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Economic uncertainty and tax aggressiveness among Brazilian companies listed on the B3

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Abstract

Objective: This study aimed to analyze the association between an economically uncertain environment and the level of tax aggressiveness among Brazilian firms listed on the B3.

Gap: Unlike previous Brazilian literature, this study analyzes the effect of economic uncertainty and its association with the level of tax aggressiveness among listed companies.

Method: This descriptive, documentary study with a quantitative approach addressed data from 2013 to 2018 of 252 companies listed on the B3 until December 31st, 2018. Descriptive statistics were used in addition to means difference tests and regression analysis with panel data. Data were collected from the COMDINHEIRO and IPEADATA websites and analyzed using Stata 16.

Results: The results show no positive association between tax aggressiveness and economic uncertainty; however, it moderates the effect of tax aggressiveness determinants. These results are robust for heteroscedasticity, autocorrelation, and different proxies for tax aggressiveness.

Implications: The results contribute to policymakers, regulators, auditors, and market analysts and suggest that tax burden has an indirect effect on adopting more aggressive tax planning, which might indicate tax evasion and/or future litigation.

Keywords: Tax Aggressiveness; Economic Uncertainty; Effective Tax Rate; Book Tax Differences.

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1. Introduction

The Brazilian political-economical environment, especially during 2015 and 2016, experienced significant economic uncertainty, with a downturn in the economy and a crisis of confidence among investors and entrepreneurs – mainly those in the industrial sector (Oreiro, 2017). Household consumption decreased in the face of escalating unemployment, inflation, political instability, and corruption, all factors that negatively influenced investors' risk assessments and favored the retraction of the Brazilian economy in recent years (Vartanian & Garbe, 2019). Edwards, Schwab, and Shevlin (2016) highlight that the payment of taxes on corporate profits tends to decrease in an environment of economic instability. In this sense, Damascena, França, Leite Filho & Paulo (2018) analyzed Brazilian companies from 2011 to 2015 and realized that precisely during the rising of a political crisis, from 2014 to 2015, the companies in the sample sought to decrease costs and expenses by any means necessary, among which, using aggressive tax measures.

Companies seek to be more tax aggressive in conducting their businesses when facing an economically uncertain context (Momente, Rezende, Silva & Dalmácio, 2017). As Martinez (2017) noted, firms seek to ensure their actions will minimize the tax burden in every possible opportunity. In turn, economic agents where tax legislation is vague or has dubious interpretation seek alternatives to ensure higher savings, which may lead them to a legally questionable position.

The Brazilian and international literature has presented evidence that companies in environments of economical and financial uncertainty seek to decrease tax burden to ensure the continuity of their businesses (Richardson, Taylor & Lanis, 2015; Edwards et al., 2016; Momente et al., 2017; Martinez & Silva, 2018; Dang, Fang & He, 2019; Kang & Wang, 2021). Studies conducted in the Brazilian and Latin American contexts generally report controversial results though (Damascena et al., 2018), suggesting an opportunity to develop research.

Given this context, this study sought answers to the following problem: **What is the relationship between an economically uncertain environment and the level of tax aggressiveness among Brazilian companies listed on the B3?** Hence, this study aimed to analyze the association between economically uncertain environments on the proxies for tax aggressiveness among Brazilian companies listed on the B3. Therefore, we analyzed publicly traded firms experiencing an environment of economic uncertainty to see whether they presented higher or lower levels of tax aggressiveness.

This descriptive, documentary, study with a quantitative approach analyzed data from 2013 to 2018 concerning 252 companies listed on the B3 up to December 31st, 2018, using descriptive statistics, means difference tests, and regression analysis with panel data. Data were collected on the COM DINHEIRO and IPEADATA websites and analyzed using Stata 16.

