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TAX AGGRESSIVENESS AND PROFITABILITY IN COMPANIES IN THE ELECTRIC POWER SECTOR IN BRAZIL

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ABSTRACT

This study aimed to analyze the influence of tax aggressiveness on the ability to generate profit in companies in the electric power sector listed in B3 in the period from 2013 to 2018. This is descriptive, quantitative, documentary and bibliographic research. The sample includes 37 companies during the period studied, forming a total of 222 observations. BTD (Book Tax Differences) and GAAP ETR (Generally Accepted Accounting Principles, Effective Tax Rate) were used as a metric for tax aggressiveness and NM (Net Margin), ROA (Return on Assets) and ROI (Return on Investment) as indicators of profitability. The results were achieved by means of descriptive statistics of the data, linear regression analysis, in which a panel model with random effects was applied, and quantile regression analysis. With the result it was found that, in general, the higher the level of tax aggressiveness, the higher the profitability indexes. This study aims to contribute to companies in the electric power sector to verify the efficiency of the use of aggressive tax planning, supporting decision making.

Keywords: Tax aggressiveness. Profitability. Tax Planning.

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1 INTRODUCTION

Brazil was considered the second country with the highest tax burden in Latin America in 2016, reaching 32.43% of the Gross Domestic Product (GDP) in 2017 (Federal Revenue of Brazil, 2018). With the high incidence of taxes in Brazil, it is essential that companies bet on a well-designed tax planning as a way to reduce tax expenses and thus maximize profits.

For Tang (2005), the high tax burden affects the performance of companies, since these charges negatively affect the return on investment and impact cash flow in the same way. In a complementary way, Machado (2011) states that the objective of tax management is to reduce the tax impact on organizations through legal forms, increasing their market value and maximizing their performance.

Schäfer, Konraht and Ferreira (2016) corroborate this reasoning by stating that companies in the electric power sector, which distributed more wealth in the period between 2007 and 2013, have a lower tax burden when compared to companies in the sector that generated less wealth. On the other hand, Ozorio (2015) points out that the Brazilian electric power sector has undergone significant changes, and it is necessary to increase efficiency in the use of its financial resources.

Shevlin, Edwards and Schwab (2013) and Martinez and Silva (2018) state that the scenario of financial restrictions is linked to higher levels of tax aggressiveness, since companies seek to avoid the state of insolvency through the tax economy.

Faced with this situation, the electric power sector was chosen for this study, considering the research by Gupta and Newberry (1997), Tang (2005), Desai and Dharmapala (2006), Chen, Chen, Cheng and Shevlin (2010) and Araújo and Leite Filho (2018), in order to investigate the relationship between tax aggressiveness and profitability, and also in order to reduce the impact of the disparity in profitability indices caused by the sector in which companies operate, since naturally a branch of activity may be more profitable than another (Padoveze & Benedicto, 2007; Matarazzo, 2010). In addition, the significant influence of the electric power sector in the national market, as well as in the development of society, is also emphasized (Rosental & Castro, 2016).

Therefore, it sought to answer the following question: how can tax aggressiveness impact the profitability of companies in the electric power sector listed in B3? Thus, this study aims to analyze the influence of tax aggressiveness on the ability to generate profit in companies in the electric power sector listed in B3 in the period from 2013 to 2018, in order to ascertain whether tax planning with a higher level of aggressiveness can be differential factor to contribute with the profit of the companies of the electric sector.

The study is relevant given the importance of the topic in the current global economic situation, in which the tax burden can directly influence the performance of organizations (Tang, 2005; Machado, 2011; Araújo & Leite Filho, 2018). Through this study, investors and managers of organizations in the electric power sector can identify whether tax aggressiveness is directly linked to the increase in corporate profitability, in order to support the investment option or the tax planning adopted.

2 THEORETICAL FRAMEWORK

2.1 Tax planning and tax aggressiveness

For Rezende and Nakao (2012), tax planning means choosing a lawful alternative prior to the occurrence of the taxable event, with the objective of reducing the tax burden and increasing profit. For Martinez (2017), tax planning aims to reduce tax obligations, taking advantage of the concessions and exemptions provided for in tax legislation, involving the company's operational organization, in order to minimize the amount spent on taxes.

Tax aggressiveness, for Frank, Lynch and Rego (2009) and Chen *et al.* (2010), is the manipulation of taxable profit downwards, without taking into account the legality of the procedure. According to Martinez (2017), the degree of tax aggressiveness measures the impetus to reduce the incidence of explicit taxes. As the degree of aggressiveness increases, the tax risk also increases, especially when the taxable person exceeds the limit of tax avoidance and begins to practice tax evasion, which consists of an illegal act (Lietz, 2013). However, it becomes difficult to understand the limit of tax avoidance, since there is no consensus on the definition of "tax evasion" or "tax aggressiveness" (Hanlon & Heitzman, 2010).

