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Fiscal Responsibility Strategy in Brazilian Football Clubs: A Dynamic Efficiency Analysis

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ABSTRACT

The objective of this study is to structure an indicator of dynamic efficiency focused on fiscal responsibility strategy of Brazilian football clubs and explain the concept of efficiency by the market structure and sports performance. Our main contribution to the previous empirical literature is the utilization of an additive model for temporal series called the Dynamic Slack Based Model. We estimated the inter-temporal efficiency of 25 football clubs of a balanced panel data that span the period 2010-2014. The results showed that the dynamic efficiency of the Brazilian football clubs is, on average, 80.62%. Finally, the results shown in the explanatory model suggest that the features of market structure and sporting factors have positive and significant associations with dynamic efficiency such as the size of the club, participation in the "Libertadores" Cup, access to a higher division and relegation to a lower division.

Keywords: Dynamic efficiency; Fiscal strategy; Football clubs; Market structure; Sports performance.

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1. INTRODUCTION

Men's professional football is the biggest sport in the world, producing an estimated $ 33 billion per year and performs important social responsibilities in the communities where clubs are inserted (ANDREWS, HARRINGTON, 2016). The efficiency issue is growing in importance for football clubs because there is a direct relationship between success of clubs on-field and their long term financial wealth (BARROS, ASSAF; SA-EARP, 2010). Given this issue, the Union of European Football Associations (UEFA) have established the regulation and efficiency of spending (Financial Fair Play) in order to aim organizational success of European football clubs (BARROS; PEYPOCHC; TAINSKYD, 2014). Globally, the "Financial Integrity" is the main issue to be regulated in football clubs by the Fédération Internationale de Football Association (FIFA) and is divided into five pillars: (1) Financial transparency and literacy; (2) Financial sustainability; (3) Fiscal responsibility; (4) Financial and concentration; (5) Social responsibility and moral reputation (ANDREWS, HARRINGTON, 2016).

In accordance with clear issues related to governance and management practices in Brazilian clubs, Law 13155/15 aims at improvements in management and fiscal responsibility in Brazilian football, establishing an attempt for a paradigm shift to the search for better conditions for Brazilian clubs. It also created the Program for Modernization of Management and Fiscal Responsibility of Brazilian Football and establishes assumptions that clubs should follow to avoid a reckless management of these entities. Therefore, there is an effort to give a new look to the Brazilian legal framework, which may show further improvements in the main national sport, especially related to football clubs.

Among its prerogatives, Law 13155/15 proposes "V - deficit reduction [...]" and "IX -financial statements should demonstrate that the cost of payroll and of athlete's image rights in professional football do not exceed 80% of the annual gross revenue of the activities of professional football". Thus, we can observe that the regulatory framework converges with the concern for establishing a level of "efficiency" acceptable to the country's football clubs.

The 24 biggest clubs in the country (in 2014, based on the amount of revenue) generated a total revenue of BRL 3.22 billion, representing a decrease of 2% compared to 2013. However, if we analyze the costs of football department, the evidenced clubs showed an increase of approximately BRL 4 million compared to 2013. In the last five years (2010-2014) that 24 clubs have increased their total debt of BRL 3.28 billion (in 2010) to BRL 6.59 billion (in 2014), demonstrating a growth of 101%, and between 2013 and 2014, an increment of 18% - representing an increase in debt of BRL 1 billion (BDO, 2015). These contexts are directed to the opposite path of the new regulatory framework - and it evidences the enquiry concerning into the segment level of commitment to the efficiency improvements over the years.

Financial stability is a key to success in the long term, especially if there is a relationship of efficiency between the resources (purchasing players, wages and investment in facilities) and generated products, such as recipes and sports scores. This 'sports results' dependent variable is caused by the lack of financial stability of the institution, for example: management without using the concept of efficiency in controlling expenses (SCARFATO; SAMAGAIO, 2014). In this perspective, football teams do not plan strategically for two sides 'financial performance' and maximizing sporting achievements, exploring the sports results as main piece, instead of generating value (CAPASSO; ROSSI, 2013).

Therefore, analyzing the efficiency of football clubs in Brazil, regarding the fiscal responsibility with a reduction of operating costs and debt as prerogatives of Law 13155/15, suggests a way to structure an intertemporal structure strategy management of clubs, and with this, to maximize economic results over time. In the context of efficiency, Tone and Tsutsui (2010) explore the concept of the dynamic structure and expanded the DEA (Data Envelopment Analysis) for the additive model known as Slack Based Model to a dynamic model capable of estimating the efficiency frontier over several periods of time - known as Dynamic Slack based Model (DSBM).

In this sense, the objective of this research is to structure an indicator of dynamic efficiency focused on fiscal responsibility strategy of Brazilian football clubs and to explain the concept of efficiency by the market structure and sports performance. The proposed objective was motivated by some scientific gaps, known by recent discussions on the clubs, such as financial sustainability, lack of financial control (SILVA; TEIXEIRA; NIYAMA, 2009) and high indebtedness (SILVA; TEIXEIRA; NIYAMA, 2009; BRANDÃO, 2012). Therefore, combining these gaps and analyzing them in dynamic efficiency structure is something that, as far as we know in previous research, has not been explored in the international empirical literature.

The paper is organized as follows. Section 2 will present a review of previous studies carried out in the area. Section 3 presents the methodological procedures, while Section 4 provides the analysis of the results. Finally, the concluding remarks are presented in Section 5.

2. LITERATURE REVIEW

The success of a club on the field interacts with the financial performance because it stimulates the interest of television and sponsors, and other forms of income (HAAS, 2003), as sales federative rights of players, sales of licensed products and the use of the sports arena. Investment in human capital is high, but may not succeed. The amount paid for a player is related to their expected productivity, helping the team win points in the championships, linking it to the creation of value. However, due to the high cost of talent acquisition, financial returns, in some cases, may be frustrated for reasons whereby the expected productivity of the player may not become plausible (McNAMARA; PECK; SASSON, 2013).

