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Influence of tax aggressivity on the forecast of financial analysts

Influência da agressividade tributária na previsão dos analistas financeiros

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Abstract

Purpose: This paper aims to verify whether the management of taxable income through aggressive tax practices negatively impacts the accuracy of market analysts' forecasts.

Originality/value: The central contribution of this study is to relate tax aggressiveness with more significant errors in analysts' forecasts. Thus, the relevance of this paper is in showing that this practice can lead to a greater perception of companies' risks and more significant informational asymmetry, in addition to influencing stock prices and resulting in lower analyst accuracy.

Design/methodology/approach: This research paper was developed from regression models with panel data with random effects, also using estimators based on instrumental variables with the application of Jensen's test to verify the validity of the generalized method of moments (GMM) estimation. The data were treated with the winsorization technique at the 1% level.

Findings: A sample of companies listed on the B3 between 2010 and 2017 (with a total of 2,805 valid observations) showed that companies with higher tax aggressiveness are subject to a higher analyst forecast error. Thus, it is inferred that, for more aggressive companies, the degree of analyst predictability decreases. With this drop in the quality of analysts' forecasts, the users of their forecasts and reports are more vulnerable to informational asymmetry.

Keywords: tax aggressiveness, analyst forecasting, results management, accuracy, bias

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Resumo

Objetivo: O presente trabalho se propôs a verificar se o gerenciamento do lucro tributável por meio de práticas de agressividade tributária gera um impacto negativo na acurácia das previsões dos analistas de mercado.

Originalidade/valor: A contribuição central deste estudo é a de relacionar a agressividade tributária com maiores erros nas previsões dos analistas. Com isso, a relevância deste estudo está em evidenciar que essa prática pode levar a uma maior percepção dos riscos das companhias e maior assimetria informacional, além de influenciar os preços das ações e acarretar menor acurácia dos analistas.

Design/metodologia/abordagem: Esta pesquisa foi desenvolvida a partir de modelos de regressões com dados em painel com efeitos aleatórios. Também foram utilizados estimadores baseados em variáveis instrumentais com a aplicação do teste de Jensen para verificação da validade da estimação pelo método de momentos generalizado (*generalized method of moments* – GMM). Os dados foram tratados com a técnica de winsorização ao nível de 1%.

Resultados: A partir de uma amostra composta por empresas listadas na B3 entre 2010 e 2017 (com um total de 2.805 observações válidas), os resultados mostraram que as empresas que apresentam maior agressividade tributária estão sujeitas a um maior erro de previsão dos analistas. Assim, infere-se que, para as empresas mais agressivas, o grau de previsibilidade dos analistas diminui. Com essa queda na qualidade da previsão dos analistas, os usuários de suas previsões e relatórios tornam-se mais vulneráveis à assimetria informacional.

Palavras-chave: agressividade tributária, previsão de analistas, gerenciamento de resultados, acurácia, viés

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INTRODUCTION

The Brazilian tax system is one of the most expensive and complex in the world; the country has more than 60 different types of taxes used for tax collection and regulatory purposes, with more than three thousand regulations in force and a tax burden that exceeds 35% of the gross domestic product (GDP) (Amaral et al., 2015). To circumvent the weight of taxes, companies resort to frequent and sometimes even abusive tax planning, which generates under-invoiced sales or artificial losses on which no taxes are levied, for example. There is evidence of tax evasion in 57% of small companies, 31% of medium-sized companies, and 16% of large companies (Amaral et al., 2020).

This context makes Brazil a suitable environment for studies on tax aggressiveness, especially on the informational asymmetry costs imposed on the investor and related to abusive tax planning. Given this scenario, this paper analyzes whether the management of taxable income negatively affects the accuracy of earnings forecasts issued by sell-side analysts.

Previous studies showed that the higher the analyst coverage, the lower the tax aggressiveness of firms (Allen et al., 2016; Chen & Lin, 2017), and the lower the number of analysts, the higher the forecast errors (Balakrishnan et al., 2019). Thus, this paper proposes to identify the impact of tax aggressiveness on analysts' accuracy.

Carvalho (2015) measured the impact of abusive tax planning on analysts' forecast errors in the Brazilian environment during the transition period of International Financial Reporting Standards (IFRS) adoption, finding evidence that tax aggressiveness activities decreased forecast accuracy. More recently, Reina et al. (2022) highlighted that no significant variations in analysts' accuracy were observed before and after adopting IFRS.

Thus, this work extends the discussion of Reina et al. (2022) and Carvalho (2015) and seeks evidence in the post-IFRS period (from 2010), besides seeking to minimize the endogenous effects of the relationship between tax aggressiveness and analysts' accuracy. Endogeneity is pointed out as a complicating factor in the relationship between analysts' accuracy and tax aggressiveness (Allen et al., 2016; Carvalho, 2015).

Chen et al. (2018) highlighted that tax aggressiveness is more pronounced in companies with lower market analysts coverage. However, the role of analysts and tax aggressiveness does not seem to be a consensus in the literature regarding the positioning of these agents, *i.e.*, it is not known whether they encourage or restrict the adoption of tax aggressiveness policies (Allen et al., 2016).

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On the other hand, Graham et al. (2014) point out that analysts play a dual role; they encourage and restrict tax aggressiveness, and they often choose to limit the adoption of tax aggressiveness practices when the company has a concern for its reputation. This role of analysts is supported by the "information demand view" and the "investor recognition view", both proposed in the work of Allen et al. (2016).

The third view addressed by Allen et al. (2016), the "market pressure view", supports analysts' role as enablers of aggressive tax policies and contradicts the other views. This was also demonstrated in the studies of Martins et al. (2016) and Mota et al. (2017), which pointed out evidence that firms are encouraged to manage their results when these are close to analysts' estimates, said that in managing results there may be the adoption of practices to decrease taxes paid.