2.2 Measures of tax aggressiveness

2.2.1 Book Tax Difference (BTD)

BTD is the name used to indicate the differences between accounting profit and taxable profit (Ferreira, Martinez, Costa & Passamani, 2012). Such differences are generated by the distinctions between accounting and tax rules: these are prepared according to tax legislation (Hanlon & Heitzman, 2010), while those are governed by generally accepted accounting principles (GAAP's).

Another reason that contributes to BTD's existence is earnings management, which may come from management over accounting profit and/or management practices over taxable profit (Ferreira *et al.*, 2012). The accounting profit can be manipulated by the administrators with the purpose of serving the financial market, in order to influence the reliable representation of the company's situation (Rezende & Nakao, 2012). On the other hand, tax management occurs when managers manipulate legal ambiguities and uncertainties to benefit the company (Formigoni, Antunes & Paulo, 2009).

For BTD calculation purposes, this study will use the model proposed by Martinez and Passamani (2014), also used by Carvalho (2015) and, later, by Araújo and Leite Filho (2018), according to Equation 1:

$$\text{BTD Total}_{i,t} = \frac{\text{LAIR}_{i,t} - (\text{Expense IRPJ}_{i,t} \text{ and CSLL}_{i,t})/0{,}34}{\text{Total Assets}_{i,t}} \quad (1)$$

Where: Total BTD i,t = Total BTD of company i in period t

Martinez and Passamani (2014) explain the exposed calculation methodology, in which the difference between LAIR (Profit Before Income Tax (IRPJ) and Social Contribution (CSLL)) is calculated by accounting standards while the calculation of real profit is based on tax rules. To arrive at the basis for calculating the real profit, the authors estimate the rate of IRPJ and CSLL at 34%, of which 15% are inherent to IRPJ, 10% are additional and IRPJ and to which 9% of CSLL is added. Finally, the result is normalized by the total assets. In this case, the higher the value of BTD, the greater the level of tax aggressiveness of the company. It is possible to obtain negative values when the accounting profit is lower than the taxable profit (Hanlon, 2005).

2.2.2 Generally Accepted Accounting Principles Effective Tax Rate (GAAP ETR)

According to Hanlon and Heitzman (2010) and Dunbar, Higgins, Phillips and Plesko (2010), ETR is a proxy used to indicate the degree of aggressive tax planning in companies. ETR also measures the effectiveness of tax planning, since effective planning results in an index lower than the nominal rate of income taxes (Shackelford & Shevlin, 2001).

The calculation of the ETR consists of dividing the Income Tax and Social Contribution Expense by the Accounting Profit: the higher the result, the lower the company's level of aggressiveness. Consequently, companies with less ETR are more tax aggressive, since the value

obtained will represent the actual tax rate (Shackelford & Shevlin, 2001; Tang, 2005; Hanlon & Heitzman, 2010, Martinez, 2017).

Hanlon and Heitzman (2010) expose, from the financial statements, some variations of the ETR: GAAP ETR, Cash ETR, Current ETR, LongRun Cash ETR, ETR Differencial. GAAP ETR, the proxy used in this study, is the measure of total tax expense per monetary unit of accounting profit. According to Martinez (2017), the metrics of aggression related to the effective tax rate are the most usual, among which the GAAP ETR is the most used to indicate the degree of aggressiveness.

To calculate GAAP ETR, according to Hanlon and Heitzman (2010), Equation 2 is used:

$$\text{GAAP ETR} = \frac{\text{Total expenses with IRPJ and CSLL}}{\text{Result before IRPJ and CSLL (LAIR)}} \quad (2)$$

Like the study by Araújo and Leite Filho (2018) and Chytis, Tasios and Gerantonis (2018) and Martinez and Silva (2020), in this research the ETR is used to measure the level of tax aggressiveness, in order to analyze the relationship of this proxy with the profitability of companies. However, in this study, the variation of this indicator is GAAP ETR.

2.3 Profitability measures

For this study, based on Katz, Khan and Schmidt (2013), Li, Liu and Ni (2017), Araújo and Leite Filho (2018) the Net Margin (NM), Return on Assets (ROA) and Return on Investment (ROI), will be used as variables to measure the profitability of companies.

The net margin compares the net profit earned with the total sales revenue, in order to show how much net profit was obtained for each monetary unit of sales revenue (Gitman, 2010). To calculate the NM, according to Gitman (2010), Equation 3 is adopted:

$$\text{NM} = \frac{\text{Profits available to ordinary shareholders}}{\text{Sales revenue}} \quad (3)$$

According to Assaf Neto (2012), the Net Margin is useful to measure the overall efficiency of the company, since it indicates for each monetary unit of the sales revenue how much was used to cover costs and expenses and how much profit was produced for the organization.

ROA is a measure that calculates the return obtained in relation to investment in assets, being able to determine the investment decision making, since it also has the function of evaluating the operational efficiency of the company. It is calculated according to Equation 4 (Assaf Neto, 2012).

$$\text{ROA} = \frac{\text{Profits generated by assets (operating)}}{\text{Average total assets}} \quad (4)$$

According to Matarazzo (2010), ROI represents the ability to gain on invested capital, that is, the higher the better. This rate is also used to measure the overall efficiency of the company's management, as it evaluates profit generation (Kassai, Kassai, Santos & Assaf Neto, 2000).

