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Influence of the level of tax aggressiveness on the profitability of publicly traded companies of industrial goods listed on B3

Influência do nível de agressividade fiscal na rentabilidade das companhias abertas de bens industriais listadas na B3

Ludimila Lopes da Silva Marinho [1]
Universidade Federal de Goiás – UFG
ludimila.lopess22@gmail.com

Maycon Helder Correia Cunha [1]
Universidade Federal de Goiás – UFG
viniciuszonatto@gmail.com

Marília Paranaíba Ferreira [2]
Universidade Federal de Santa Catarina – UFSC
lari_ipo@hotmail.com

Ercilio Zanolla[1]
Universidade Federal de Goiás – UFG
fersoutomachado@gmail.com

Abstract: Tax aggressiveness represents the most advantageous legal method of taxation chosen by taxpayers, after exploring the ambiguities and uncertainties contained in the tax legislation. In this sense, this study aims to verify the influence of the tax aggressiveness level on the profitability of publicly traded companies of industrial goods listed on B3 (Brazilian Stock Market) in the period from 2010 to 2019. The information was collected in the Economatica@ database and 52 companies were analyzed by means of multiple and quantile regressions. The results pointed out, based on the mean functions of the MQO method, that the level of tax aggressiveness does not influence the profitability. However, when considering the conditional quantile functions of the MEA method, the GAAP ETR starts to present statistical significance

[1] Universidade Federal de Santa Maria—Cidade Universitária– CEP 97105-900 – Santa Maria (RS) – Brasil

[2] Universidade Federal de Santa Maria—Cidade Universitária– CEP 97105-900 – Santa Maria (RS) – Brasil

and negative coefficient as expected for the Q50 and Q75 quintiles of NM (Net Margin), ROA (Return on Assets) and ROE (Return on Equity) and for the Q90 quintile of NM and ROA and then, the hypotheses H1a, H1b and H1d that the tax aggressiveness level positively influences the NM, the ROA and the ROE of the investigated companies are not rejected. Having said that, in general, it is concluded that the higher the tax aggressiveness the higher the profitability of the publicly traded companies of industrial goods listed on B3 and that, even with issues not fully resolved, the theme can be very useful for various users of accounting information, such as tax legislators, regulators, investors, company directors and academic researchers.
Keywords – Tax Aggressiveness; Tax Planning; Profitability.

Resumo: A agressividade fiscal representa o método legal mais vantajoso de tributação escolhido pelos contribuintes, após explorar as ambiguidades e incertezas contidas na legislação tributária. Nesse sentido, este estudo objetiva verificar a influência do nível de agressividade fiscal na rentabilidade das companhias abertas de bens industriais listadas na B3 no período de 2010 a 2019. As informações foram coletadas na base de dados da Economatica@ e 52 companhias foram analisadas por meio de regressões múltiplas e quantílicas. Os resultados apontaram, com base nas funções médias do método MQO, que o nível de agressividade fiscal não influencia a rentabilidade. Contudo, ao considerar as funções quantis condicionadas do método MEA, a GAAP ETR passa a apresentar significância estatística e coeficiente negativo conforme o esperado para os quintis Q50 e Q75 da ML (Margem Líquida), ROA (Retorno sobre os Ativos) e ROE (Retorno sobre o Patrimônio Líquido) e para o quintil Q90 da ML e ROA e, então, não se rejeitam as hipóteses H1a, H1b e H1d de que o nível de agressividade fiscal influencia positivamente a ML, o ROA e o ROE das companhias investigadas. Posto isto, de modo geral, conclui-se que quanto maior a agressividade fiscal maior a rentabilidade das companhias abertas de bens industriais listadas na B3 e que, mesmo com questões não plenamente resolvidas, a temática pode ser muito útil para diversos usuários da informação contábil, como legisladores tributários, reguladores, investidores, diretores de empresas e pesquisadores acadêmicos.
Palavras-chave – Agressividade Fiscal; Planejamento Tributário; Rentabilidade.

Introduction

Brazil has the highest tax burden compared to the average of the countries of Latin America and the Caribbean in the period from 2008 to 2017 (Brazilian Internal Revenue Service - BIRS, 2020). This tax burden represents the percentage of the division of the total tax collection of the country in a year by

the Gross Domestic Product (GDP) of the country in the same year and, while the average Brazilian tax burden in this range corresponds to 32.4%, the average of Latin American and Caribbean countries is 21.9% (BIRS, 2020).

While Brazil shows a practically stable tax behavior in the last decade, given that, according to the National Treasury (2020), in 2018 the Brazilian Gross Tax Burden (CTB) is equivalent to 33.15% and in 2019 to 33.17%, other countries, such as Ireland, South Korea and the United States, also evidence percentages lower or close to 25% (Brazilian Institute of Tax Planning - IBPT, 2018). Therefore, due to the substantial amount required by the State for the payment of taxes in relation to the GDP, companies seek for options that provide tax benefits through tax planning (Graham, 2003), defined as a lawful way for the company to reduce spending on taxation and, consequently, optimize the operating performance (Ferreira & Duarte, 2005).

Given that taxes represent a significant cost for the company and investors and are fundamental to the sales price formation, since they impact the result and then influence both the liquidity and profitability of organizations (Caldeira, 2006; Chenet al. 2010; Araújo & Leite Filho, 2018), it is believed that tax aggressiveness can benefit organizational performance.