In the case of football, the investment in human capital may be reflected in a higher chance of sporting success. However, there are examples of clubs that do not have a high investment, but can achieve results higher than expected (ESPITIA; ESCUER; GARCÍA-CEBRIÁN, 2010). The main expenses and investments are wages, purchasing players and the construction of stadiums and facilities (ROWBOTTON, 2002). Productive efficiency is one of the goals of any company, including professional clubs (JANE; KONG; WANG, 2010), from this perspective, it is notorious the importance of efficiency evaluation to verify if the sports results are being achieved with an acceptable level of spending. Furthermore, the positive sports results may allow an increase in revenues, thus bringing financial stability to the organization (ESPITIA; ESCUER; GARCÍA-CEBRIÁN, 2010).

The efficiency in a given period would be a function of sports results in the immediately preceding periods; in this case, the wherewithal to maximize profits should be to reduce the use of inputs (ESPITIA; ESCUER; GARCIA; CEBRIAN, 2004). However, such a possibility would result in bad sports results, which would have negative repercussions on the income of next season (DANTAS, 2013). This type of discussion is grounded by Neale (1964) and Ferguson et al (1991) where the authors treat football clubs as uncommon companies, because their performances are linked to a league or more, as well as the maximization of profit. In this case, there is still the issue of non-profit purpose (but only satisfaction with the results on the field), jeopardizing the Theory of the Firm proposed by Coase (1937).

In this context, there are indications that the revenues from sports entities associated to sports performance, but still not a clear relationship, because there is no consensus among the studies (SAMAGAIO; COUTO; CAIADO, 2009). However, football clubs aim at the creation of a competitive team with the resources allocated to achieve sporting success and consequently transform this success in increasing revenue (KERN; SCHWARZMANN; WIEDENEGGER, 2012). Whence, it corresponds to a trading strategy that aims to balance economic and financial results, with sports performance, which enables the development and deployment of a culture of generating future revenue (HAMIL; WALTERS; WATSON, 2010; ROCCO JUNIOR, 2014).

Currently there is a major concern of clubs to combine spending with performance of the organization, both in economic and financial issues, and in maximizing the sporting achievements. Therefore, knowing the investment efficiency has become one of the goals of the football scholars (DANTAS; MACHADO; MACEDO, 2015). For Barros and Rossi (2014), the literature on the football efficiency takes into account that the clubs are maximizing revenue and market value. Table 1 details the research on the efficiency of Brazilian football clubs, involving sports and financial dimensions.

Table 1. Studies on the efficiency of football clubs in Brazil.

Paper	Sample/Panel/Model	Main findings
Barros, Assaf and Sá-Earp (2010)	20 clubs 2006-2007 DEA (Super-efficiency)	The clubs operate at a high level of inefficiency. The size and the city club are not related to efficiency, but efficiency increases with wins and goals scored and decreases with defeats and goals conceded.
Barros, Assaf and Araújo Júnior (2011)	20 clubs 2003-2007 SFA	The inefficiency varies along the sample from a minimum of 10.58% for Sao Paulo, and a maximum of 39.17% for Juventude. The metropolitan areas of Rio de Janeiro and São Paulo contribute to greater cost efficiency.
Dantas and Boente (2012)	14 clubs 2006-2009 DEA	Internacional was the most efficient club in all aspects analyzed as a financial and sporting efficiency.
Barros, Wanke and Figueiredo (2015)	20 clubs 2003-2011 SFA	Clubs are not homogenous but fixed-effects are heterogeneous; Remoteness affects small Brazilian clubs increasing the clubs' costs; fans decrease the clubs' costs and cost efficiency increases according to the annual trend.
Dantas, Machado and Macedo (2015)	36 clubs 2010-2012 DEA (Super-efficiency)	The average efficiency of the years 2010, 2011 and 2012 was 0.75, 0.86 and 0.84, respectively. Obtaining a title of the year is positively associated with efficiency.
Nascimento et al (2015)	13 clubs 2006-2011 DEA	The analysis enabled us to identify that Corinthians, Santos, Flamengo and Figueirense were the clubs that had the most efficient financial management in 2010 and 2011. Coritiba and Fluminense were the clubs that reached the efficiency of 100% in the period.

In the previous studies related to the efficiency of football clubs in Brazil, there is a predominance of DEA models. In this perspective, the present study aims to analyze the efficiency of clubs using the additive DEA model, a dynamic model capable of estimating the production frontier over time, known as the DSBM model. We also noticed the application (in a second stage) of market and sports variables to determine the association between these variables with the efficiency or inefficiency of clubs.

In 2015, the 30 biggest clubs in Brazil showed an increase of 14% on their brands consolidated value compared to the ranking in 2014 and 76% growth in the last five years (according to BDO). This improvement over the years is directly related to the intensification of different factors, such as: (i) deep evolution of the amounts received with the broadcast rights; (ii) continued expansion of revenues of each entity with marketing, stadium, partners and media; (iii) evolving the fan partner programs of clubs; (iv) increase the amounts received from sponsors and expansion of interest from companies in joining the clubs; (v) greater participation of fans in business generated by the entities; and (vi) new arenas with several potential use (BDO, 2015).

There are around 800 football clubs in Brazil, most non-profit organizations of private law classified as sports associations. But recently some clubs have emerged as Limited Liability Companies. In the Brazilian sporting context, the main championship match is the Brazilian Football Championship, organized by the Brazilian Football Confederation (CBF) and includes 20

clubs in the called "SérieA" (the first division of the championship). The "SérieB" is the second division and has a similar format to the first division. The "SérieC" and "SérieD" correspond to the third and fourth divisions, respectively, and have particular formats, considering that in the "SérieC" twenty clubs are divided into two groups. In the "SérieD" 68 teams (qualified through the state championships or other tournaments conducted by state federations) vie for the title. The four top finishers of a certain series rise to a next higher series, while the last four are relegated to a lower series immediately. The top four scorers in the "SérieA" earn the right to access to the "Libertadores" Cup.

In addition to the Brazilian Championship, there are state and regional championships, which are held at the beginning of the season (like the championships: Carioca, Paulista, Mineiro and Gaúcho), as well as Brazil Football Cup, in which the champion also ensures access to "Libertadores".