According to Assaf Neto (2012), ROI is calculated according to Equation 5:

$$\text{ROI} = \frac{\text{Net operanting income from IR and CSLL}}{\text{Average investment}} \quad (5)$$

Where: Investment = Total Assets - Operating Liabilities

Kassai *et al.* (2000) state that ROI is the simplest measure of return on investment, being used to evaluate the return on invested resources, showing the comparison of operating profit with financial liabilities and the investment made.

2.4 Relationship between tax aggressiveness and profitability

According to Santana (2014), tax planning aims to contribute to the economic and financial performance of a company, maximizing the return obtained by investors. The more aggressive the company, that is, the greater its impetus to reduce the tax burden in its planning, the more profits will be available to distribute to the partners (Hanlon & Slemrod, 2007; Frank *et al.*, 2009; Machado, 2011).

Katz *et al.* (2013) investigated the relationship between tax aggressiveness and companies' current and future profitability. For this, they used an association between future ROA, net operating profit margin, net turnover of current operating assets and leverage of operating liabilities. It was identified that, on average, despite the higher return before taxes on net equity, in relation to the associated indexes, the more aggressive companies tend to have lower future profitability compared to companies that are not tax aggressive.

Araújo and Leite Filho (2018) analyzed the relationship between the level of tax aggressiveness and the profitability of companies listed on the Brazilian and American stock exchanges. They used ROA as a measure of profitability and BTD and ETR as measures of tax aggressiveness. After statistical analysis of the data, it was possible to verify that, on average, the level of tax aggressiveness negatively influences companies' profitability.

There is no consensus on the influence of tax aggressiveness on corporate profitability. Gupta and Newberry (1997) and Chen *et al.* (2010) found a positive relationship between ETR and ROA, that is, the better the performance, the greater the tax burden. Studies by Tang (2005) and Desai and Dharmapala (2006), on the other hand, show a negative relationship between the indices.

Thus, based on research by Gupta and Newberry (1997) and Chen *et al.* (2010), which indicate a negative relationship between tax aggressiveness and performance, as well as the studies by Tang (2005) and Desai and Dharmapala (2006), the following hypotheses are admitted in the study:

– H_1: The degree of tax aggressiveness impacts the ROA of companies in the electric power sector listed in B3.
– H_2: The degree of tax aggressiveness impacts the ROI of companies in the electric power sector listed in B3.
– H_3: The degree of tax aggressiveness impacts the NM of companies in the electric power sector listed in B3.

3 METHODOLOGY

3.1 Typology, population and sample

For the development of methodological procedures, the research is classified as descriptive, quantitative, documentary and bibliographic.

The population is comprised of companies in the public utilities group in the electric power sector listed in B3, totaling 59 companies, among which 17 were excluded for not having shares being traded and 5 companies for having been constituted to operate in areas not linked to electric power production chain (these are companies that operate as a holding company), which is comprised of the generation, commercialization, transmission and distribution branch. In total, data from 37 companies from the period 2013 to 2018 will be used, adding up to 222 observations.

3.2 Identification of variables and procedures for data collection, treatment and analysis

The data collection files were extracted from the B3 website, quantified and tabulated in an electronic spreadsheet. Afterwards, the aggressiveness indices (BTD, GAAP ETR) were calculated as independent variables, the profitability indices (NM, ROI and ROA) as dependent variables and control variables (LEV, SIZE and PPE). Then, descriptive statistics covering average, median, standard deviation, minimum and maximum values were used to better understand the data worked. To verify the relationship between the aggressiveness and profitability indices, linear regression in unbalanced panel was used according to the proposed models, as well as quantile regressions, aiming to solve problems with the presence of heteroscedasticity of the variables.

Table 1 presents the variables used in the research that constitute the econometric models to be presented, as well as demonstrating the calculation methodology adopted to measure the variables.

Table 1
Variables used in the research

Variables		Type	Calculation
Profitability	ROA	Dependent	Operating Income Divided by Previous Year's Assets
	ROI	Dependent	Net Operating Income from IR and CSLL / Average Investment
	NM	Dependent	Profit available to ordinary shareholders / Sales Revenue
NAGG	GAAP ETR	Independent	Total expenses with IRPJ and CSLL / Income before IRPJ and CSLL
	BTD	Independent	(Profit before income tax - Actual profit) / Total assets
Size	SIZE	Control	Natural logarithm of the company's total assets at the beginning of the year
Capital Intensity	PPE	Control	The company's net fixed assets divided by the total assets
Leverage	LEV	Control	Long-term debt divided by the previous year's total assets

Note. ROA = return on assets; NAGG = variable that indicates level of tax aggressiveness; SIZE = variable that indicates the size of the company; PPE = investment in assets (plants, properties and equipment); LEV = financial leverage index.
Source: Own elaboration (2019)

3.2.1 Independent variables - Level of Tax aggressiveness (NAGG)

In the case of the BTD proxy, it is considered that the higher the value of the variable, the greater the level of tax aggressiveness (Martinez & Dalfior, 2016). For ETR, the lower the index, the greater the tax aggressiveness, since it represents the effective tax rate (Shackelford & Shevlin, 2001; Tang, 2005; Hanlon & Heitzman, 2010, Martinez, 2017).

