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Key factors in the sporting and financial success of professional first division football clubs in Spain

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Abstract

Purpose: The purpose of this study is to identify the primary sporting and financial variables that drive success for professional football clubs in Spain's first division. By understanding these determinants, clubs can optimize both sporting outcomes and economic stability, which are essential in today's multimillion-dollar football industry.

Design/methodology/approach: The study adopts a quantitative, empirical design based on secondary data collected from official financial statements and Transfermarkt over ten seasons (2013/2014 to 2022/2023) of Spain's top-tier football league. The final sample consists of 189 valid observations from 30 clubs. After a descriptive analysis and filtering correlation, the study applies Principal Component Analysis (PCA) to reduce seven explanatory variables into two latent dimensions: SIZE (club size) and FINANCIAL PERFORMANCE. These components are used in an OLS regression model to examine their relationship with sporting success (measured by league points). All statistical procedures were carried out using R software.

Findings: The analysis shows that the size of the club has a significant relationship with sporting success. In other words, clubs with higher revenue, investment in transfers, and a more valuable squad tend to achieve better results in terms of points. On the other hand, financial performance, while important for the club's economic health, is not a determining factor for short-term sporting success. The study also categorizes clubs into four types: those that achieve both sporting and financial success, those that excel in the sporting arena but have poor financial performance, those with financial success but not sporting success, and those that do not achieve good results either on the field or in economic management. This approach allows for the identification of patterns and trends in the strategies relationship between sporting and financial success, providing a useful tool for analyzing football clubs and their management.

Research limitations/implications: The analysis is constrained to Spanish first-division clubs over ten seasons, which may limit the generalization to other leagues or sports with different financial and regulatory contexts. Moreover, the cross-sectional design does not allow for causal inference. Future research could address these issues by applying longitudinal methods and expanding the analysis to other European competitions.

Practical implications: This research provides a tool for club managers and stakeholders to assess the balance between economic management and on-field achievements. The findings support strategic decisions in investment and spending to enhance club sustainability and competitiveness. Likewise, for

regulators and policy makers like Laliga (Spain) or UEFA (Europe) this study provides evidence of the limited effect of debts structure in the short term and the significant impact on teams' results of level of income (in the case of TV rights, the regulators police of distribution is determinant), market value and capex strategy have in teams' results. Any attempt to impact on fair play or competitive balance should be considered by policy makers.

Social implications: Given the prominent role football plays in European culture, understanding financial and sporting success can impact public and fan perceptions, and influence regulatory frameworks like Financial Fair Play that aim to sustain competitive balance.

Originality/value: In addition to contributing to the limited literature on dual sporting-financial performance, the paper offers a simplified yet rigorous model using PCA to capture latent dimensions, facilitating strategic classification and benchmarking among clubs.

Keywords: Sporting success, Economic success, Football clubs, Turnover, Investment in players, Principal component analysis, Regression analysis, Spanish football

Jel Codes: L83, M21, Z20

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1. Introduction

Certain sports have long since ceased to be mere sporting events and have become multi-billion-euro businesses. In Europe, professional football has undoubtedly undergone the biggest transformation. In the 2022/23 season, European top-flight football revenues grew to 25.6 billion Euros, 7 % higher than in the previous season (UEFA, 2023). Of the European total, the five major leagues have driven this growth with a turnover of €17.244 million. In the 2022/2023 season, turnover has continued to grow in double digits for most of the big teams (Football Benchmark, 2024). Thus, for example, Real Madrid reached €830 million, 16 % more than the previous year, FC Barcelona €800 million, 26 % more and Manchester City €826 million, 13 % more.

In parallel to revenue growth, two variables have grown even more strongly, leading many clubs to negative operating results and high levels of net financial debt. On the one hand, the growth in sports personnel costs and, on the other hand, investments in transfers (cost of transfer fees) have, in many cases, outpaced the increase in revenues, eroding the profitability and solvency of the clubs. Considering the two winter and summer windows, transfers reached 9.12 billion Euros in the 2022/23 season (CIES, 2023).

This context led UEFA (2023) in 2010 to develop a Financial Fair Play (FFP) regulation (Ahtiainen & Jarva, 2020) that establishes, among other regulations, limits on sports salaries in relation to revenue figures in order to safeguard the solvency of clubs while limiting disproportionate investments in transfers that could adulterate the competition. The national regulators of the major leagues have followed the same line. La Liga, for example, places restrictions on expensive new signings by means of the "Sports Staff Cost Limit" regulation (La Liga, 2024).

In this context of strong growth in the industry and increasing concentration of turnover and investment in large, mainly European, clubs, success in sporting activity becomes key, not only for reasons of prestige for owners (or members) and fans, but also because sporting success seems to determine the continuity and increase in revenue. Thus, ranking in the national leagues conditions the distribution of television rights, a fundamental component of revenue. Similarly, qualification for the Champions League or UEFA League has direct repercussions in terms of monetary compensation. Each of the 32 clubs that qualified for the group stage of the Champions League 2021/2022 received 15.64 million Euros. The cumulative remuneration for the champion, for all concepts, is close to €100 million Euros. This situation has led several authors as Andreff (2007), Fort (2015),

Lang, Grossmann and Theiler (2011) and Sloane (1971) to question whether certain strategic decisions of a sporting nature are not taking precedence over the profitability and solvency of the clubs themselves. In this context, it is important for investors, shareholders and other stakeholders of the clubs to have reliable information on ratios and indicators related to sporting success and economic/financial success and, fundamentally, both.

The growing financial complexity of professional football clubs and the strategic trade-offs between short-term sporting success and long-term viability raise critical questions about how to assess club performance. As financial indicators derive directly from the accounting data reported by clubs, the reliability and comparability of this information are essential. Therefore, any empirical analysis of financial performance in football must also consider the quality of financial reporting practices and the need for transparent, standardized metrics.

The aim of this research is, firstly, to identify in the literature the main variables of sporting success and economic/financial performance of professional football clubs and to identify other possible variables, based on market value. These variables will be obtained for a sample of ten seasons of the first division of football in Spain (currently, the EA Sports) between the 2013/2014 and 2022/2023 seasons in order to determine, on the one hand, the correlation of the different variables of economic and financial performance in the achievement of sporting success. In a second phase, given the high co linearity identified, the number of significant variables is reduced to eight: sporting success (Points) is selected as the dependent variable, three of an economic nature relating to the size (Turnover, Staff Costs and Market Value) of the clubs and four relating to financial performance AC/PC (Current Assets/Current Liabilities), PN/A (Equity/Assets), ROA (Earnings Before Interest and Taxes/Assets) and ROE, defined as EBIT divided by Equity.