Rego and Wilson (2012) also point out that in capital risk-incentivizing firms, there is a motivation for managers to make riskier decisions as long as they have positive present value. Included in these risk-taking activities are aggressive tax and earnings management practices.

Evidence that tax aggressiveness decreases analysts' accuracy was found in this paper. Furthermore, the results show that there is a positive relationship between the number of analysts charging firms and analyst forecast accuracy, a result similar to which was found by Balakrishnan et al. (2019). Thus, this study contributes to the consolidation of the literature on tax aggressiveness' impact on analysts' accuracy.

For Allen et al. (2016), the informational asymmetry existing in the market provides a dark, informative environment and encourages the adoption of aggressive tax strategies. Given this, this paper contributes to investors improving their investment strategies in order to protect their wealth by considering the implications of aggressiveness on the predictive power of market analysts. Additionally, this research provides evidence that the strategies related to tax aggressiveness can decrease analysts' predictability and lead to higher risk perception for companies that adopt these practices.

THEORETICAL BACKGROUND

The implementation of tax aggressiveness policies has, as a main motivator, the weight of taxes that companies pay to the state, which in Brazil can reach up to 34% (Dalfior & Martinez, 2015). For Hanlon and Heitzman (2010), tax aggressiveness is a continuum of actions and strategies of tax planning, in which, at one end, there is legality, with less aggressive actions.

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On the opposite side, there is illegality, with the predominance of much more aggressive activities from the tax point of view.

For Martinez and Ramalho (2014) and Chen et al. (2010), tax aggressiveness has marginal benefits from savings in paying less taxes. However, it generates other elements, such as marginal costs arising from the difficulties of implementation and additional costs involved in tax management, including potential fines levied by tax agencies.

According to Allen et al. (2016), the cost of aggressive tax policies decreases the return on these activities because of non-tax expenses, among them the cost of reputation, because as more analysts cover the company, the greater its image risk. For Hanlon and Slemrod (2009), the market has a negative reaction when faced with a news report that reveals that a company has tax shelter policies (one of the forms of tax aggressiveness). In the same vein, Hanlon and Slemrod (2009) concluded that a company's share price has a negative impact when there is news about this company's involvement with tax aggressiveness strategies.

Tax planning seeks to reduce tax expenses and is one of the tools used to execute aggressive tax policies. For Chiachio and Martinez (2018), tax planning is a way to obtain resources internally. From a tax planning strategy more prone to tax aggressiveness, the strategy's reach may depend on a more risky tax aggressiveness policy, even with a greater uncertainty, just by having a positive return (Rego & Wilson, 2012).

For Silva and Martinez (2017), tax planning techniques used to reduce taxes may be considered illegal practices. In contrast, the study of Vello and Martinez (2014) in Brazil verifies that, with the help of good corporate governance practices, it is possible to perform tax planning that promotes the reduction of market risk.

If the company chooses to seek funds in the stock market, Fonseca and Martinez (2017) do not recommend reducing the taxes paid since it can bring a decrease to the company's market value by the cost of reputation, the same evidence presented by Hanlon and Slemrod (2009). To avoid this cost, the authors propose the search for actions that focus on tax reduction and actions that maximize the firm's value. The impact on reputation can often be more harmful than paying tax charges. In this line, Hanlon and Slemrod (2009) point out that stock markets have a rejection of news related to tax protection, which may be related to a policy of tax aggressiveness.

The most traded companies demand a greater volume of information based on the investor recognition view. Moreover, they may have a more significant number of analysts following their activities (Allen et al., 2016).

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According to Chen and Lin (2017), in companies with a reduction in financial analyst coverage, there was an increase in tax aggressiveness. The authors state that this effect is related to companies with greater tax planning capabilities (which includes tax havens) and with less monitoring by tax authorities.

For Allen et al. (2016), tax aggressiveness is more present in companies with lower investor recognition and darker informational environments. Thus, the impact of governance is direct since transparency policies can reduce aggressiveness and mitigate tax evasion. Another point is the strategy the company will use since adopting aggressive tax policies to obtain financial gains and make up its results to show an image of good performance. It may cause a reputational problem and lead to a large capital outflow by investors, reflecting the company's market value.

Also, for Allen et al. (2016), in the "information demand view", the high uncertainty and high volatility of aggressive tax strategies increase informational asymmetry among stakeholders and especially affect minority shareholders. The study in question points out that as market analyst coverage increases, there is a proportional increase in information made available by firms, which puts pressure on management for more transparent information. If more analysts cover a company, the speed of transmission of negative information increases, as does the pressure for the company to present a satisfactory result to the market.

Allen et al. (2016) also point out a third view, the "market pressure view," which contrasts the other two mentioned above. This last view approaches tax aggressiveness as a consequence of the demands for better results imposed on companies by the market.

Chiachio and Martinez (2018) highlight some tax aggressiveness variables, among them the book tax difference (BTD) and the effective tax rate (ETR). In Silva and Martinez's (2017) work, the ETR is used as a proxy of tax aggressiveness and has a maximum theoretical rate on taxable income of 34%. These variables were also used in the studies of Balakrishnan et al. (2019), Allen et al. (2016), and Rego and Wilson (2012).

In the work of Allen et al. (2016), evidence was found that greater analyst coverage inhibits the adoption of more aggressive strategies from the tax point of view (by the opinions of investor recognition and demand for information). The authors argue that the increased visibility of companies and the greater demand for transparent information are the factors that lead to the reduction of aggressive tax practices and, consequently, of informational asymmetry. Financial analysts bring tax-related issues to companies' conferences and comment on their tax behavior in their valuations and

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reports, which increases the visibility of companies' tax-aggressive actions to investors (Allen et al., 2016).

