

# The Influence of Tax Practices on the Probability of Financial Distress among B3 Non-Financial Companies

Mirian Mara Batista da Silva

<https://orcid.org/0000-0003-1669-2964>

Luiz Ernani de Carvalho Junior

<https://orcid.org/0000-0002-2855-2611>

Eduardo Mendes Nascimento

<https://orcid.org/0000-0002-2188-9748>

## Abstract

**Objective:** this study aimed to verify whether engaging in tax practices influences the probability of financial distress.

**Method:** financial information from 2010 to 2020 of non-financial companies listed on B3 was collected from the Refinitiv Thomson Reuters database. This information was used to measure financial distress (i.e., when earnings before interest and taxes, depreciation, and amortization (EBITDA) are lower than financial expenses, besides a drop in the company's market value in two consecutive periods) and tax practices using the following proxies: Generally Accepted Accounting Principles, Effective Tax Rate (GAAP ETR), Book-Tax Differences (BTD), CURRENT ETR, and Deferred ETR (DIF ETR). The relationship between the companies' financial distress and tax practices was obtained using logistic regression.

**Results:** the variable Generally Accepted Accounting Principles, Effective Tax Rate (GAAP ETR) was found to positively and significantly influence the response variable, while Book-Tax Differences (BTD) and Deferred ETR (DIF ETR) negatively and significantly affect the likelihood of financial distress to occur, suggesting that the fewer tax reducing activities a company performs, the higher the probability of it to face financial distress.

**Theoretical/methodological/practical contributions:** this study suggests that not engaging or using few tax strategies may be decisive for companies experiencing financial difficulties considering that companies fail to use legally obtained resources to maintain their activities.

Published in Portuguese and English. Original Version in Portuguese.

Round 1: Received in 6/15/2022. Review requested on 2/1/2023. Round 2: Resubmitted on 3/24/2023. Accepted on 4/17/2023 by Vinicius Gomes Martins, PhD (Editor assistant) and by Gerlando Augusto Sampaio Franco de Lima, PhD (Editor). Published on 6/30/2023. Organization responsible for the journal: Abracicon

## 1. Introduction

Efficiently estimating the onset of corporate financial distress before companies enter into insolvency, or even bankruptcy (*ex-ante*), regardless of their legal consequences, has great utility and applicability in the corporate environment (Konstantaras & Siriopoulos, 2011; Pindado et al., 2008). It enables companies to implement measures and avoid insolvency, especially during crises, when corporations may become more economically and financially vulnerable.

Insolvency risks increase in times of crisis, and it is public and notorious that the international crises in the last decades, especially in 2008, 2014, and more recently, the Covid-19 pandemic, economically and financially impacted the global corporate business scenario. According to Rezende et al. (2017), internal and global crises increased the probability of company insolvency in the Brazilian context. Hence, it is important to identify a stage before this phenomenon occurs to allow companies more time to plan and implement preventive actions, increasing their opportunities to reverse such a situation.

Additionally, being able to correctly identify financial problems in advance contributes to better information disclosure to investors, as preliminary information enables managers, investors, and rating agencies to perform more efficient analyses, ensuring more security in the corporate world (Konstantaras & Siriopoulos, 2011; Pindado et al., 2008). In this sense, problems in interpreting financial information, such as those that occurred in the August 2007 crisis, which resulted in increased capital costs, can be avoided (Pindado et al., 2008).

The potential strategies to decrease the probability of financial distress include tax planning, which is a way of obtaining financial resources internally. According to Myers (1984), based on the Pecking Order Theory, internal resources are the first companies use to finance their activities. The connection between tax planning and a company's financial situation is evidenced in the literature. Chiachio & Martinez (2019) found that the level of a company's tax aggressiveness changes according to its financial structure; companies with a better financial situation present lower levels of tax aggressiveness. Rezende et al. (2018) identified that tax incentives, along with the companies' profit, are a financing source that enables companies to generate margins and added value and, in contrast, present a negative relationship with the financing cash flow and the debt ratio.

Based on this reasoning, Richardson et al. (2015) pointed out that, due to the degradation of their economic and financial situations, companies experiencing a high risk of bankruptcy may choose tax planning as an alternative, as the costs of these practices, such as penalties and damaged reputation would be considered minimal, compared to potential earnings. Thus, the authors above note that previous research highlights that, as bankruptcy costs are potentially high, companies tend to adopt more aggressive strategies from a tax point of view, despite the risk of being audited by the Treasury.

Added to these findings is the fact highlighted by Desai & Dharmapala (2006) about taxes representing a substantial cost for organizations and being an important aspect considered in managerial decisions regarding a company's finances. Such a fact is evidenced by tax planning practices, which are increasingly present in the corporate world. According to Chen et al. (2010), tax planning is a way to increase a company's cash flow, as well as those of its shareholders and executives, because it reduces the amount disbursed with taxes. Hence, tax planning is related to the companies' financial and economic issues and impacts at the same time that it is impacted by the decisions of companies facing financial distress, insolvency, or bankruptcy.

The studies on tax planning emphasize that some terminologies, such as tax avoidance, tax planning, and tax aggressiveness, are used in research on taxes to refer to the efforts of organizations to reduce or eliminate taxes. Hanlon and Heitzman (2010) state that there are no globally accepted concepts or constructs for tax avoidance but define it as a scale of tax planning activities, in which, on the one end, are the practices considered lawful and, on the other end, are the operations related to tax non-compliance, aggressiveness, or evasion.

It is also important to note that studies seek to highlight the factors determining a company's involvement in tax planning. Richardson, Taylor, and Lanis (2013) consider that some aspects – such as being audited by a Big Four company, implementing an efficient risk management and internal control system, and having an independent external auditor and an internal audit committee – are relevant in determining a company's degree of tax aggressiveness. Martinez and Ramalho (2017) argue that when a company is concerned with social sustainability, it tends to be less aggressive from a tax point of view.

In addition to the reasons affecting a company's decision to adopt tax strategies, the literature emphasizes the impacts caused by a search for minimizing or eliminating taxes in the corporate environment. For example, Richard et al. (2019) examined the effect of corporate tax planning on the financial performance of listed manufacturing companies in Nigeria. They identified that Nigerian industrial organizations have not been able to capitalize and take advantage of the loopholes enshrined in local tax laws, considering that a change in the Effective Tax Rate (ETR) leads to a decrease of 9.3% in the Return on Total Assets (ROA).

