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THE RELATIONSHIP BETWEEN FINANCIAL AND SPORTING PERFORMANCE OF PROFESSIONAL FOOTBALL CLUBS: EMPIRICAL EVIDENCE FROM BRAZILIAN FOOTBALL

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SUMÁRIO

ABSTRACT

The aim of this research is to investigate the relationship between sports and financial performance of Brazilian football clubs. Using data extracted from the Itaú-BBA reports (2015, 2016, 2018 and 2020), and from the Brazilian Football Association team performance rankings it was possible to calculate financial and sporting performances of twenty-six Brazilian football clubs for the period between 2013 to 2019. The results presented in this paper indicate that sports performance has a positive effect on the financial results of Brazilian football clubs, and that the financial result exerts a positive influence on sports performance.

Keywords: Sports economics, football industry, sports performance, financial performance, simultaneous equations modelling.

JEL Codes: G32, L21, L25, L83 and Z23

RESUMO

O objetivo desta pesquisa é investigar a relação entre o desempenho esportivo e financeiro dos clubes de futebol do Brasil. A partir de dados extraídos dos relatórios do Itaú-BBA (2015, 2016, 2018 e 2020) e dos rankings de desempenho de clubes da Confederação Brasileira de Futebol foi possível calcular indicadores para a performance financeira e esportiva de vinte e seis clubes do futebol brasileiro para o período compreendido entre 2013 para 2019. Os resultados apresentados neste trabalho indicam que o desempenho esportivo tem efeito positivo nos resultados financeiros dos clubes de futebol do Brasil, e que o resultado financeiro também exerce influência positiva sobre o desempenho esportivo.

Palavras-chave: Economia do esporte, indústria do futebol, performance esportiva, desempenho financeiro, modelagem de equações simultâneas.

1. INTRODUCTION

Professional football in Brazil has undergone in recent years, a growing modernization and professionalization in the administrative scope. Since the 2014 World Cup, based in the country, Brazilian teams have modernized their stadiums and increased the number of fan memberships, thereby maximizing their revenues. According to official balance sheets released by football associations, the sum of the highest turnovers of professional football clubs in Brazil was over R$ 5.8 billion in 2019 or something around US$ 1.47 billion[1] (ITAÚ-BBA, 2020).

It is worth noting that the revenue of football clubs generally comes from four main sources: broadcast[2], sponsorship, ticket sales and sales of players. Thus, the clubs with the largest fan base usually obtain higher revenues in most of the categories mentioned, where only the sale of players does not represent a direct relationship with the size of the team fan base. Regarding the other categories, teams negotiate contracts individually therefore, the most supported clubs obtain the highest turnover and, therefore, can finance higher payrolls. These teams can count on players of a higher quality in their squads, increasing the probability of obtaining sporting success. (SZYMANSKI & KUYPERS, 1999; DOBSON & GODDARD, 2001).

The same way, a better sporting performance attracts more fans that are willing to acquire the clubs' products and follow games in the stadium or by some means of media outlet, which increases the visibility of the institution and its turnover. Thus, revenues, fan base and sporting performance in football have a peculiar relationship, with one variable influencing the other simultaneously. This situation raises the following question: what is the relationship between the financial and sporting performance of football teams?

In general, the academic literature on sports economics focused on North American sports, with papers that identified the sports industry as a set of profit-maximizing firms (ROTTEMBERG, 1956; NEALE, 1964; EL HODIRI & QUIRK, 1971). Sloane (1971) disagreed with this statement, emphasizing that English football clubs deviate from this norm, as they rarely present profitable financial statements. According to this author, football clubs can spend beyond their income, generating a financial loss in favor of sporting success. According to Sloane (1971), there are other variables that football clubs seek to maximize beyond profits, such as sports performance, the number of fans in the stadium and the quality of the competition. Késsenne (1996) and Garcia-del-Barrio & Szymanski (2009) considered that football clubs have the objective of maximizing victories. Samagaio et al. (2009) and Wilson (2017) corroborated this statement by emphasizing that the main goals of football clubs are to maintain a high sports performance and maximize their revenues to cover expenses with the qualification of the team.

The correlation between revenues and sports performance in football has been extensively analyzed in the literature (SZYMANSKI & KUYPERS, 1999; BARAJAS ET AL., 2005; DIMITROPOULOS & ALEXOPOULOS, 2014; ROHDE & BREUER, 2016). As well as the relationship between sporting success and wage expenses (SZYMANSKI & SMITH, 1997; SZYMANSKI & KUYPERS, 1999; HALL ET AL., 2002; FERRI ET AL., 2017; PEREIRA, 2018; FERREIRA ET AL., 2018).

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[1] According to the average US Dollar to Brazilian Real exchange rate in 2019 of US$ 1 = R$ 3.94.

[2] It is important to highlight that since 2011 Brazilian football clubs have negotiated broadcast contracts individually.

However, the relationship between financial results and sports performance is widely debated in the literature, with little consensus. Szymanski & Smith (1997), Szymanski & Kuypers (1999), Barajas et al. (2005) and Göllü (2012) found that there is no statistically significant relationship between net profit and sports performance of football clubs. Other papers contested these conclusions stating that there is a significant and positive influence of financial results on sports performance (FERRI ET AL., 2017; FERREIRA ET AL., 2018; PEREIRA, 2018). Although Sánchez et al. (2020) estimated a negative and significant influence of financial results on sports performance.