Tax aggressiveness, or tax avoidance, is directly linked to tax planning and portrays the most advantageous legal method of taxation chosen by taxpayers, after investigating the ambiguities and uncertainties contained in the tax legislation (Tang & Firth, 2011). The tax aggressiveness can still be considered as a management measure (Mulyadi & Anwar, 2015), because companies that adopt practices of tax burden reduction report lower profits and therefore pay less taxes (Omar & Zolkaflil, 2015).

For this reason, since the search for tax payment reduction is linked to the profitability of organizations, expressed through performance indicators that measure the value addition, the focus of shareholders (Rocha, Beuren & Hein, 2012), this study has the following research problem: What is the influence of the tax aggressiveness level on the profitability of publicly traded companies of industrial goods? Therefore, this study aims to verify the influence of the tax aggressiveness level on the profitability of publicly traded companies of the industrial goods sector listed on B3 in the period from 2010 to 2019.

Different studies have been carried out regarding the tax aggressiveness and have addressed several aspects, such as the relationship of tax aggressiveness to firm size, cost planning and international operations, corporate governance, financial reporting, controlling shareholders' incentives, relevance of accounting information, and profitability (Desai & Dharmapala, 2006, 2009; Dyreng, Hanlon & Maydew, 2008; Martinez & Passamani, 2014; Li, Liu & Ni, 2017; Kovermann & Velte, 2019; Balakrishnan, Blouin & Guay, 2019; Santos & Oliveira, 2020).

As for profitability, Araújo and Leite Filho (2018) analyzed the reflection of the tax aggressiveness level on the profitability of companies listed on B3 and NYSE in the period from 2010 to 2015 and found results adverse to those expected or not significant for the B3 context. Martinez and Reinders (2018) also assessed the effect of the aggressive tax planning on the profitability of Brazilian publicly traded companies between 2004 and 2013 and did not identify the existence of a significant relationship.

For this reason, it is noted, due to the lack of consensus among the studies, the importance of this research, which in addition to generating evidence, based on four profitability proxies, which may be useful for legislators, regulators, managers, investors and researchers (Martinez, 2017), contributes to the advancement of the literature on the influence of tax aggressiveness on profitability, a topic considered by Utzig et al. (2014) as extremely relevant, due to the participation that the tax costs have in the company value composition.

When considering that studies carried out with general samples may omit the particularities of each sector (Gupta & Newberry, 1997; Barcellos, Silva & Costa Júnior, 2012; Araújo & Leite Filho, 2018, Santos & Oliveira, 2020), this study verifies the influence of the tax aggressiveness level on the profitability within a specific sector. Santos and Oliveira (2020), for example, analyzed the influence of tax aggressiveness on the ability to generate profit in companies of the electric power sector listed on B3.

The choice of the industrial goods sector is due to its high significance in the Brazilian economy. Data from the National Industry Confederation (CNI) in March 2021, shows that the industry's share in GDP is 20.4%, in formal employment it covers over 9.7 million people, and in exports of goods and services and business investment in R&D is 69.2%. In addition, although the industrial sector has an

advantage over other sectors because its rates of Corporate Income Tax (CIT) and Social Contribution on Net Income (CSLL) are lower. Almost half (44.8%) of its production is intended for the payment of taxes, which leads to several problems, one of them being the loss of competitiveness, given that this sector competes with the international market (Federation of Industries of the State of Rio de Janeiro – FIRJAN, 2018).

The demand for an efficient tax planning is supported by the impact that the tax burden has on the decision making (Martinez, 2017), the results (Tang & Firth, 2011) and the business environment (Desai & Dharmapala, 2009), after all this planning should consider all areas of the business and not only tax issues (Scholes et al., 2014). In this sense, in practice, this study is justified by the relevance of the theme in determining the organizations' strategies in face of the current situation of global development of markets and of the Brazilian tax scenario. Investors, managers and tax legislators can make use of the findings to better understand the tax relationship with the company's ability to present satisfactory results.

Theoretical foundation and research hypotheses

Tax Avoidance

Although Hanlon and Heitzman (2010) claim there are no universally accepted definitions or concepts for tax aggressiveness, in the authors' view, the more studies on the topic, the closer one is to a standard definition or concept. Chen et al. (2010) define tax aggressiveness, also known as tax avoidance or tax management, as a downward management of taxable income through tax planning activities.

From the perspective of being a practice of significant tax reduction (Balakrishnan, Blouin & Guay, 2019), the tax aggressiveness has been arousing the interest of shareholders, since its relationship with the company's value is questioned, because it reflects in value increase both for the company and for investors (Huseynov, Sardarli & Zhang, 2017). In this case, according to Desai and Dharmapala (2006), the company value increase occurs when the managerial incentives are properly designed and the managers' interests are aligned with those of shareholders.

Kovermann and Velte (2019) state that, currently, the tax aggressiveness is a widespread subject in

the business world and, therefore, it arises in the Brazilian scenario the need to verify the influence of tax behavior on the organizations profitability due to the growing government demand for tax revenues (Martinez, 2017). Thus, as relevant as defining tax aggressiveness is to report the proxies for its analysis (Primola & Nascimento, 2020).

Among the proxies presented by the literature, the Book-Tax Differences (BTD) and the Accouting Effective Tax Rate (GAAP ETR) stand out as the most used tax aggressiveness measures in quantitative researches (Martinez, 2017; Araújo & Leite Filho, 2018). The BTD shows the difference between the accounting profit and the taxable income (Tang & Firth, 2011) and the higher the BTD value, the higher the company's level of tax aggressiveness (Martinez & Passamani, 2014).

