and 3 rounds (3rd round replicates 1st round) format.

Increasing the number of rounds and diminishing the number of teams are indicators that both attendance and competitive balance are benefited. More rounds mean more unpredictable matches as teams with different objectives play against each other more times.

A structure composed by 12 teams and a Split Two & Two format had the best results overall. What are the real advantages of embracing a structure like this and why did it stand out from the rest? Key benefits and reasons for success are presented below:

- 32 instead of current 34 matchdays fit in UEFA and FIFA calendars and give teams 2 additional weeks for preparation for European competitions, space for national cups or even more time to rest or practice;
- First half of season is not conclusive as there are fewer games for a team or group of teams to isolate at the top or bottom of the league but may be essential for stronger teams to get points against weaker teams;
- Second half of season offers decisive matches between teams fighting for the same objectives which could generate a more balanced league (goal and point gap) and closer matches as teams in each half are expected to have the same strength;
- Bottom half of the league may be given an additional incentive as they could not only be fighting to avoid relegation but also for an European spot that would otherwise be almost impossible for a bottom team to achieve in a 2-round format alone;
- Top half is fighting for championship and European competitions as matches between these teams are double in this structure;
- Less league teams and thus less matches per matchday would allow every match to be televised in proper kick-off schedules generating organic interest from viewers and higher sponsor interest;
- Attendances and TV audiences would increase as all matches are important, not only those on the first half of season but especially those after the league is divided.

Results for these groups/categories are demonstrated in Table 8 bellow for the 5 seasons studied:

Table 8 - Combinations of each format that are better than the current league structure in at least 1 of the 3 groups of measures

Membership	Format	Attendance					Standings					Goals					Combinations
		14/15	15/16	16/17	17/18	18/19	14/15	15/16	16/17	17/18	18/19	14/15	15/16	16/17	17/18	18/19	
16	2 rounds	78	78	78	78	78	13	12	15	1	2	12	12	22	11	16	78
16	3 rounds (3rd round replicates 1st round)	78	68	73	78	78	-	14	12	-	13	4	10	23	21	63	78
16	3 rounds (3rd round replicates 2nd round)	78	78	78	78	77	8	-	18	5	-	43	20	27	3	5	78
14	2 rounds	715	715	715	715	715	59	88	160	23	42	58	83	146	77	119	715
14	3 rounds (3rd round replicates 1st round)	715	715	715	715	715	22	45	152	5	180	32	72	157	159	362	715
14	3 rounds (3rd round replicates 2nd round)	715	715	715	715	715	37	7	150	39	-	175	100	165	34	48	715
12	2 rounds	1716	1716	1716	1716	1716	111	81	287	21	73	107	128	335	107	281	1716
12	3 rounds (3rd round replicates 1st round)	1716	1716	1716	1716	1716	97	47	285	13	321	70	146	356	226	611	1716
12	3 rounds (3rd round replicates 2nd round)	1716	1716	1716	1716	1716	99	27	265	61	-	195	155	363	80	104	1716
12	Split Two & Two	1716	1716	1716	1716	1716	820	413	701	197	32	787	382	836	636	811	1716
10	3 rounds (3rd round replicates 1st round)	1287	1287	1287	1287	1287	115	29	152	4	100	59	78	272	141	446	1287
10	3 rounds (3rd round replicates 2nd round)	1287	1287	1287	1287	1287	42	39	129	25	-	127	92	275	83	112	1287
10	4 rounds	1287	1287	1287	1287	1287	81	56	166	6	34	72	83	221	81	196	1287
8	4 rounds	286	286	286	286	286	21	-	20	-	-	27	9	68	27	52	286
8	6 rounds	286	286	286	286	286	21	-	20	-	-	27	9	68	27	52	286

Table 9 takes into consideration the average percentage of better combinations per season:

Table 9 - Average percentage of better combinations per season in each structure

Membership	Format	Attendance	Standings	Goals
16	2 rounds	100%	11%	19%
16	3 rounds (3rd round replicates 1st round)	96%	10%	31%
16	3 rounds (3rd round replicates 2nd round)	100%	8%	25%
14	2 rounds	100%	10%	14%
14	3 rounds (3rd round replicates 1st round)	100%	11%	22%
14	3 rounds (3rd round replicates 2nd round)	100%	7%	15%
12	2 rounds	100%	7%	11%
12	3 rounds (3rd round replicates 1st round)	100%	9%	16%
12	3 rounds (3rd round replicates 2nd round)	100%	5%	10%
12	Split Two & Two	100%	25%	40%
10	3 rounds (3rd round replicates 1st round)	100%	6%	15%
10	3 rounds (3rd round replicates 2nd round)	100%	4%	11%
10	4 rounds	100%	5%	10%
8	4 rounds	100%	3%	13%
8	6 rounds	100%	3%	13%

Even though each format can provide better results to some extent than the status of the League in terms of members and format, when looking at the top the league for the final standings in each generated combination, it is possible to understand that different champions than those who usually win are hard to be found. Out of the 13 676 combinations studied in 15 alternative leagues created, only 10 showed a new champion that had not been placed in the top 3 of the seasons analyzed as can be seen in Table 10. Those 10 combinations occurred in the 17/18 season in 3 different formats. 17/18 season saw a top 3 final standings composed by FC Porto (88 points), SL Benfica (81 points) and Sporting CP (78 points), the Big 3 teams in Portugal. SC Braga, that in Primeira Liga accomplished 71 points, was crowned champions in those out of the ordinary 10 combinations. All these 10 combinations saw leagues where Marítimo, Vitória FC, Rio Ave, Feirense or Boavista had been removed. SC Braga suffered only losses and draws against these teams apart from negative results against FC Porto, SL Benfica and Sporting CP. The Big 3 saw

most of their wins against the same teams not being counted in these simulated leagues. As mentioned, this extremely rare combination of results allowed SC Braga to come at the top. This shows again the unlikelihood of other teams to emerge.

These results show the power and dominance of the Big 3. Even with efforts made to increase supporters at stadiums and produce the most competitive league possible, these teams would eventually continue to be at the top of the league season after season. However, this should not discourage other teams from aiming higher and continue to focus on building competitive teams that could challenge those bigger teams in the end. A new league structure would be helpful to reduce the gap between teams. Additional studies regarding negotiation of broadcasting rights individually or together as league, revenue sharing, and salary caps would be helpful to compensate the findings of this dissertation.

Table 10 - Number of champions that had not been placed in the top 3

Membership	Format	14/15	15/16	16/17	17/18	18/19	Combinations
16	2 rounds	-	-	-	-	-	78
16	3 rounds (3rd round replicates 1st round)	-	-	-	-	-	78
16	3 rounds (3rd round replicates 2nd round)	-	-	-	-	-	78
14	2 rounds	-	-	-	-	-	715
14	3 rounds (3rd round replicates 1st round)	-	-	-	-	-	715
14	3 rounds (3rd round replicates 2nd round)	-	-	-	-	-	715
12	2 rounds	-	-	-	2	-	1 716
12	3 rounds (3rd round replicates 1st round)	-	-	-	-	-	1 716
12	3 rounds (3rd round replicates 2nd round)	-	-	-	4	-	1 716
12	Split Two & Two	-	-	-	-	-	1 716
10	3 rounds (3rd round replicates 1st round)	-	-	-	-	-	1 287
10	3 rounds (3rd round replicates 2nd round)	-	-	-	4	-	1 287
10	4 rounds	-	-	-	-	-	1 287
8	4 rounds	-	-	-	-	-	286
8	6 rounds	-	-	-	-	-	286

5.2. Implications on revenues

As seen before, the introduction of the 12-team Split Two & Two structure would generate a distinctive increase in the number of supporters at stadiums as well as making the championship race tighter. But what would it mean for matchday revenues and tv broadcasting rights of the teams composing the league?