According to Baroncelli & Lago (2006), the relationship between financial and sports performance in football involves a virtuous cycle where teams invest in the qualification of their squad by financing a high payroll and therefore high-quality players. The club then obtains sporting success and attracts greater visibility that increases its revenues. The increase in revenues restarts this virtuous cycle, as it increases the club's ability to pay higher salaries for good players, as well as generating profits.

There is an ongoing debate in economic literature about the statistical relationship between financial and sporting performance of football clubs. Therefore, this paper aims to contribute to the research agenda regarding the understanding of the relationship between financial and sporting performance of football clubs, analyzing this relationship for clubs from Brazilian football. To achieve this objective, this paper will present, in addition to this introduction, three more sections. Section 2 presents the review of the related literature. Section 3 analyses the data, describes the sample, discusses the methodology used and presents the results of the estimated models. Section four in turn presents the final considerations

2. THE RELATIONSHIP BETWEEN FINANCIAL VARIABLES AND SPORTS PERFORMANCE IN FOOTBALL

Sloane's (1971) seminal paper was a pioneer in the academic study of the economic aspects of the football industry and served as inspiration for a series of empirical research projects about the economic and financial structure of football. The academic literature about financial and sporting variables of football teams has focused on different indicators using very different samples and statistical methods.

The positive influence of sports performance on revenues of football clubs has been widely acknowledged in literature (DOBSON & GODDARD, 1998; SZYMANSKI & KUYPERS, 1999; BARAJAS ET AL., 2005; DIMITROPOULOS & ALEXOPOULOS, 2014; ROHDE & BREUER, 2016). Likewise, the positive impact of payroll on the sporting performance of football teams has also been extensively documented (SZYMANSKI & SMITH, 1997; SZYMANSKI & KUYPERS, 1999; HALL ET AL., 2002; ROHDE & BREUER, 2016; FERRI ET AL., 2017; PEREIRA, 2018; FERREIRA ET AL., 2018).

The empirical evidence about the relationship between financial results and sports performance in football is more ambiguous. Some authors used simple linear regression to show that there was no significant influence of sports performance on net profits of English football clubs (SZYMANSKI & SMITH, 1997; SZYMANSKI & KUYPERS, 1999) and Spanish football clubs (BARAJAS ET AL.,

2005). Göllü (2012) also supported these findings, by estimating Spearman's correlation coefficient; this author presented evidence that there was no statistical relationship between financial and sports performance of the main football teams in Turkey. According to these authors even though successful sports performance generates higher revenues, this is not sufficient to produce profits, as most of the team's budget is directed into salaries and transfers of players with the aim of maintaining a high sports performance (SZYMANSKI & KUYPERS, 1999; BARAJAS ET AL., 2005).

Baroncelli & Lago (2006) disagree with these findings by stating that investment in the squad and the consequent successful sport performance is responsible for higher revenues, and this can generate higher budgets for the team but can also be responsible for generating profits. The authors suggested that this situation involves a virtuous cycle where teams can obtain a high sport and financial performance if efficiently organized. According to Samagaio et al. (2009) the owners of English football clubs seek to achieve financial and sports performance simultaneously, although in many cases the profits are reinvested in the acquisition and salaries of the players.

Using multiple regression techniques Dimitropoulos & Alexopoulos (2014) presented evidence that the clubs with the largest assets were able to obtain higher profits in Greek football. The authors attributed this fact to the economies of scale and the more efficient business organization of larger football clubs. Ferri et al. (2017) and Pereira (2018) also used multiple regression techniques and showed that profitability, measured by ROA[3], positively influences the sports performance of football teams. Ferreira et al. (2018) also supports these findings by stating that EBIT[4] has a positive influence on the sports results of teams in Brazilian football.

By estimating a simultaneous equation model with two equations to investigate the determinants of financial and sports, performance of the main European football teams Sánchez et al. (2020) concluded that financial results have a negative impact on sports performance, while sports performance had no significant impact on profitability. These findings contradict the results obtained by Ferri et al. (2017), Pereira (2018) and Ferreira et al. (2018) but corroborate with the conclusions of Szymanski & Kuypers (1999) and Barajas et al. (2005).

The review of the literature presented in this section highlights different samples, statistical methods, and findings about the relationship between sports and financial performance in football. Some papers have analyzed the relationship between financial and sports performance by estimating Spearman's correlation coefficient (GÖLLÜ, 2012). Other authors have estimated this relationship using linear regression, with the financial indicator as the dependent variable and sports performance as an independent variable (SZYMANSKI & KUYPERS, 1999; BARAJAS ET AL., 2005; DIMITROPOULOS & ALEXOPOULOS, 2014; ROHDE & BREUER, 2016). There were also articles that used sports performance as the dependent variable and financial indicators as independent variables (SZYMANSKI & SMITH, 1997; HALL ET AL., 2002; FERRI ET AL., 2017; PEREIRA, 2018; FERREIRA ET AL., 2018).

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[3] Return on assets (ROA), is a financial indicator that measures the profitability of a company, it is calculated by the ratio between net profit and total assets.

[4] Acronym for earnings before interest and taxes. It consists of an indicator that measures the company's profit from operating activities only, not considering the firm's financial income or expenses and tax expenses.

These surveys analyzed the influence of sports performance on financial variables or financial variables on sports performance by estimating a single equation, without considering the fact that these variables are determined together and are therefore simultaneous and endogenous. These estimations of the relationship between financial variables and sports performance did not consider the bidirectional relationship of the variables in which one variable influences the other simultaneously. When one or more explanatory variables are determined together with the dependent variable, a form of endogeneity known as simultaneity occurs. Simultaneity generates inconsistency and bias in a regression, as it generally causes the independent variable to be correlated with the error term (WOOLDRIDGE, 2012). Sánchez et al. (2020) described this simultaneous relationship between sports and financial performance in football and analyzed the relationship between the variables using the Three Stage Least Squares (3SLS)[5] technique to estimate simultaneous equations models and correct the bias generated by endogeneity.