It is important to note that such a difference may result in indications of discretion by managers via accounting and/or tax management and, then, companies that are more aggressive present higher BTD, because they show efforts to reduce the tax base (Marqueset al., 2020). For BTD calculation purposes, Equation 1 is presented, based on Hanlon and Heitzman (2010):

$$\text{Total BTD}_{i,t} = \text{PBT} - \frac{\text{IT} + \text{CSLL}}{0{,}34} \qquad \text{(Equation 1)}$$

On the other hand, the GAAP ETR corresponds to the value of the total tax expense divided by the profit before taxes (Hanlon & Heitzman, 2010; Gomes, 2016) and is pointed out by Hanlon and Heitzman (2010) and Asiri et al. (2020) as the most used measure to indicate the level of tax aggressiveness, since it represents the effective tax rate. For the purpose of measuring the GAAP ETR, it is shown the Equation 2, presented by Hanlon and Heitzman (2010):

$$\text{GAAP ETR}_{i,t} = \frac{\text{IT} + \text{CSLL}}{\text{PBT}} \qquad \text{(Equation 2)}$$

Where:

Total $BTD_{i,t}$ represents the total difference between accounting profit and taxable profit of company *i* in period *t*;

PBT represents the profit before tax of company *i* in period *t*;

GAAP $ETR_{i,t}$ represents the amount of total tax expense divided by profit before tax, i.e. the effective tax rate of company *i* in period *t*;

IT represents the income tax of company *i* in period *t*;

CSLL represents the social contribution on net income of company *i* in period *t*.

In terms of analysis, the GAAP ETR is inverse to the BTD. Thus, the lower the value of the GAAP ETR, the higher the level of tax aggressiveness of the firm (Martinez, 2017) and then, if the GAAP ETR is below the legal tax rate, there is tax aggressiveness (Gebhart, 2017).

Profitability Measures

Since the high tax burden implies in lower financial performance and affects the organization competitiveness, because the tax charges negatively influence the profitability and reduce the company cash flows, whenever possible companies should opt for the lowest tax burden available (Tang, 2005; Araújo & Leite Filho, 2018). To determine corporate profitability, Assaf Neto (2014) points to four indexes as being determinants: Net Margin (NM), Return on Assets (ROA), Return on Investments (ROI) and Return on Equity (ROE). NM, useful to measure the company's overall efficiency (Assaf Neto, 2012) since it compares net income with net sales revenue (Gitman, 2010), indicates, as a percentage, in addition to the profit generated by the company, how much each monetary unit of sales revenue contributes to covering costs and expenses. According to Gitman (2010), NM is calculated according to Equation 3 and whilst a lower margin means lower profitability, a higher margin represents greater profitability.

$$\text{NM} = \frac{\text{Earnings Available to Common Stockholders}}{\text{Net Sales Revenue}} \qquad \text{(Equation 3)}$$

ROA is an index that identifies the company's profit in relation to investments in assets (Assaf Neto, 2012), thus, it has the function of evaluating the company's operational efficiency and for this reason, it has the power to assist in the investment decision making process (Santos & Oliveira, 2020). In this study, ROA (Equation 4) is calculated as of Assaf Neto (2012) and according to the author, the higher the return, the better the company's condition.

$$\text{ROA} = \frac{\text{Operating Income Net of IT and CSLL}}{\text{Total Assets}} \qquad \text{(Equation 4)}$$

The analysis of the return on investment through ROI is based on information generated by Accounting (Kassai, 1996). This index is used to evaluate and compare investment projects (Kouskyet al., 2019) and demonstrates how much profit the company obtains compared to investments made (Assaf Neto, 2012). Thus, given that ROI portrays the capacity of gain over the amount invested, the higher the index, the better (Matarazzo, 2010). Equation 5 expresses ROI calculation based on Assaf Neto (2014) and it is emphasized that investment equals total assets minus operating liabilities, that is, total assets minus the sum of onerous liabilities and equity.

$$\text{ROI} = \frac{\text{Net Operating Income of IT and CSLL}}{\text{Average Investment}} \qquad \text{(Equation 5)}$$

Lastly, the return on equity (ROE) is an index that identifies the return of resources invested in the company by its owners. That is, it shows, as a percentage, how much profit the shareholders earn for each monetary unit of own resources (equity) invested in the company (Assaf Neto, 2012). Through this result, it is possible to verify the company's profitability and its possibility of presenting good results. Equation 6 is utilized to calculate ROE, according to Assaf Neto (2012).

$$\text{ROE} = \frac{\text{Net Income}}{\text{Equity}} \qquad \text{(Equation 6)}$$

Relation between tax aggressiveness and profitability

When considering that the tax planning objective is to maximize the return obtained by the shareholders through the use of legal practices that somehow offer the company tax saving benefits, the less taxes the company collects, the greater the amount to be distributed to investors (Frank, Lynch & Rego, 2009). Dueto this, it is highlighted the Owner Theory, which advocates that decisions should be taken in the best interest of shareholders (Sousa, Weffort & Cillo, 2015).

North (1990) presents relevant contributions contained in his Institutional Theory, which indicates that institutions are created to take advantage of existing opportunities in a given society and that these opportunities define the behavior and the actions that are practiced by the institutions. Therefore, in the light of the Stakeholder and Institutional Theory, it is noted that the tax planning is related to the tax aggressiveness, because it can be understood as an inalienable right of the company to plan its tax expenditures in order to reduce them lawfully and thus optimize the operating result (Ferreira & Duarte, 2005). Tax avoidance, in turn, represents the most advantageous legal method of taxation chosen by taxpayers, after exploring the ambiguities and uncertainties contained in the tax legislation (Tang & Firth, 2011).