Based on this dual framework, this study seeks to answer the following research question: to what extent do financial performance and structural size explain sporting success among Spanish first division football clubs? This study aims to get a simplified model of two components using Principal Component Analysis (PCA) that let reduce the number of variables and visualize the teams in clusters reflecting their financial and sports strategy.

2. Literature Review

The conversion of football into a multi-billion Euro business has led to a growing interest in the literature on its different dimensions.

On the one hand, a significant number of authors have focused their attention on the individual performance of football players and its impact in their market value (Transfermarket España, 2024; Poli, Ravenel & Besson, 2022; Coates & Paskow, 2022; Leone, 2019; Müller, Simons & Weinmann, 2017) or, less abundant due to the difficulty of obtaining reliable information in long series, on the effective price of the federative rights (Poli, Ravenel & Besson, 2020; Gallopo & Boido, 2020). Fundamentally, these studies use multiple linear regressions, logistic regression, *rain forest* and, more recently, *machine learning* and algorithms as their methodology. This first stream of literature ends with articles focusing on valuation methodology (Amat & Gómez, 2024) and panoramic studies or meta-analyses such as that of Franchesi, Brocard, Follert and Gouguet (2023).

These studies, while targeting the professional football player and not the sporting or legal entity (hereafter, the club) can provide the basis for subsequent studies, such as those of Toma and Campobasso (2023), which use these individual variables as a basis and aggregate them to the club level. A sample of the main independent variables used in the literature to predict the market value or the price of players' transfer rights can be found (Amat & Gómez, 2024; Franchesi et al., 2023).

The next focus of interest, which is already in line with the aim of this paper, is the study of the relationship between the financial dimension of the club and its sporting performance. A first conclusion on the subject can be found in Szymanski (1998): the performance of a club is reflected in its financial and sporting results. However, this dual objective can be a source of conflict, giving rise to two types of clubs (Osokin, 2018): the *"win maximization club"* and the *"profit* maximization *club"*.

No empirical evidence has been found to give primacy to one strategy over the other. There is, however, a feedback loop that complicates the analysis. The sporting result can be an effect, but also a cause of the economic and financial result, which translates into a virtuous circle (Baroncelli, Lago & Szymanski, 2004) that is broken, either when the investment in resources (payroll, transfer fees, etc.) systematically exceeds the capacity to generate cash flow, or when the sporting results do not materialize despite the financial effort.

This link between financial and sporting performance and its sometimes-perverse outcome has led UEFA, as indicated above, to introduce measures to preserve financial *fair play*. The effectiveness of such measures is the subject of interest of some authors such as Segoviano (2022) or Fernández (2023) at national level, where the regulations are issued by the respective national regulator, and also at European level (UEFA, 2023).

Another important body of literature, which addresses the subject matter of this paper from different perspectives, is that which focuses on the use of ratios and indicators for the measurement of sport and financial performance. Different contributions can be seen in Tables 1 and 2 below and a summary of the main works consulted is provided in Annex 1.

Finally, from an accounting and financial theoretical standpoint, this study builds on the principles of accounting-based valuation theory, which asserts that financial statement data, particularly ratios derived from the balance sheet and income statement, are key indicators of an entity's performance and long-term sustainability (Altman, 1968; Galariotis, Germain & Zopounidis, 2018) such as liquidity, solvency, and profitability ratios, which are widely used in the financial diagnosis of firms. Likewise, Amat, Manini and Renart (2017) set in its Z-score model four key ratios to predict the default risk.

2.1. Indicators of Sporting Success

Sporting success can be defined as the ability of a club to obtain a large number of victories in the competitions in which it participates (Garcia-del-Barrio & Szymanski, 2009).

The most common indicators in the literature are points or position achieved in the competition. Sometimes modified variables of the monotonically decreasing points ranking as proposed by Dobson and Godard (2001) or their logarithmic transformation according to Szymanski and Kypers (1999) are used to achieve better correlations. On the other hand, it has to be taken into account that if national cup competitions and the UEFA and Champions League are taken into the sample, a point system has to be determined (Barajas, Fernández-Jardón & Crolley, 2005).

Likewise, considering the work of Toma and Campobasso (2023) as an example, it is also possible to consider indirect variables of sporting success such as the performance of footballers (goals, passes, etc.) which, subsequently, the authors aggregate at the team level. On the other hand, they measure sporting success directly from the ranking, by quartiles of the teams considering 10 years and the five major leagues. Silva (2015), interested in corporate governance, along with the points weighted by league weight as a variable that directly measures sporting success, considers certain characteristics of the board of directors and the ownership structure of the club as indirect variables.

Table 1 below summarizes the main indicators of sporting success proposed in the literature.

As can be seen in Table 1, on the one hand, we find authors who use what the study has called indirect variables or ratios: goals per game (Palacios-Huerta, 2004), passes (Cintia et al., 2015), average goals scored minus goals conceded (Koning, 2003). On the other hand, there are authors who rely on the winning percentage (Marques, 2002) or who take the final ranking of the teams in the respective leagues as a reference and therefore use direct variables. The way of measuring sporting performance from Silva (2015) onwards focuses on the points or position of the teams, i.e. on variables that directly measure sporting success.

The choice between direct and indirect indicators of sporting success has methodological implications that influence both the robustness and interpretability of results. Direct metrics such as winning percentage or final league ranking (Marques, 2002; Silva, 2015) are simple to compute and directly linked to qualification for European competitions and revenue distribution mechanisms. However, they may fail to capture in-game performance nuances that can act as early signals of structural improvement or decline. Conversely, indirect

variables such as individual player statistics aggregated at the team level (Toma & Campobasso, 2023) allow for a more granular understanding of team dynamics but introduce complexity and potential issues of comparability across seasons. Therefore, selecting between these approaches involves a trade-off between accessibility and analytical depth, depending on the research objective.