Interestingly, Allen et al. (2016) recognize that analysts play a dual role concerning tax aggressiveness. From the views of investor recognition and demand for information, analysts inhibit aggressive tax policies precisely because of the image cost. Given their knowledge of market pressure, analysts encourage the adoption of results management, and this is where tax aggressiveness comes in so that the company does not disappoint market expectations. Graham et al. (2014) also recognize this duplicity when researching whether the cost of an image would be a significant factor in adopting tax planning. Thus, it was found that, for 70% of the companies in their sample, the reputation cost is relevant for decision-making about tax planning.

Healy and Palepu (2001) point out the financial analyst position as a type of monitor for companies, responsible for producing and disseminating information about them. For Gatsios (2013), analysts use the available information from companies in order to estimate the results of these companies. For Martinez and Salim (2004), accuracy is the proximity of the estimator developed by the analyst and the actual result presented by the company. Thus, it is used to analyze the quality of the projections made by analysts. In short, to the extent that greater analyst coverage increases the visibility of aggressive tax strategies, the returns from such activities decrease by generating non-tax costs, such as the cost of reputation. Greater analyst coverage also reduces firms' incentives to avoid taxes aggressively (Allen et al., 2016).

Some factors interfere with analyst accuracy, such as the number of analysts covering firms, firm size, corporate governance levels, and positive earnings releases (as analysts are more interested in protecting profitable firms). Along these lines, Dalmácio et al. (2013) point to corporate governance as a factor capable of positively influencing the accuracy of market analysts. Several studies relate analyst forecasts and the complexity of accounting information, such as those developed by Antônio et al. (2019), Francis et al. (2019), and Martins et al. (2016).

Francis et al. (2019) point out that tax planning exacerbates the operational complexity of firms and can influence analysts' efforts to understand and forecast corporate earnings. Francis et al. (2019) conclude that increased firm complexity due to tax planning makes profits and taxes less predictable, and analysts do not adequately adjust for these effects. Complementarily, He et al. (2020) point out that tax avoidance obfuscates the trends in financial information analysts use in their forecasts.

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On the other hand, Bratten et al. (2017) proved that analysts are more accurate about ETR management as complexity increases, with real effects on the accuracy of earnings per share (EPS) forecasts. According to the authors, analysts improved management estimates in this scenario.

The study by Novaes et al. (2018) examined the existence of incentives between optimistic analyst forecasts and earnings management. This work found no evidence that discretionary accruals increase after analysts err (with optimistic forecasts). It also failed to identify that earnings management influences analysts' future forecasts. However, Martins et al. (2016) highlighted that discretionary accruals positively correlate with analysts' forecast errors. For the authors, managers have incentives to manage results when they are close to the values of analysts' forecasts because when the company is far from the estimates, the accruals level is lower, indicating fewer results management (Martins et al., 2016).

In this same sense, Mota et al. (2017) found evidence that the results management practiced by managers aims to achieve the forecast of market analysts and complements what Martins et al. (2016) said. In Brazil, Rodrigues et al. (2019) highlighted that the fourth quarter is the one that presents the most intense results management. Table 1 summarizes the main studies and results on the relationship between analyst forecasts and tax aggressiveness.

Table 1

Summary of studies linking analysts' forecasts and tax aggressiveness

Authors	Sample and period analyzed	Main results
Carvalho (2015)	Companies in Brazil between 1999 and 2014.	This study measured the impact of abusive tax planning on analysts' forecast errors during the transition period of IFRS adoption, finding evidence that aggressive tax planning activities decreased forecast accuracy.
Allen et al. (2016)	A sample of 29 brokerage firms matched Hong and Kacperczyk's (2010) and Kelly and Ljungqvist's (2012) studies between 1988 and 2008.	This study showed that the higher the analysts' coverage, the lower the firms' tax aggressiveness.
Chen and Lin (2017)	Companies listed in the US between 1999 and 2011.	This study showed that the higher the analysts' coverage, the lower the firms' tax aggressiveness.

(continues)

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Table 1 (conclusion)

Summary of studies linking analysts' forecasts and tax aggressiveness

Authors	Sample and period analyzed	Main results
Bratten et al. (2017)	Companies with information available in the I/B/E/S, Compustat, and CRSP databases, between 2003 and 2012.	They highlighted that analysts are more accurate about ETR management as complexity increases, with real effects on the accuracy of EPS forecasts.
Francis et al. (2019)	Companies incorporated in the US between 2003 and 2016.	The authors concluded that the increased complexity of firms due to tax planning makes profits and taxes less predictable, and analysts do not adequately adjust for these effects.
He et al. (2020)	Companies with information available in CRSP, Compustat, I/B/E/S and Factset databases between 1995 and 2014.	The study pointed out that tax avoidance obscures the trends in the financial information analysts use in their forecasts.

Given what was exposed in this theoretical reference, it is expected that the companies analyzed in this research present a relationship between tax aggressiveness and analyst's accuracy, which is valid and supports the research hypothesis investigated:

- H1: In companies with higher tax aggressiveness, is the accuracy of profit forecasts by analysts lower?

METHODOLOGY

The methodology used to answer the presented research question is based on the multiple linear regression technique, with panel data run with random effects estimators and endogeneity correction (generalized method of moments – GMM). The dependent variable used was the analyst's accuracy, measured through the mean and median of the consensus of forecasts, and the observations considered valid contained all the values of the variables analyzed in this study.

As independent variables, the tax aggressiveness proxies BTD and ETR were used. The model was controlled through the size of the variables (SIZE), leverage (LEV), number of analysts (ANALYSTS), market-to-book (MTB), operating cash flow (FCO), and results management (JONES, in absolute values), measured through the modified Jones model of 1995.