Regarding the influence of tax aggressiveness on the company's profitability, the international studies of Gupta and Newberry (1997) and Chen et al. (2010) point out a positive relationship between ETR and ROA. Gupta and Newberry (1997) analyzed a panel formed by 823 companies in the period from 1982 to 1985 and by 915 companies between the years 1987 and 1990. Chen et al. (2010) examined 1,003 companies in the period from1996 to 2000, in which 476 are family companies and the remaining, 527, are non-family companies, and found that family companies are less aggressive.

In the national scenario, there are studies of Araújo and Leite Filho (2018), Martinez and Reinders (2018) and Santos and Oliveira (2020). Araújo and Leite Filho (2018) investigated the reflection of the tax aggressiveness level on the profitability of companies listed on B3 and NYSE in the period from 2010 to 2015. The authors used the ROA as a profitability measure and the ETR and the CashETR as measures of tax aggressiveness and concluded that, on average, the higher the level of tax aggressiveness, the lower the profitability of the companies listed on B3 and NYSE. According to the authors themselves, this result is adverse to what was expected for the B3 context and convergent for the NYSE context.

Martinez and Reinders (2018) assessed the effect that the aggressive tax planning has on the profitability of 204 Brazilian publicly traded companies in the period from 2004 to 2013 and did not identify the existence of a significant relationship between tax aggressiveness and profitability. Whereas Santos and Oliveira (2020) have analyzed the influence of tax aggressiveness on the ability to generate profit of 37 companies of the electric power sector listed on B3 during the period from 2013 to 2018. The authors used the BTD and the GAAP ETR as metrics of tax aggressiveness and the NM, the ROA and the ROI as profitability indicators and the results indicated that, on average, the higher the level of tax aggressiveness, the higher the profitability rates of the electric power companies.

Thus, based on the aforementioned evidence and given that the Brazilian tax system is not only complex but also expensive (BIRS, 2020; Santos & Oliveira, 2020). Hence, the hypothesis are formulated as follows:

H1a: The level of tax aggressiveness positively influences the NM of publicly traded companies of industrial goods listed on B3;

H1b: The level of tax aggressiveness positively influences the ROA of publicly traded companies of industrial goods listed on B3;

H1c: The tax aggressiveness level positively influences the ROI of publicly traded companies of industrial goods listed on B3;

H1d: The level of tax aggressiveness positively influences the ROE of publicly traded companies of industrial goods listed on B3.

In general, it is assumed that the lower the tax burden, the higher the return to investors, so it is believed that the tax aggressiveness positively influences the companies' profitability. It is important to reinforce that this aggressiveness does not imply illegality and that it is up to the manager to choose the level of aggressiveness to be practiced by the company, whether higher or lower.

Methodology

Sample and data collection

This study, of quantitative approach, analyzes the companies classified by Economatica@ in the economic sector of industrial goods that traded shares on B3 between 2010 and 2019. The population is equivalent to 53 companies, all with common shares and the same taxation regime, Taxable Income. However, since one company does not present the required information, the sample is composed of 52 publicly traded companies of industrial goods.

The temporal window comprises the complete period, up to then, of the International Financial Reporting Standard (IFRS) adopted by publicly traded companies in Brazil, as well as the beginning of the implementation of Law nº. 11,638/07, and the data is collected from the Economatica@ database and organized into an electronic spreadsheet. It is relevant to mention that the statistical software used is Stata and that results should avoid generalizations, as they refer to the sample and the years in question.

Variables, econometric models and statistical approach

The tax planning addresses the choice between equally valid possibilities of factual or legal situations in order to minimize the tax burden within the legal parameters (Tang & Firth, 2011). Therefore, the profitability indexes tend to demonstrate the result of the measures taken in order to reduce the tax burden, so they are often used in studies with this theme as a type of verification of how efficient the company's tax planning is (Araújo & Leite Filho, 2018). That said, it has as dependent variables the NM, ROA, ROI and ROE.

There are several ways to measure tax aggressiveness (Hanlon & Heitzman, 2010) and, among the most common, which are the BTD and the GAAP ETR (Carvalho, Paulo & Tavares, 2014), this study adopts as independent variable of interest the GAAP ETR, pointed out by the literature as the most used

tax avoidance measure (Hanlon & Heitzman, 2010; Asiri et al., 2020). As this variable represents the effective tax rate paid by the firm, it expresses how aggressive the company presents itself and therefore, the lower the GAAP ETR, the more aggressive is the company (Hanlon & Heitzman, 2010; Gebhart, 2017).

Finally, the control variables of firm size (SIZE) and leverage (LEVERAGE) are used, as suggested by Gupta and Newberry (1997), Frank, Lynch and Rego (2009), Frank, Lynch and Rego (2009), Araújo and Leite Filho (2018), Martinez and Reinders (2018) and Santos and Oliveira (2020). Table 1 illustrates the variables that make up the econometric models and the method of calculation of each one.

Table 1.
Variables.