Study	Indicator
Toma & Campobasso (2023)	Individual qualitative and sporting performance data of the players and, in a second phase, aggregate data. Team position at the end of the competition in quartiles.
Ahtiainen & Jarva (2020)	Position in the Champions League (1) Position in the national league.
Prayoga, Dharma & Sukmasari (2022)	Points weighted by League weight.
Alaminos, Esteban & Fernandez-Gamez (2020)	Points, promotion/descent, Szymanski rating (Szymanski, 1999) among others.
Lepschy, Wäsche & Woll (2018)	Goals/attempts, goals, possession, passing, playing home or away.
Galariotis et al. (2018)	Position of the teams in the French Ligue 1.
Silva (2015)	Points weighted by League weight. Characteristics of the Board of Directors. Sport Performance Indicator (1).
Cintia, Giannotti, Pappalardo, Pedreschi & Malvaldi (2015)	Mean and variance of passes as predictors of goals.
Barajas & Rodríguez (2010); Barajas et al. (2005)	League points, winning percentage, goal difference.
Palacios-Huerta (2004)	Goals per game.
Koning, Koolhaas, Renes & Ridder (2003)	Average goals for minus goals against.
Marques (2002)	Winning percentage.

(1) Scoring is established according to the milestone achieved: group stage and different rounds until the final.

Table 1. Indicators of sporting success

Despite their widespread use, accounting-based financial performance indicators have significant limitations. Ratio analysis depends on the quality, consistency and transparency of financial reporting, which can vary significantly across football clubs due to differences in governance, accounting practices, or legal status (Galariotis et al., 2018). Moreover, such measures may not fully capture off-balance sheet risks, contingent liabilities, or the volatility of transfer market operations. In this regard, the application of high-quality financial reporting standards is essential to ensure the reliability and comparability of financial data. The adoption of composite indicators —such as the Z-score proposed by Amat et al. (2017)— offers a simplified yet robust approximation. Likewise, most clubs in the Spanish "liga" are limited responsibility entities subject to audit review and the close supervision of the regulator.

2.2. Financial Performance Indicators

Indicators of economic success are considered to be those ratios and indicators related to the economic and financial profitability, solvency and short- and long-term survival of football clubs.

Some of the main indicators proposed in the literature are presented in Table 2 below.

Regarding the first meaning of club survival in the short and long term, as can be seen in Table 2, there is a group of authors such as Prayoga et al. (2022), Alaminos (2020) Galariotis et al. (2018), Ecer and Böyukaslan (2014) who consider, to a greater or lesser extent, the traditional liquidity, debt and profitability ratios in financial analysis with a focus on the balance sheet and results. On the other hand, there is a group of authors who focus primarily on the income statement. In this group are Ahtiainen and Jarva (2020), Barajas et al. (2005) and, to some extent, Késene (2009), who focuses on the limit of wages over turnover. Finally, the study has indicators relating to investment in transfers and the relative weight of the figures in the overall squad (Toma & Campobasso, 2023), transfer cost or market value (Barajas & Rodríguez, 2010) and share price or earnings per share in cases where the club is listed on the stock exchange (Silva, 2015).

Study	Indicator
Toma & Campobasso (2023)	Investment in transfers, team value as the sum of the value of the 20 players with the most minutes played.
Prayoga et al (2022)	Liquidity (liquidity ratio: current assets/current liabilities), Solvency (debt ratio: debt/assets), Profitability (net profit margin), Share price (1)
Ahtiainen & Jarva (2020)	Operating profit (Earnings before interest and taxes), Earnings before taxes
Alaminos et al. (2020)	Battery of profitability, solvency and liquidity ratios plus ratios related to corporate reputation (for example. Instagram, Facebook followers, average stadium attendance among others).
Amat et al (2017)	A Z variable is defined as a predictor of financial default (scoring) based on the ratios CA/CL, E/A, ROA and ROE, with different weights for each of the variables.
Galariotis et al (2018)	Financial performance: operating margin (operating profit/revenue, net profit on sales, ROE (net profit on equity, ROI (EBITDA/assets), working capital (Long term financing - Non-current assets), indebtedness (debt/equity), autonomy (equity/assets), independence (equity/(equity + long-term debt + long-term provisions))
Ferri, Macchioni, Maffei & Zampella (2017)	ROI, Assets, Wages, Size, FCFO, Leverage
Silva (2015)	Earnings per Share, Characteristics of the Board of Directors (2). Ownership model
Ecer & Böyükaslan (2014)	Debt and liquidity ratios
Késenne (2009)	Wages/Sales. Suggested limit 67 %.
Barajas & Rodríguez (2010); Barajas et al. (2005)	Revenues, sports personnel costs, net transfer cost, market.

(1) From listed clubs.
(2) Total number of directors and percentage of independent directors among other governance aspects.

Table 2. Financial performance indicators

On the other hand, apart from the traditional approach in the literature described above, it is appropriate to incorporate into the analysis the model of automated credit assessment systems (Scoring) proposed by (Amat et al., 2017). Using different multivariate and factor analysis techniques, the authors identify four key ratios that make up a Z score with the following components: the liquidity ratio (Current assets/Current liabilities), the debt ratio (Equity/Assets), economic profitability (ROA) and financial profitability (ROE). As will be seen below, this approach has been adopted to simplify the financial performance of the tangle of financial ratios, which are usually correlated and have strong predictive power. Fitó, Plana-Erta, D. and Llobet (2018) have tested successfully the usefulness of this model.

3. Methodology

3.1. Sample

The population of the study comprises all professional football clubs that competed in the Spanish LaLiga First Division between the 2013/2014 and 2022/2023 seasons. Over this ten-season period, with 20 teams participating each year, the total number of potential observations amounts to 200. The final sample includes 189 observations, after excluding 11 cases due to the unavailability of financial data or the presence of anomalous accounting values, such as negative equity or inconsistent financial ratios, which could have distorted the analysis. The sampling technique applied was non-probabilistic and purposive, based on the completeness and reliability of data across the seasons considered. It should be noted that each season involves promotions and relegations (three teams in each direction); teams relegated to the second division were excluded from the sample in the relevant season if they did not meet the required data quality criteria.

The secondary data were obtained mainly from the Iberian Balance Sheet Analysis System (SABI). For those entities for which no information was available, the annual accounts of the clubs were obtained from their corporate website, by direct request to the club in some cases that were not public limited companies, or by request to the Mercantile Register.