In the context of Brazilian football, there is a persistent operating deficit and debt accumulation, the dependence on exports of players and the failed model of the "Timemania" lottery to ensure the balance of the debt. Some measures have been taken to minimize the financial difficulties faced by the national clubs; however, most of them have produced few benefits (BARROS; ASSAF; ARAÚJO JÚNIOR, 2011). Thereby, the government should induce football clubs to adopt sustainable procedures, combining sports results with financial results, as well as increasing the transparency of club finances and improving accounting procedures, to encourage more investors to support clubs (BARROS; ASSAF; ARAÚJO JÚNIOR, 2011), the first step taken by Law 13155/15.

In brief, the efficiency of Brazilian football clubs is a topic that has interesting works already developed. However, to the best of our knowledge, no analytic-empirical studies have been conducted with the use of DSBM method for calculating the dynamic (inter-temporal) efficiency and the choice of efficiency variables based on Law 13155/15. Thus, this study is justified by exploring these two literature gaps. It also aims to structure an indicator of dynamic efficiency focused on fiscal responsibility strategy of Brazilian football clubs and explain the concept of efficiency by the market structure (size, attendance and region-based) and sports performance ("Libertadores" Cup participation, promotion to a higher division and relegation to the lower division).

3. METHODS

3.1. SAMPLE

Due to governance practices currently implemented in Brazil it is impossible to obtain the financial statements of the 800 clubs of Brazilian football. Unfortunately, only 25 clubs disclose their financial statements, enabling the researchers to collect data for an annual longitudinal panel

from 2010-2014. These clubs belong to Series A, B and C of the Brazilian championship and cover nine states, with a superior concentration of clubs between the south and southeast regions of the country. The clubs of the sample are considered the most important clubs in Brazilian football.

The retrieval of financial statements of clubs was fulfilled from their official websites and by visiting pages of official gazettes of the states and municipalities where the clubs are based. Sports performance data were collected from specialized football statistics sites www.bolanaarea.com and www.transfermarkt.com.

3.2. DYNAMIC EFFICIENCY MODEL

First, the study aims to establish a dynamic efficiency score according to the DSBM model, to be able to estimate the efficiency frontier over time. The main difference between the proposed DEA and the others is the presence of a term called *carry-over*, a variable related to the transition efficiency between periods (TONE; TSUTSUI, 2010).

When employing a DSBM model, it is necessary to identify the efficiency of connecting components (carry-over) from one period to another, according to their characteristics. Therefore, relatively to carry-over as the link variable that connects periods over time in dynamic structure, Tone and Tsutsui (2010) classified them in four categories: Desirable (good); undesirable (bad); discretionary (free); non-discretionary (fixed).

Briefly, the DSBM proposed by Tone and Tsutsui (2010) is structured for a range of production possibilities, considering a number of "n" of DMUs (Decision Making Unit) $(j = 1,...,n)$ in "T" periods $(t = 1,...,T)$. In each period, the DMU's feature "m" inputs $(i = 1,...,m)$, "p" non-discretionary inputs (fixed) $(i = 1,...,p)$, "s" outputs $(i = 1,...,s)$ and "r" non-discretionary outputs (fixed) $(i = 1,...,r)$.

Moreover, $x_{ijt}(i = 1,...m)$, $x_{ijt}^{fix}(i = 1,...p)$, $y_{ijt}(i = 1,...s)$ and $y_{ijt}^{fix}(i = 1,...r)$ respectively represent the values of discretionary inputs, non-discretionary inputs, non-discretionary outputs and discretionary outputs of DMU *j* in period *t*.

In DSBM, the model-oriented efficiency of DMUo input θ_o^* (o = 1, ..., n) is obtained by the following expression:

$$\theta_o^* = \max \frac{1}{T}\sum_{t=1}^{T} w^t \left[1 + \frac{1}{s + nbad}\left(\sum_{i=1}^{m} w_i^- s_{it}^- + \sum_{i=1}^{nbad} \frac{s_{it}^{bad}}{z_{iot}^{bad}} \right) \right] \quad (1)$$

Subject to the conditions:

a) the continuity of *carry-over links* between the periods t and t+1, where the symbol α represents the position relations of the links *good* (z^{good}), *bad* (z^{bad}), *free* (z^{free}) and *fix* (z^{fix}).

$$\sum_{j=1}^{n} z_{ijt}^{\alpha} \lambda_j^t = \sum_{j=1}^{n} z_{ijt}^{\alpha} \lambda_j^{t+1} \qquad (\forall i; t = 1,...,T-1) \quad (2)$$

b) $$x_{iot} = \sum_{j=1}^{n} x_{ijt}\lambda_j^t + s_{it}^-, \qquad (i = 1,...,m; t = 1,...,T) \quad (3)$$

$$x_{iot}^{fix} = \sum_{j=1}^{n} x_{ijt}^{fix}\lambda_j^t, \qquad (i = 1,...,m; t = 1,...,T)$$

$$y_{iot} \leq \sum_{j=1}^{n} y_{ijt}\lambda_j^t - s_{it}^+, \qquad (i = 1,...,s; t = 1,...,T)$$

$$y_{iot}^{fix} = \sum_{j=1}^{n} x_{ijt}^{fix}\lambda_j^t, \qquad (i = 1,...,r; t = 1,...,T)$$

$$z_{iot}^{good} = \sum_{j=1}^{n} z_{ijt}^{good}\lambda_j^t - s_{it}^{good}, \qquad (i = 1,...,ngood; t = 1,...,T)$$

$$z_{iot}^{bad} = \sum_{j=1}^{n} z_{ijt}^{bad}\lambda_j^t + s_{it}^{bad}, \qquad (i = 1,...,nbad; = 1,...,T)$$

$$z_{iot}^{free} = \sum_{j=1}^{n} z_{ijt}^{free}\lambda_j^t + s_{it}^{free}, \qquad (i = 1,...,nfree; t = 1,...,T)$$

$$z_{iot}^{fix} = \sum_{j=1}^{n} z_{ijt}^{fix}\lambda_j^t, \qquad (i = 1,...,nfix; t = 1,...,T)$$

$$\sum_{j=1}^{n} \lambda_j^t = 1, \qquad (t = 1,...,T)$$

$$\lambda_j^t \geq 0, \; s_{it}^- \geq 0, \; s_{it}^+ \geq 0, \; s_{it}^{good} \geq 0, \; s_{it}^{bad} \geq 0 \text{ and } s_{it}^{free} : free(\forall i,t)$$

Where s_{it}^-, s_{it}^+, s_{it}^{good}, s_{it}^{bad} and s_{it}^{free} are slack variables representing respectively the input excess, insufficient output, link insufficiency, the excess of the link and its deviation. w_i and w_i^- are weights for the period *t* and the input *i*. If all the weights are equal, it is possible to adjust $w^t = 1(\forall t)$ and $w_i^- = 1(\forall t)$.