Dependent Variables			
Variable	**Calculation**	**Expected Signal**	**Source**
Net Margin (NM)	Earnings available to common stockholders divided by net sales revenue.	N/A	Gitman (2010); Assaf Neto (2012); Santos and Oliveira (2020)
Return on Assets (ROA)	Operating income net of IT and CSLL divided by total assets.	N/A	Gupta and Newberry (1997); Chen et al. (2010); Assaf Neto (2012); Araújo and Leite Filho (2018); Martinez and Reinders (2018); Santos and Oliveira (2020)
Return on Investment (ROI)	Operating income net of IT and CSLL divided by average investment.	N/A	Assaf Neto (2012); Assaf Neto (2014); Santos and Oliveira (2020)
Return on Equity (ROE)	Net income divided by shareholders' equity.	N/A	Assaf Neto (2012)
Independent Variable of Interest			
Variable	**Calculation**	**Expected Signal**	**Source**
Accouting Effective Tax Rate (GAAP ETR)	Sum of IT and CSLL divided by profit before tax.	Negative	Hanlon and Heitzman (2010); Carvalho, Paulo and Tavares (2014); Araújo and Leite Filho (2018); Martinez and Reinders (2018); Asiri et al. (2020); Santos and Oliveira (2020)
Control Variables			
Variable	**Calculation**	**Expected Signal**	**Source**
Company Size (SIZE)	Natural logarithm of total assets.	Positive	Araújo and Leite Filho (2018); Martinez and Reinders (2018); Santos and Oliveira (2020)

Financial Leverage (LEVERAGE)	Ratio of long-term debt to total assets.	Negative	Gupta and Newberry (1997); Frank, Lynch and Rego (2009); Araújo and Leite Filho (2018); Santos and Oliveira (2020)

Note. N/A stands for Not Applicable.

In order to verify the influence of the tax aggressiveness level on the profitability of publicly traded companies of the industrial goods sector, four linear models of multiple regression are used, one for each dependent variable, are estimated by the Ordinary Least Squares (OLS) method, according to the following Equations:

$$NM_{i,t} = \beta_0 + \beta_1 GAAPETR_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEVERAGE_{i,t} + \varepsilon_{i,t} \quad \text{(Equation 7)}$$

$$ROA_{i,t} = \beta_0 + \beta_1 GAAPETR_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEVERAGE_{i,t} + \varepsilon_{i,t} \quad \text{(Equation 8)}$$

$$ROI_{i,t} = \beta_0 + \beta_1 GAAPETR_{i,t} + \beta_2 \text{SIZE}_{i,t} + \beta_3 LEVERAGE_{i,t} + \varepsilon_{i,t} \quad \text{(Equation 9)}$$

$$ROE_{i,t} = \beta_0 + \beta_1 GAAPETR_{i,t} + \beta_2 \text{SIZE}_{i,t} + \beta_3 LEVERAGE_{i,t} + \varepsilon_{i,t} \quad \text{(Equation 10)}$$

From these Equations, it can be seen that the first model, represented by Equation 7, tests Hypothesis 1a (H1a), the second model (Equation 8) tests Hypothesis 1b (H1b), the third model (Equation 9) tests Hypothesis 1c (H1c) and the fourth and last model (Equation 10) tests Hypothesis 1d (H1d). Furthermore, it can be seen that data is structured in a short panel, since the number of companies (52) is greater than the number of years (10).

Since there are different models for panel data - fixed effects model, random effects model and POLS - the Chow's F test, Lagrangian Multiplier of Breusch-Pagan and Hausman are performed to define the most appropriate for this study. To meet the regression assumptions, the Shapiro-Francia and Breusch-Pagan tests are performed to verify the normality and homoscedasticity of the residuals and the VIF

(Variance Inflation Factor) and the Pearson Correlation Matrix are calculated to identify whether or not there are multicollinearity problems in the explanatory variables and if the variables present high or perfect correlations (Fávero & Belfiore, 2017).

The winsorization at the 1% level is used in all variables with the purpose of smoothing the outlier observations, because, according to Ohlson and Kim (2015), the models estimated by OLS with winsorization have more robust performances in relation to the models that do not employ this technique. Furthermore, as the sample is restricted to the industrial goods sector, it is understood that it is best to reduce the effect that outlier observations have on the regression results instead of excluding them from the analysis.

Analysis of results

Analysis of descriptive statistics

The descriptive statistics of the variables are presented in Table 2, built from the data of the 52 companies over the 10 years (2010 to 2019). As 114 observations have no value, missing values, the analysis panel is formed by 406 valid observations.

Table 2.
Descriptive statistics

Variables	Observations	Average	Median	Standard Deviation	Minimum	Maximum
NM	406	1.8501	5.62	15.6289	-47.73	19.32
ROA	406	1.9896	3.89	8.7494	-24.96	13.15
ROI	406	7.0641	7.21	7.7873	-9.93	23.30
ROE	406	7.9951	9.00	16.0759	-32.00	40.00
GAAP ETR	406	29.7573	27.79	21.5037	0.00	94.74
SIZE	406	13.7266	14.00	1.8058	10.00	17.00
LEVERAGE	406	21.5306	20.89	15.0367	0.00	53.15

According to the results of Table 2, one notices that in as much as profitability indexes are concerned, the averages of net revenue converted into profit (1.85%) and return on assets (1.98%) are close, as are the averages of return on invested capital (7.06%) and return on equity (7.99%). As to the effective tax rate paid by the companies (GAAP ETR), one notices that the average of 29.75% is lower

than the rate provided by the tax legislation of 34% and that the minimum values of 0 and maximum of 94.74% may have been influenced by the fact that the companies use current periods for taxable income adjustments of accrued periods. Regarding the control variables firm size and financial leverage, it is noted that the averages of 13.72% and 21.53% are similar to their respective standard deviations of 14% and 20.89%. By observing the standard deviations and the differences between the minimum and maximum, it is believed that the values of the variables have changed substantially over time and that the sample is heterogeneous.