To eliminate outliers that distort ETR, the methodology used by Gupta and Newberry (1997) and Araújo and Leite Filho (2018) was adopted, according to which negative ETR values assume zero value and ETR values greater than one assumes value one. That is, in this research, the values referring to the ETR will be in the range [0.1]: the value of zero suggests absence of taxation and 1 indicates an effective taxation rate of 100%.

3.2.2 Dependent variables - Profitability ratios (NM, ROI, ROA)

According to Machado (2011) and Santana (2014), the objective of tax planning is to maximize the return obtained by investors. Therefore, the profitability indexes must also demonstrate the result of the set of measures adopted to reduce the tax burden (Carvalho, 2015). Thus, profitability indices are commonly used in the literature as a type of verification of the efficiency of tax planning (Katz *et al.*, 2013; Araújo & Leite Filho, 2018).

3.2.3 Control variables

From the studies carried out by Gupta and Newberry (1997), Richardson and Lanis (2007), Guimarães, Macedo and Cruz (2016), Araújo and Leite Filho (2018) and Martinez and Brito (2019), the variables SIZE (Size), PPE (Plants, properties and equipment) and LEV (Leverage) were established.

Reinders and Martinez (2018) indicate that larger companies tend to be less tax aggressive, while smaller companies tend to be the opposite. Lopes (2012) justifies that, because of the greater potential for harm to society, the authorities are stricter when monitoring larger companies. Therefore, the variable SIZE will be used, which is calculated from the natural logarithm of the total asset, in a manner equivalent to the methodology adopted in the studies of Gupta and Newberry (1997), Richardson and Lanis (2007) and Araújo and Leite Filho (2018).

Gupta and Newberry (1997), Richardson and Lanis (2007) and Chen *et al.* (2010) found evidence that the greater the investment in fixed assets, the lower the amount of taxes paid. According to the authors, it can be inferred that the relationship occurs due to the possibility of deducting depreciation in the calculation of taxes and the incentives offered at the time of major investments. To measure the degree of investment, Araújo and Leite Filho (2018) used the variable capital intensity (PPE), which corresponds to the division of net fixed assets by total assets (Gupta & Newberry, 1997; Araújo & Leite Filho, 2018).

According to Frank *et al.* (2009) and Chen *et al.* (2010), higher levels of leverage may reflect an aggressive tax planning, aiming at reducing the net tax burden and, consequently, higher levels of tax aggressiveness. Still, Gupta and Newberry (1997) state that there is a relationship between leverage and tax aggressiveness, so that the higher the leverage, the lower the effective rate of taxes levied.

Therefore, this study considers leverage as a control variable, based on the studies by Gupta and Newberry (1997), Richardson and Lanis (2007), Frank *et al.* (2009) and Araújo and Leite Filho (2018), in which the measurement of leverage was due to the long-term debt divided by the total assets of the previous year.

3.4 Presentation of linear regression model

In order to meet the research objectives, based on the studies of Gupta and Newberry (1997), Richardson and Lanis (2007), Guimarães, Macedo and Cruz (2016) and Araújo and Leite Filho (2018), the estimation models were elaborated according to Equations 6, 7 and 8, described below:

$$NMit = \beta 0it+\beta 1NAGGit+\beta 2SIZEit+\beta 3PPEit+\beta 4LEVit+\varepsilon it \quad (6)$$

$$ROIit = \beta 0it+\beta 1NAGGit+\beta 2SIZEit+\beta 3PPEit+\beta 4LEVit+\varepsilon it \quad (7)$$

$$ROAit = \beta 0it+\beta 1NAGGit+\beta 2SIZEit+\beta 3PPEit+\beta 4LEVit+\varepsilon it \quad (8)$$

In addition, to measure the level of tax aggressiveness (NAGGit) the BTD and GAAP ETR proxies were used, so that each econometric model was tested twice, once for each variable of tax aggressiveness. With this model, it is intended to obtain as a result the immediate impact of tax aggressiveness on profitability.

4 ANALYSIS OF RESULTS

4.1 Descriptive analysis of the data

Table 2 shows the descriptive statistics of the adopted variables. For this table, data from 2013 to 2018 from 37 companies were used, thus making a total of 222 observations. It is

noteworthy that for all variables treated in Table 2, high values of standard deviation were found. This is attributed to the heterogeneity already commonly found in accounting and financial data (Brito & Vasconcelos, 2004; Duarte, Girão & Paulo, 2016).