Thus, this paper intends to analyze the relationship between sporting and financial performance in Brazilian football by estimating a system of simultaneous equations. For this purpose, regression models will be estimated using OLS and 3SLS, applying the methodology suggested by Sánchez et al. (2020) for data of the main football clubs in Brazil. This relationship has not yet been analyzed for a sample of teams from the same country using this statistical method. In addition, the investigation of the relationship between financial and sporting performance can provide interesting evidence for future research on this topic and to the strategic management of sports associations.

Using data from Itaú-BBA (2015, 2016, 2018 and 2020), it was possible to obtain a variety of financial indicators for twenty-six football clubs in Brazil between 2013 and 2019. The data presents panel composition and, therefore, allows a more robust analysis for the estimates that will be performed. The data obtained from Itaú-BBA (2015, 2016, 2018, and 2020) will be presented in the next section, to describe the empirical strategy conducted in this paper.

3. EMPIRICAL STRATEGY

3.1. Sample

To investigate the statistical relationship between financial and sporting performance in Brazilian professional football, data from twenty-six clubs that played in the top two divisions of the Brazilian league between 2013 and 2019 will be used. The accounting and financial data for these teams were extracted from the Economic-Financial Analysis reports of the Brazilian Football Clubs elaborated by Itaú-BBA (2015, 2016, 2018 and 2020). These reports present a variety of financial indicators for twenty-six Brazilian clubs between 2013 and 2019.

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[5] According to Baltagi (2011) 3SLS is a methodology for estimating the coefficients of a system of simultaneous equations. Unlike 2SLS, which is used to estimate the coefficients of only one equation of the system, 3SLS provides the estimates of the parameters of the entire system, using the variance and covariance matrix of the disturbances of the system of equations. For more details, see Zellner and Theil (1962).

It is important to understand the period covered in these reports as it considers the periods before and after the implementation of Brazilian Football Management and Fiscal Responsibility Modernization Program (PROFUT) in 2015. PROFUT consists of a set of rules that seeks to modernize the financial management of football clubs in Brazil, in return for the installed payment of their debts with the Federal Government. The main conditions for teams to maintain their adhesion to PROFUT and have their tax debts divided over the long run are include in the club' statute a clause that makes club executives responsible for their actions, mandatory disclosure of balance sheets and annual disclosure of a revenue anticipation report. Through these measures, PROFUT aims to bring greater transparency and accountability to the administrations of Brazilian football clubs (ITAÚ-BBA, 2015).

Data from all Brazilian professional clubs would be ideal, but there is no information available for all teams. In addition to the difficulty of collecting data from all the professional teams that exist in Brazil, most of them do not publish detailed accounting balance sheets and financial statements frequently, since not all clubs have adhered to PROFUT. Thus, the sample of twenty-six clubs that competed in the two main divisions of the Brazilian football league between 2013 and 2019 was considered the most appropriate for the development of this paper. Table 1 presents the clubs that compose the sample used in this research.

TABLE 1
Clubs involved in the sample

Clubs				
América-MG	Ceará	Figueirense	Palmeiras	Vasco
Atlético-MG	Chapecoense	Flamengo	Paraná	Vitória
Athlético-PR	Corinthians	Fluminense	Ponte Preta	
Avaí	Coritiba	Goiás	Santos	
Bahia	Criciuma	Grêmio	São Paulo	
Botafogo	Cruzeiro	Internacional	Sport	

Source: self-elaboration.

3.2. Description of the models and variables

As previously mentioned, the main goal of this paper is to analyze the statistical relationship between financial and sports performance in Brazilian football. According to Sánchez et al. (2020), these variables are determined simultaneously and therefore require estimation through a system of simultaneous equations. To analyze the relationship between the variables, two equations will be estimated, one with sports performance and the other with financial performance as the dependent variables. Likewise, most of the literature described, ROA was used to measure financial performance (FERRI ET AL., 2017; PEREIRA, 2018; SÁNCHEZ ET AL., 2020). To measure sports performance, the points obtained in the CBF National Club Ranking was chosen, like most papers that have analyzed Brazilian football teams (SILVA, 2013; NASCIMENTO ET AL., 2015; FREITAS, FARIAS & FLACH,

2017; FERREIRA ET AL. 2018). Six other explanatory variables will also be used: Leverage, population, total assets, total costs and expenses and a dummy variable for modernized stadium. The variables selected in this research are presented in Table 2, alongside a brief description and the source of the data.

TABLE 2
Description of the variables

Variable name	Abbreviation	Description	Source
Return on Assets	ROA	Measures the team's financial performance, calculated by the ratio between net profit and total assets	Itaú-BBA
Sports performance	SP	Calculated by the ratio between the number of points obtained by the team in the CBF Performance Ranking and the number of points obtained by the maximum observation of the sample in the year	CBF
Leverage	LEV	Measure of the team's indebtedness, calculated by the ratio between total debt and total assets	Itaú-BBA
Population	POP	Logarithm of the population in the team's home city	IPEA*
Assets	AT	Logarithm of the team's total assets	Itaú-BBA
Costs and Expenses	CE	Logarithm of the team's total costs and expenses	Itaú-BBA
Modern Stadium	ST	Dummy variable to indicate whether the team is the owner of a new or renovated stadium; 1 if the team owns the modern stadium, 0 otherwise	Itaú-BBA

Source: self-elaboration
Note*: the acronym IPEA stands for Institute for Applied Economic Research in Portuguese and provides a wide database of economic and demographic indicators for Brazil.