To deal with the endogeneity problem, we used the GMM with an application of instrumental variables, whose results showed no endogenous

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regressors at a probability of the regression model with instrumental variables at 1%. For Barros et al. (2010), the GMM estimators present sufficient capacity to deal with the endogeneity problem. The one-period lagged control variables served as instruments for the GMM. To validate the instruments used in the GMM. The Jensen test was performed, whose null hypothesis is for the validity of the instruments. Thus, the instruments used were valid by the value presented in Table 8.

The tests were performed in Stata software, and the means and medians of the EPS consensus were extracted from the Institutional Brokers' Estimate System (I/B/E/S) database, available at Thomson Reuters Eikon.

According to Martinez and Salim (2004), there is a tendency of proximity between the value reported by the companies and the values proposed by analysts in their forecasts, so the concept of accuracy is precisely this tendency of proximity, which increases as the analyst's accuracy is higher. Interestingly, the number of analysts covering the company is directly related to the quality of the analysts' forecasts.

In this work, the measurement of analysts' forecast quality follows the studies of Martinez and Salim (2004), Carvalho (2015), Gatsios (2013), and Oliveira and Coelho (2018), treating accuracy as the analyst's forecast error, according to Equation 1.

$$ACCURACY = (-1)\ x \left| \frac{LPA\,reported_{i,t} - LPA\,analyst_{i,t}}{LPA\,reported_{i,t}} \right| \quad (1)$$

The interpretation is that the more the value is distant from zero, the lower the accuracy, since the higher the errors of these forecasts, regardless of their negative or positive sign. For Dalmacio et al. (2013), the inversion of the sign helps to understand why there is a measure that increases when accuracy is higher, so if a variable negatively impacts accuracy, it is clear that the variable decreases analysts' accuracy.

To measure tax aggressiveness, two proxies will be used. The first is the ETR, which shows the ratio between taxes paid by the company and its pre-tax earnings. For Hanlon and Heitzman (2010), the ETR is a quotient between an estimated tax on earnings and a measure before those taxes. For Dyreng et al. (2010), ETR is the total current tax expense (plus deferred tax expense) divided by the pre-tax book profit. In this study, to configure the ETR, we took into consideration the corporate income tax (CIT), the additional income tax (AIR), and the social contribution on net income (SCNI). These represented the taxes paid by the company on the result in Brazil.

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In Brazil, these taxes (CIT, AIR, SCNI) add up to a rate of 34%. Companies that present an ETR below this index have a strong tendency to adopt aggressive tax policies. On the contrary, values above 34% indicate tendencies towards less aggressive policies from the tax point of view.

Another variable used to represent tax aggressiveness is the BTD, calculated from the amount of income tax and profit contribution divided by the rate of 34%; thus, this result is divided by the company's total assets in the previous period. In their work, Allen et al. (2016) also use BTD as a representative variable of tax aggressiveness. Works published in Brazil, such as those by Mota et al. (2017), Dalfior and Martinez (2015), and Martinez and Ramalho (2014), and Chen et al. (2010) have also used this variable. In this work, as in Chiachio and Martinez (2018), BTD was divided by the total assets of the previous period to adjust the basis of comparison better.

For control, the following variables were used: size, leverage, number of analysts, operating cash flow, market value divided by equity (market to book), and an earnings management variable, measured by discretionary accruals (modified Jones model – 1995). For Costa and Soares (2021), the Standard Jones model and its modifications are relevant to the theories associated with accounting manipulation.

For Gatsios (2013), size influences the estimate since it presents a relationship in which larger companies have more information. Thus, analysts will have greater input to enrich their analysis, and consequently, they will be able to adjust their forecasts to the reality of the companies. This paper represents size by the natural logarithm (ln) of assets.

In their work on financial leverage and fiscal aggressiveness in Brazil, Martinez and Martins (2014) confirmed leverage as a measure related to fiscal aggressiveness. The authors reported a relationship in which tax aggressiveness is higher in more leveraged firms. In the present work, leverage will be third-party capital over total asset value.

The number of analysts, as previously pointed out in Antônio et al. (2019), Allen et al. (2016), and Gatsios (2013), presents a direct relationship with accuracy. Therefore, a control measure validates the model developed in this study. According to Martinez and Salim (2004), there is evidence that a greater number of analysts following a given company increases the accuracy of forecasts for this company. In the work of Clement (1999), the variable of the number of analysts following companies was used to find the relationship between the complexity of each analyst's portfolio and their respective accuracy, measured by forecast errors.

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The market-to-book variable shows the relationship between the market value and the equity value of a given company. This variable is used in some works involving accuracy (da Costa et al., 2018; Oliveira & Girão, 2018; Aguiar Domingues & Nakao, 2017; Martinez & Salim, 2004).

For earnings management, using discretionary accruals can favor the managers' wishes. For Martinez (2008), discretionary accruals are a proxy of earnings management, and for Dechow et al. (1995), the modified Jones model (1995) presents better results. From this, total accruals and non-discretionary accruals were calculated. Thus, discretionary accruals are calculated by subtracting non-discretionary accruals from total accruals.

The sample is composed of 212 companies listed on the Brazilian stock exchange and, with analyst coverage, 32 quarters were analyzed over the years between 2010 and 2017, which ensured that the transition during the adoption of IFRS standards did not influence the research since the collection took place after the adoption of the standard (in 2010).

Data was extracted from two databases, Economática and Thomson Reuters Eikon I/B/E/S. The data extracted from the I/B/E/S database were the mean consensus of the analysts' EPS forecast, the median consensus of the EPS forecast, and the EPS reported by each company. All other bases were taken from Economática; and Excel and Stata software were used for statistical treatment and analysis; Excel was used only for data tabulation purposes, while all the creation of standardized variables, creation of the result management variable and all the parts related to econometrics were performed in Stata software.