While tax planning strategies result in savings, they might simultaneously increase an organization's financial complexity. To the extent that this greater financial complexity cannot be adequately clarified through communications with third parties, such as investors and analysts, transparency issues may arise, such as analyst errors and a negative impact on earnings quality. Hence, it suggests that aggressive tax planning is associated with lower corporate transparency, possibly leading to higher capital costs (Balakrishnan et al., 2018).

In this context, tax planning was also related to bankruptcy and financial problems. Dhawan, Ma, and Kim (2020) report that the probability of bankruptcy increases as the adoption of tax planning practices increases. They state that this relationship aligns with previous research indicating that tax planning increases the cost of debt and the possibility of lowering bond ratings. Therefore, Dhawan, Ma, and Kim (2020) suggest that the negative assessments of banks and risk rating agencies for companies engaging in tax planning do not refer only to the idiosyncratic risk preferences of these entities but to the higher probability of bankruptcy among companies engaging in tax planning practices.

Finally, considering the understanding of Rezende et al. (2017) that the models adopted in the literature predict the insolvency of a company when it is no longer able to implement strategies to reverse this condition, this study aims to answer the following question: What is the impact of the level of tax practices on the probability of financial distress (understood here as an indication of bankruptcy) of non-financial companies listed on Brasil, Bolsa, Balcão (B3)? Therefore, the objective is to verify whether the level of tax practices changes a company's probability of dealing with financial distress.

Over the years, studies on tax planning have sought the determinants, measurement methods, reasons that lead managers to resort to tax practices, and the consequences of such practices on companies. However, studies investigating the relationship between tax strategies and corporate financial distress are still incipient in Brazil and the international context.

Hence, the relevance of this study lies in investigating whether the level of tax practices positively or negatively influences a company's situation, which according to Rezende et al. (2017) precedes bankruptcy. Considering the absence of universally accepted definitions in the literature for tax planning, this study conceptualizes all tax reduction strategies as tax practices.

Evidence found in this study suggests that tax practices influence a company's financial problems. It has been documented that the lower an organization's involvement in strategies that minimize taxes disbursement, the greater the probability of it being affected by financial distress.

## 2. Theoretical framework

### 2.1 Tax Practices

An analysis of the literature on the subject indicates that the corporate tax environment has reached a multinational scope. Technological advancement and globalization have led companies to change the way they operate in the market, enabling economic, political, and social integration on a global scale (Moraes et al., 2021). According to De Simone (2016), multinational companies find tax incentives to transfer taxable income from high-taxation jurisdictions to low-taxation ones. Thus, they strategically assess company transactions to reduce tax costs in their corporate environment.

Beck et al. (2014) state that tax planning is a phenomenon that occurs among companies worldwide and is an important factor in social crises, such as the ongoing sovereign debt case. Moraes et al. (2021) note that organizational restructuring and the migration of firms to other economic contexts can be considered tax-planning activities intended to decrease the tax burden resulting from the new globalized market relationships.

Moraes et al. (2021) aimed to analyze the effect of fiscal aggressiveness on corporate transparency in Brazilian publicly traded companies and verified that fiscal aggressiveness negatively influences corporate transparency; and that industry and commerce sectors, company size, leverage, and profitability positively impact information disclosure. According to Balakrishnan et al. (2018), the fact is that fiscal aggressiveness may affect corporate information transparency, making it more complex, which in turn may negatively impact a company's value, its cost of debt, and the possibility of downgrading securities, thus increasing the likelihood that such a company will face financial distress and even bankruptcy (Balakrishnan et al., 2018; Dhawan, Ma and Kim, 2020).

On the other hand, an environment permeated with financial innovations, market integration, and a complex tax regulatory framework sets precedents for companies to engage in more elaborate tax planning. In such a context, understanding how these variables interact with corporate decisions, influencing the company's results and, consequently, the lives of their shareholders, is paramount. At this point, a company's governance levels are believed to influence the relationship between incentives and tax planning considered aggressive (tax sheltering), which leads to a search for the role of both managers and those preparing tax information in this corporate tax environment (Desai & Dharmapala, 2006).

In this sense, studies show that companies highly committed to corporate social responsibility (CSR) have high tax expenditures arising from their activities and, consequently, low tax aggressiveness (Melo et al., 2020). According to such authors, there is a positive relationship with the ETR tax aggressiveness proxy, suggesting that adopting more or improved socially responsible practices is related to fewer tax aggressiveness practices. Based on this result, Melo et al. (2020) argue that companies that consider all organizational stakeholders generate their resources environmentally sustainably, care about human resources and the community, and tend to pay their fair share of due taxes.

The potential relationship between stock liquidity and tax aggressiveness was investigated in the Brazilian capital market, where the longitudinal effects of stock liquidity on the book-tax difference were assessed. As a result, a statistically significant and economically positive relationship was identified between the fiscal aggressiveness proxy and stock liquidity. These findings suggest that companies with less volatile shares, greater relative shares in B3 businesses, and lower trading costs tend to adopt more aggressive tax planning. Additionally, investors in an emerging capital market such as Brazil tend to sparingly disregard occasional increases in profits due to more aggressive tax practices, provided these might incur future losses (Prímola et al., 2021).

Despite the global trend of adopting tax practices, the relationship between such practices and companies facing financial problems, insolvency, or bankruptcy still requires investigations. As indicated by Dhawan, Ma, and Kim (2020), the probability of bankruptcy increases as tax-planning practices are increasingly adopted. However, based on Richardson, Taylor, and Lanis (2015), companies experiencing a high risk of bankruptcy may opt for tax planning to increase earnings, considering that the costs of such practices as penalties and damaged reputation become less relevant.

In this context, it is important to understand how the literature addresses financial distress to verify the possibility that tax practices have some impact on such events.

## 2.2 Financial Distress

Financial distress has been studied over the years and has proven to be relevant for several players in the business context. To Geng, Bose, and Chen (2015), if an organization engages in the preparation of a reliable forecast of financial distress, managers can preventively implement strategies to avoid serious effects resulting from it, and shareholders can assess the situation of profitability and adjust their investment portfolios to minimize losses related to the anticipated investment.