To analyze the individual behavior over time of each profitability metric it is used the Box-Plot chart (Figure 1). It is verified, apparently, that there are not very relevant variations over the years between the variables. In 2017, NM demonstrates a small dispersion in the minimum values; from 2010 to 2011 and 2019 ROI reduces the distance between quartiles 25% and 75%; and in 2011 and 2016 there is a considerable change in the minimum values of ROE. Furthermore, as in Table 2, Figure 1 shows that ROE presents the highest averages in relation to the other profitability metrics (NM, ROA and ROI).

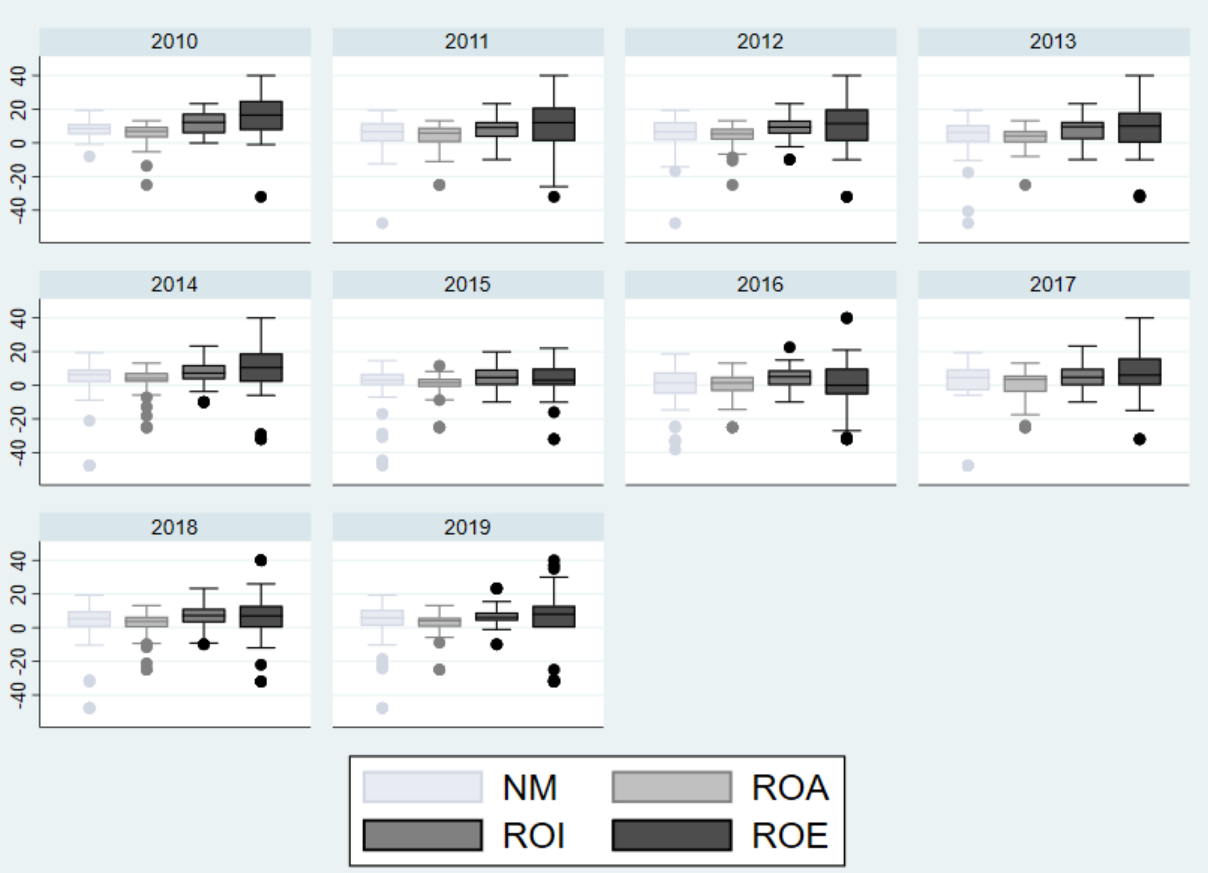

Figure 1. Box-plot chart of the analytical behaviour of profitability over the years.

Analysis of multiple regressions

To test the research hypotheses, initially, the multiple regression technique is employed. After performing the tests F of Chow, LM of Breusch-Pagan and Hausman and the Shapiro- Francia and Breusch-Pagan tests, it is found that the most appropriate model for Equations 7, 8, 9 is the random effects model with robust standard errors and clustering by individual, since the estimation with robust standard errors clustered by company is a way to minimize heteroscedasticity (p-value of Breusch-Pagan test less than 0.05). For Equation 10, the most appropriate model is only the random effects model, since, in this case, the variance of the residuals is constant (p-value of Breusch-Pagan test higher than 0.05). In the

four equations, the Shapiro-Francia test shows non-normal distribution of the residues, however this assumption is usually violated in applied social science studies and justified by the central limit theorem.