Information on market values, market values per field position, market value of the three most valuable players per team and season, as well as the net transfer balance was obtained from (Transfermarket España, 2024).

3.2. Selection of Variables

Data were initially collected for twenty-one potential variables, which are detailed in Annex 2. After the preliminary descriptive analysis and the study of the correlation with the POINTS, the variables considered potentially significant were reduced to the seven listed below, together with their main descriptive statistics.

	Dependent	Financial Variables				Size variables		
STAT.	POINTS	CA/CL	LIABILITIES/ Assets	ROA EBIT/Assets	ROE EBIT/E	EXPENDITURE_ON _PERSONAL	VALUE_ MARKET	REVENUE
R	1,00	-0,14	0,02	-0,20	-0,14	0,75	0,79	0,75
$\bar{x}$	52,94	0,88	0,77	0,06	0,26	97,41	242,36	144,50
s	17,29	0,68	0,32	0,16	1,33	123,16	255,34	189,77
Max	94,00	4,13	2,02	0,64	12,64	625,72	1.160,00	836,73
Min	20,00	0,06	0,16	-0,71	-5,81	10,91	7,00	18,07

R: Correlation coefficient, $\bar{x}$: sample mean, s: standard deviation, Max: maximum, Min: minimum

Table 3. Selected variables and descriptive statistics

The dependent variable of sporting success chosen was POINTS, which is also one of the most widely used variables in the literature, often taking its logarithm. Likewise, it has been verified that the variable position in the competition offers the same results.

Regarding the independent variables, as can be seen in Table 3, all the size variables correlate very significantly with the variable POINTS, which is consistent with previous studies where turnover or staff costs are frequently used (Barajas et al., 2005; Szymanski & Kuypers, 1999; Toma & Campobasso, 2023). This study also provides the market value of the team as an indicator of size. The market value, obtained from Transfermarket España (2024), corresponds to the sum of the market value of the first team players. It is therefore an enterprise value (EV) that only considers the value of the squad and does not take into account the reduction in value resulting from the debt that the club may hold. As can be seen in Table 3 above, the market value shows the highest correlation with the points with an R=0.79, making it a relevant predictive indicator of sporting success.

In most studies, turnover and staff costs tend to be considered as financial variables. As will be seen below, these two variables together with the market value form a dimension of SIZE, which is independent of the financial situation of the club and whose nature is more economic than financial.

The financial variables as liquidity (CA/CL), (Equity/Assets) and ROA have been selected taking as a reference the principal components of the Z of the *Scoring* model of Amat et al. (2017) discussed above. The ROE ratio has not been included as some observations were missing in the sample and it was considered that, indirectly, it was already largely represented by the other ratios considered.

Likewise, the low influence of financial ratios on sporting performance can be observed, with correlations between -0.2 and 0.02. However, a first limitation to consider is that teams that have had consistently poor financial ratios over time may have left the competition (and, therefore, disappeared from the sample), either to move to the second division or, in some cases, to enter bankruptcy proceedings. It could also be that the progressive financial deterioration led to a gradual worsening of the points and that this relationship was not captured in the linear models.

Finally, as described in the following section, the independent variables have been simplified by means of Principal Component Analysis (PCA) into two single explanatory factors: SIZE and FINANCIAL PERFORMANCE. The use of PCA that enables dimensionality reduction and the identification of latent constructs, is justified by the high degree of multicollinearity among the selected financial and size variables. PCA

3.3. Statistical Modeling

Once the descriptive analysis had been carried out (Annex 2) and the analysis of variables had been reduced to one dependent and seven independent or explanatory variables (Table 3), a Principal Component Analysis (PCA) was carried out for the three variables related to size and the four variables related to financial performance.

PCA is a useful methodology for reducing dimensionality and eliminating co linearity noise by focusing on those variables that explain the greatest variability. On the other hand, reducing the number of variables simplifies interpretation and facilitates the visualization of the data by making it possible to see underlying structures in the data.

The principal components or latent variables with the highest explanatory power of both groups of variables have been denoted as SIZE and FINANCIAL PERFORMANCE. The ultimate purpose of reducing the variables is to enable an explanatory model that avoids redundancies and over-explanations and, on the other hand, to enable clearer and more effective visualizations that reveal relationships between clubs that would otherwise not be possible.

To obtain the graphs of teams by quadrants from the latent variables, the study proceeded to obtain the medians of these variables, which were used as abscissa or ordinate axes depending on the concept to be visualized. Depending on their score with respect to the mean or median (depending on the graph), teams have been positioned in the corresponding quadrant.

The R statistical package was used for the statistical calculations.

$$POINTS = \beta 0 + \beta 1 \times SIZE + \beta 2 \times FIN.PERFORMANCE$$

Finally, based on the variables SIZE and FINANCIAL PERFORMANCE, a model has been designed, using the multiple regression technique (OLS), which explains the POINTS by means of the following linear algebraic expression:

4. Results

4.1. Principal Component Analysis (PCA)

4.1.1. Analysis of Financial Performance Variables

On the one hand, the co-linearity between the selected financial variables has been reduced: liquidity as measured by the CA/CL variable, indebtedness as measured by the E/A variable, and economic performance as measured by the EBIT/ASSETS ratio (ROA) and ROE.

The PCA results for these four variables representing the latent variable size are presented below.

	Dim 1	Dim 2	Dim 3	Dim 4
Variance	1.707	1.018	0,775	0,500
Variance	42,67 %	25,45 %	19,38 %	12.502
Cumulative Variance	42,67 %	68,12 %	89,50 %	100 %

Table 4. Eigenvalues

As can be seen in Table 4, the first two components (dimensions) explain almost 70 % of the variability and the next two explain the remaining 30 %. Therefore, there was autocorrelation between the financial performance variables.

Table 5 presents the contribution of the variables for the two components with the highest significance.

Variable	Dim 1	Ctr	Cos2	Dim 2	Ctr	Cos2
CA/CL	0,78	35,461	0,61	1157,00	2415,00	0,03
E/A	0,82	36,600	0,68	0,11	1194,00	0,01
ROA	0,65	28,000	0,42	0,07	0,53	0,01
ROE	-0,02	0,016	0,00	0,99	95864,00	0,98

Table 5. Contribution of the variables to the components

As can be seen in Table 5, the variability of component or dimension 1 is explained by CA/CL (35.461 %), E/A (36.6 %) and ROA (28 %). Component 2 is almost entirely explained by EBIT/PN, although the weight of this component is much lower than that of the main component 1.