The expression 1 is considered a great solution for the expressions 2 and 3. Considering $\left(\{s_o^{-*}\}, \{s_o^{+*}\}, \{s_o^{good*}\}, \{s_o^{bad*}\}, \{s_o^{free*}\}\right)$, the equation used to define the efficiency of input-oriented period θ_o^* is:

$$\theta_o^* = 1 - \frac{1}{m + nbad}\left(\sum_{i=1}^{m} \frac{w_i^- s_{iot}^{-*}}{x_{iot}} + \sum_{i=1}^{nbad} \frac{s_{iot}^{bad*}}{z_{iot}^{bad}}\right), \quad (t = 1,...,T) \quad (4)$$

If all optimal solutions of expression 1 satisfy $\theta_o^* = 1$, DMU_o is called input-oriented term-efficient for the term *t*. It is noteworthy that the mathematical notations described were extracted in its short form of Tone and Tsutsui (2010). For more details see the said paper.

The input-oriented choice is due to the goals established by Law 13155/15, which requires the reduction of operating costs and debt position of Brazilian clubs. For this reason, the orientation efficiency score does not follow the trend-oriented output which is used by some previous studies on efficient implementation football with DEA, such as Haas (2003); Guzman and Morrow (2007); Barros, Assaf and Sa-Earp (2010); Dantas and Boente (2011); and Halkos and Tzeremes (2013). Guidance on inputs also allows evaluating the efficiency to reduce costs and debt as a form of club strategy to become efficient and compliant with the legal aspects simultaneously.

Regarding the choice of returns of scale (Constants Returns of Scale - CRS or Variable Returns of Scale -VRS) we used the model proposed by Zhu (2000), which applies the average test of efficiency scores calculated for two efficiency score groups calculated (the first is calculated with CRS and the second, VRS). If there is a significant difference between the two groups of averages, the VRS model should be selected. In this study, the VRS specification was used because it presented a significant difference to the average between the efficiency scores calculated in groups. The use of VRS also corroborates previous studies related, that used the VRS by justifying difference of Brazilian clubs in terms of structure, ability to generate revenue, total assets, among others. Also, another justification for the use of VRS follows the question of the difference between the sizes of the clubs, but considering that they can contest in the same competition, obtaining similar results.

There is a consensus on the use of variables OPEX as input and REVENUE[1] as output in the definition of the football efficiency scores in all of the studies described in Table 1. This study also follows the same understanding and uses these same variables as input and output, respectively. However, we highlight the inclusion of input LIABILITIES, established by Law 13155/15, however, we are not aware of it being used in other studies involving efficiency in football.

The amounts related to the variable OPEX are the costs of football activity covering salaries, travel, food and others. The values obtained for the variable LIABILITIES are the total value of the liability at the end of the accounting period and the values of the variable REVENUE represent the sum of the operating revenues of the clubs that will be collected from published financial statements.

According to Tone and Tsutsui (2010), the desirable links (good) behave as outputs and can be retained earnings and the net surplus obtained, transported to the next exercise. In accounting aspects, both the retained earnings as surplus/net obtained deficit are elements of equity, therefore

[1] Revenue was also used as output in other studies unlisted in Table 1 as: Haas (2003), Barros and Leach (2006), Soleimani-Damaneh, Hamidi and Sajadi (2011) and Kern, Schwarzmann and Wiedenegger (2012).

the carry-over (good) will be the EQUITY variable, which corresponds to the total equity of clubs also collected from their published financial statements. Table 2 describes the inputs, outputs and carry-over (link) used in the study and their descriptive statistics.

Second step, as an econometric analysis, the scores obtained in Dynamic Efficiency Scores (Eff) is the dependent variable being explained in terms of market structure factors and sports performance. A methodological direction of the econometric technique is more suitable for the two-stage analysis of the efficiency scores produced by the DEA is not clear (LIU et al, 2016). Halkos and Tzeremes (2013) and Dantas, Machado and Macedo (2015) have used truncated regression models and Tobit regression, respectively, for explaining the differences of the football efficiency scores, but using the Tobit Model (SIMAR; WILSON, 2007; BANKER; NATARAJAN, 2008; McDONALD, 2009) and truncated regression (BANKER; NATARAJAN, 2008) are of questionable applicability.

The results presented in efficiency scores are not generated by a censoring process but are fractional data (McDONALD, 2009), which are comprised between the values of 0 to 1. Thus, McDonald (2009) suggests that one way to use the second stage DEA would be by using similar models to logit and probit in the binary choice situation.

An econometric technique that may fit this profile are the Generalized Estimating Equation (GEE), recommended when there is no normal distribution of data or when the panel data is strongly correlated over the periods. This model considers the correlation structure between the observations, thereby producing efficient and not biased estimates, because it enables estimates with matrices work correlation: independent auto regressive, stationary, nonstationary, unstructured and interchangeable. The GEE modeling also enables the choice of the binomial family for the response variable proportions and probit and logit link of random components (HARDIN; HILBE, 2003), converging with the profile of the econometric model indicated by McDonald (2009). For

Table 2. Dynamic Efficiency Variables.

Variable	Definition	Classification	In thousands of Real (BRL)			
			Mean	Std. Dev.	Min	Max
OPEX	Total amount of Operational Expenditure.	Input x_{1jt}	82,894.09	64,506.98	263,020.00	4,416.23
LIABILITIES	Total amount Liabilities.	Input x_{2jt}	299,678.49	306,431.77	1,597,812.55	5,291.62
EQUITY	Total amount of owner's equity.	Good Carry--over z^{good}_{1jt}	12,942.51	202,209.30	707,333.39	-790,100.00
REVENUE	Total amount of revenue.	Output y_{1jt}	104,481.59	84,289.51	362,832.00	5,935.19

this reason, GEE is used as a model to evaluate the second stage of this work and to test some hypotheses.