Table 2
Descriptive statistics of the sample, from 2013 to 2018

Variables	Average	Median	Standard deviation	Minimum value	Maximum value	Observations
NM	0.068866	0.068276	0.292813	−2.279834	0.671417	222
ROA	0.030257	0.032889	0.075056	−0.389008	0.328488	222
ROI	0.070834	0.083457	0.304309	−3.124814	1.159551	222
GAAP ETR	0.246250	0.198283	0.238625	0.000000	1.000000	222
BTD	0.077330	0.074319	0.113578	−0.410675	0.498871	222
LEV	0.454653	0.435930	0.221223	0.033087	2.295940	222
ASSETS	12456077906	7240421000	19235558867	17463000	181210208000	222
PPE	0.542578	0.550344	0.203667	−0.550474	0.952886	222

Source: Research data (2019)

According to Table 2, an average NM of 6.8866% is observed in the profitability variables, a percentage that represents the gross revenue that was converted into profit. In the ROA variable, a return of 3.0257% on the asset value was obtained. As for ROI, a return of 0.070834 cents was obtained for each real invested.

In the case of tax aggressiveness variables, the ETR presented an average tax burden of 24.625%, lower than the rate applied on the profit of companies in the sector, which is 34%. As for BTD, a positive difference was identified between accounting profit and taxable profit: for each real of assets, a difference of 0.077330 cents between profits is obtained. BTD's positive average value indicates that, on average, companies have higher accounting profit than tax profit, which, in turn, results in a lower tax burden.

As for the control variables, an average LEV value of 0.4554653 was obtained, and for PPE, an average of 0.542578. The size variable, on this occasion represented by the total asset value, presented an average of approximately 12.456 billion.

4.2 Regression analysis

For the analysis, an unbalanced panel regression model was used. Due to the problems of autocorrelation and heteroscedasticity identified, robust Newey-West standard errors were estimated. In order to define the most suitable panel to analyze the data, the Chow, Breusch Pagan and Hausman tests were performed, whose results indicated that the estimation through random effects was the most adequate. It is noteworthy that due to the heteroscedasticity of the variables, the relations of significance change between the quantiles and, therefore, the results of the existing relations should not be generalized.

4.2.1 Analysis of the relationship between NAGG and NM

Table 3 shows that, on average, there is a positive significance of 10% of GAAP ETR (0.1923) in NM, which indicates that the higher the level of aggressiveness, the lower the NM. However, this relationship is not confirmed when the quantiles are examined, which suggests that there is no significant relationship when companies are segregated into groups of different levels of profitability.

On average, a positive statistical significance ratio of 1% of the NM with the PPE (0.4106) was also identified, confirmed in all quantiles. Therefore, the greater the investment and asset, the greater the NM. It is also possible to visualize a positive ratio of 1% in quantile 25, negative of 1% in quantile 75 and also negative of 5% in quantile 50 between the variable SIZE and NM, indicating that for companies with lower NM, the larger the company, greater the NM.

For companies with NM values close to or above the average, the relationship is reversed. The other variables used in this research were not statistically significant when related to NM.

Table 3
Regression equation and quantile regression of variable NM and variable of interest GAAP ETR

Variables	Robust Random		Quantile Regression		
NM	Effects Panel		Quantil.25	Quantil.50	Quantil.75
GAAP ETR	0.1923*		0.0328	−0.0091	−0.0336
LEV	0.2712		0.0363	−0.005	0.0078
SIZE	0.0021		0.0196***	−0.0119**	−0.0328***
PPE	0.4106***		0.2782***	0.3464***	0.4515***
Const	−0.3733		−0.6115***	0.1655	0.6694***
F test	0.0000	*Pseudo* R²	0.0661	0.0865	0.1815
Between R²	0.0867	Obs.	222	222	222
Obs.	222				

Note. *, ** and *** indicate significance of 10%, 5% and 1%, respectively. ** Robust standard errors estimated with correction for autocorrelation and Newey-West heteroscedasticity.
Source: Research data (2019)

Table 4 shows that, on average, there is a positive significance of 1% of BTD (1.5109) in NM. However, the result differs from the GAAP ETR and NM ratio as shown in Table 3. In addition to an average significance level of 1%, a positive relationship was identified between tax aggressiveness and NM, indicating that companies with greater aggressiveness have better NM rates, contrary to the previous result. The 1% significance ratio between NM and BTD is repeated in all quantiles. Therefore, the results differ from Gupta and Newberry (1997), Richardson and Lanis (2007), Chen *et al.* (2010) and Araújo and Leite Filho (2018) corroborating Tang (2005) and Desai and Dharmapala (2006).

In terms of leverage, a positive average relationship was identified with a significance of 10%, so that the greater the leverage, the greater the NM. However, examining the quantiles, only the 25 and 50 quantiles are significant, both of 1%. An inverse relationship was also identified with the variable SIZE in quantiles 50 and 75, indicating that the larger the company, the lower the NM. PPE showed a positive 1% significance level in the quantile 75. In this quantile, the greater the investment in assets, the greater the NM. The other variables were not statistically significant.