Companies facing financial distress will not necessarily go bankrupt; however, a significant and continuous decline in economic performance can determine bankruptcy, causing shareholders and creditors to incur considerable losses. Therefore, stakeholders should identify the factors that indicate financial difficulties to protect their interests (Habib, Costa, Huang, Bhuiyan & Sun, 2020).

Considering that speedy managerial actions are needed to deal with the financial restructuring of companies facing difficulties, Rezende et al. (2017) note that knowing whether such a situation is reversible is essential. Still, such is a typical event, considering that some solvent companies fell into this condition at some point in their trajectories.

Koh, Durand, Dai, and Chang (2015) argue that when a firm falls into financial distress, it needs to act immediately to control costs and increase efficiency. According to the authors above, changes in dividend policies or the company's capital structure are usually related to financial restructuring. In addition to these practices, tax planning is also an option for rebuilding the company. Richardson, Taylor, and Lanis (2015) point out that companies facing financial distress are encouraged to engage in more aggressive tax planning, as the benefits of tax activities outweigh the costs.

Corroborating the previous arguments, Martinez and da Silva (2018) highlighted that, in times of financial constraints, with increased difficulty in accessing traditional sources of financing, companies may use tax planning as an alternative to meet their needs. Therefore, they concluded that organizations facing financial problems use fiscal strategies to recover with the additional cash generated.

## 2.3 Crises

According to Barbosa (2017), the decreased financial capacity of the Brazilian government significantly reduced consumption and investment in 2015 and 2016. During that time, Brazil's country risk increased along with the interest rate and uncertainty. Complementing this information, Paula and Pires (2017, p.125) stated that after having an average growth rate of 4% per year from 2004 to 2013, the Brazilian economy retracted "abruptly from 2014, experiencing a strong and prolonged recession in 2015-2016, with a negative average GDP growth rate of 3.7%, accompanied by the deterioration of several social indicators".

Another time of uncertainty in the economy occurred with the COVID pandemic. At the end of 2019, several people were hospitalized with pneumonia in China. The reason was later discovered to be a new virus, the COVID-19 virus (2019-nCoV), which, according to Zhu et al. (2020), is the seventh type of this virus that can infect humans.

Consequently, social isolation was one of the main strategies adopted to prevent the virus dissemination, considerably impacting the world economy, with the sales and profitability of Brazilian companies dropping during the period (Amorim et al., 2022).

The literature relates economic instability to tax practices. Habib, Costa, Huang, Bhuiyan, and Sun (2020) emphasize that when companies face financial distress during a crisis, they tend to employ aggressive tax planning strategies to finance their activities with the amounts saved.

In line with this understanding, Richardson, Taylor, and Lanis (2015) verified in an empirical study that the level of involvement in tax practices aimed at reducing tax payments was positively impacted by financial difficulties and the 2008 global crisis.

## 3. Methodology

### 3.1 Study classification and sample

This descriptive study, with a quantitative approach, describes the relationship between tax practices and financial distress among Brazilian non-financial companies listed on B3 (Martins & Theóphilo, 2009).

Hence, using the Stata software, we analyzed data from non-financial companies listed on B3 from 2010 to 2020. Table 1 shows that financial entities were excluded due to differences in the way their financial reports are published, in addition to the fact that these entities differ regarding tax aspects (Freitas et al., 2020; Konstantaras & Siriopoulos, 2011; Martinez & da Silva, 2018; Martinez & Dalfior, 2015; Pindado et al., 2008; Theiss & Beuren, 2017). The period from 2010 to 2020 was chosen because it concerns the period after international accounting standards were adopted (Martinez, 2017). Additionally, companies with negative equity and missing observations were excluded, as these would compromise the statistical data analysis.

Table 1

**Sampling**

Sample	Initial	Exclusion	Final
Companies listed on the Thomson Reuters database	573		
Financial companies, funds, and others		254	
Companies with negative equity or that did not have data on all variables for at least one year		164	
<b>Total</b>			<b>155</b>

Source: developed by the authors.

## 3.2 Econometric approach

### 3.2.1 Test of difference between means for the study variables

In this study, it is relevant to verify the existence of statistically significant differences between the variables composing the study sample [BTD, GAAPETR, CURRENTETR, DIFETR, net working capital (CG), asset turnover (GIRO) and ratio between shareholders' equity and total liabilities (PLPT)], separated according to the existence or inexistence of financial distress. Establishing whether there are statistically significant differences between the companies facing/not facing financial distress is important because it enables statistical comparisons of these two groups of variables, supporting the application of inferential statistics.

To correctly apply the difference in means test requires verifying whether data meet the assumptions required (Siegel & Castellan Jr, 2006). In this sense, confirming whether data is normally distributed and if the sample data are matched or unmatched (dependence or independence) is important (Siegel & Castellan Jr, 2006).

The absence of normality determines the use of a non-parametric test. If a Gaussian distribution is found, a parametric test is required to treat data (Levine, Berenson & Stephan, 2005). Additionally, verifying whether data are independent is important to determine the use of unmatched data. In contrast, dependence determines the use of a test for matched data (Levine, Berenson & Stephan, 2005).

In this study, we verified the need to use a test for unmatched or independent data because the companies in the sample are classified as facing/not facing financial distress. This aspect determines that the companies are separated into two groups; hence, data are independent. The statistical literature presents Student's t-test and the Mann-Whitney test to verify differences between unmatched data. The first is a parametric test, and the second is a non-parametric test (Siegel & Castellan Jr, 2006). Both tests consider the null hypothesis of equality of means/medians, respectively (Siegel & Castellan Jr., 2006).

### 3.2.2 Econometric procedures – Logistic regression model

The assessment of the impact of tax practices on the probability of companies facing financial distress in this study is performed through logistic regression. This methodology is necessary because the financial distress response variable has a particular nature, as it is represented by a dichotomous dummy variable, which indicates whether a given company is facing financial distress.

A logistic regression model is an econometric approach showing the probability of a given event. It is analyzed through a set of regressors that may or may not be dichotomous. The characteristic of logistic regression models is the fact that the response variable is categorical (dichotomous), i.e., it assumes 1 (one) if the event of interest occurs and 0 (zero) otherwise (Greene, 2003).

Unlike a multiple linear regression model, in which estimators are obtained using the Ordinary Least Squares (OLS) estimation method, logistic regression has an estimation method obtained through the Maximum Likelihood Method (Wooldridge, 2010).