The winsorization technique was applied to treat outliers to make the model more robust. This technique consists of trimming the extreme values (above or below the defined minimum and maximum percentiles), replaced by the lowest and highest values remaining in the distribution, calculated by the selected percentiles. In this study, winsorization was performed at the 1% level, in line with the survey by Venturini et al. (2022). With winsorization, the mean EPS become clearer (free of outliers) and allow the results to verify whether there is any difference between analyzing EPS by the mean or by the median.

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Table 2

Sample composition

Description	Observations
(=) Brazilian listed companies with analyst coverage	212
(x) Number of investigated quarters	32
(=) Number of observations (company-quarter)	6,784
(-) Adjustments are made by creating the variable earnings management (Jones 1995 model) and removing missing data	(3,978)
(=) Number of valid observations	2,804

When calculating the modified Jones model (1995), 3,980 observations were lost by generating the results management variable since, during the steps, not all companies in the original database contained the information necessary for calculating the Jones model (1995). Another step performed on the database was excluding all observations whose analyst coverage was equal to zero. In addition, missing data from all the research variables, both the dependent and independent variables, were also removed, which included the control variables. After these procedures, we were left with 2,804 valid observations.

The current study uses a longitudinal temporal cut, which makes it possible to measure the proposed variables in different periods where the panel data model is short (when the number of individuals is greater than the number of periods). Another characteristic is that the panel is unbalanced. Next, the regression model of the research is presented, sometimes estimated by a panel with random effects per company, sometimes estimated by GMM.

$$\begin{aligned} ACCUR_{it} = {} & \beta_0 + \beta_1.AGR\_FISC_{it} + \beta_2.MARKET\,TO\,BOOK_{it} + \\ & \beta_3.ANALYSTS_{it} + \beta_4.ALAV_{it} + \beta_5.SIZE_{it} + \beta_6 ROA + \\ & \beta_7 OPERATIONAL\,CASH + \beta_8 GRESULTS\,MANAGEMENT + \varepsilon \end{aligned} \quad (2)$$

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Table 3

Description of model variables

Variable	Description
ACUR	Variable to measure the accuracy of analysts of company i in period t, using both the mean and median of analysts' EPS. The higher the ACUR, the more accurate the analyst's forecast. $$ACURMEAN = (-1)\,x\left(\frac{LPAreported_{i,t} - LPAmean_{i,t}}{LPAreported_{i,t}}\right)$$ $$ACURMEDIAN = (-1)\,x\left(\frac{LPAreported_{i,t} - LPAmedian_{i,t}}{LPAreported_{i,t}}\right)$$
ETR	The metric of tax aggressiveness of company i in period t. The lower the ETR, the more aggressive the company is. $$ETR = \frac{Total\ income\ tax\ expense + Total\ CSLL\ expense}{LAIR}$$
BTD	Metric of fiscal aggressiveness of company i in period t. The higher the BTD, the more aggressive the company is. $$BTD = \frac{\left(LAIR - \frac{Total\ income\ tax\ expense - CSLL}{0{,}34}\right)}{Total\ assets}$$
ALAV	Control variable for the leverage of firm i in year t. $$ALAV = \frac{Non\text{-}current\ liabilities}{Total\ assets}$$
SIZE	The control variable for the size of firm i in period t is the natural logarithm of assets. $$SIZE = Ln Total\ assets$$
Analysts	The control variable for analyst coverage of firm i in period t is the total number of analysts covering the firm.
Market-to-book	The control variable is the price to book firm i in period t.
Results management	Discretionary accruals measure variables through the modified Jones model (1995).

Table 4 presents the descriptive statistics of the research data, which has 2,804 valid observations. The dependent variables, ACCURMEAN and ACCURMEDIAN, have similar central tendency measures, and the ACCUR-

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MEAN variable has a higher variability. These results show no representative differences in analyzing accuracy by mean or median.

Table 4

Descriptive statistics

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
ACCURMEAN	2,804	-0.0918578	0.5192881	-3.076632	2.363333
ACCURMEDIAN	2,804	-0.0899872	0.4487115	-2.747126	1.866667
BTD	2,804	0.0020561	0.0304584	-1.013257	0.0985366
ETR	2,804	0.2045028	0.4917769	-2.491264	2.642857
MTB	2,804	2.467808	2.962399	-4.784563	18.96483
ANALYSTS	2,804	8.740371	4.214334	1	16
ALAV	2,804	0.559044	0.1920899	0.0916759	2.019705
SIZE	2,804	15.75676	1.258576	12.59434	18.8422
FCO	2,804	0.0170483	0.031386	-0.2793884	0.1403906
JONES	2,804	0.0154277	0.0200531	0.0002037	0.2088101

Note. Jones' 1995 model was used.

A more significant difference between the means is observed in the variables that deal with tax aggressiveness (BTD and ETR), in which the ETR variable has a greater standard deviation than the BTD variable. The mean of the ETR variable is below 34%, which indicates that the companies may have tax-aggressive activities on a mean. Most companies present a degree of indebtedness of approximately 56% (ALAV). Martinez and Martins (2016) show that companies with higher tax aggressiveness are also more leveraged.

It is noteworthy that all companies in the sample have at least one analyst, and the companies with the highest analyst coverage have 16 analysts following them. In the mean, companies are followed by approximately nine analysts.

Results management (Jones' model, 1995)

For the variable of earnings management, we adopted the modified Jones model (1995), which is used in several works involving earnings management (Martinez, 2008; Novaes et al., 2018; Martins et al., 2016, for example).