Because of its major contribution to the explanation of variability, the principal component 1, which the study has called FINANCIAL PERFORMANCE, has been considered as the latent variable representing economic and financial performance.

4.1.2. Analysis of Size Variables

The component or dimension that captures the latent variable SIZE has been obtained from the PCA analysis of the variables TURNOVER, STAFF COSTS and MARKET VALUE. The results are presented in the following two Tables 6 and 7:

	Dim 1	Dim 2	Dim 3
Variance	2,854	0,116	0,02
% Variance	95,48 %	3,85 %	0,67 %
Cumulative Variance	95,48 %	99,3 %	100 %

Table 6. Eigenvalues

As can be seen in Table 6, dimension 1 explains 95.48 % of the total variability in the variables relating to size, which suggests that practically all the relevant information is captured in the first component. The rest of the dimensions hardly contribute to the explanation of the variability of the variables.

Variable	Dim 1	Ctr	Cos2	Dim 2	Ctr	Cos2
BILLING	0,99	33,934	0,972	-0,13	15,452	0,018
PERSONNEL_COSTS	0,96	32,176	0,922	0,28	67,815	0,078
MARKET_VALUE	0,99	33,891	0,971	-0,13	16,733	0,019

Table 7. Contribution of the variables to the components

As can be seen in Table 7 above, the three variables contribute in a balanced way (around 33 %) to the definition of component one. Also, the high values of the squared cosines for each of these variables (0.972, 0.922, and 0.971) indicate a balanced representation of these variables in the first component. This shows that component one synthesizes well the variability of the three variables, which in turn reflects a latent variable. This first component has been named FINANCIAL PERFORMANCE.

Table 8 below shows some of the main statistics for the two dependent variables and the independent variable.

4.2. OLS Model

In order to verify the goodness of dimension reduction, a simplified version of the traditional regression models (OLS, Ordinary Least Squares) that abound in the literature with multiple independent variables has been carried out, using the two latent variables generated by PCA: SIZE and FINANCIAL PERFORMANCE.

Some of the descriptive statistics of the model are detailed in Table 8 below.

	Dependent	Independent	
STAT.	POINTS	SIZE	PERFORMANCE FINANCIAL
R	1,00	0,8	-0,1
$\bar{x}$	52,94	0,0	0,0
s	17,29	1,7	1,3
x	94,00	5,8	4,9
Min	20,00	-1,3	-4,5

R: Correlation coefficient, $\bar{x}$: sample mean, s: standard deviation,
Max: maximum, Min: minimum

Table 8. Descriptive statistics of the model variables

The resulting linear regression model is as follows:

$$POINTS=52,9 + 7,93 \text{ x } SIZE - 0.29 \times FINANCIAL\ PERFORMANCE$$

The regression results are detailed in Table 9 below:

	Datum	coef	p-value	Significance
F	147,1		2,2e-16	Significant
R^2	0,61			
β0		52,9	<2e-16	Significant
SIZE		7,9340	< 2e-16	Significant
FINANCIAL PERFORMANCE		-0,2943	0,63	Not significant

Table 9. Regression results

As can be seen in Table 9 the model has a good level of fit with a coefficient of determination R^2 of 0.61. The variable SIZE with a $p < 0.000$ is highly significant while the variable FINANCIAL PERFORMANCE with a p-value of 0.63 does not show statistical significance but, as can be seen, it facilitates a classification of football clubs by their financial performance and sporting success that hides non-linear relationships between groups of teams. As might be expected the relationship between size and points is positive with a coefficient of 7.93. Financial performance shows a small negative relationship, with a coefficient of -0.29, which is not significant and contributes little to the explanation of points.

Finally, taking advantage of the reduction of dimensions achieved through the latent variables and the evidence of the non-linearity of the variable FINANCIAL PERFORMANCE, it has been proceeded to design data visualizations with the aim of detecting non-linear team group structures. To do this, it has been necessary to calculate the average results of the variables for the set of seasons that the team has been in and to normalize the variables.

The results obtained in this study align with previous literature highlighting the strong association between club size and sporting performance. Like Barajas et al. (2005) and Szymanski and Kuypers (1999), this analysis confirms that revenue, market value, and staff expenditure are highly correlated with on-field success. The explanatory power of the latent variable Size in the regression model reinforces the idea that economic scale is a critical driver of competitive outcomes in top-tier football.

Conversely, the finding that financial performance—measured through liquidity, solvency, and profitability—has limited explanatory power for sporting success is consistent with the results of Xiao (2021) and Galariotis et al. (2018), who report weak or even negative relationships between financial health and league performance. This divergence may reflect the short-term focus of sporting results versus the long-term horizon of financial stability, underscoring the potential trade-off between profitability and competitive ambition in professional football.

4.3. Visualization of Model Variables

A) Relationship between sPorting Success (Points) and Club Size

A visualization of the variables financial performance and points is presented in Figure 1.

The trend line shows the linear relationship between Size and Points. Also, in order to plot the points, variable averages have had to be calculated for each team and set of seasons in which the team has been in the top division. The lines dividing the quadrants have been placed at the averages.

Underlying the linear regression model three groups of teams can be observed. The largest teams, Barcelona FC, Real Madrid and Atlético de Madrid (Group 1) are at a great distance from the rest of the teams. In fact, these three teams have shared the top three positions in La Liga in the ten seasons analysed and have therefore also participated in all ten editions of the UEFA Champions League (see Table 10). Leaving aside the debt factor, for the period analyzed these three teams show a clear dominance of the competition.