Oreiro (2017) and Schineller, Mukherji, and Brandazza (2018) note that 2015 and 2016 were marked by increased corruption, judicial investigations, impeachment, readjustment of electricity tariffs, substantial devaluation of the exchange rate, increased inflation, and a downward in workers' real income, which differentiate the Brazilian context from the global crisis in 2008 (Momente et al., 2017). Therefore, this study adds to the previous ones, first because it analyzes a different period (2015/2016) and an environment of economic uncertainty with specific characteristics, differently from the Asian financial crisis (1997), Enron's (2000), Argentina's (2001) or Subprime mortgage crisis (2008). Additionally, the hypothesis adopted here is that the level of the companies' tax aggressive measures tends to increase in times of economic uncertainty; thus, the Emerging Market Bond Index Plus (EMBI+) index is adopted as a proxy, as it captures the country risk, recurrently used in studies addressing economy (Ornelas, 2017).

This study's contributions include evidence it presents that can influence the decision-making of managers, auditors, investors, and lawmakers; empirical evidence is presented regarding the behaviors of firms in an environment of economic uncertainty. On the one hand, it shows that the effects of a crisis environment of the Effective Tax Rate (ETR) are fragile, i.e., inverse to the theoretical hypotheses analyzed. The Book Tax Difference (BTD) as a proxy for tax aggressiveness, on the other hand, showed a result that partially confirms the hypothesis proposed, while the literature thus far (Damascena et al., 2018; França et al., 2018) reports similar evidence that the tax aggressiveness of Brazilian firms does not significantly increase in times of economic uncertainty. Nevertheless, the study indicates that an environment of economic uncertainty plays a moderating role on significant factors that explain tax aggressiveness, showing a need to analyze tax planning practices within a given context so that other factors that act together on the result cannot be neglected. Additionally, tax aggressiveness by itself may not have expressive effects on operations.

2. Literature Review

2.1 Contextualization and delimitation of the expression "economically uncertain environment"

Since its economic stabilization, Brazil has shown a tendency to grow, but as noted by Paula and Pires (2017), after recovering from the 2008 crisis, the country has experienced cycles of growth and deceleration. According to Ornelas (2017), the Brazilian economy has presented a deceleration trend since 2011, and in 2015 it entered a strong recession. Schineller et al. (2018) highlight the government effort to stimulate the economy at the time (decreasing financing interest rates, promoting currency devaluation, exempting the payroll in some sectors, and imposing import taxes for certain capital goods, in addition to subsidies and tax exemptions).

Oreiro (2017) considers that the "new macroeconomic matrix," implemented from 2011 to 2014, was an attempt of public policy to boost economic growth that was successful (even though for a short period). However, after the second semester of 2014, deceleration worsened toward the last quarter of 2015 and stabilized in 2017.

Garcia, Monte-Mor, and Tardin (2019) note that in the first years from 2006 to 2016, Brazil was classified in the sovereign credit rating as an investor country; however, it was constantly downgraded at the end of the period, until finally classified as a speculative country. Furthermore, according to Oreiro (2017) and Ornelas (2017), factors such as the readjustment of electricity tariffs, the substantial devaluation of the nominal exchange rate, and inflation jumping from 6.41% in 2014 to 9.48% in 2015, coupled with a sharp drop in oil prices, among other factors, fueled recession in 2015 and 2016.

In this context, Vartanian and Garbe (2019) highlight that some events worked as vectors of the Brazilian economic recession in 2015 and 2016, but the main ones were: the base interest rate, exchange rate, national imports, and gross fixed capital formation. Additionally, a decrease in the prices of commodities, such as oil and iron ore, interest rates in the United States, and the influence of the Global Gross Domestic Product (GDP), raised country risk in Brazil.

Country risk is associated with default risk and arises from factors under the government's control and indicates economic uncertainty. Garcia and Santos (2007) consider that country risk is a measure that considers general liquidity conditions, the degree of risk aversion, and the specific risk attributed to each asset. The authors mentioned above state that the EMBI+ is one of the indicators most frequently used as a risk proxy for an emerging economy.

J. P. Morgan calculates the EMBI+ and mainly comprises external debt securities (Brady and Eurobonds) and external loans (Soihet, Ribeiro, & Safins, 2016). EMBI+ has a related sub-index for each emerging country; hence, the Brazilian sub-index is EMBI+ Brazil (Ornelas, 2017). EMBI+ is used to verify whether a country can honor its financial commitments. Therefore, the higher the index, the riskier a given country is in terms of investments (Garcia & Santos, 2007). Franzen, Meurer, Gonçalves, and Seabra (2009) note that the Brazil risk index (EMBI+BR) is the percentage variation of this indicator, based on the risk premium of Brazilian bonds in relation to US Treasury bonds.