Despite the real possibilities of economies of scale that would benefit the biggest clubs in Brazil in their efficiency (for existing disparities in relation to the structure and investments), studies such as Barros and Rossi (2014) and Barros, Assaf and Araújo Júnior (2011) found no significant empirical evidence to reinforce this assumption. Thus, based on previous studies, an initial hypothesis is formulated in relation to the market structure:

> **H1: The dynamic efficiency focused on fiscal responsibility strategy is not associated with the size of Brazilian football clubs.**

The variable logarithm of assets (LogAssets) was introduced in the econometric model to capture the associations of the size of the clubs with the efficiency focused on input reduction strategy and to test the hypothesis related, which one expects will have a non-significant coefficient.

Although the average attendance of Brazilian football is not the same of the big leagues around the world, and may be less than places where football leagues are not as important as the Brazilian, it is understood that the fans participation is important to the clubs, even as a way to raise revenue. In Brazil, this variable does not follow the size of the club, because in some cases, clubs with smaller assets exceed average more valued clubs. Moreover, after the World Cup in 2014, when there were several more modern arenas, the trend is that average fans increase in the medium term. Regarding this phenomenon, Barros, Wanke and Figueiredo (2015) suggest that the number of fans in the stadiums provided reductions in costs. So a second hypothesis to market structure is suggested:

> **H2: Betters dynamic efficiency focused on fiscal responsibility strategy are associated with average attendance level of Brazilian football clubs.**

To test this hypothesis the variable logarithm of average annual public (LogAttendance) was proposed in the model and it is expected that its coefficient results in a positive and significant association in the econometric model.

It is possible that training centers improve the performance of clubs (HOROWITZ, 2000). In the Brazilian football context, clubs based in metropolitan areas do not reach differences efficiencies with based clubs outside of metropolitan areas (BARROS; ASSAF; ARAÚJO JÚNIOR, 2011), however the clubs outside the "Rio de Janeiro-São Paulo" axis are associated with higher costs (BARROS; WANKE; FIGUEIREDO, 2015). In the years 2000-2002 there was a competition which covered the clubs of the South-"Minas Gerais" region, and currently there is an effort to build a championship involving the South-Minas-Rio axis ("Primeira Liga"). So it is possible that the greatest Brazilian football talent barns are in the clubs belonging to the axis Rio-São Paulo and

South-Minas, and for this reason these clubs achieve better performance. Therefore, there is a third hypothesis related to market structure:

> **H3: Greater dynamic efficiency focused on fiscal responsibility strategy is associated with Brazilian football clubs based in "Rio-São Paulo" and "South-Minas" axis.**

To capture associations between clubs based in the axis "Rio-São Paulo" and South-"Minas" based on the efficiency, two dummy variables were included in the econometric model, and their results are compared with those of clubs that do not have their business location in the two axes: the Clubs in the states of "Rio de Janeiro" and "São Paulo" (RioSP) and the clubs in the state of "Minas Gerais" and southern Minas (SulMinas), in which a positive and significant coefficient is expected in both.

According to Barros and Rossi (2014), who studied Italian football, the presence of the club in the UEFA Champions League allows the club to reach higher yields, giving as an example the 2011/12 season, where AS Roma, in its annual report, revealed that total revenues decreased due to the absence in the UEFA Champions League. Participation in the Champions League is restricted to clubs with better sporting performances in their most relevant national contests. With this argument, a fourth hypothesis is structured and is related to the sporting factor:

> **H4: Higher dynamic efficiencies focused on fiscal responsibility strategy are associated with Brazilian football clubs that participate in the "Libertadores" Cup.**

In Brazilian football, the "Libertadores" is the version of the UEFA Champions League for clubs in South America and Mexico, so the dummy variable participation in the "Libertadores" Cup (LCup) was incorporated into the econometric model, where a positive and significant association is expected.

The sports performance measured by the number of victories in the national championship is associated with improved efficiencies obtained by Brazilian clubs who competed in the "SérieA", whereas the number of losses is associated with lower efficiencies (BARROS; ASSAF; ARAÚJO JÚNIOR, 2011). Our study has changed the analysis strategy for clubs that also competed in the "SérieB" and "SérieC" of the national championship, so the sporting performance of the club is checked via access to a next higher series or its relegation to lower series. In this sense, two more hypotheses are structured and are related to the sporting factor:

> **H5: Increases in dynamic efficiency focused on fiscal responsibility strategy are associated with Brazilian football clubs that were promoted to a higher division.**

> **H6: Decreases in dynamic efficiency focused on fiscal responsibility strategy are associated with Brazilian football clubs that were relegated to a lower division.**

Depending on the series in which the club is participating, the number of games is different as well; number of victories, losses, goals and own goals may produce biased results. To remedy this problem, we have included in the model two dummy variables such as sports performance proxies to test H5 and H6, respectively: The clubs ranked among the top 4 national championship (4championship), was expected to present a positive and significant coefficient and relegation (relegated), was expected to present a negative and significant coefficient.

Other variables that also capture the sporting performance with functions to control the clubs heterogeneities in particular status are: the club points in CBF ranking (CBFpoints), obtaining a title in the year (Winner) and participation in the "SérieA" (Aseries), is expected to present a positive and significant association in all of them. Barros, Wanke and Figueiredo (2015) highlighted the need to capture the dynamic effects of the costs over time for this; their findings show a positive trend. The Annual Trend variable (Trend) was incorporated into the model and it is expected to present a significant positive association. Appendix 01 provides a breakdown of all the variables of the explanatory model and descriptive statistics.

4. RESULTS AND DISCUSSION

Table 3 shows that the overall dynamic efficiency of the panel was 80.62% for Brazilian clubs. Looking at the scores over the years, in 2012 the mean was 75.26% and increased to 85.14% in 2013. However, in 2014 there was a slight drop in efficiency to an average of 84.28% compared to the previous year. Considering the number of efficient DMUs, 6 clubs resulted in efficient for overall score. In terms of scores for 2010 there were 9 DMUs, with the year 2013 being the most favorable of all for efficiency with 15 efficient DMUs.