It is important to note that if there is a variation in time and space in the data under analysis, the logistic regression approach for panel data should be used. In this type of analysis, the econometric literature indicates three potential approaches: pooled logit, fixed effects, and random effects (Baltagi, 2005).

Verifying the feasibility of these approaches concerns the use of specific statistical tests. Thus, as proposed by Wooldridge (2010), the following tests must be verified before the logistic regression model is used in data analysis:

- i) the overall fit of the logistic regression model is evaluated by the total proportion of correct classifications obtained by the estimated logit model. It is important to note that the Pseudo R<sup>2</sup>, which integrates the logistic regression model, is not considered an adequate measure of adjustment to support the adequacy of the proposed logit model;
- ii) the global significance of the logistic regression model is given by the LR test, which, under the null hypothesis, assumes the global insignificance of the parameters obtained by the proposed logit regression model;
- iii) the sensitivity and specificity show, respectively, the proportion of correct classifications obtained by the model regarding the event of interest (companies facing financial distress) and the proportion of correct classifications for the group classified as 0 (zero) (companies not facing financial distress);
- iv) the ROC (Receiver Operating Characteristic) curve is a measure of the fit of the logistic regression model, corresponding to the area under the curve; values close to 1 (one) are expected to achieve a better fit of the proposed logistic regression model (Wooldridge, 2010).



Considering that this study’s data are arranged in time and space, verifying the adequacy of the Pooled logit, Fixed Effects, and Random Effects models is necessary. The Hausman test is used to verify these approaches. This test’s null hypothesis assumes the viability of the Logit Random Effects approach.

In this context, the following logistic regression model is proposed to answer the research problem addressed here:

$$DIF_{it} = \beta_1 GAAPETR_{it} + \beta_2 BTD_{it} + \beta_3 CURRENTETR_{it} + \beta_4 DIFETR_{it} + \beta_5 CG_{it} + \beta_6 GIRO_{it} + \beta_7 PLPT_{it} + \beta_8 CRISE_{it} + v_{it} + u_i$$

Where:

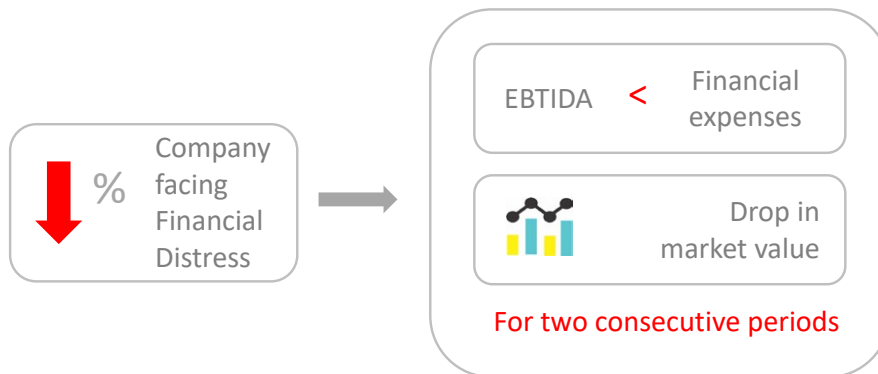
- $DIF_{it}$ : financial distress;
- $GAAPETR_{it}$ ,  $BTD_{it}$ ,  $CURRENTETR_{it}$ , and  $DIFETR_{it}$ : variables of interest – tax practices proxies;
- $CG_{it}$ : net working capital – calculated by the difference between current assets and current liabilities divided by total assets;
- $GIRO_{it}$ : asset turnover – calculated by the ratio between net income and total assets;
- $PLPT_{it}$ : ratio between shareholders’ equity and total liabilities;
- $CRISE$ : dummy equals 1 (um) for 2015, 2016, and 2020 and 0 (zero) otherwise;
- $v_{it}$ : model error term; and
- $u_i$ : non-observed heterogeneity.

### 3.2.3 Definition of variables

#### 3.2.3.1 Dependent variable

According to the Brazilian and international literature, the variables in this study were selected because they are related to financial distress.

The dependent variable Financial Distress (DF) is a dummy, which, according to Pindado et al. (2008), equals 1 (one) when earnings before interest and taxes, depreciation, and amortization (EBITDA) is less than financial expenses, along with a decrease in the company’s market value in two consecutive periods, and 0 otherwise, as shown in Figure 1.



**Figure 1.** Companies facing Financial Distress

Source: adapted from Pindado et al. (2008) and Rezende et al. (2017).

### 3.2.3.2 Variable of Interest

The tax practices proxies (Table 2) were included in this study because the influence of tax planning on the companies' financial/economic aspects was verified by previous studies, such as Richard et al. (2019), Balakrishnan et al. (2018); Dhawan, Ma, and Kim (2020) and Richardson, Taylor, and Lanis (2015).

Table 2

#### Variables of Interest

Metrics	Operationalization	Expected relationship	Authors
<i>GAAP ETR</i> (Effective tax rate on profit)	$\frac{\text{Total income tax expense}}{\text{Earning before taxes}}$	The more aggressive the company, the lower the <i>GAAP ETR</i> .	Hanlon and Heitzman (2010); Martinez (2017); (Baderscher et al., 2013); Beladi et al. (2018); Cen et al. (2017); (Cen et al., 2019)
<i>BTD</i>	$\frac{\text{Earnings before taxes} - (\text{Total income tax expense}/0.34)}{\text{Total assets}}$	The more aggressive the company, the higher the <i>BTD</i> .	Cabello et. al. (2019)
<i>CURRENT ETR</i>	$\frac{\text{Current expense with taxes on earnings}}{\text{Earnings before taxes}}$	The more aggressive the company, the lower the <i>CURRENT ETR</i> .	Chiachio & Martinez (2019)
<i>DIFETR</i>	$\frac{\text{Deferred income tax expense}}{\text{Earnings before taxes}}$	The more aggressive the company, the lower the <i>DIFETR</i> .	Chiachio & Martinez (2019)

Source: study's data, 2020.

### 3.2.3.3 Independent variables

The proxies in Table 3 are highlighted in the literature as financial variables that impact financial distress. Altman et al. (1979) and Sanvicente & Minardi (1998) adopted the Net Working Capital (GC) variable.