Considering the last season analyzed for this dissertation, 2018/2019 season, I started by looking at the annual financial results of the teams, SL Benfica (2019), FC Porto (2019), Sporting CP (2019), SC Braga (2019), Rio Ave (2019) and Belenenses SAD (2019) that have them available on their websites to collect matchday revenues and TV broadcasting contracts regarding Primeira Liga. The numbers presented in Table 11 exclude UEFA revenues and corporate seats and offer total and average match revenues for each of the 17 home matches.

Table 11 - 2018/2019 matchday and TV broadcasting revenues

Team	Matchday	TV Broadcasting	Matchday per match	TV Broadcasting per match
SL Benfica	12 700 000 €	43 500 000 €	747 059 €	2 558 824 €
FC Porto	9 627 000 €	40 748 000 €	566 294 €	2 396 941 €
Sporting CP	8 186 000 €	24 532 000 €	481 529 €	1 443 059 €
SC Braga	690 000 €	7 710 000 €	40 588 €	453 529 €
Rio Ave	302 054 €	4 200 000 €	17 768 €	247 059 €
Belenenses SAD	273 042 €	3 500 000 €	16 061 €	205 882 €

The 2018/2019 season had 11 692 supporters per match on average that resulted in around 56,60% of seats occupied in Primeira Liga stadiums. The 12-team Split Two & Two structure is made of 1716 combinations and all of them surpassed the numbers of the current structure of Primeira Liga. On average, 16 524 supporters were in stadiums in every match (more than 41% increase) and 65,42% of seats were taken (more than 15% increase). Taking into consideration the upgrade in terms of interest from supporters, a natural growth in terms of revenues is expected. This structure is especially suitable to generate more interest from fans as, even though fewer games than the current structure are played, all matches are important and more matches between top teams are expected to occur. In this structure it is almost impossible for the league standings to be defined early in the season and it is expected that nearly every team will be involved in any decision at the end of the season. The values presented above in table 11 consider a league where teams play 17 home matches while this new structure has one less home match for every team.

A 41% increase of fans in stadiums would directly mean an increase in matchday revenues. This means that it is likely that the performance of teams is better resulting in more sponsorship deals that would result in negotiating TV broadcasting rights in similar increasing values. If in a near future both these revenues increase in 41%, Table 12 summarizes what it would mean for the teams seen before with 16 home matches. This considers that TV broadcasting rights are negotiated individually by each team which would foster the discrepancy between the Big 3 and the rest of the league but give additional power to invest in facilities and players to every team in the league. As mentioned, it would be useful study the benefits of embracing a new model for negotiating TV broadcasting rights or maintain the *modus operandi* for Primeira Liga teams.

Table 12 - New matchday and TV broadcasting revenues

Team	New Matchday	New TV Broadcasting
SL Benfica	16 853 647 €	57 727 059 €
FC Porto	12 775 595 €	54 074 993 €
Sporting CP	10 863 304 €	32 555 407 €
SC Braga	915 671 €	10 231 624 €
Rio Ave	400 843 €	5 573 647 €
Belenenses SAD	362 343 €	4 644 706 €

6. Conclusion

Football in Portugal is one of the main sources of interest for the population and is an enabler to gather families and friends around the TV, pubs or even at stadiums. Almost everyone, one way or another, has an eye on what is happening in Primeira Liga every week whether it is because of the results and player's highlights on the pitch and social life off the pitch, energetic support by fans from the stands and classic rivalries between teams. For these reasons there should always be a high interest from the governing bodies of the league to constantly increase the football quality and competitive balance to generate more awareness and thus uplift stadium attendance, broadcasting rights and all types of advertising.

Several major football leagues across Europe have recently dealt with this subject by in some cases changing their competition formats or number of teams composing the championship not only to increase competitive balance but also to optimize fan and sponsor interest in all things regarding the football ecosystem.