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Discretionary accruals represent earnings management. However, it is necessary to calculate the total accruals and, subsequently, the beta coefficients of the model variables to find the non-discretionary accruals. Finally, to find the discretionary accruals, it is necessary to subtract the non-discretionary accruals from the total accruals.

Table 5

Results management model (Jones' model, 1995)

Stage	Used equation
Total accruals calculation	$TA_{it} = \frac{\left(\Delta AC_{it} - \Delta Disp_{it}\right) - \left(\Delta PC_{it} - \Delta Div_{it}\right) - Depr_{it}}{A_{i,t-1}}$
Estimating the parameters for calculating non-discretionary accruals	$\frac{TA_{it}}{A_{i,t-1}} = \alpha_i \frac{1}{A_{i,t-1}} + \beta_{1i} REV_{it} + \beta_{2i} PPE_{it} + \varepsilon_{it}$
Calculation of non-discretionary accruals	$NDA_{it} = \alpha_i \frac{1}{A_{i,t-1}} + \beta_{1i}\left[\Delta REV_{it} - \Delta REC_{it}\right] + \beta_{2i}\left[PPE_{it} + \varepsilon_{it}\right]$

ANALYSIS OF RESULTS

Table 6 presents the Pearson correlation coefficients obtained through Stata. When analyzing the correlations, it is observed that they are statistically significant. The variables ACCURMEAN and BTD show a negative correlation because when the BTD increases, that is, when there is an increase in tax aggressiveness, there is a decrease in accuracy.

When observing ETR together with ACCURMEAN, a positive correlation is noticed, which indicates that the higher the ETR, the lower the tax aggressiveness, and the higher the ACCURMEAN. The same happens with the variable ACCURMEDIAN, which suggests that the relationship between tax aggressiveness and analysts' accuracy is inverse. The correlation shows that, in more aggressive companies, analysts' accuracy is lower. In these four correlations, there is statistical significance in at least 10%.

There is a low correlation among the independent variables, which contributes to the robustness of the model. Thus, the multiple linear regression model presented below has greater certainty regarding the multicollinearity assumption since the independent variables are not strongly correlated.

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Table 6

Correlation

	ACCUR MEAN	ACCUR MEDIAN	BTD	ETR	MTB	ANALYSTS	ALAV	SIZE	FCO
ACCURMEAN	1								
ACCURMEDIAN	0.9083 ***	1							
BTD	-0.0860***	-0.0273	1						
ETR	0.0507**	0.0452*	0.0093	1					
MTB	0.0234	0.0306	0.0348*	0.0469**	1				
ANALYSTS	0.0279	0.0546***	0.0391**	0.0559**	0.3176***	1			
ALAV	-0.004	-0.0071	-0.2079***	0.0342*	0.2605***	0.1584***	1		
SIZE	-0.0027	0.0108	0.0141	0.0273	-0.1054***	0.3962***	0.2347 ***	1	
FCO	0.0272	0.0278	0.0557***	-0.0043	0.2145***	0.0946***	-0.0805 ***	0.0141	1
JONES	0.05***	0.0284	-0.2232***	-0.0373**	0.1677***	-0.0454**	0.0545 ***	-0.0674***	0.0260

Note. Significance: ***1%, **5% e *10%.

Source: Adapted from Jones' model (1995).

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Regression model analysis

When analyzing the models with the variable BTD, the F statistic shows that the regression has statistical validity, where it presents a significance level of 1% in equations 1 and 3. The four models introduced the same number of valid observations (2,804). It is worth noting that the Chow, Breusch-Pagan, and Hausman tests were performed for adherence to the models, as seen in tables 7 and 8.

By the regressions of equations 1 and 3, the coefficients of the tax aggressiveness proxy, BTD, influence the analysts' accuracy in a way that its increase decreases the accuracy of market analysts. Even if the dependent variable is MEAN ACCURACY or MEDIAN ACCURACY, the statistical significance of the BTD influence is 1%.

With the independent variable ETR, the result is in the same direction as the BTD variable. However, Equation 4 could not point to evidence that the ETR variable influences analysts' accuracy measured by the median because its F-statistic is not statistically significant, to at least 10%.

Thus, of the four regression equations used in the model, three present results that support the hypothesis that the higher the companies' tax aggressiveness, the lower the analysts' accuracy. The results presented by the BTD variable concerning those presented by the ETR variable are more decisive, given their level of statistical significance. As expected, the increase in the coefficient of the BTD variable denotes greater tax aggressiveness, while, in the ETR variable, the lower its value, the more tax-aggressive the company will be. It is necessary to point out that possible results management practices influence the BTD, and the ETR variable does not always represent all that was paid in taxes by the company.

The results corroborate the findings in the works of Allen et al. (2016) and Carvalho (2015), contributing to the consolidation of this result in the Brazilian literature dealing with the influence of tax aggressiveness on analysts' forecast accuracy. Moreover, these results also enable the same interpretation of the works of Hanlon and Slemrod (2009), who argue that there is an impact on price in companies with policies linked to tax aggressiveness. Therefore, in companies with tax aggressiveness policies, there is the possibility of an effect on the share price. However, this act was not counted as positive or negative, as was done in this work by Hanlon and Slemrod (2009).