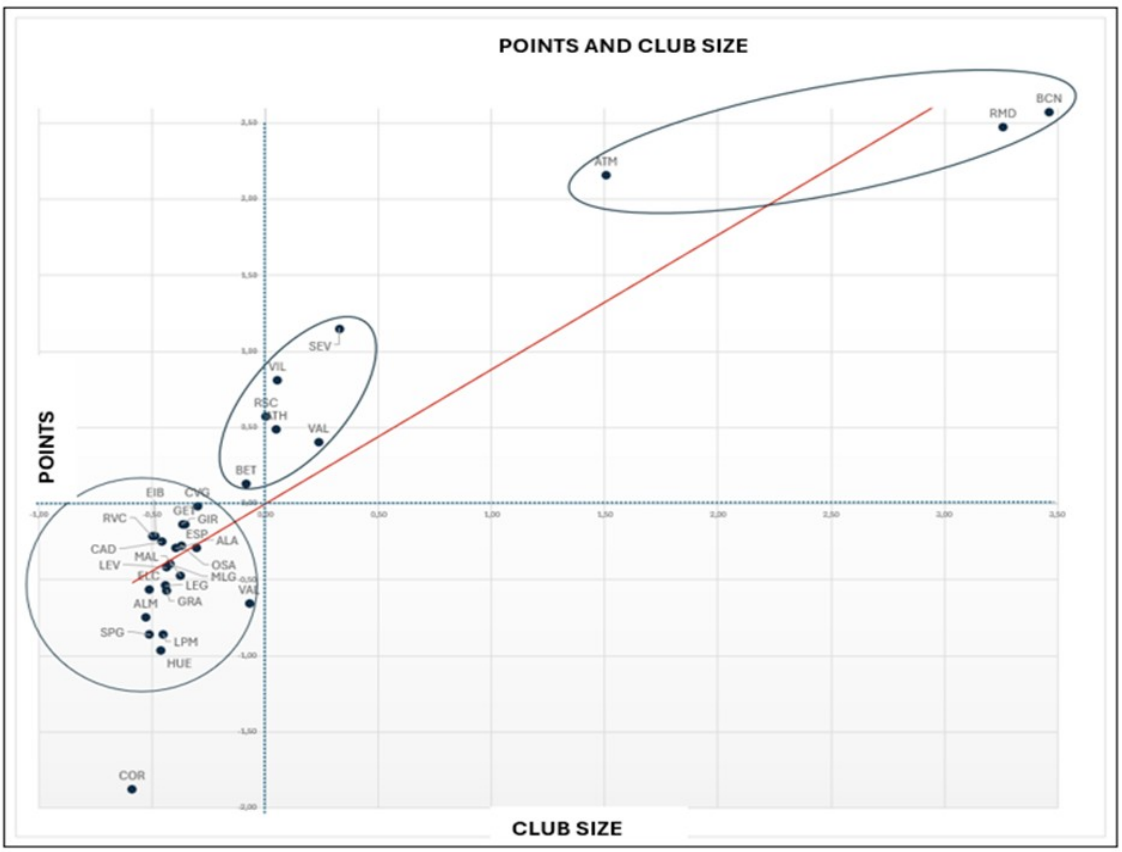

Figure 1. Relationship between Sporting Success (Points) and Club Size

On the other hand, medium-sized teams with average sporting success can be seen at points such as Sevilla FC, Valencia, Villarreal, Athletic Bilbao and Real Sociedad (Group 2).

	Champions	UEFA	Total	Average number of points
ATM	10		10	79
BCN	10		10	85
RMD	10		10	83
SEV	5	5	10	63
VIL		7	7	62
RSO	1		1	71
ATH		4	4	65
BET		4	4	61
CTV		1	1	60
ESP		1	1	53
GET		1	1	59
GRN		1	1	60
OSA		1	1	53
RSO		2	2	66

Table 10. Sporting success in points and participation in European championships.

Among the members of Group 2, only Sevilla has competed five times in the Champions League in the period. Meanwhile, Valencia FC, at the other end of this group, with an average of 54 points, has not participated in any European competition despite being the fifth team in terms of market value with an average of approximately

300 million Euros. Finally, there are the small and poorly performing teams. Table 11 below shows the number of seasons and average points of a sample of these bottom teams.

Team	Abridged	Sample seasons	Points average
Cordoba	COR	1	20
Almeria	ALM	3	37
Elche	ELC	4	40
Sporting de Gijón	SPG	2	35
Huesca	HUE	2	33
Cadiz	CAD	3	42
Las Palmas	LPM	3	35
Sample			42

Table 11. Group 3- Position and average points

As can be seen in Table 11, the teams in the last group are characterized by below average results and, more importantly, the number of seasons. Among the rest of the teams there is the so-called "yo-yo" teams (Barajas et al., 2015) that move between the first and second division.

B) Relationship between Sporting Success (Points) and Financial Performance

In the previous section it has been seen that the Financial Performance component, even unifying the main variables of the Z of Amat et al., 2017 in a single latent variable that included the main factor to explain the variability, was not statistically significant in the explanation of sporting success (points), providing very little explanation to that provided by the variable SIZE. However, it should be noted that the study has not specifically considered financial impairment and erosion in points in long time series where today's over-indebtedness may have an impact on the performance of future seasons and not the current one. On the other hand, as can be seen in Figure 2 below, Financial Performance is relevant when discriminating between groups of teams.

A visualization of the variables financial performance and points is presented in Figure 2.