Seeking to analyze the relationship between financial variables and sports performance in football, some researchers used revenue as a financial indicator (DIMITROPOULOS & ALEXOPOULOS, 2014; ROHDE & BREUER, 2016) or net profit (SZYMANSKI & SMITH, 1997; SZYMANSKI & KUYPERS, 1999; BARAJAS ET AL. 2005; GÖLLÜ, 2012). Ferreira et al. (2018) used EBIT as an indicator of financial performance of football clubs. Other authors have used ROA as an indicator of financial performance (FERRI ET AL., 2017; PEREIRA, 2018; SÁNCHEZ ET AL., 2020). In this context, this paper will also use ROA as a measure of the financial performance of football clubs, since this variable ponders the institution's net profit by the size of its assets (SÁNCHEZ ET AL., 2020). In addition, this indicator is the most used in corporate finance surveys to measure a company's financial performance. The Itaú-BBA (2015, 2016, 2018, and 2020) reports provided data of net profit and total assets of the main Brazilian clubs between 2013 and 2019. From this data, it was possible to calculate the ROA for the sample under analysis.

To measure the sports performance of football teams, one can use a variety of variables, depending on the focus of the analysis. When analyzing the influence of match attendance on sports

performance in English football, Dawson et al. (2000) used win percentage in the league as a measure of sports performance. Goddard (2005) elaborated some models of prediction of goals and sports results, as a measure of performance, such author used the number of goals scored, conceded and results (win, draw or defeat).

To analyze sports performance in league championships, the variable of accumulated points is generally used (GERRARD, 2001; BARAJAS ET AL., 2005), or the league position at the end of the season (SZYMANSKI & SMITH, 1997; DOBSON & GODDARD, 1998; SZYMANSKI & KUYPERS, 1999; HALL ET AL., 2002). To measure the sports performance of football teams in different tournaments Barajas et al. (2005) and Pereira (2018) developed a performance index composed of the main tournaments played by teams in the season. When analyzing Brazilian football, Silva (2013), Nascimento et al. (2015), Freitas, Farias & Flach (2017) and Ferreira et al. (2018) used the number of points in the National Performance Rankings calculated by the Brazilian Football Confederation (CBF)[6]. In accordance with these publications, the present paper will also use the ranking of points calculated by CBF as a measure of sports performance; since it considers the progress of the clubs in the main tournaments played by Brazilian teams in the season and represents a consolidated calculation methodology previously developed by CBF.

To obtain a final indicator of sports performance for the Brazilian clubs in the sample, the number of points obtained by the club in the ranking was divided by the maximum score of the sample as suggested by Ferri et al. (2017). This transformation is necessary because as the variables of financial performance will be expressed in relative terms, it is necessary that sports performance be expressed in the same way (FERRI ET AL., 2017; SÁNCHEZ ET AL., 2020).

The equation estimated to analyze the determinants of financial performance of Brazilian football clubs will present the mathematic specification represented by equation (1):

$$ROA_{it} = \alpha + \beta_1 SP_{it} + \beta_2 LEV_{it} + \beta_3 POP_{it} + \beta_4 AT_{it} + \beta_5 PRFT_{it} + \beta_6 ST_{it} + \varepsilon_{it} \qquad 1)$$

The variables ROA and SP represent the financial and sports performances that have already been described. The variable LEV was included in the model since there have been studies that found a negative relationship between a football club's debts and its financial results (SÁNCHEZ ET AL., 2020).

Cocco & Jones (1997) and Barajas & Rodríguez (2010) pointed out that the size of a team's consumer market is directly related to the ability to generate financial results, due to the number of potential customers. Therefore, just like Sánchez et al. (2020), the population size of the city where the team is located will be used as a proxy for market size (POP). The POP variable underwent a logarithmic transformation to reduce the exponential character generally present in demographic data.

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[6] The CBF National Club Ranking is calculated considering the sports performance of Brazilian teams in the last 5 years, pondering the greatest weight for the most recent years. The score criterion consists of guaranteeing the champions of the 1st, 2nd, 3rd, and 4th divisions 800, 400, 200 and 100 points respectively. The second placed teams in each division receives 80% of the champion's score, the third receives 75%, the fourth 70%. From the fifth placed, each position loses 1 percentage point in relation to the team placed immediately before. The score for the Brazilian Cup is given according to the stage reached: champion (600), runner-up (480), semi-final (450), quarterfinal (400) and round of 16 (200). There is also a bonus of 400 points for clubs that participate in the *Copa Libertadores* and 280 points for the club that is champion of the *Copa Sulamericana*.

The greater the club's assets, the greater the potential to generate financial results due to economies of scale and organizational structure (DIMITROPOULOS & ALEXOPOULOS, 2014; SÁNCHEZ ET AL., 2020). Therefore, the club's total assets were added to the model as an independent variable represented in equation (1) as AT. This variable was also expressed in logarithmic terms to reduce the exponential discrepancies commonly present in financial data, as did Ferri et al. (2017).