Table 4
Regression equation and quantile regression of the NM variable and variable of interest BTD

Variables	Robust Random Effects Panel		Quantile Regression		
NM			Quantil.25	Quantil.50	Quantil.75
BTD	1.5109***		1.1788***	1.1754***	1.2110***
LEV	0.2444*		0.1149***	0.0885***	0.0841
SIZE	0.0106		−0.0049	−0.0093***	−0.0196**
PPE	0.0806		−0.0098	0.0247	0.0708***
Const	−0.2281		0.0012	0.1393	0.3926
F test	0.0000	*Pseudo* R²	0.2705	0.2919	0.3105
Between R²	0.6537	Obs.	222	222	222
Obs.	222				

Note. *, ** and *** indicate significance of 10%, 5% and 1%, respectively. ** Robust standard errors estimated with correction for autocorrelation and Newey-West heteroscedasticity.
Source: Research data (2019)

The relationship between BTD and NM was positive, as well as the relationship between ETR and NM, so that the first indicates that the greater the aggressiveness, the greater the NM

and the second, the opposite. The differences between BTD and ETR also occur in Ramalho and Martinez (2014). However, in this work, the difference is attributed to the nature of the proxies used.

4.2.2 Analysis of the relationship between NAGG and ROA

Table 5 shows an average 5% positive correlation between GAAP ETR (0.0472) and ROA. That is, more aggressive companies, on average, have lower ROA. This relationship is not confirmed in any quantile, in which there is no statistical significance, which is justified by the heterogeneity of accounting and financial data. This result corroborates Araújo and Leite Filho (2018) and Chytis, Tasios and Gerantonis (2018).

The SIZE variable is not statistically significant when the average is analyzed. However, quantile 25 indicates a positive relation of significance of 1%, while quantile 75 indicates a negative relation also with a significance of 1%, suggesting a positive relation between SIZE and ROA in smaller companies and a negative relation of these indexes in larger companies. In this case, the quantile analysis allows us to state that the result obtained in quantile 75 on the ROA and SIZE relationship corroborates Quirino, Moreira, Melo and Mól (2018), while quantile 25 contradicts them.

A positive relationship was also identified, with a significance of 1%, of the ROA with the PPE (0.1788), corroborating Araújo and Leite Filho (2018). The relationship with the PPE was confirmed in all quantiles, in which the same level of significance was obtained. This indicates that companies, when increasing investments in assets, also increase the return on them in the average proportion of 0.1788 cents for each real invested. In addition, according to Table 5, it was not possible to identify a statistically significant relationship in the case of the LEV control variable.

Table 5
Regression equation and quantile regression of the variable ROA and variable of interest GAAP ETR

Variables	Robust Random Effects		Quantile Regression		
ROA	Panel		Quantil.25	Quantil.50	Quantil.75
GAAP ETR	0.0472**		0.0164	−0.0182	0.0102
LEV	0.0515		0.0101	0.0041	−0.0189
SIZE	0.0027		0.0110***	−0.0000	−0.0080***
PPE	0.1788***		0.1748***	0.1468***	0.1069***
Const	−0.1645		−0.3517***	−0.0395	0.1964***
F test	0.0000	*Pseudo* R^2	0.1257	0.1050	0.1290
Between R^2	0.2400	Obs.	222	222	222
Obs.	222				

Note. *, ** and *** indicate significance of 10%, 5% and 1%, respectively. ** Robust standard errors estimated with correction for autocorrelation and Newey-West heteroscedasticity.
Source: Research data (2019)

The analysis of Table 6, which deals with the relationship between ROA and BTD, contradicts the results found in Table 5, showing a positive relationship with a 1% significance between ROA and BTD (0.4374). That is, the more tax-aggressive the company is, the greater the return on the asset. The result is confirmed in all quantiles.

On average, the PPE and ROA ratio has no statistical significance. However, by examining the quantiles, it is possible to identify a relationship with a 1% significance in the quantile 25 (0.0605), in the quantile 50 (0.0256) of 5% and in the quantile 75 (0.0261) of 1%, which corroborates Araújo and Leite Filho (2018). The relationship between ROA and PPE, when verifying the quantiles, confirms the data in Table 5, indicating that the greater the investment in assets, the greater the return on them.

Leverage, on average, did not show static significance. However, in quantile 75, a positive 1% relationship with ROA was identified, so that the greater the leverage, the greater the return on the asset. The SIZE variable, on the other hand, did not present, on average, statistical significance. However, at quantile 75 it presented a negative relation with a significance of 1%, so that the larger the company, the lower the return on fixed assets.

Table 6
Regression equation and quantile regression of the variable ROA and variable of interest BTD

Variables	Robust Random Effects	Quantile Regression			
ROA	Panel		Quantil.25	Quantil.50	Quantil.75
BTD	0.4374***		0.5002***	0.5777***	0.5936***
LEV	0.0336		0.0133	0.0007	0.0252***
SIZE	0.0198**		0.0012	0.0001	−0.0033***
PPE	0.0577		0.0605***	0.0256**	0.0261***
Const	−0.4990**		−0.0864	−0.0265	0.0537**
F test	0.0000	*Pseudo* R²	0.4593	0.5041	0.5431
Between R²	0.5405	Obs.	222	222	222
Obs.	222				

Note. *, ** and *** indicate significance of 10%, 5% and 1%, respectively. ** Robust standard errors estimated with correction for autocorrelation and Newey-West heteroscedasticity.
Source: Research data (2019)

Similar to the result of the NAGG and NM comparison, the relationship between NAGG and ROA also presents contradictions that are again attributed to the nature of the aggressiveness proxies used. However, in this case the positive relationship between BTD and ROA is more significant (1%) since the significance of the relationship between GAAP ETR and ROA is 5% and is not confirmed in any of the quantiles. Therefore, the relationship is considered stronger: the impact shows that the more aggressive the company, the higher the ROA. This result is similar to those found by Tang (2005), Desai and Dharmapala (2006) and Castro and Flach (2013).