The Asset Turnover (GIRO) variable was adopted by Altman et al. (1979) and Rezende et al. (2017); negative effects were reported by Altman et al. (1979), Sanvicente & Minardi (1998) and Rezende et al. (2017).

The Equity over Total Liabilities (PLPT) variable was adopted by Altman et al. (1979), Rezende et al. (2017), and Sanvicente & Minardi (1998). Sanvicente and Minardi (1998) found a positive effect of this variable in the model, and a negative effect was reported by Rezende et al. (2017).

The crisis proxy was included as a control variable because, according to Rezende et al. (2017), internal and global crises increased the probability of company insolvency in the Brazilian context. This Dummy variable assumes 1 in 2015, 2016, and 2020 and 0 otherwise.

Table 3

**Metrics and Operationalization**

Metrics	Operationalization	Expected Relationship	Authors
Net working capital (CG)	$CG = \frac{(AC-PC)}{Ativo\ total}$	( - )	Altman et al. (1979); Sanvicente and Minardi (1998); Rezende et al. (2017)
Asset turnover	$GIRO = \frac{Receita\ líquida}{Ativo\ total}$	( - )	Rezende et al. (2017) Altman et al. (1979).
Equity over total liabilities (PLPT)	$PLPT = \frac{Patrimônio\ líquido}{Passivo\ total}$	( - )	Altman et al. (1979); Sanvicente and Minardi (1998); Rezende et al. (2017)
Crisis	2014 crisis Considering its effects in 2015/2016: The Dummy variable equals "1" for the Covid-19 period, "1" in 2020, and "0" otherwise	( + )	(Andreoli, 2018; Barbosa, 2017; Richardson et al., 2015; Simão, 2017)

## 4. Results analysis and discussion

This section presents the results obtained with the application of the methodological procedures previously described.

### 4.1 Descriptive statistics of data

The outliers in this study were treated with the Winsorization technique. Figure 2 presents the box-plot graphs of the data under analysis.

Box-plot of the variables analyzed

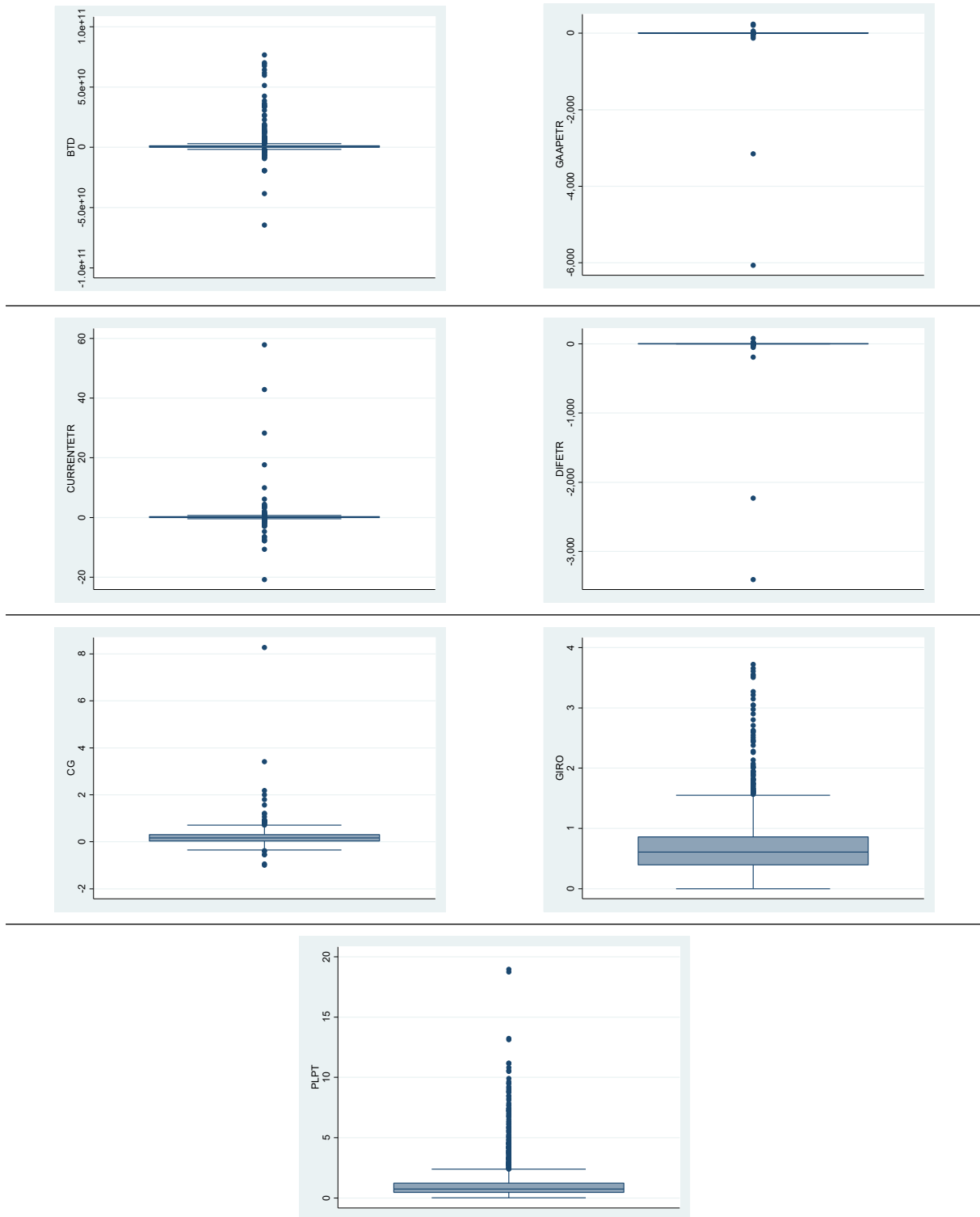


Figure 2. Box-plots of the regressors used in this study

Source: study's data.

The box-plot graphs show the presence of atypical observations; i.e., data do not come from sample measurement errors and, therefore, were not considered outliers. In this case, data need to be treated due to the presence of discrepant observations that may impair the estimation of the parameters of the econometric model proposed. Table 4 presents the descriptive statistics.

Table 4 presents the descriptive statistics.