2.2 Tax aggressive planning: measurement methods

According to Hanlon & Heitzman (2010), tax planning is a way to decrease a firm's tax burden by legal means, not to be confused with evasive, illegal practices, which may result in future sanctions on the part of inspection agencies. This way translates into tax planning practices that aim to decrease a firm's level of the tax burden, not necessarily implying evasion. Lietz (2013) states that, to understand what aggressive tax planning is, one needs to draw an imaginary line in which conservative practices (e.g., tax compliance) evolve into more aggressive practices (e.g., tax litigation) and are closer or result in tax evasion (abusive and/or illegal practices). In the meantime, Martinez (2017) notes a gap between the legality and tax evasion zones, which is not clear enough to be defined as illegal. It results in conceptual imprecision and has encouraged research on taxation. Nevertheless, the firms' tax aggressiveness has been measured through proxies such as BTD and ETR (and their variations), while evidence regarding their determinants is recurrent in the Brazilian and international literature.

The Brazilian literature has systematically analyzed the association between BTD and different variables (Martinez, 2017), such as earnings management, duration, industrial sector, periods, and incidence of international taxation. These studies report that BTD is considered a proxy related to the quality of profit, and, to some extent, it is restricted as a metric of tax aggressiveness (Ferreira et al., 2012). Nevertheless, BTD and its variations – Permanent BTD (BTDP), Temporary BTD (BTDT), and Abnormal BTD (BTDA) – are widely used in studies addressing tax aggressiveness, but also in studies addressing earnings management and the quality of accounting information (Momente et al., 2017).

Like BTD, ETR, and its different versions, is widely used in studies addressing this topic: Generally Accepted Accounting Principles (GAAP ETR); ETR Total; CashETR; Current ETR; and Long Run ETR. Carvalho, Paulo, and Tavares (2014) investigated Brazilian and international studies published from 2000 to 2012 and verified that the ETR, BTD, and CashETR proxies were widely adopted by studies addressing tax planning and how to measure it. These proxies measure the effective rate of income tax and social contribution due/paid by firms and the difference between accounting income and taxable income (Martinez, 2017).

Hence, BTD and ETR were adopted in this study as proxies for tax aggressiveness. Additionally, as a test of the robustness of the results, BTDP, BTDT, CashETR, and DifETR were used – all systematically used in the literature addressing taxation.

2.3 Previous studies and hypotheses development

The tax burden is a recurrent concern of governments and taxpayers (Slemrod, 2007) because, on the one side, resources are needed to finance social welfare, and on the other hand, individuals, families, and firms seek to maximize their wellbeing by avoiding tax burden. From the perspective of Richardson et al. (2015), taxpayers based their actions on the cost/benefit ratio. In this context, taxation consists in adopting tax-planning practices and assuming greater or lesser risk, according to the expected benefits. These decisions are intensified in contexts of more significant financial constraints and/or economic uncertainties, as they act as additional incentives to decrease taxes (Dang et al., 2019).

In recent years, this hypothesis has been studied in various countries. For instance, Richardson et al. (2015) verified in the Australian context that firms with the greatest financial restrictions tended to be more tax aggressive, especially in times of crisis. Reinforcing this evidence, Dang et al. (2019) observed that those with the highest bankruptcy risks among Chinese listed companies tended to be more aggressive. Additionally, factors such as an environment with great economic uncertainty subjected to a higher tax burden drive firms to adopt more aggressive tax planning practices.

Thus, evidence regarding the effect of an economically uncertain environment on tax aggressiveness is controversial. For example, Kang & Wang (2021) verified that an economically uncertain environment in the Chinese context encouraged tax-aggressive measures. Therefore, in this scenario, it is worth noting that the effect discussed here is contemporary, with gradual reversals in the medium and long terms. Shen et al. (2021) also analyzed the Chinese market though, and verified that tax aggressiveness tends to be significant in state-owned companies in periods of crisis because even though they are subject to the same tax rules, tax pressure tends to be lower.