4.2.3 Analysis of the relationship between NAGG and ROI

In Table 7, on average, no statistically significant relationship was found. However, in the case of the GAAP ETR and ROI relationship, a negative relationship was identified in quantile 50 (−0.0840) with a significance of 5% and in quantile 75 (−0.1356) with a significance of 1%. The result indicates that in quantiles 50 and 75 the most aggressive companies have a higher ROI.

Analyzing the averages, the variables SIZE and PPE did not show statistical significance. However, the SIZE variable showed a positive significance of 5% in quantile 25 and a negative significance of 1% in quantile 75. PPE, on the other hand, presented a positive significance of 1% in quantile 25 and negative also of 1% in quantile 75. These results indicate that the higher the SIZE and PPE in the quantile 25, the higher the ROI. In quantile 75, the relationship is inverse: the higher the SIZE and PPE, the lower the ROI. LEV was not statistically significant.

Table 7
Regression equation and quantile regression of the variable ROI and variable of interest GAAP ETR

Variables	Robust Random	Quantile Regression			
ROI	Effects Panel		Quantil.25	Quantil.50	Quantil.75
GAAP ETR	0.1008		0.0005	−0.0840**	−0.1356***
LEV	0.2045		0.0297	−0.0477	−0.0645
SIZE	0.0092		0.0171**	0.0033	−0.0181***
PPE	0.2844		0.2118***	−0.0109	−0.2266***
Const	−0.4101		−0.5043***	0.0584	0.7542***
F test	0.8391	*Pseudo* R²	0.0213	0.0156	0.0489
Between R²	0.0016	Obs.	222	222	222
Obs.	222				

Note. *, ** and *** indicate significance of 10%, 5% and 1%, respectively. ** Robust standard errors estimated with correction for autocorrelation and Newey-West heteroscedasticity.
Source: Research data (2019)

Table 8, in turn, shows the relationship between ROI and BTD: it shows a positive relationship of 1% statistical significance. This is confirmed in all quantiles and suggests that more aggressive companies have a higher ROI and, consequently, less aggressive companies have a lower ROI.

There is also a positive relation of 1% of statistical significance in all the quantiles of the LEV variable, which suggests, through the quantile analysis, that the greater the leverage, the greater the ROI. However, this relationship is not confirmed in the panel regression analysis. The SIZE variable showed a negative statistical significance ratio of 10% in quantile 50 and 1% in quantile 75. It also did not show statistical significance when observing panel regression analysis. The PPE showed a negative relation with a significance of 1% in quantiles 50 and 75, indicating that the greater the investment in depreciable assets, the lower the ROI. In addition, considering the panel regression analysis, again, no statistical significance was found.

Table 8
Regression equation and quantile regression of the ROI variable and variable of interest BTD

Variables	Robust Random Effects	Quantile Regression			
ROI	Panel		Quantil.25	Quantil.50	Quantil.75
BTD	1.6787***		1.1542***	1.2506***	1.3693***
LEV	0.2530		0.1314***	0.0928***	0.0720***
SIZE	0.0002		0.0010	−0.0049*	−0.0096***
PPE	−0.1636		−0.0138	−0.1558***	−0.2517***
Const	−0.0913		−0.1160	0.1468**	0.3346***
F test	0.8391	*Pseudo* R²	0.3423	0.3957	0.5431
Between R²	0.7350	Obs.	222	222	222
Obs.	222				

Note. *, ** and *** indicate significance of 10%, 5% and 1%, respectively. ** Robust standard errors estimated with correction for autocorrelation and Newey-West heteroscedasticity.
Source: Research data (2019)

When analyzing Tables 7 and 8, there is a positive relationship between tax aggressiveness and ROI. In the case with the BTD variable, an average positive relationship was obtained in all quantiles. GAAP ETR, on the other hand, presented a strong negative relationship exclusively in the quantile 75 and a negative average relationship in the quantile 50, which corroborates the result of the BTD and ROI relationship. The reason why GAAP ETR does not show significance on average can be attributed to the heterogeneity of accounting and financial data, as already mentioned. The results found corroborate Tang (2005), Desai and Dharmapala (2006) and Castro and Flach (2013).

Table 9 summarizes the results of the analysis of the Robust Random Effects Panel, and Table 10, the results of the Quantile Regression analysis. The need to observe the quantile analysis together due to the heteroscedasticity of the variables is emphasized.