The dummy variable to identify whether the team owns a stadium was used by Sánchez et al. (2020) to analyze the influence of owning a stadium on financial results. According to such authors, teams that do not own stadiums save on maintenance costs and this can have a positive impact on the institution's profitability. However, on the other hand, teams that own stadiums can rent the space for other activities not related to football and thus obtain income from this source. In Brazil, several teams modernized or built their stadiums in the period before and after the 2014 World Cup hosted in the country. Thus, the dummy variable ST was introduced in the model to try to explain the team's financial performance, with a small change in the variable used by Sánchez et al. (2020). In this paper, a dummy variable was elaborated to capture whether the team owns a stadium that was renovated or built between 2013 and 2019. This variable was added to the model to clarify the influence of owning a modern stadium on the results financial results of football clubs.

To analyze the determinants of sports performance of Brazilian football clubs, another equation with SP as the dependent variable will be estimated. This model is represented mathematically by equation (2):

$$SP_{it} = \alpha + \beta_1 ROA_{it} + \beta_2 LEV_{it} + \beta_3 POP_{it} + \beta_4 CE_{it} + \beta_5 AT_{it} + \beta_6 ST_{it} + \varepsilon_{it} \qquad (2)$$

Several papers have found evidence of a positive influence of financial results on the sports performance of football clubs (FERRI ET AL., 2017; PEREIRA, 2018, FERREIRA ET AL., 2018); however, Sánchez et al. (2020) estimated a negative impact of ROA on sports performance. Therefore, the ROA variable in equation (2) has the objective of identifying the influence of financial results on the sports performance of Brazilian football teams.

Some authors used the team's indebtedness to analyze the influence of this variable on sports performance (FERRI ET AL., 2017; PEREIRA 2018; FERREIRA ET AL., 2018). Football clubs' executives can accumulate debts to hire expensive players of high quality and thus aim for successful sporting results (SÁNCHEZ ET AL., 2020). Therefore, the LEV variable was added to the model represented by equation (2).

There are papers that have identified that teams from cities with a larger population obtained better sports results (BURAIMO ET AL., 2007; SANCHEZ SANTOS ET AL., 2012). According to these authors, sports associations in large cities have a larger consumer audience, thus obtaining a great potential for generating revenue and consequently large budgets to hire more expensive and high-quality players. Therefore, the variable POP was introduced in the model represented by equation (2) to designate the population of the city where the team is located. This variable was expressed in logarithmic terms to reduce the exponential discrepancies frequently present in demographic data.

The positive and significant influence of payroll on sports performance of football teams has already been widely verified in the literature (SZYMANSKI & SMITH, 1997; SZYMANSKI & KUYPERS, 1999; HALL ET AL., 2002; ROHDE & BREUER, 2016; FERRI ET AL 2017, FERREIRA ET AL., 2018; SÁNCHEZ ET AL., 2020). Therefore, this variable was also incorporated into our model to analyze the impact of wage expenses on the sports performance of Brazilian teams. For this, the variable total expense was used as a proxy for payroll. This variable was represented by CE in equation (2) and was expressed in logarithmic terms, as do the referenced papers, with the aim of reducing exponential discrepancies in financial data.

Ferri et al. (2017) pointed out that larger teams have better sports results, so the total asset (AT) variable was inserted in the model of equation (2), with the objective of verifying the impact of the size of the institution on their sports performance. This variable underwent a logarithmic transformation, as was done by Ferri et al. (2017), to reduce the exponential disparities typical of financial data.

Brazil, as the host of the 2014 Football World Cup, modernized its infrastructure in all areas. The stadiums and training centers were renovated or built, to present the best possible structure for the athletes who would compete in the 2014 World Cup (ITAÚ-BBA, 2018). Therefore, a dummy variable was also inserted into equation (2) to identify whether the team owns a modern stadium, where they play their home games. This variable was added to the model to analyze whether renovating or building the stadium, itself had an impact on the sports performance of Brazilian teams.

Based on the information obtained from Itaú-BBA (2015, 2016, 2018, and 2020), CBF and Institute for Applied Economic Research (IPEA), it was possible to gather data on financial performance, sports performance and the other explanatory variables that will be used in the estimated models. The descriptive statistics for these variables are presented in table 3. The number of observations of the variables varied according to data availability.

TABLE 3
Descriptive statistics of the variables

Variable	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
ROA	165	-0.04	0.40	-4.52	0.71
SP	182	0.66	0.22	0.17	1
LEV	165	0.88	0.87	0	6.16
POP	182	14.55	1.13	12.20	16.32
AT	165	19.32	1.23	15.30	21.58
CE	166	18.44	0.84	16.38	20.15
ST	182	0.65	0.48	0	1

Source: self-elaboration

Likewise, Sánchez et al. (2020) this paper will estimate a system of two equations, one with ROA and the other with sports performance as the dependent variable as represented by equations (1) and (2). The difference in the explanatory variables used in the present paper compared to Sánchez et

al. (2020) is due to data availability and the ownership structure[7] of Brazilian football clubs. The equations will be estimated using OLS and 3SLS estimation for panel data. This methodology was selected because it presents results that are possible to be compared with previous research that estimated the relationship between financial variables and sports performance in football using regression techniques. Moreover, the methodology developed by Zellner and Theil (1962) to estimate systems of simultaneous equations using 3SLS has the advantage of correcting the bias generated by simultaneity in an asymptotically efficient way combining instrumental variables, random effects and generalized least squares (GREENE, 2003).

To compare the statistical consistency of the parameters estimated by OLS and 3SLS the Hausmann[8] test will be applied. This test is necessary to confirm or reject the hypothesis of simultaneity between financial and sports performance in football. If the Hausmann test indicates that the parameters estimated by 3SLS are more efficient than the parameters estimated by OLS, it is concluded that there is a simultaneous relationship between financial results and sports performance, and therefore justifying the need for the estimation using the 3SLS methodology.