Both competitive balance and attendance have been studied across Europe and the World as well, but no literature has been applied to the Portuguese Primeira Liga. This aspect may allow this dissertation to have a special consideration by the ruling bodies of Primeira Liga and even be used to support current analysis that are being performed.

The main questions of this dissertation are related to finding ways for Primeira Liga to be maximized in terms of both attendance and competitive balance resulting in finding the best structure for Primeira Liga taking into consideration other major European leagues. To try to answer to these questions, data from previous seasons of the league was gathered while information about other league changes and current structures across Europe but mainly from countries like Portugal in terms of population was investigated. Mixing both these aspects resulted in finding 15 possible alternative league structures. In order to study the current state of the league as well as the 15 additional structures, attendance and competitive balance methods were executed so that disparities among all members in terms of fans attending matches, point droughts at the end of the season, goal differences in each match and titles won could be compared and characterised.

First, by reducing the number of teams composing the league it was expected that no matter what structure was considered, attendances would increase due to the usually near sold out stadiums of the bigger teams that would bend the curve in their favour. When bigger teams, especially the Big 3, visit grounds of weaker teams, these usually tend to be full of supporters, so this statistic was verified by the both of analyses that were performed. More than 99% of the combinations studied saw attendances rise both in number of seats sold and percentage of stadium occupation. This allowed to focus more on the second topic even though they are connected: competitive balance.

The first analysis performed, that combined all competitive balance measures regarding goals scored and points obtained, showed that despite some measures saw improvements, it was penalised by aggregating all measures together for a combination to be considered better than the current league structure. Only a residual number of combinations saw their results outperform Primeira Liga. This measure is believed to be important after some adjustments had been performed in the league should they occur, in an advanced stage to assess if changes are generating positive results. At the time being this is an aggressive measure to be applied to a league that has never seen any significant change regarding its structure. Nevertheless, the top suggested candidate has a league structure composed by 12 teams and a Split Two & Two format. Despite overall results from all leagues studied being poor, this structure presented twice as much percentage of positive of leagues examined than the second placed structure (10,2% vs 4,1%).

The second performed analysis presented better results and saw one of the simulated leagues with outstanding results. A league composed by 12 teams and a Split Two & Two format was found to be best out the 15 structures again. This structure offers a combination between lower point gaps among the teams (25% of the simulated leagues) and lower goal gaps in matches (40% of the simulated leagues), apart from 100% of better attendances, in a wide number of simulations. Should this structure be implemented, it would generate several improvements over the current structure of Primeira Liga. It reduces the championship calendar, allows the league to be closer by providing more matches between teams with the same strength and making the race for the title and to avoid relegation and European spots livelier than ever and in every moment of the season. This would intrinsically generate attendance and media audience, more sponsors and revenues. As a result, all teams could invest more in facilities and players shortening the gap between the contestants in Primeira Liga.

When analysing the impact of trying to find a league structure as competitive as one that could generate new champions apart from chronical winners (Big 3), this was so much harder to perform. None of the 15 structures that were created offered reliable outputs as only 10 (always crowning SC Braga as champions) out of the 13 676 combinations had a new winner that was not FC Porto, SL Benfica or Sporting CP. This proves that methods such as Number of Different Title Winners and Repeated Tittle Wins that were brought into this study failed immensely as the historical and financial gap between top teams and the rest of the league members is huge.

For those interested in studying this subject, new chapters can be added to continue and strengthen this dissertation. Combining not only match and attendance statistics but adding layers that were discussed in the Literature Review that could help fighting the Big 3 always coming up on top of the league such as studying different situations like revenue sharing among all teams, negotiation of broadcasting rights as a whole league and not each team alone or even introducing salary caps would allow to make this a more realistic and in-depth dissertation. These are directly

involved with financial subjects that would help weaker teams to develop themselves and challenge FC Porto, SL Benfica or Sporting.

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