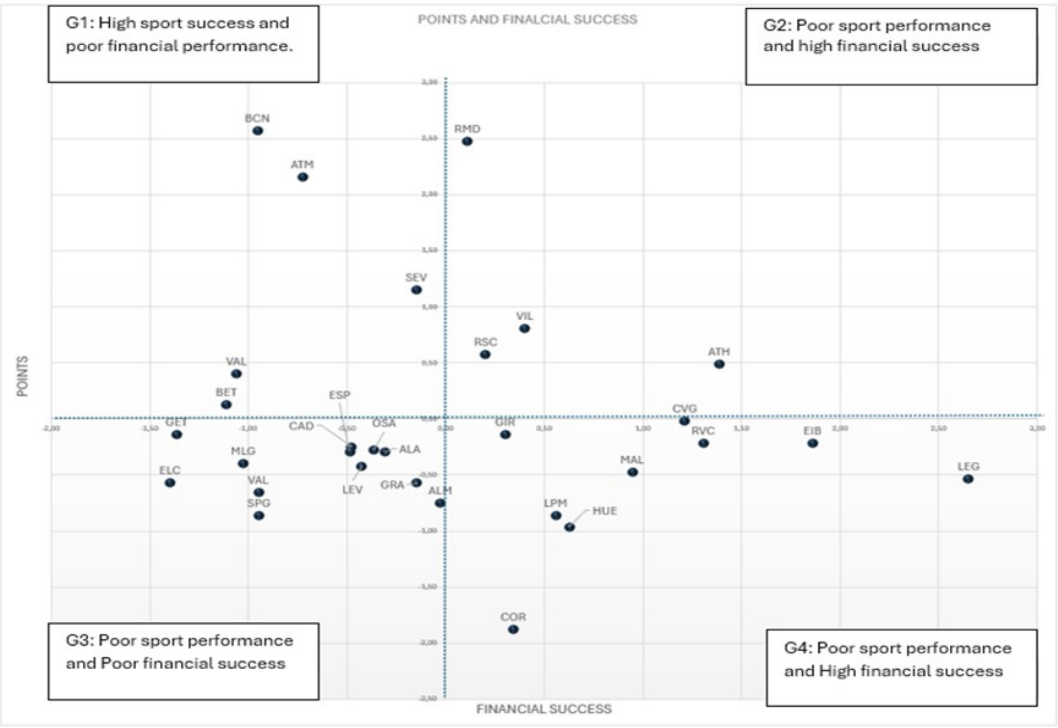

Figure 2. Relationship between Sporting Success (Points) and Financial Performance

The teams have been divided into four quadrants according to their averages with respect to the mean (normalized variables) at the crossover point between the POINTS variable and the FINANCIAL PERFORMANCE variable.

The high correlation between points and size also makes it possible an interpretation in terms of club size.

As can be seen in Figure 2, after segmenting the teams according to their relative position with respect to the median, four groups of teams (G1, G2, G3 and G4) are obtained, with homogeneous characteristics in terms of sporting success, size and financial performance. On the one hand, there are teams in G1 such as FC Barcelona with great sporting success, both in terms of points in the league and in terms of participations and prizes in European competitions and, at the same time, a complicated financial situation that has forced it to divest strategic assets and has meant, in application of the League's financial *fair play*, severe restrictions on the hiring of new players.

The G2 quadrant represents successful teams in the sporting and financial domains. This group includes teams such as Real Madrid, Sevilla, Girona or Villareal.

The G3 quadrant captures the "elevator" teams, with below average points, poor financial performance and recurrent entries and exits from the top division.

Finally, the G4 includes healthy teams, with good financial management but reduced sporting performance. Eibar and Leganés are clear examples of this group.

5. Conclusions

It is common to find in the literature that a significant number of variables are used to explain the sporting success of teams, such as turnover (or its logarithm), personnel costs, total assets or market value, among others. The explanatory power of turnover (its logarithm, in many cases) has a very high correlation coefficient with the points, explaining up to 80 % of its variability. The rest of the variables also have a high level of correlation, both with points and turnover, reflecting a high co linearity and over-explanation of the variable. In our opinion, all these variables refer to an underlying construct of an economic nature, which is club size. By means of PCA the variables turnover, staff costs and market value and reduced the dimensionality to a single latent variable which has been denoted SIZE.

On the other hand, it has been found that the financial variables hardly correlate with financial success measured in points and, as in the previous case, in many cases they are redundant or linear transformations of each other. Thus, first, the initial financial variables selected were those established in the Z model of Amat et al. (2017). Subsequently, these variables (Current assets/Current liabilities), (Equity/Assets), ROA and ROE were reduced to a single latent variable through PCA that we have called FINANCIAL PERFORMANCE, which explains a significant proportion of the variability of all the variables.

Based on these two latent constructs —Size and Financial Performance— a linear regression model was estimated to explain the dependent variable, Points, as a measure of sporting success.

On the other hand, the reduction of variables to two allows the design of data visualizations that provide relevant information about underlying club groupings that would otherwise be hidden.

The visualization of the clubs in the quadrants determined by the averages of the axes POINTS (ordinates) and SIZE (abscissas) reflects three clusters of teams: the *top* teams (BCN, MDR and ATH) which share between them the top three positions in all ten seasons and are far distanced both in size and points from the rest. A second line of big groups (but far from the three above) that occasionally enter the Champions League (SEV) and often reach European league positions. Finally, the group of small teams, with similar points averages, with high rivalry between them and which, in many cases, move up and down from the second to the first division (yo-yo teams).

On the other hand, FINANCIAL PERFORMANCE, which provided little explanation in the linear models, offers, thanks to the reduction to a single latent variable, the possibility of discriminating groups of teams by means of visualization techniques. From the crossing of the POINTS variable and the FINANCIAL PERFORMANCE variable, it has been possible to discriminate between groups of teams.

In this case, four groups have been identified, the first and second groups are the strongest teams in the competition in terms of points, but unlike the clusters by size in Figure 1 above, it is now possible to discriminate between top teams (in the top positions in the league and participation in European championships) that are well managed financially (in relative terms) and those with a weaker financial situation. Thus, it is now possible to differentiate, for example, between FC Barcelona and Real Madrid. Both are strong teams that have been fighting for the last ten leagues for the top positions, but Real Madrid's finances are healthier than those of FC Barcelona. The other two groups, three and four, include clubs with little sporting success (points below the median) but enrich the previous model based only on size by differentiating again between clubs with a better or worse financial situation.

Group three includes the "elevator" clubs, such as Elche, Valladolid, Huesca and Alavés. These are teams that are not very competitive and that also have weak financial situations in many cases, with low budgets and limitations of La Liga that make it difficult for them to maintain the competitiveness of the squad. The last group, group four, is generally made up of modest and well-managed teams (such as Eibar) but with squads that are not always competitive as their own strategy limits high levels of indebtedness.

Regarding the FINANCIAL PERFORMANCE variable, like a Z score, can be used by clubs to test their level of financial health and their position with respect to the sector average. An indicator such as this, which is undoubtedly simplified, does not cover all the explanatory power, but as a counterpart, it offers simplicity compared to a ratio-by-ratio comparison. Future research can build on this work in predictive models of clubs' financial performance.

The results obtained in this study align with previous literature highlight the strong association between club size and sporting performance. Like Barajas et al. (2005) and Szymanski and Kuypers (1999), this study confirms that revenue, market value, and staff expenditure are highly correlated with on-field success. The explanatory power of the latent variable Size in the regression model reinforces the idea that economic scale is a critical driver of competitive outcomes in top-tier football.