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Table 7

Regression models (with winsorization)

Variable	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond
BTD	-1.371901	-1.2274075	-0.41211677	-0.54695919				
	-2.94	-188.15	-1.14	-148.46				
	0.0033	0	0.2538	0				
ETR					0.04709082	0.03918621	0.03437501	0.03955143
					1.72	199.33	1.44	101.4
					0.0858	0	0.1501	0
MTB	-0.00535548	-0.01536474	-0.00501518	-0.01656869	-0.00774811	-0.01530936	-0.00594671	-0.01612861
	-0.98	-175.1	-1.11	-162.32	-1.47	-418.02	-1.39	-165.88
	0.3287	0	0.2686	0	0.1428	0	0.1659	0
ANALYSTS	0.00471993	0.00899154	0.00635194	0.00238124	0.00453778	0.00946918	0.00620079	0.00244859
	1.21	49.75	1.98	52.04	1.14	83.52	1.93	16.06
	0.2279	0	0.0476	0	0.2526	0	0.0538	0
ALAV	0.06092725	0.15027745	0.0723456	0.3016012	0.121528	0.22239745	0.09089621	0.34067164
	0.45	28.08	0.63	46.49	0.99	26.66	0.84	37.7
	0.6532	0	0.5297	0	0.3235	0	0.4036	0
SIZE	-0.00753383	0.19878663	-0.0063048	0.18652187	-0.01049898	0.19274987	-0.0072515	0.18092195
	-0.48	83.2	-0.45	54.15	-0.74	91.77	-0.53	66.06
	0.6298	0	0.6525	0	0.4585	0	0.5956	0

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Table 7 (continuation)

Regression models (with winsorization)

Variable	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond
JONES	1.448777	1.56523	1.2293265	1.3402412	2.1741279	2.4591729	1.4753908	1.774455
	2.18	155.15	2.32	110.59	2.72	378.03	2.9	108.76
	0.0292	0	0.0201	0	0.0066	0	0.0037	0
FCO	0.64800236	0.67821772	0.51173042	0.44222123	0.60830707	0.68237695	0.5081195	0.46907226
	1.76	67.65	1.65	70.47	1.68	99.11	1.63	101.4
	0.0785	0	0.0983	0	0.0925	0	0.103	0
ACCURMEAN L1.		0.1776917				0.18652684		
		2441.48				1740.12		
		0				0		
ACCURMEDIAN L1.				0.0946499				0.09915456
				1092.53				702.71
				0				0
_cons	-0.06612919	-3.3762353	-0.10099848	-3.2026024	-0.06874496	-3.3464315	-0.10440664	-3.1527006
	-0.3	-87.8	-0.49	-60.06	-0.33	-107.21	-0.52	-79.95
	0.7629	0	0.6219	0	0.7412	0	0.6015	0

(continues)

Table 7 (continuation)

Regression models (with winsorization)

Variable	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond
N	2,804	2,476	2,804	2,476	2,804	2,476	2,804	2,476
r2								
r2_o	0.01504414		0.00942522		0.01232118		0.01031289	
r2_b	0.04143413		0.04037117		0.02087975		0.03419256	
r2_w	0.01310154		0.00544483		0.0097066		0.00628418	
F								
chi2	31.860286	105100000	19.514159	1322000000	14.311119	885200000	16.106088	144500000
Heteroscedasticity Test								
Chi²	125.86		0.86		68.18		8.25	
Prob > Chi²	0		0.3533		0		41	
Ramsey test (omission of variable)								
F	8.04		5.73		8.78		4.84	
Prob > F	0		0.0007		0		0.0023	
Statistics VIF								
Mean VIF	1.26		1.26		1.2		1.2	

(continues)

Table 7 (conclusion)

Regression models (with winsorization)

Variable	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond
Serial autocorrelation								
F	11.083		3.068		10.925		3.039	
Prob > F	0.0012		0.824		0.0013		0.0839	
Chow's Test								
F	2.11		2.07		2.1		2.06	
Prof > F	0		0		0		0	
Breusch Pagan test								
Chi²	59.22		56.81		55.82		56.27	
Prob > Chi²	0		0		0		0	
Robust Hausman test								
Chi²	5.05		3.74		5.98		4.34	
Prob > Chi²	0.654		0.809		0.5418		0.7394	

The earnings management variable stands out, with statistical significance in the four proposed equations, which shows that the higher the practice of earnings management, the more accurate the analysts' forecast will be. This result is justified by the vast literature on analysts' forecasts and earnings management. The findings of this literature show that earnings management is influenced by analysts' forecasts, which encourages managers to adopt means to achieve the estimates (Martins et al., 2016; Graham et al., 2005; Allen et al., 2016). Thus, because companies tend to manage results to meet market expectations, the equations in this paper presented coefficients with positive signs about analysts' accuracy. This result supports the concept of the market pressure view, discussed in the work of Allen et al. (2016).

Although some control variables did not show statistical significance, their choice aligns with previous literature. This statistical validity result exposes that in the sample of this work, there was no interference of these variables in the mode. However, these controls should not be interpreted as irrelevant to explaining the forecast errors of other models with different samples.

In analyzing the endogeneity issue, Table 8 presents the GMM with the Jensen statistic, indicating that there are no endogenous regressors in this research.

The endogeneity between accuracy and tax aggressiveness could be justified because of omitted variable bias since the analysts' forecast involves other information. According to Beiruth et al. (2014), if evaluation methods based on accounting information are used, analysts will have an improvement in the accuracy of their forecasts compared to models that do not have this basis. The authors used the Ohlson-Juettner (OJ) model, which indicates that other variables can influence the accuracy of analysts in addition to those worked on in this research.