Table 4  
**Descriptive Statistics**

<b>Group of companies facing financial distress</b>							
STATISTICS	BTD	GAAPETR	CURRENTETR	DIFETR	CG	GIRO	PLPT
Median	-3344118	0.06	0.00	0.02	0.18	0.46	0.54
Mean	-699000000	-1.24	0.40	-2.16	0.26	0.65	1.24
Standard Deviation	6960000000	13.08	4.33	19.37	0.86	0.64	1.93
Minimum	-64500000000	-131.12	-7.83	-192.87	-0.94	0.00	0.003
Maximum	18000000000	11.51	42.86	8.46	8.28	3.61	13.22
Coefficient of Variation	996.24%	1051.18%	1089.83%	898.06%	326.13%	98.01%	154.88%
No.observations	102	102	102	102	102	102	102
<b>Group of companies without financial distress</b>							
STATISTICS	BTD	GAAPETR	CURRENTETR	DIFETR	CG	GIRO	PLPT
Median	360000000	0.23	0.15	0.01	0.16	0.62	0.74
Mean	1690000000	-7.40	0.21	-4.77	0.19	0.70	1.27
Standard Deviation	6850000000	200.68	2.19	119.44	0.24	0.48	1.79
Minimum	-38400000000	-6063.52	-20.77	-3406.01	-0.99	0.00	0.02
Maximum	76700000000	236.45	57.85	78.28	3.42	3.72	18.95
Coefficient of Variation	405.46%	2712.47%	1027.46%	2502.58%	126.21%	68.84%	140.88%
No.observations	1162	1162	1162	1162	1162	1162	1162
<b>Mann Whitney Test of difference in means</b>							
Z Statistics	7.0750***	5.0070***	5.1260***	-0.5840	-0.6350	2.9160***	.9040**

Notes: The tests' statistical significance is represented using the following: \*10%; \*\*5%; \*\*\*1%.

Source: study's data.

Table 4 shows high data variability regarding the variables' means, possibly explained by the sample's heterogeneity.

Table 4 presents the Mann-Whitney test of difference in means for the variables classifying according to the existence of financial distress. This test was used because data were not normally distributed.

Additionally, the statistical differences concerning the means are confirmed by the data description. In this sense, the variables: BTD, GAAPETR, CURRENTER, GIRO, and PLPT are statistically different regarding the existence of financial distress.

The results provide statistical evidence that the indicators (BTD, GAAPETR, CURRENTER, GIRO, and PLPT) of the companies facing financial distress are lower than those of companies not facing financial distress. The results concerning the variables of interest GAAPETR and CURRENTER are aligned with those reported by Chiachio & Martinez (2019), indicating that companies in a better financial situation present lower levels of tax aggressiveness. Thus, this finding also corroborates Richardson, Taylor, and Lanis (2015), in which companies facing financial problems tend to engage in more aggressive tax practices.

## 4.2 The regression logistic model estimated to treat data

Table 5 shows the Pooled and random effects logit models estimated for this study's data. Global significance evidenced by the LR test was verified for the Pooled logit model, in which the null hypothesis of the insignificance of the model's parameters was rejected. The goodness of fit test shows the adequacy of the model's adjustment and ROC curve equal to 67.44%. Finally, the sensitivity and specificity linked to the pooled logit model are 1.96% and 99.74%, respectively. The overall fit of the Pooled logit model is equal to 91.85%. The Random Effects logit model is validated using Rho statistics, which shows the importance of the logit panel for processing data. Failure to reject the null hypothesis of the Hausman Test indicates that random effects logit is appropriate.

Table 5  
Logistic regression model for panel data – Random Effects

Logistic regression models				
Variables	Pooled Logit		Random effects logit	
	Marginal Effect	P-value	Coefficient	P-value
BTD	-1.0x10e-10***	0.0010	-1.18x10e-11***	0.0040
GAAPETR	0.0117	0.1750	0.0307**	0.0280
CURRENTETR	0.0071	0.8220	-0.0249	0.4740
DIFETR	-0.0165	0.1780	-0.0441**	0.0270
CG	0.4196**	0.0420	0.1819	0.5320
GIRO	-0.2433	0.3100	-0.1303	0.7640
PLPT	-0.0270	0.6550	-0.0044	0.9670
CRISE	0.1877	0.4310	0.4002	0.1590
CONS	-2.3272***	0.0000	-4.2444****	0.0000
Logit Model Validation Statistics				
No. of observations	1264		1264	
McFadden R <sup>2</sup>	3.61%		–	
Sensitivity	1.96%		–	
Specificity	99.74%		–	
Model's fit	91.85%		–	
Area under the ROC curve	67.44%		–	
LR Test	25.57***		–	
Goodness of fit	1177.67		–	
Rho	104.77 ***		–	
Hausman	–		7.48	

Notes: The tests' statistical significance is represented by the following: \*10%; \*\*5%; \*\*\*1%.

Source: study's data.

The Random Effects logit model results indicate a negative relationship between BTD and DIFETR and a positive relationship between GAAPETR and financial distress. Hence, the less a company engages in tax practices, the higher the probability of facing financial distress.

The analysis of results indicates a contrary association between the probability of financial distress and tax practices; i.e., such findings are opposed to evidence reported by Chiachio and Martinez (2019) and Richardson, Taylor, and Lanis (2015). Such studies suggest that the more aggressive the company is, the higher the probability of financial distress.

## 5. Final Considerations

The importance of estimating a company's bankruptcy risks in advance is indisputable. In such a context, financial distress is an opportunity to identify the onset of financial problems before companies enter into insolvency or even bankruptcy (*ex-ante*) (Konstantaras & Siriopoulos, 2011; Pindado et al., 2008). The great advantage is to allow companies to implement preventive actions before entering insolvency or bankruptcy, increasing the probability of reversing the situation.

Another point highlighted here is that tax planning has the potential to negatively affect a company's financial and economic situation. As highlighted by Balakrishnan et al. (2018), even though it saves tax expenses, it can simultaneously increase the financial complexity of an organization, increase the probability of bankruptcy and the cost of debt, besides the possibility of downgrading security ratings. However, the literature shows that companies dealing with an unfavorable financial and economic situation may opt for aggressive tax planning because the costs of such practices, like penalties and damaged reputation, might be considered minimal compared to potential gains.