The VIFs indicate absence of multicollinearity between the explanatory variables, since all individual values are less than 4 and, therefore, represent less than 75% of shared variance between a given explanatory variable and the others (Fávero & Belfiore, 2017). Additionally, through Table 3, it can be seen that the explanatory variables do not present high or perfect correlations among themselves. Among the dependent variables, as the four are profitability proxies, the high correlations occur because these variables are, in a way, interconnected, but this is not a problem because there is a model for each dependent.

Table 3.
Pearson correlation matrix.

	NM	ROA	ROI	ROE	GAAP ETR	SIZE	LEVERAGE
NM	1.000						
ROA	0.810*	1.000					
ROI	0.713*	0.781*	1.000				
ROE	0.639*	0.617*	0.683*	1.000			
GAAP ETR	0.159*	0.174*	0.118*	0.014	1.000		
SIZE	0.191*	0.244*	0.082	0.140*	0.201*	1.000	
LEVERAGE	0.160*	0.095	0.142*	0.077	0.134*	0.414*	1.000

Note. *Statistically significant at 5% level (p-value < 0.05).

The bivariate technique of Pearson's Correlation Matrix (Table 3) displays the statistically significant correlations at the 5% level of all variables and, when considering the profitability proxies and the GAAP ETR, it is noticed that the positive signs obtained are contrary to what was expected in this study, since the lower the GAAP ETR the greater the company's tax aggressiveness and, consequently, the higher the profitability. On the company size (SIZE), the positive correlations show a direct relationship with profitability and with GAAP ETR, therefore, the larger the company size, the higher the return and the effective rate of taxes paid. Such positive correlation between SIZE and GAAP ETR

corroborates with the findings of Martinez and Reinders (2018), in which the authors point out that larger companies tend to be less tax aggressive, so the larger the company, the higher the tax rate. With regard to GAAP ETR and LEVERAGE, the positive correlation does not agree with the findings of Frank, Lynch and Rego (2009), since the authors state that higher leverage levels can be a reflection of an aggressive tax planning.

Next, Table 4 shows the results of the multiple regressions.

Table 4.
Multiple regression results (MQO).

Dependent Variable	Hypothesis	Independent Variable of Interest	Control Variables			
		GAAP ETR	SIZE	LEVERAGE	_Cons	R^2 *between*
NM	H1a	0.0433	1.1775	-0.0292	-15.8207	0.0549
ROA	H1b	0.0086	0.9803	-0.0046	-12.0239	0.0645
ROI	H1c	0.0011	0.0833	0.0341	4.6875	0.0397
ROE	H1d	-0.0462	0.4109	0.0024	2.5627	0.0069

Note. ***Statistically significant at 1% level; **at 5% level and *at 10% level.

When observing Table 4, it is verified that the GAAP variables ETR, SIZE and LEVERAGE are not statistically significant at the level of 1%, 5% or 10% in any of the four models. Therefore, when considering the results of multiple regressions, the four research hypotheses of this study that the level of tax aggressiveness positively influences the profitability of publicly traded companies of industrial goods listed on B3 are rejected. The p-value found for variables NM and GAAP ETR (H1a) is 0.316, for ROA and GAAP ETR (H1b) is 0.716, for ROI and GAAP ETR (H1c) is 0.959 and for ROE and GAAP ETR (H1d) is 0.183.

Martinez and Reinders (2018) assessed the effect that the aggressive tax planning has on the profitability of Brazilian publicly traded companies and did not identify the existence of a significant relationship between tax aggressiveness and profitability. Whereas Araújo and Leite Filho (2018) investigated the reflection of the tax aggressiveness level on the profitability of companies listed on B3 and NYSE and concluded that, on average, the higher the tax aggressiveness level, the lower the ROA of the

companies listed on B3 and NYSE. On the other hand, the study of Santos and Oliveira (2020), conducted with the Brazilian companies in the electric power sector and which also uses the confirmatory technique of multiple regression with random effects to analyze the influence of tax aggressiveness on profitability, points out statistical significance at the level of 10% and 5% for the dependent variables of NM and ROA, respectively, and positive coefficient. These authors did not find significance for ROI and did not take into account ROE as a proxy.

Analysis of quantile regressions

Due to the absence of statistical significance in all models estimated by multiple regression, quantile regression is additionally used. While the MQO method considers the average functions, the quantile considers the conditional quantile functions and, therefore, it is possible to detect the differences between the coefficients of the response variables along the pre-defined quantiles (Ferreira et al., 2020). In this study, the quantile regression is calculated using five quintiles, 0.10; 0.25; 0.50; 0.75 and 0.90 (Table 5) and, as this technique is based on the Absolute Error Minimization (AEM) method, the multiple regression assumptions of normality, homodecasticity, multicollinearity and autocorrelation are not necessary (Greene, 2000).

Table 5.
Results of quantile regressions (MEA).