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Table 8

Regression models (without winsorization)

Variable	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond
BTD	-4.2517548	-3.6062519	-3.1190196	-3.6449392				
	-1.47	-2628.58	-0.96	-5353.69				
	0.1416	0	0.3354	0				
ETR					0.06085071	0.04480958	0.04368756	0.04525658
					2.38	738.72	2.37	139.33
					0.0171	0	0.0177	0
MTB	0.00415741	-0.01538674	-0.00114102	-0.02942929	-0.0019658	-0.01566297	-0.00562338	-0.02974111
	0.33	-696.12	-0.08	-1033.97	-0.2	-112.15	-0.53	-975.13
	0.7437	0	0.9325	0	0.8419	0	0.5943	0
ANALYSTS	-0.02406766	0.01577827	-0.02344809	-0.05834009	-0.02432365	0.01865225	-0.02363376	-0.05689943
	-1.09	161.39	-0.98	-649.04	-1.09	264.19	-0.99	-577.18
	0.2759	0	0.3262	0	0.2737	0	0.3244	0
ALAV	-0.25185382	-2.4755738	-0.20037351	-1.3006874	-0.07339848	-2.248353	-0.06947384	-1.0145933
	-0.36	-2074.34	-0.27	-1742.16	-0.12	-1893.14	-0.11	-419.12
	0.7164	0	0.7845	0	0.9022	0	0.9126	0
SIZE	0.00528227	0.84800678	0.00593916	0.91076655	-0.00139687	0.82233488	0.00104867	0.86645518
	0.08	606.54	0.09	1033.39	-0.02	678.94	0.02	378.87
	0.9363	0	0.9317	0	0.9821	0	0.9873	0

(continues)

Table 8 (continuation)

Regression models (without winsorization)

Variable	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond
JONES	3.3842768	4.2180933	3.0193363	1.5687418	5.3760131	6.927578	4.479096	4.2386209
	1.62	4024.23	1.52	1060.75	1.79	5139.23	1.52	2463.64
	0.1048	0	0.129	0	0.0734	0	0.1294	0
FCO	0.06156642	0.56934749	-0.12017521	-0.31647042	-0.09501718	0.46898681	-0.23540284	-0.37911761
	0.07	117.75	-0.14	-157.05	-0.1	80.27	-0.24	-72.26
	0.9449	0	0.8922	0	0.9217	0	0.809	0
ACCURMEAN L1.		0.11444358				0.11459225		
		20124.21				26379.13		
		0				0		
ACCURMEDIAN L1.				0.13677252				0.13647932
				81075.75				70882.33
				0				0
_cons	0.19738684	-12.199556	0.1852723	-13.086838	0.17004911	-12.00661	0.16526561	-12.608722
	0.28	-509.61	0.24	-1528.11	0.25	-533.6	0.22	-405.2
	0.7818	0	0.8132	0	0.8057	0	0.8297	0

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Table 8 (continuation)

Regression models (without winsorization)

Variable	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond
N	2,804	2,476	2,804	2,476	2,804	2,476	2,804	2,476
r2								
r2_o	0.00503299		0.00305987		0.00403626		0.00259779	
r2_b	0.03052528		0.01937869		0.02250632		0.01914266	
r2_w	0.00222001		0.00092448		0.00101833		0.00034203	
F								
chi2	12.413326	49070000000	7.8681428	2.216E+11	14.57212	1.603E+12	10.515458	1.903E+12
Heteroscedasticity Test								
Chi²	4323.84		3726.88		1918.44		2114.58	
Prob >Chi²	0		0		0.6295		0	
Ramsey test (omission of variable)								
F	1.39		2.21		0.58		0.39	
Prob > F	0.2432		0.0853		0.6295		0.7581	
Statistics VIF								
Mean Vif	1.23		1.23		1.17		1.17	

(continues)

Table 8 (conclusion)

Regression models (without winsorization)

Variable	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond	Random effects robust	Arellano-Bond
Serial autocorrelation								
F	0.865		1.184		0.868		1.27	
Prob > F	0.3542		0.2788		0.3534		0.28	
Chow's Test								
F	1.28		1.36		1.27		1.35	
Prof > F	0.0201		0.0055		0.0253		0.0067	
Breusch Pagan test								
Chi^2	0.001		0		0		0	
Prob > Chi^2	1		1		1		1	
Robust Hausman test								
Chi^2	4.21		3.12		3.07		2.9	
Prob > Chi^2	0.7552		0.8739		0.8789		0.894	

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CONCLUSIONS

This study sought to identify the relationship between tax aggressiveness and market analysts' accuracy. The influence that the tax aggressiveness exerts on the analysts' forecast was analyzed from a temporal cut from 2010 to 2017, in which there was no change concerning the accounting standards because the IFRS was fully implemented in 2010, unlike other works that used temporal cuts with data from pre- and post-IFRS adoption periods.

The results obtained from this study show that the most aggressive companies present a lower degree of analyst predictability. With this drop in the quality of analysts' forecasts, the users of their forecasts and reports are more vulnerable to information asymmetry. This relationship can interfere with the price of the assets in question and can also have a greater perception of the companies' risks. This is the main gap that this study sought to fill.

By analyzing the variable number of analysts, it was possible to find statistical evidence that, in companies with a higher number of analysts, there is an increase in the quality of their forecasts, as in the work of Martinez (2009). For Allen et al. (2016), this provides evidence that analyst coverage is a factor that influences both the adoption of policies linked to tax aggressiveness and the accuracy of forecasts since it increases the demand for information from companies (investor recognition view). In line with Allen et al. (2016), the study developed by Chen et al. (2018) indicated that ETR reduction is more pronounced in companies with less analyst coverage.

As a limitation of this research, there is the fact that the taxes considered to calculate aggressiveness were the taxes on income. The other taxes were not present. The present work is concluded by reaching its objective and presenting evidences that support the null hypothesis of the work. Thus, it contributes to the consolidation of the influence of tax aggressiveness on analysts' accuracy.

This study is limited to the institutional environment, the Brazilian market, and the analyzed period. As a suggestion for future research, additional variables can be adapted to the model, and the analysis can also be expanded to other markets to compare the behavior of emerging and developed markets. Furthermore, it is suggested that the behavioral aspects of earnings management (as indicated by Brennan, 2021) and the relationship of this management with analysts' estimates be analyzed, which may be an enlightening path.

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