3.3. Results

Based on the data and the models described, it was possible to estimate regressions according to the mathematical specification of equations (1) and (2). At first, it was suspected a high correlation between the variables AT and CE, since teams with higher assets generally have higher costs and expenses. This is because part of the costs and expenses of football teams are with the acquisition of athletes, thus the economic rights of the players are incorporated into the club's assets at the time of hiring, therefore accounting for a significant fraction of this item.

A high correlation between two independent variables of a regression can generate multicollinearity; this fact makes the variances calculated for the estimators to be inflated and therefore presenting inaccurate test statistics for the coefficients of the correlated variables (BALTAGI, 2011; WOOLDRIDGE, 2012). According to Wooldridge (2012) the problem generated by multicollinearity is not clearly defined in the literature since it does not violate any of the basic assumptions of the OLS estimation, however the smaller the correlation between the explanatory variables of a regression, the better the model specification. This fact raised several discussions about how to resolve the problem generated by multicollinearity. According to Wooldridge (2012), there is no consolidated way to reduce the variances of consistent estimators other than to collect more data; however, this is rarely possible in Applied Social Sciences where researchers collect data in a passive manner. Other ways of correcting the multicollinearity issue suggested by the author are mathematical transformations in the correlated explanatory variables or the exclusion of the correlated independent variables. However, the exclusion of variables that belong to the population model can also generate bias in the estimation (WOOLDRIGE, 2012).

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[7] In the period comprised by the data in this paper Brazilian football clubs were political associations with a president elected by members of the clubs' council. In 2021, law number 14.193/2021 passed in congress, which enabled a change to this structure where clubs could transition from political associations into private owned companies, although up to the date of this publication most clubs have not adhered to this law.

[8] According to Baltagi (2011), the Hausmann test consists of a specification test to compare the statistical consistency between two estimators. For more details, see Hausmann (1978).

The calculated correlation between the variables AT and CE was 0.74, thus indicating that they have an almost linear correlation. The linearity between two explanatory variables generates the problem of multicollinearity, and as mentioned, this fact can generate problems for the estimations.

To avoid the problems generated by multicollinearity, a slight change was made to the estimation, adding the first lag of the variable AT as an explanatory variable in equation (2) for sports performance instead of just simply AT. This change is justified by the fact that the simple exclusion of AT would cause a loss to the estimation of the model, as it is an important variable for the explanation of the sports performance of the teams since it measures the size of the institution.

The calculated correlation between the first lag of the variable AT and CE was 0.72 and, therefore, is slightly less correlated with CE than AT. Thus, the lagged AT variable was inserted in place of the AT variable in equation (2) to reduce the problem generated by multicollinearity. In addition, the AT variable lagged by one year can be considered a good proxy for the size of the club, since the club's assets generally do not vary significantly from one year to the next.

The regressions represented by equations (1) and (2) were estimated for panel data using OLS and 3SLS and the results are shown in table 4 below. A dummy variable for PROFUT was inserted in the model to try to capture the effect of the effectiveness of the PROFUT measures that began in 2015. The main purpose of PROFUT was to prevent Brazilian football teams from spending beyond their means to minimize financial losses (ITAÚ-BBA, 2015). However, this dummy variable was omitted in the regression due to perfect collinearity, since it is a time dummy that was repeated equally for all teams in the sample. Therefore, when performing the estimation with panel data, we controlled for this fixed effect on all sample units, but unfortunately, it was not possible to obtain an estimated parameter for this variable.

Sánchez et al. (2020) did not directly specify the instrumental variables used to correct the simultaneity bias between financial and sporting performance. Although most empirical researchers that used instruments to correct endogeneity issues have stated the use of lags of variables as instruments to address this topic. Therefore, likewise most of the econometric literature this paper used the lags of control variables as instruments to correct the simultaneity bias. The instrumental variables used the results of the estimated models, and some model specification tests are depicted in table 4.

The Hausmann test rejected the null hypothesis that there is no systematic difference between the estimated coefficients, therefore indicating that the coefficients estimated by 3SLS are preferred to those estimated by OLS. Thus, the results indicate that the simultaneity bias should not be neglected. The estimated model passed the rank condition test of identification of the system of equations presented by Baum (2007); thus, indicating that the system of equations is identified and therefore suggesting that we obtain unique values for the estimated parameters. The Hansen-Sargan test did not reject the null hypothesis that the instruments used are exogenous. The Breusch Godfrey autocorrelation test, presented by Shehata (2011) for systems of simultaneous equations, did not reject the null hypothesis of absence of autocorrelation in the two equations estimated by 3SLS. Therefore, the tests described validate the methodology used to estimate equations (1) and (2) using 3SLS, thus the analysis of the results will focus on this model.

The results obtained by the model estimated by 3SLS indicated that SP has a positive and significant influence on ROA, and that ROA has a positive and significant effect on SP. These results indicate that better sports performance is associated with greater financial results for Brazilian clubs. This evidence contradicts the findings of Szymanski and Kuypers (1999) and Barajas et al. (2005) who

stated that sports performance had no significant influence on the financial results of football teams. In addition, the results obtained also showed that the clubs' financial results presented a positive and significant influence on sports performance. This result corroborates the conclusions of Ferri et al. (2017), Pereira (2018) and Ferreira et al. (2018) and contradicts the results obtained by Sánchez et al. (2020). These results can be explained by the fact that Brazilian football teams that obtain positive financial results generally present an efficient form of management and organization, thus obtaining profits and at the same time managing to present good sporting results.