This study achieved its primary objective, which was to verify whether the level of tax practices influences the probability of facing financial distress (understood here as an indication of a bankruptcy process) among non-financial companies listed in Brasil, Bolsa, Balcão (B3).

The tendency showed in the literature – that aggressive tax planning influences a company's probability of experiencing financial distress – was confirmed in this study. A statistically significant negative influence was found in the relationship between BTM and CURRENTETR, and a positive influence was found between GAAPETR and the probability of a company facing financial distress. These results align with previous studies such as Balakrishnan et al. (2018), Richard et al. (2019), and Richardson et al. (2015).

This finding suggests that companies should always assess the implementation of tax practices-related activities wisely, as the savings generated are considered a source of internal funds, even more so among companies dealing with financial difficulties, keeping in mind that the costs linked to such strategies can exacerbate a company's financial constraints.

An interesting finding is that the crisis in 2014/2015 and the pandemic did not significantly affect the probability of financial distress in the companies addressed here. This result is likely explained by how these crises affected these companies due to their idiosyncrasies.

The last aspect to highlight here is that the PLPT index did not significantly influence the probability of financial distress among the companies in this study's sample. This fact is possibly explained by the effects of the components of the items comprising this index, such as the level of cost of own capital and third-party capital, the liability structure such as the composition of terms (short and long term), and the characteristics of third-party capital origins (commercial banks vs. development banks).

One potential limitation is that other taxes that compose the results of Brazilian companies at the federal, state, and municipal levels are not captured by the measures of tax practices applied here.

The suggestion for future research includes assessing aspects that may have influenced the changes in the results, such as other elements of corporate governance, the Executives' characteristics, and macroeconomic components.

## References

- Altman, E. I., Baidya, T. K. N., & Dias, L. M. R. (1979). Previsão de problemas financeiros em empresas. *Revista de Administração de Empresas*, 19, 17–28. <https://doi.org/10.1590/S0034-75901979000100002>
- Amorim, J. Q., Sales, G. A., & Grecco, M. C. P. (2022). Covid-19 e os impactos nas políticas de financiamento e investimento. *RAM. Revista de Administração Mackenzie*, 23 (2). <https://doi.org/10.1590/1678-6971/eRAMF220225.pt>
- Andreoli, P. H. (2018). *Nível de transparência da remuneração executiva e comportamento da remuneração variável em períodos de estabilidade e crise econômica*. <http://bibliotecadigital.fgv.br/dspace/handle/10438/24595>
- Baderscher, B. A., Katz, S. P., & Rego, S. O. (2013). The separation of ownership and control and corporate tax avoidance. *Journal of Accounting and Economics*, 56(2–3), 228–250. <https://doi.org/10.1016/j.jacceco.2013.08.005>
- Balakrishnan, K., Blouin, J. L., & Guay, W. R. (2018). Tax Aggressiveness and Corporate Transparency. *The Accounting Review*, 94(1), 45–69. <https://doi.org/10.2308/accr-52130>.
- Baltagi, B. H. (2005). *Econometric Analysis of Panel Data*. 3 ed. New York: John Wiley & Sons.
- Barbosa, F. de H. (2017). A crise econômica de 2014/2017. *Estudos Avançados*, 31, 51–60. <https://doi.org/10.1590/s0103-40142017.31890006>
- Beck, T., Lin, C., & Ma, Y. (2014). Why Do Firms Evade Taxes? The Role of Information Sharing and Financial Sector Outreach. *The Journal of Finance*, 69(2), 763–817. <https://doi.org/10.1111/jofi.12123>
- Beladi, Hamid, Chao, C. C., & Hu, M. (2018). Does tax avoidance behavior affect bank loan contracts for Chinese listed firms? *International Review of Financial Analysis*, 58, 104–116. <https://doi.org/10.1016/j.irfa.2018.03.016>
- Cabello, O. G., Gaio, L. E., & Watrin, C. (2019). Tax avoidance in management-owned firms: evidence from Brazil. *International Journal of Managerial Finance*, 15 (4), 580-592. <https://doi.org/10.1108/IJMF-04-2018-0117>
- Cen, L., Maydew, E. L., Zhang, L., & Zuo, L. (2017). Customer–supplier relationships and corporate tax avoidance. *Journal of Financial Economics*, 123(2), 377–394. <https://doi.org/10.1016/j.jfineco.2016.09.009>
- Cen, L., Maydew, E., Zhang, L., & Zuo, L. (2019). Tax planning diffusion, real effects, and sharing of benefits. 41.
- Chen, S., Chen, X., Cheng, Q., & Shevlin, T. (2010). Are family firms more tax aggressive than non-family firms? *Journal of Financial Economics*, 95(1), 41–61.