Table 9
Summary of the results of the Robust Random Effects Panel analysis

Hypothesis	Profitability Variable	Tax Aggressiveness Variable	Relationship Found	Significance obtained
H_1	NM	GAAP ETR	Negative	10%
H_1	NM	BTD	Positive	1%
H_2	ROA	GAAP ETR	Negative	5%
H_2	ROA	BTD	Positive	1%
H_3	ROI	GAAP ETR	No significance	No significance
H_3	ROI	BTD	Positive	1%

Source: Research data (2019)

Table 10
Summary of the results of the Quantile Regression analysis

Hypothesis	Profitability Variable	Tax aggressiveness Variable	Relationship Found	Significance obtained
H_1	NM	GAAP ETR	No significance	No significance
H_1	NM	BTD	Positive	1%
H_2	ROA	GAAP ETR	No significance	No significance
H_2	ROA	BTD	Positive	1%
H_3	ROI	GAAP ETR	Positive in quantiles 50 and 75	5% and 10%
H_3	ROI	BTD	Positive	1%

Source: Research data (2019)

It is possible to state that there is a positive relationship between profitability and tax aggressiveness when using the BTD metric, since the relationship found in the Robust Random Effects Panel is confirmed by the Quantile Regression analysis. When using the GAAP ETR metric, the results of the Robust Random Effects Panel analysis are not confirmed by the Quantile Regression analysis. However, on average, it is possible to identify a negative relationship when comparing them with NM and ROA. As for ROI, there is a positive relationship with tax aggressiveness in quantiles 50 and 75 when using the GAAP ETR proxy.

5 CONCLUSION

This research aimed to analyze the influence of tax aggressiveness on the profitability of companies in the electric power sector listed in B3, considering the period from 2013 to 2018. It is noteworthy that the objective was achieved after descriptive, quantile and linear regression analysis of the data. Thus, regarding regression models, to measure aggressiveness, the GAAP ETR and BTD proxies were used and for profitability, the variables NM, ROA and ROI and SIZE, LEV and PPE were used as control variables. After analyzing the data, it was possible to verify the significant impact of tax aggressiveness on the studied profitability indices.

Analyzing the data of the linear regression, there is a significant positive relationship between tax aggressiveness and NM when using the BTD proxy, and negative when using the GAAP ETR proxy. However, the negative relationship obtained by GAAP ETR is not confirmed in the quantiles, which is justified by the heteroscedasticity of the variables. Therefore, H1 is confirmed, given the positive relationship between BTD and NM, so that the higher the BTD the greater the NM.

As for H2, strong relationship of positive significance was identified between fiscal aggressiveness and ROA, when using BTD as NAGG, so that the higher the BTD the greater the

ROA. The analysis with the variable GAAP ETR showed, on average, a negative relationship between aggressiveness and ROA. However, again the result is not confirmed when the quantiles are analyzed. Again, the result of the relationship between GAAP ETR and ROA is attributed to the heteroscedasticity of the variables. Therefore, H2 is accepted due to the strong positive relationship between BTD and ROA.

In terms of ROI, there is a positive relationship with tax aggressiveness in quantiles 50 and 75 using the GAAP ETR variable. The relationships of statistical significance of 5% found in quantile 50 and 1% in quantile 75 indicate that the greater the aggressiveness, the greater the ROI. Using the BTD proxy, the result is confirmed, on average, in all quantiles with a significance of 1%. Therefore, a positive relationship between tax aggressiveness and ROI is admitted, also confirming H3. It is concluded that, immediately, tax aggressiveness positively impacts the profitability of companies in the electric power sector when using the BTD proxy, while whereas analyzed by GAAP ETR it was not possible to verify a consistent result, so that the relationship obtained in the Robust Random Effects Panel is not confirmed in Quantile Regression. However, on average, a negative relationship was obtained among tax aggressiveness and NM and ROA. In Quantile Regression, there was a positive relationship regarding ROI only in quantiles 50 and 75.

The results are similar to those identified by Tang (2005), Desai and Dharmapala (2006) and Castro and Flach (2013) and differ from Gupta and Newberry (1997), Richardson and Lanis (2007), Chen *et al.* (2010) and Araújo and Leite Filho (2018). This study contributed so that companies in the electric power sector can verify the efficiency of using aggressive tax planning, supporting decision making by managers, as well as contributing to the literature in order to demonstrate the reflexes of tax aggressiveness in the profitability of companies, taking into account the sector in which they operate.

This work is limited to companies in the electric power sector listed in B3 that had shares in marketing and had activities directly related to the sector, in the study period between 2013 and 2018. Therefore, holding companies were excluded. There are also limitations inherent to deficiencies in the metrics used, as well as the confidentiality of tax data. It is noteworthy that the result obtained may undergo changes if proxies of tax aggressiveness different from those used in this research are used, for example Cash ETR, Current ETR, LongRun Cash ETR.

It is suggested that future research develop studies aimed at other sectors of B3, in order to understand the behavior in different sectors of activity, in addition to analyzing the relationship of tax aggressiveness with other performance indicators, as well as other tax metrics.

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