An interesting analysis can be viewed with a kernel density diagrams panel, first considering a vector for each year and another consolidated (Pooled), which groups all years from panel as a single vector, as shown in Figure 1.

All diagrams present that the efficiency assumes a bimodal distribution with respect to peak densities close to 0.6 and 1.0. In 2010, the highest peak density showed a little higher than 1.5, representing an efficiency close to the 60% zone. However, this scenario was reversed from the year 2011 with higher peak density than 1.5, but with efficiency close to the 100% area. The highest peak densities had increased gradually by the year 2013, however in 2014; there was a slight reduction of density of the highest peak with efficiency close to 100%. In the analysis as a pooled panel (single vector), the density of the highest peak approaches 2.5 and was situated next to the 100% efficiency area.

One possible explanation for the loss of dynamism in growth in the efficiency of clubs over the years is due to the World Cup in 2014, because important parts of investments were channeled

Table 3. Results of dynamic efficiency scores.

DMU	Overall Score	2010	2011	2012	2013	2014
Atlético-MG	0.6713	0.5336	0.6129	0.5845	1	0.6253
Atlético-PR	1	1	0.9998	1	1	1
Avaí	0.7530	0.7117	0.6473	0.5867	1	0.8194
Bahia	0.4796	0.4839	0.4442	0.5372	0.4190	0.5138
Botafogo	0.4604	0.4764	0.3668	0.4327	0.4043	0.6220
Corinthians	1	1	1	1	1	1
Coritiba	0.5991	0.5550	0.6066	0.5295	0.6573	0.6470
Criciúma	1	1	1	1	1	1
Cruzeiro	0.7029	0.6341	0.7570	0.5328	0.6014	0.9893
Figueirense	0.6133	0.5972	0.6157	0.6068	0.6047	0.6422
Flamengo	1	1	1	1	1	1
Fluminense	0.8402	0.8161	0.7118	1	1	0.6732
Goiás	0.7007	0.5318	0.3769	0.8239	0.7711	1
Grêmio	0.7474	0.6850	0.6371	0.8879	0.5994	0.9277
Internacional	1	1	1	1	1	1
Náutico	0.8709	0.6076	1	0.7468	1	1
Palmeiras	0.7721	0.5921	0.5905	1	1	0.6777
Paraná	0.8480	1	1	1	0.7008	0.5391
Ponte Preta	0.6430	0.4353	0.5040	0.3826	1	0.8933
Santos	0.7641	0.6758	0.8771	0.9628	0.6316	0.6730
São Caetano	1	1	1	1	1	1
São Paulo	0.9655	1	1	1	1	0.8276
Sport	0.9670	0.8350	1v	1	1	1
Vasco	0.8604	0.6443	1	0.6576	1	1
Vitória	0.8958	1	0.8161	0.7675	0.8955	1
Mean	0.8062	0.7526	0.7826	0.8016	0.8514	0.8428

to the event, causing even further reduction in revenues from sponsorship of clubs. Another explanation may be capital investments in football arenas, made by some major clubs, enabling increased costs, as argued by Barros, Wanke and Figueiredo (2015).

Six clubs were efficient in the overall score: Atlético-PR, Corinthians, Criciúma, Flamengo, Internacional and São Caetano. Of course, the theory based on resources, for example, justifies different efficiency scores because of the heterogeneity of resources and capabilities of the clubs (BARROS; ASSAF; ARAUJO JUNIOR, 2011).

Figure 2 shows another spatial analysis perspective of efficiency with display of clustered error bar by club of the efficiency scores over the years inserted on the panel. All clubs from Botafogo to Sport are finding an increasing order of inefficiency - on the other hand, efficiency is found from Atletico-PR onwards. Among the clubs that suffered more variations, Ponte Preta has the highest, with a standard error of 0.5 nearing 0.8. As an example, the club presented the worst

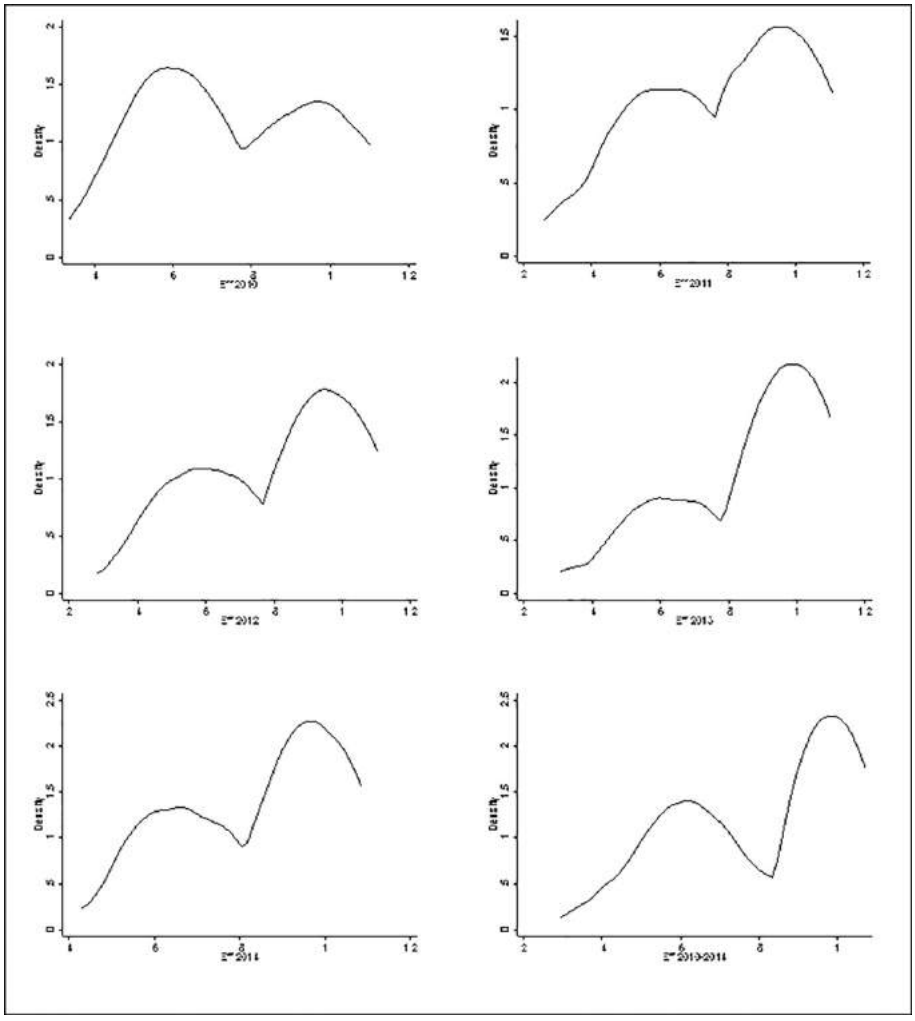

Figure 1. Panel with Kernel density estimates of efficiency scores.