- Chiachio, V. F. de O., & Martinez, A. L. (2019). Efeitos do Modelo de Fleuriet e Índices de Liquidez na Agressividade Tributária. *Revista de Administração Contemporânea*, 23, 160–181. <https://doi.org/10.1590/1982-7849rac2019180234>
- De Simone, L. (2016). Does a common set of accounting standards affect tax-motivated income shifting for multinational firms? *Journal of Accounting and Economics*, 61(1), 145–165. <https://doi.org/10.1016/j.jacceco.2015.06.002>
- Desai, M. A., & Dharmapala, D. (2006). Corporate tax avoidance and high-powered incentives. *Journal of Financial Economics*, 79(1), 145–179. <https://doi.org/10.1016/j.jfineco.2005.02.002>
- Dhawan, A., Ma, L., & Kim, M. H. (2020). Effect of corporate tax avoidance activities on firm bankruptcy risk. *Journal of Contemporary Accounting & Economics*, 16(2), 100187.
- Freitas, M. R. D. O., Pereira, G. M., Vasconcelos, A. C. D., & Luca, M. M. M. D. (2020). Concentração Acionária, Conselho de Administração e Remuneração de Executivos. *Revista de Administração de Empresas*, 60, 322–335. <https://doi.org/10.1590/S0034-759020200503>
- Geng, R., Bose, I., & Chen, X. (2015). Prediction of financial distress: An empirical study of listed Chinese companies using data mining. *European Journal of Operational Research*, 241(1), 236–247.
- Greene, W. H. (2003). *Econometric analysis*. Pearson Education India.
- Habib, A., Costa, M. D., Huang, H. J., Bhuiyan, M. B. U., & Sun, L. (2020). Determinants and consequences of financial distress: review of the empirical literature. *Accounting & Finance*, 60, 1023–1075.
- Hanlon, M., & Heitzman, S. (2010). A review of tax research. *Journal of Accounting and Economics*, 50(2–3), 127–178. <https://doi.org/10.1016/j.jacceco.2010.09.002>
- Koh, S., Durand, R. B., Dai, L., & Chang, M. (2015). Financial distress: Lifecycle and corporate restructuring. *Journal of Corporate Finance*, 33, 19–33. <https://doi.org/10.1016/j.jcorpfin.2015.04.004>
- Konstantaras, K., & Siriopoulos, C. (2011). Estimating financial distress with a dynamic model: Evidence from family owned enterprises in a small open economy. *Journal of Multinational Financial Management*, 21(4), 239–255. <https://doi.org/10.1016/j.mulfin.2011.04.001>
- Levine, D. M., Berenson, M. L., & Stephan, D. (2005). *Estatística: teoria e aplicações-usando Microsoft Excel português*. Ltc.
- Martinez, A. L. (2017). Agressividade Tributária: Um Survey da Literatura. *Revista de Educação e Pesquisa em Contabilidade (REPeC)*, 11(0), 106–124. <https://doi.org/10.17524/repec.v11i0.1724>
- Martinez, A. L., & Dalfior, M. D. (2015). *Agressividade Fiscal entre Companhias Controladoras e Controladas*. 20.
- Martinez, A., & da Silva, R. (2018). Restrição financeira e agressividade fiscal nas empresas brasileiras de capital aberto. *Advances in Scientific and Applied Accounting*, 11(3), 448–463. <https://doi.org/10.14392/ASAA.2018110305>
- Martinez, A. L., & Ramalho, V. P. (2017). Agressividade tributária e sustentabilidade empresarial no Brasil. *Revista Catarinense da Ciência Contábil*, 16(49).
- Martins, G. de A., & Theóphilo, C. R. (2009). *Metodologia da investigação científica para ciências sociais aplicadas*. Atlas.
- Melo, L. Q. de, Moraes, G. S. de C., Souza, R. M. de, & Nascimento, E. M. (2020). A responsabilidade social corporativa afeta a agressividade fiscal das firmas? Evidências do mercado acionário brasileiro. *Revista Catarinense da Ciência Contábil*, 19. <https://doi.org/10.16930/2237-766220203019>

- Moraes, G. S. de C., Nascimento, E. M., Soares, S. V., & Prímola, B. F. L. (2021). Agressividade fiscal e evidência tributária: Um estudo das companhias brasileiras de capital aberto. *Contextus – Revista Contemporânea de Economia e Gestão*, 19, 197–216. <https://doi.org/10.19094/contextus.2021.61612>.
- Myers, S. C. (1984). The Capital Structure Puzzle. *The Journal of Finance*, 39, (3), 575-592.
- Paula, L. F. D., & Pires, M. (2017). Crise e perspectivas para a economia brasileira. *Estudos avançados*, 31(89), 125-144. <https://doi.org/10.1590/s0103-40142017.31890013>
- Pindado, J., Rodrigues, L., & La Torre, C. de. (2008). Estimating financial distress likelihood. *Journal of Business Research*, 61(9), 995–1003. <https://doi.org/10.1016/j.jbusres.2007.10.006>
- Prímola, B. F. L., Nascimento, E. M., & Campos, O. V. (2021). Liquidez acionária e agressividade fiscal no mercado de capitais brasileiro. *Revista Catarinense da Ciência Contábil*, 20, e3188–e3188. <https://doi.org/10.16930/2237-766220213188>
- Rezende, A. J., Dalmácio, F. Z., & Rathke, A. A. T. (2018). Avaliação do Impacto dos Incentivos Fiscais sobre os Retornos e as Políticas de Investimento e Financiamento das Empresas. *Revista Universo Contábil*, 14 (4). <http://dx.doi.org/10.4270/ruc.2018426>
- Rezende, F. F., Montezano, R. M. D. S., Oliveira, F. N. D., & Lameira, V. D. J. (2017). Previsão de dificuldade financeira em empresas de capital aberto. *Revista Contabilidade & Finanças*, 28(75), 390-406.
- Richard, D., Monday, E., & Ude, B., Emmanuel. (2019). The Impact of Corporate Tax Planning on Financial Performance of Listed Industrial Firms in Nigeria. 5(4), 12.
- Richardson, G., Taylor, G., & Lanis, R. (2013). The impact of board of director oversight characteristics on corporate tax aggressiveness: An empirical analysis. *Journal of Accounting and Public Policy*, 32(3), 68-88. <https://doi.org/10.1016/j.jaccpubpol.2013.02.004>
- Richardson, G., Taylor, G., & Lanis, R. (2015). The impact of financial distress on corporate tax avoidance spanning the global financial crisis: Evidence from Australia. *Economic Modelling*, 44, 44-53. <https://doi.org/10.1016/j.econmod.2014.09.015>
- Sanvicente, A. Z., & Minardi, A. M. A. F. (1998). Identificação de indicadores contábeis significativos para previsão de concordata de empresas. *Instituto Brasileiro de Mercado de Capitais*, Working Paper12.
- Siegel, S., & Castellan Jr, N. J. (2006). *Estatística não-paramétrica para ciências do comportamento*. Artmed Editora.
- Simão, M. F. (2017). *Práticas de remuneração em período de crise econômica: Um estudo com empresas automotivas do Brasil*. <https://app.uff.br/riuff/handle/1/6414>
- Theiss, V., & Beuren, I. M. (2017). Estrutura de Propriedade e Remuneração dos Executivos. *Revista de Administração da Universidade Federal de Santa Maria*, 10(3), 533–550.
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.
- Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., ... & Tan, W. (2020). A novel coronavirus from patients with pneumonia in China, 2019. *New England journal of medicine*.

Round 1: Received in 06/15/2022. Review requested on 02/1º/2023. Round 2: Resubmitted on 03/24/2023. Accepted on 04/17/2023 by Vinícius Gomes Martins, PhD (Editor assistant) and by Gerlando Augusto Sampaio Franco de Lima, PhD (Editor). Published on XX/XX/23. Organization responsible for the journal: Abracicon