Although based on well-established techniques such as PCA and regression analysis, this study makes a novel contribution by simplifying these tools to a dual dimension model of two potential predictors of sporting success in Spanish professional football (size, and financial strength). The quadrant-based classification provides a practical framework for segmenting clubs according to their strategic positioning. This visualization is not merely descriptive—it has implications for financial strategy, as it helps club executives assess whether current investment levels and financial health are aligned with on-field performance. Furthermore, the strength of the "SIZE" component as a predictor of sporting success opens opportunities for predictive modeling.

The findings provide valuable insights for club executives, league authorities, and sports regulators (such as LaLiga). They reveal that on-field success is more strongly associated with club size than with short-term financial health, suggesting that strategies focused solely on financial ratios may overlook key determinants of competitiveness. Similarly, in the long run, the pursuit of success through size may perversely lead to irreversible financial imbalance. The model proposed in this study may support more balanced decision-making by identifying clubs at risk of financial distress despite favorable sporting performance. This could assist institutions such as LaLiga or the Spanish Football Federation in designing more effective financial control mechanisms that safeguard both the integrity and fairness of competition (competitive balance). The results also highlight that the traditional European approach to football regulation (in clear divergence with US, for example)—primarily centred on financial indicators—may be insufficient, as club size appears to be the fundamental driver of sporting success and therefore, the competitive rivalry.

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Annexes

Annex 1: Details of Some of the Studies Analysed

Study	Country	Target	Method	Key results
Yiapanas, Thrassou & Vrontis (2023)	Cyprus	Identify the key stakeholders of today's football and their distinctive value contribution.	Multi-level approach. Design of the preliminary conceptual framework and 41 semi-structured interviews.	The football industry has some distinctive structural factors that differentiate it from the rest and are embodied in a distinctive value contribution that football clubs bring to their different stakeholders.
Toma & Campobasso (2023)	European Football (UEFA) Five major leagues (10 years)	Main factors of sporting success from a strategic perspective.	Data visualization, Gini index and logistic/ordinal regression	
Prayoga et al. (2022)	European football in demand	Explanation of listed equipment prices	Multiple regression It combines financial ratios and a sports performance indicator as independent variables. The dependent variable is the share value.	Sporting performance has a significant impact on the clubs' share price. Liquidity ratio shows positive correlation with share price.
Ahtiainen & Jarva (2020)	European football (UEFA) Five major leagues.	Impact of Financial *Fair Play* (FFP) regulations on UEFA football.	Generalized Estimated Equations (GEE), logistic regression and OLS models.	The implications of FFP can only be seen, with some significance, in Spanish football, being negligible in the rest of the major leagues.
Alaminos et al. (2020)	234 1st and 2nd division teams of the European national leagues	Analysis of the financial performance of European clubs using neural network technology.	*Mutilayer Perceptron* (MLP)	The financial performance of a club depends primarily on liquidity, indebtedness and sporting performance.
Xiao (2021)	Spanish League	Correlation Financial and sporting performance	Factor analysis and correlation analysis	Sporting and financial performance are not linearly correlated. Financial success does not guarantee sporting success.

Study	Country	Target	Method	Key results
Lepschy et al. (2018)	N/A	Literature review	N/A	Three types of studies: comparative, predictive and local advantage.
Galariotis et al. (2018)	France (Ligue 1).	Correlation analysis between financial, business and sporting performance	Double step: multi-criteria (Promethee II) and partial Least Squares	Positive correlation between the endogenous variable of business performance and sports performance and, at the same time, from sports performance to business performance. Negative correlation of financial and sporting performance.
Silva (2015)	Sample of European clubs.	Impact of corporate governance on the financial and sporting performance of European football.	Multiple regression	The type of ownership has an impact on the financial results of the analyzed clubs.
Cintia et al. (2015)	Four major European championships.	Correlation between passing data in a football match (synthesized in the H-indicator) and the sporting success of a team.	Correlation analysis Simulations	Correlation between the H indicator, which collects several averages and variances related to passing, and sporting success in terms of goals and goal attempts.
Barajas et al. (2005)	Spain (first and second division).	Causes of the poor financial situation of football clubs in the two Spanish big leagues.	Multiple regressions	Structural deficiency of Spanish football. Correlation between sports staff costs and turnover. The model is not conclusive as to why some of the clubs end up in competition and others do not.

Annex 2: Descriptive Statistics of the Main Baseline Variables

VARIABLE	TYPE	R	DST	PRM	CP
POINTS E. SPORT	DEP	17,2	52,9	0,33	94,0
MARKET_VALUE	TAM	0,79	255,3	267,5	0,95
PORTER_VALUE	TAM	0,67	19,55	13,70	1,43
GOALKEEPER_VALUE_PROP	TAM	0,00	0,03	0,05	0,66
DEFENCE_VALUE	TAM	0,75	65,68	79,81	0,82
VALUE_DEFENCES_PROP	TAM	0,12	0,07	0,30	0,24
MIDFIELD_VALUE	TAM	0,76	86,83	80,83	1,07
MIDFIELDERS_VALUE_PROP	TAM	0,14	0,09	0,31	0,29
FRONT_VALUE	TAM	0,75	101,1	93,24	1,08
FORWARD_VALUE_PROP	TAM	0,04	0,08	0,34	0,25
INVOICING (*)	TAM	0,75	189,7	95,39	1,99
PERSONNEL_EXPENDITURE (*)	TAM	0,75	123,1	72,03	1,71
BILLING	TAM	0,12	0,16	0,75	0,21
CAPEX/ASSETS	FIN	0,07	0,17	0,14	1,25
FCF/A	FIN	0,07	0,18	-0,01	-13,3
CA/CL	FIN	0,14	0,68	0,53	1,29
E/ASSETS	FIN	0,02	0,32	0,08	3,81
INTANGIBLE/ASSET	FIN	0,05	0,18	0,36	0,51
ROA_EBIT/ASSETS	FIN	0,20	0,16	0,04	4,31
EBITDA/REVENUE	FIN	0,08	0,21	0,25	0,82
NET_PROFIT/REVENUE	FIN	0,10	0,20	-0,03	-5,80

(*) in EUR million.
R: Correlation coefficient with respect to Points, STD: standard deviation, PRM: average, PC: Pearson correlation coefficient.