TABLE 4
Results of the estimated models

Independent Variables	OLS		3SLS	
	Dependent Variables		Dependent Variables	
	ROA	SP	ROA	SP
SP	0,126		0,406***	
	(0,149)		(0,152)	
ROA		0,022		1,872***
		(0,065)		(0,449)
LEV	-0,047*	0,025*	-0,065**	0,107***
	(0,027)	(0,015)	(0,026)	(0,031)
POP	0,030	-0.057***	0,036	-0.092***
	(0,024)	(0,014)	(0,022)	(0,027)
AT	-0,045		-0,085***	
	(0,036)		(0,031)	
First lag of AT		0,063***		0,162***
		(0,019)		(0,039)
CE		0,184***		0,083**
		(0,023)		(0,035)
ST	0,020	0,016	0,012	-0,026
	(0,053)	(0,031)	(0,051)	(0,053)
Constant	0,384	-3,157***	0,893*	-2,717***
	(0,531)	(0,290)	(0,473)	(0,455)
R²	0,046	0,741	0,004	-1,864
F-statistic	0,78	37,84***		
Chi squared			11,46**	90,76***
Breusch Godfrey test			0,64	1,24
Instruments	Third lags of the variables SP, CE and AT			
Hausmann test	16,71***			
Hansen-Sargan	8,64			

Source: self-elaboration
Note: standard errors in parentheses.
***p < 0, 01, **p < 0, 05, *p < 0, 1.

The variable LEV presented a negative and significant effect on ROA, indicating that the indebtedness has a negative influence on the financial results of football teams, this result is in line with the conclusions presented by Sánchez et al. (2020). This is an indication of the incidence of financial costs on the debts of Brazilian clubs that end up having a negative impact on the teams' financial performance. The estimated model also found a positive and significant correlation between LEV and SP, as obtained by Ferri et al. (2017) and Ferreira et al. (2018). This indicates that more indebted teams obtain better sports performance, since a large share of the clubs' debts are due to salaries and acquisition of players, which directly influences the teams on field performance.

These estimated results in indicated that the variable LEV has an inverse influence on ROA and SP. While LEV affects ROA negatively, it presented a positive effect on SP. From the estimated coefficients of ROA, SP and LEV, the elasticity of the variables ROA and SP in relation to LEV were calculated. This calculation is intended to provide evidence on the net impact of the variation of indebtedness on the sports and financial performance of Brazilian clubs. The elasticity calculations were detailed in Appendix A and indicated that the final effect of a unitary variation in the club's indebtedness results in an impact of -0.09 and -0.06 on financial and sports performance respectively. These results indicate that indebtedness is not an advisable way to aim for better sports performance, as this is reflected in a simultaneous worsening of financial and sports performance.

The model also pointed out that there is no statistically significant relationship between the variables POP and ROA, but it found a negative and significant coefficient for POP in equation (2) for SP. The inverse relationship between POP and SP can be explained by the fact that larger cities offer more comfortable infrastructure conditions for visiting teams. While smaller cities demand a more stressful trip, in addition to generally presenting smaller stadiums where the pressure of the crowd is great, thus generating a sporting advantage for the teams from smaller cities. Therefore, this negative relationship between the size of the city's population and sports performance could be linked to the hostile environment typical of teams from smaller cities, such as Chapecoense and Santos.

The AT variable presented a negative and significant coefficient in equation (1), indicating that teams with larger assets have smaller financial results. This result is opposed to the evidence obtained by Dimitropoulos and Alexopoulos (2014) and Sánchez et al. (2020) who found that teams with larger assets had higher profits. Therefore, this result is an indication of failure in the financial management of large teams in Brazil, which for the most part are unable to take advantage of the economies of scale of their large assets, to generate financial results. The lagged AT variable in equation (2) demonstrated a positive and significant influence on SP, indicating that the largest Brazilian teams obtain better sports results, this result is in line with the research conducted by Ferri et al. (2017).

As expected, the variable CE demonstrated a positive and significant influence on sports performance, indicating that teams that have higher salary expenses generally obtain better sports performance, as has been widely verified in the literature (SZYMANSKI AND SMITH, 1997; SZYMANSKI AND KUYPERS, 1999; HALL ET AL., 2002; ROHDE AND BREUER, 2016; FERRI ET AL. 2017; PEREIRA, 2018; FERREIRA ET AL., 2018; SÁNCHEZ ET AL., 2020).

The dummy variable of teams owning a modernized stadium did not show a statistically significant relationship with ROA or with SP, indicating that renovating or building the stadium itself had no significant impact on the generation of financial results or on sports performance.

4. FINAL CONSIDERATIONS

According to Sloane's (1971) seminal article, unlike other conventional economic activities, football teams do not have the main objective of generating profits. On the other hand, the football industry is currently a segment of the entertainment sector that can generate large financial sums. In this context, it is essential to understand the relationship between financial and sports variables in football, for the purposes of market regulation and for strategic management of the clubs.

As described throughout this research, this paper aimed to analyze the statistical relationship between financial and sports performance in Brazilian football. The results obtained indicated that sports performance has a positive impact on the generation of financial results of Brazilian clubs. As well as the financial performance of the teams also showed a positive influence on sports performance. This indicates that these two variables should be an important focus for Brazilian football executives since the estimated model showed that they have a positive and simultaneous relationship.

The size of the team's assets presented a distinct influence on financial and sports performance. The results of the estimated models indicated that the size of the asset had a negative impact on the financial performance of the institution and therefore that the largest teams presented worse financial results. This result is an indication of failure in the administrations of Brazilian clubs since most of the literature described points out that larger teams usually obtain greater profits due to economies of scale. However, this is not verified in Brazilian football, and it is a fact that needs to be addressed by executives of football clubs in Brazil. The size of the asset had a positive impact on the sports performance of Brazilian clubs, indicating that the largest Brazilian teams present better sports results.