efficiency in 2012, but had full efficiency in the subsequent year. This is due to lower costs in 2013, concomitantly with the increase of approximately 50% of revenues. In 2013, the club was runner-up of the "Sul-Americana" Cup, which may have impacted this result.

Table 4 shows the results of the regression model. We emphasize that we did not find evidence of multicollinearity (Variance Inflation Factor) between the independent variables or endogeneity (Hausman specification test) of the explanatory variables in relation to Eff. Estimates for the 4 models GEE: Independent-Binomial-Probit; Independent-Binomial-logit; Autoregression-Binomial-Probit and autoregressive-Binomial-logit showed converging results and all regressions were significant as Wald test<0.01. Table 4 presents estimated coefficients with their significance (after the marginal effects), the Wald test and the Quasi-likelihood under the Independence model Criterion (QIC) calculated for each model.

The QIC is a generalization of Akaike's information criterion, that the smaller the specification, the better is the econometric model (HARDIN; HILBER, 2003). Thus, considering that we have

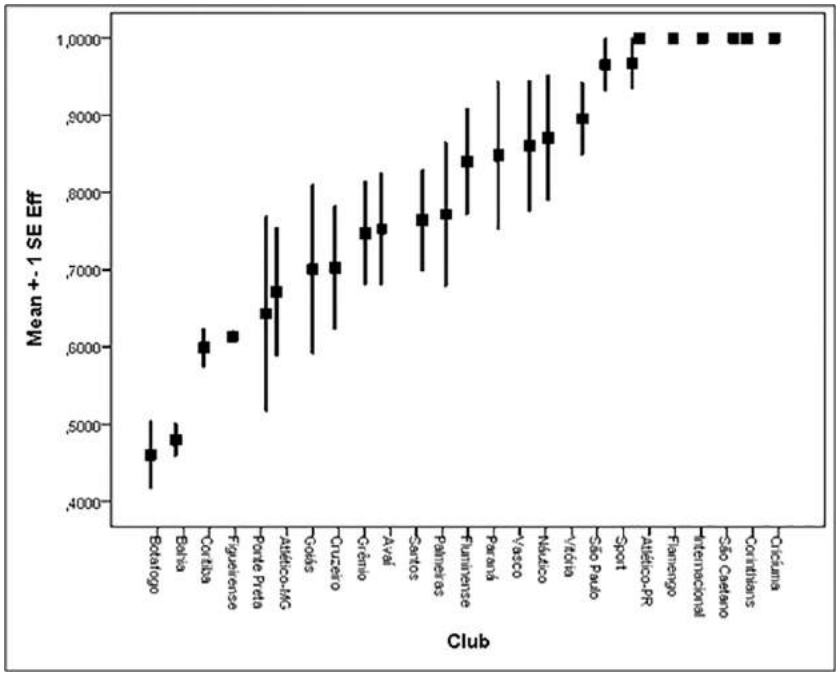

Figure 2. Efficiency score with clustered error bar by Club.

Table 4. Econometrics models results of dynamic efficiency (N = 125 observations).

Variable	Independent-Probit	Independent-Logit	Autorregressive--Probit	Autorregressive-Logit
LogAssets	0.081 (0.004)***	0.075 (0.005)***	0.038 (0.143)	0.034 (0.178)
LogAttendance	-0.075 (0.230)	-0.073 (0.236)	0.001 (0.985)	0.001 (0.997)
RjSp	-0.039 (0.693)	-0.039 (0.687)	0.004 (0.967)	-0.001 (0.999)
SulMin	-0.078 (0.332)	-0.072 (0.344)	-0.018 (0.832)	-0.009 (0.903)
LCup	0.111 (0.000)***	0.108 (0.001)***	0.088 (0.011)**	0.083 (0.016)**
4championship	0.062 (0.042)**	0.056 (0.059)*	0.063 (0.006)***	0.061 (0.006)***
Relegated	0.126 (0.000)***	0.118 (0.000)***	0.123 (0.000)***	0.118 (0.000)***
CBFPoints	-0.001 (0.454)	-0.001 (0.471)	-0.001 (0.168)	-0.001 (0.151)
Winner	0.061 (0.105)	0.061 (0.086)*	0.072 (0.012)**	0.071 (0.008)***
Aseries	-0.083 (0.089)*	-0.077 (0.111)	-0.022 (0.549)	-0.016 (0.670)
Trend	0.010 (0.426)	0.011 (0.366)	0.014 (0.217)	0.014 (0.199)
Wald test	95.38 (0.000)***	77.12 (0.000)***	55.77 (0.000)***	38.91 (0.000) ***
QIC	122.196	122.297	124.080	123.989

* Significant at 10%;** significant at 5%;***significant at 1%.

more than one possible correlation structure, we choose which displays the lowest QIC. Among the four models, the lowest QIC was 122.196 calculated for model developed from the independent correlation structure and link the Probit binomial family, which is the model chosen to test related hypotheses. The choice of the independent correlation structure confirms the presence of fluctuations in the efficiency score, in which the efficiency/inefficiency of a certain year is not necessarily the determinant factor for efficiency/inefficiency in another given year.