Dependent variable NM (H1a)	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
GAAP ETR	0,3303*	-0,0264	**-0,0723*** **	**-0,0737*** **	**-0,0842** **
SIZE	3,1114	0,9169	0,4633*	0,7126**	0,1810
LEVERAGE	0,1088	0,0196	0,0688**	0,1339***	0,1558**
Dependent Variable ROA (H1b)	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
GAAP ETR	0,1060**	0,0229	**-0,0504*** **	**-0,0938*** **	**-0,0731*** **
SIZE	2,8608***	1,3252**	0,1870	-0,1919	-0,6778***
LEVERAGE	0,0190	0,0266	0,00005	-0,0066	-0,0561**
Dependent Variable ROI (H1c)	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
GAAP ETR	0,0365	0,0131	0,0020	-0,0178	0,0663**
SIZE	0,9001*	0,7017**	0,5920**	-0,2954	-1,6405***
LEVERAGE	0,1649***	0,0522	0,0380	0,0295	-0,0058

Dependent variable ROE (H1d)	Q10	Q25	Q50	Q75	Q90
GAAP ETR	0,1159	-0,0364	**-0,1022*** **	**-0,1349*** **	-0,0973
SIZE	0,8041	0,7524**	2,2090***	1,3125**	-2,5537**
LEVERAGE	-0,0000	0,0085	-0,0295	0,0706	0,3937***

Legend. Q10 = Quintile 10; Q25 = Quintile 25; Q50 = Quintile 50; Q75 = Quintile 75; Q90 = Quintile 90.
Note. ***Statistically significant at 1% level; **at 5% level and *at 10% level. Source:

When analyzing Table 5, it is noted that the independent variable of interest (GAAP ETR) presents statistical significance and negative coefficient as expected for the quintiles Q50 and Q75 of the dependent variables NM, ROA and ROE and for the quintile Q90 of NM and ROA. This means that, the lower the effective tax rate represented by GAAP ETR, the higher the company's profitability and, given that this rate and the tax aggressiveness have an inverse relationship, i.e., the lower the effective rate, the higher the aggressiveness, the hypotheses H1a, H1b and H1d that the tax aggressiveness level positively influences the NM, the ROA and the ROE of publicly traded companies of industrial goods listed on B3 are not rejected.

These results are in line with the studies of Martinez and Reinders (2018), who did not identify the existence of a significant relationship between the aggressive tax planning and profitability, of Araújo and Leite Filho (2018), who found adverse results to those expected or not significant, and of Gupta and Newberry (1997), Chen et al. (2010) and Katz, Khan and Schmidt (2013), who found a positive relationship between ETR and ROA. Whereas they meet the researches carried out by Santos and Oliveira (2020), who concluded that, on average, the higher the level of tax aggressiveness, the higher the NM and ROA indexes of the electric power companies, and by Tang (2005) and Desai and Dharmapala (2006), who like in this research, also identified a significant and negative relationship between ETR and profitability.

According to Araújo and Leite Filho (2018), the level of tax aggressiveness tends to be different among countries, after all, the tax burdens differ from one country to another. For example, it is known that the Brazilian tax system is very complex and burdensome (Araújo & Leite Filho, 2018; BIRS, 2020; Santos & Oliveira, 2020), so, in this context, it is expected a negative relationship between tax expenditures and profitability, in other words, it is expected that a greater tax aggressiveness results in higher

profitability, given that the amount invested in tax planning must somehow return to the company. On the other hand, it is believed that North American companies tend to adopt less aggressive tax practices, for being more conservative, for the high cost related to a more rigid tax planning and for the perception that investors may have about the more aggressive policies (Chen et al., 2010; Araújo & Leite Filho, 2018), therefore, it is expected a positive relationship between tax expenditures and the company's return.

Final considerations

This study aims to verify the influence of the tax aggressiveness level on the profitability of publicly traded companies of the industrial goods sector listed on B3 in the period from 2010 to 2019. For this, it is used the GAAP ETR as a tax aggressiveness proxy, the NM, the ROA, the ROI and the ROE as profitability proxies, the Economatica@ database as a collection source and the multiple and quantile regressions, which are confirmatory statistical techniques, for the analysis of the research hypotheses prepared.

Initially, through multiple linear regressions, it is verified the absence of statistical significance between the dependent variables (NM, ROA, ROI and ROE) and the independent variable of interest (GAAP ETR) and, until then, it is rejected the four research hypotheses that the level of tax aggressiveness positively influences the profitability of publicly traded companies of industrial goods listed on B3.

However, since the multiple regression considers the average functions, the quantile regression technique is additionally employed, which, in turn, considers the pre-defined quantile functions. When analyzing the results of the quantile regressions, divided into the quintiles 0.10; 0.25; 0.50; 0.75 and 0.90, it is noted that the independent variable of interest (GAAP ETR) starts to present statistical significance and negative coefficient as expected in some quintiles of the dependent variables NM, ROA and ROE and, therefore, hypotheses H1a, H1b and H1d are not rejected.

Having said that, in general, it is concluded that the higher the tax aggressiveness, the higher the profitability of the publicly traded companies of industrial goods listed on B3 in the period between 2010 and 2019. This finding corroborates the studies of Tang (2005), Desai and Dharmapala (2006) and Santos and Oliveira (2020) and contributes to the literature advancement on the subject. According to Matinez

(2017), talking about tax aggressiveness has been something fruitful and beneficial, even with issues not fully resolved, and the theme can be very useful for various users of accounting information, such as tax legislators, regulators, investors, companies' directors and academic researchers.

Some reflections may be exposed. First, due to the greater presence of implicit costs when tax planning is more aggressive, it is important to ponder the trade-off between the costs and the marginal benefits of tax management. Second, it is relevant to observe the specificities of each country, because, for example, while the Brazilian companies follow the code law legal system, the North American companies follow the common law, so the latter suffer greater pressure from shareholders and tax authorities regarding the quality and transparency of the information disclosed in relation to the former (Lélis et al., 2011; Araújo & Leite Filho, 2018) and then it is expected that the Brazilian companies adopt more aggressive tax practices and the North American ones less aggressive. It is suggested for future researches the analysis in other business sectors, since new empirical evidence may result in greater inferences and better theoretical contributions.

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