The results obtained in this research also pointed out that the indebtedness of the Brazilian teams had a negative impact on the teams' financial performance. This indicates that it is essential that the executives of Brazilian football reduce the debts of their clubs if they want to obtain financial results. However, this is not an easy task since the club's indebtedness also presented a positive impact on sports performance. Thus, Brazilian football executives face a trade-off between increasing indebtedness and aiming for sporting success at the expense of a worsening of financial performance or sacrificing successful sports performance to reduce debts and obtain better financial results.

To address this trade-off between on field performance profits, the elasticities of financial and sports performance were calculated in relation to indebtedness. The results indicated that an increase in the clubs' debts has a negative net effect on both sports and financial performance, therefore highlighting the adverse effects of indebtment to Brazilian football clubs.

The results presented in this research also indicated that teams that have higher costs and expenses obtained better sports performance. This result has already been widely verified in the literature and confirms the famous thesis that in football the teams with the largest investments are the most likely to emerge victorious.

These results described indicate that there is a great opportunity for the largest Brazilian clubs to organize themselves, to aim for a high financial and sports performance simultaneously. After all, most teams that have large debts and assets are not obtaining profits. In this way, the large teams that manage to organize themselves financially, reducing debts and generating profits can obtain a great advantage in relation to the others.

This fact can create a sporting and financial disparity between the Brazilian teams, since well-managed teams with better financial results presented a better sports performance, which in turn will increase the financial results in the form of a virtuous cycle as suggested by Baroncelli and Lago (2006). This process can be intensified with the new Law number 14.193/2021 that enables clubs to create the *Sociedade Anônima do Futebol* allowing Brazilian football clubs to transition from political institutions to business enterprises. In this way, clubs that adhere to this law become companies subject to bankruptcy like any other business from conventional sectors, but they can also attract investments from different sources of funding. In addition, the political aspect becomes irrelevant as the team is managed by a private owner, thus enabling a long-term planning for the football club. Obviously, the better-managed teams will attract greater investments due to the probable financial returns through the payment of profits and dividends to investors. This would allow the teams that present better financial indicators a greater budget to invest in the squad and consequently obtain an on-field hegemony.

This scenario can be seen in the recent experience of Flamengo and Palmeiras, who after a few years of irresponsible managements from a financial point of view started a process of administrative organization in 2013. These clubs started to control their expenses and increase their revenues, making conscious investments within their spending limits, thus showing constant profits since 2015. Recently these clubs have reaped the fruits of conscientious management, with Flamengo winning the Brazilian League Championship twice (2019 and 2020) and winning the *Copa Libertadores* in 2019. Palmeiras won two Brazilian Cups (2015 and 2020), two Brazilian League Championships (2016 and 2018) and two *Copa Libertadores* in 2020 and 2021. In these victorious years, Flamengo and Palmeiras have always presented profitable balance sheets, therefore reflecting their success on and off the pitch.

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APPENDIX A

To calculate the elasticities of the variables ROA and SP with respect to LEV, we will start using the model of simultaneous equations presented by equations (I) and (II) below. This system of equations is analogous to the system estimated in equations (1) and (2) in the text but excluding the intercepts and other explanatory variables for simplification purposes. The variables Y_{it}, X_{it} and Z_{it} represent the variables ROA, SP and LEV respectively.

$$Y_{it} = \beta_1 X_{it} + \beta_2 Z_{it} + \varepsilon_1 \qquad (I)$$

$$X_{it} = \alpha_1 Y_{it} + \alpha_2 Z_{it} + \varepsilon_2 \qquad (II)$$

To obtain the reduced form of Y_{it} we substitute equation (II) in (I) and after a brief algebraic manipulation we obtain the following:

$$Y_{it}(1 - \alpha_1\beta_1) = (\beta_2 + \alpha_2\beta_1)Z_{it} + \varepsilon_1$$

$$Y_{it} = \frac{(\beta_2 + \alpha_2\beta_1)}{(1 - \alpha_1\beta_1)}Z_{it} + \varepsilon_1$$

Taking the derivative of Y_{it} with respect to Z_{it} we obtain the elasticity of ROA with respect to LEV:

$$\frac{dY_{it}}{dZ_{it}} = \frac{(\beta_2 + \alpha_2\beta_1)}{(1 - \alpha_1\beta_1)} \qquad (III)$$

Similarly, by replacing equation (I) in (II) and solving for X_{it}, we get the following expression:

$$X_{it} = \frac{(\alpha_2 + \alpha_1\beta_2)}{(1 - \alpha_1\beta_1)}Z_{it} + \varepsilon_1$$

Taking the derivative of X_{it} with respect to Z_{it} we obtain the elasticity of ROA with respect to LEV:

$$\frac{dX_{it}}{dZ_{it}} = \frac{(\alpha_2 + \alpha_1\beta_2)}{(1 - \alpha_1\beta_1)} \qquad (IV)$$

The respective parameters α_1, α_2, β_1 and β_2 estimated in the system of simultaneous equations using 3SLS and presented in table 4 were: 1.872, 0.107, -0.406 ,-0.065. By replacing these values in the elasticity, equations (III) and (IV) we obtain:

$$\frac{dROA_{it}}{dLEV_{it}} = -0,09 \quad and \quad \frac{dPS_{it}}{dLEV_{it}} = -0,06$$