Within the market structure, the size of the club is associated with efficiency, because LogAssets variable showed a 0.081 coefficient and significant at 1%, indicating that each logarithmic unit of total assets, efficiency increases on average, 8.1%. This result rejects H1 and suggests a small economy of scale, following a different trajectory of Barros, Assaf and Araújo Júnior (2011). One possible explanation for the association between the efficiency of the clubs and their sizes is the explanation given by Barros and Rossi (2014) when they state that the biggest clubs have a greater ability to reduce inputs more efficiently and strategically that smaller clubs. In addition, the clubs in the "SérieA" Brazilian league are more efficient in this respect than other clubs in other divisions (DANTAS; MACHADO; MACEDO, 2015).

Another aspect of the market structure is a proxy representing the "clients" of clubs, in this case the attendance in stages measured by the logarithm of the public annual average of each club in the explanatory econometric model was not significant, thus rejecting H2. Our findings differ from those of Barros, Wanke and Figueiredo (2015), suggesting a reduction in costs with an increased public.

Contrary to our expectations, the H3, which is also in the market structure, was also rejected, as the variables representing the clubs with headquarters in the axis Rio-São Paulo and South-Minas resulted as non-significant. This finding suggests that efficiency is not associated with the location of the states that form most athletes. One possible explanation for this phenomenon may be in repatriations of athletes who were abroad and hiring athletes from other countries in South America, which increased the expenses and liabilities of the clubs in these two axes. This finding is also divergent with that of Barros, Assaf and Araujo Junior (2011) and Barros, Wanke and Figueiredo (2015) indicating a positive association efficiency with clubs in the metropolitan area and clubs in Rio-São Paulo, respectively.

Regarding the sporting factors associated with efficiency, participation in the "Libertadores" has a positive and significant association with elasticity of 0.111. This means that, by participating in this event, the clubs achieve an efficiency of 11.1% higher (on average). This finding does not reject H4 and follows the same trajectory of the study by Barros and Rossi (2014), with the effects of the participation of clubs in the UEFA Champions League, and can also be explained by the

greater potential for revenue generation among the participants of the "Libertadores", because it improves yields in various spheres, as box office, sponsorship and others.

The association between efficiency and the sporting performance measured by access to a higher division and demotion to a lower division are analyzed. Access to a higher division achieved a 0.062 and a significant coefficient of 5%, which suggests a positive association with efficiency and allows us to not reject H5. Our findings follow the same direction Barros, Assaf and Araújo Júnior (2011).

For those relegated to a lower division the coefficient was significant and positive, with the elasticity equal to 0.126, suggesting that the efficiency is on average 12.6% higher for relegated clubs, rejecting H6. This result is also different to our expectations, but Barros, Wanke and Figueiredo (2015) already indicated the existence of this phenomenon, when suggested that the scored points has a positive association with the costs.

In this case, an explanation for the positive association with relegation can be two aspects: 1) There is a hope that the fans of the clubs, when the clubs are relegated, strive in alternative income generation as fan partner and lottery. Furthermore, the number of fans is associated with improved cost efficiency (BARROS; WANKE; FIGUEIREDO, 2015). 2) Prudently, the club reduces the football department costs by limiting the quality of their team and making the sports results not satisfactory, effects that are fairly considered in an input-oriented structure.

Finally, other variables of sport performance that capture the differences in status between the clubs that were points in the CBF ranking, obtaining a title of the year and participation in "SérieA" showed no significant coefficients at 5%, nor is there a trend of change in efficiency over the years of the panel, also supported by the independent correlation structure.

5. CONCLUSIONS

This research aimed to structure an indicator of dynamic efficiency focused on fiscal responsibility strategy of Brazilian clubs and it explains this concept of efficiency through the market structure and sports performance. The efficiency of the clubs in Brazil, considering the prerogatives established by Law 13155/15, aims to advocate parameters for fiscal and financial responsibility and to avoid reckless management of professional sports entities, with more transparent and efficient management. We measure the efficiency of clubs using DSBM with variable returns of scale and input-oriented. Overall, the average results of the dynamic efficiency score was 0.8062 (DSBM model), results approximate to efficiency found in other recent study also applied in Brazilian football clubs, namely the Barros, Wanke and Figueiredo (2015); with average efficiency score of 0.820 (SFA model).

The general conclusion of this research is that strategically clubs should seek efficiency, taking the reduction of costs and debt into account. In addition, one should take into account that some features of market structure and sporting factors that have positive and significant associations with efficiency such as the size of the club; participation in the "Libertadores" and access to a higher division. The relegation to a lower division also has a positive association, but does not represent a desirable sports performance.

In practice, the results suggest a strategic alert to comply with Law 13155/15, considering a slight decrease in the average efficiency of the clubs in 2014 (compared to 2013) and investments in football arenas that are still compromising the indebtedness capacity of clubs. On the other hand, the size of the club's assets suggests an economy of scale that deserves to be observed with caution in the decision-making process, taking into account that some large clubs do not manage their equity and liabilities efficiently. Practical implications can also be drawn from the sports performance, such as: a) the natural strategic effort of the clubs to participate in the "Libertadores" Cup is a behavior that does not suggest risks to the compliance of Law 13155/15; b) the current strategy of restraint spending in the "fear management" to the risk of imminent relegation is not an obstacle to the sector's efficiency and converges with Coase's Theory of the Firm.

In analyzing the statements of clubs used in the research, we can observe the existing financial difficulties, especially regarding the generation of profits and growth of debt. As presented in 2014, there was a reduction of revenue and costs, but an increase in liabilities, which corroborates the modeling DSBM based on Law 13.155/15. Thus, it is believed that the new legislation will be an important step for Brazilian football, and following its prerogatives is an important strategy in maintaining the financial health of long-term clubs, in this case, future studies will proceed to study this phenomenon.

Unfortunately, the problem of data availability of Brazilian football clubs set the sample size and did not provide a segregation of important variables to be studied (eg intangible assets and revenue of associated fans). This problem has been responsible for important limitations present in this work, such as: a sample with 25 football clubs for the period 2010-2014, which can interfere with the robustness of the results; the assumption that the studied clubs have similar cost functions and the equity as a single variable transition that connects the periods over time (carry-over). Future studies could overcome the limitations mentioned, including the assumption that intangible assets of the players' talents are also carry-over.

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