Momente et al. (2017) analyzed the level of tax planning among Brazilian firms listed on the B3 in times of crises in the domestic market and verified that the effective tax rate on profit decreases in periods of crisis. They also verified that managers tend to put more aggressive tax practices into action. Damascena et al. (2018), on the other hand, analyzed data of Brazilian companies from 2011 to 2015 and verified that those with financial restrictions increased their tax burden specifically between 2014 and 2015 (a time of economic uncertainty), contradicting the hypothesis that tax aggressiveness is greater in times of crisis. The authors noted that this result might be explained by a greater default risk and supervision of tax compliance arising from the government's fiscal pressure. Complementarily, França et al. (2018) assessed data from Latin-American companies and verified that greater tax aggressiveness is associated with greater financial restrictions. According to these authors, however, an uncertain environment did not significantly affect the Brazilian firms. The opposite happened in Colombia, Chile, and Peru though, suggesting riskier tax planning practices. Hence, given previous evidence, the following hypothesis (H_1) is proposed:

H_1: In times of economic uncertainty, companies tend to adopt tax aggressiveness practices more frequently.

Additionally, in line with França et al. (2018), Kang & Wang (2021), and Shen et al. (2021), even though evidence in emerging countries does not reinforce the hypothesis that an economically uncertain environment has a significant effect on tax aggressiveness, it possibly plays a moderating role on the effect of tax aggressiveness determinants. The reason is that an economically uncertain environment pressures the firms' level of activity, decreasing expectation of future performance, which implies a search for additional ways to decrease costs and expenses, especially taxes (Dang et al., 2019). Hence, the following hypothesis (H_2) was also proposed:

H_2: Economic uncertainty moderates the association of the determinants of levels of tax aggressiveness

3. Methodological Procedures

3.1 Sample and data collection

The sample was composed of 252 non-financial companies listed on the B3 with greater liquidity due to its representativeness in the capital market and the Brazilian economy. Data were collected from the COMDINHEIRO database and the IPEADATA website concerning 2013 to 2018. This time frame was adopted to compare homogeneous periods of the years concerning economic instability (2015-2016). The initial sample was composed of 2,394 observations firms/year. According to Martinez & Silva (2018) and Kang & Wang (2021), 798 observations with profit before negative taxes were excluded. Another 454 observations were excluded for being outliers. As Billor, Hadi & Velleman (2000) proposed, the BACON algorithm, which identifies outliers in multivariate models based on the Mahalanobis distance, was used. Finally, 245 observations without data available for estimation were also excluded. Data were analyzed using descriptive statistics, means difference tests, and regression analysis with panel data using Stata 16.

Differences between the means/medians of the variables of interest were compared between the pre-uncertainty (2013-2014), economic uncertainty (2015-2016), and post-uncertainty (2017-2018) periods using Student's t-test and Wilcoxon-Mann-Withney. According to Richardson et al. (2015), Momente et al. (2017), Damascena et al. (2018), França et al. (2018), Dang et al. (2019), and Kang & Wang (2021), regression analysis was used to verify whether there was a significant association between uncertain environments and tax aggressiveness. After adopting the procedures that Wooldridge (2011) proposed to estimate panel data, models with Random Effects estimated by Generalized Least Squares and with adjustments for heteroscedasticity and serial correlation of residuals were used.

3.2 Model and variables

Regression models (equation 1 and 2) adapted from Richardson et al. (2015), Momente et al. (2017), Damascena et al. (2018), França et al. (2018), Dang et al. (2019), and Kang & Wang (2021), were used:

$$\text{TaxAgr}_{it} = \beta_0 + \mathbf{D_1 EconUncert} + \beta_j \sum_{1}^{10} \text{Controls} + \varepsilon \quad (1)$$

$$\text{TaxAgr}_{it} = \beta_0 + \mathbf{D_1 EconUncert} + \beta_j \sum_{1}^{10} \text{Controls} + \mathbf{\beta_k EconUncert} * \mathbf{Controls} + \varepsilon \quad (2)$$

In which $TaxAgr_{it}$ – Tax Aggressiveness proxies; *EconUcert* – Economically uncertain environment; *Controles* – Control variables (Appendix 1).

The models were estimated by the Generalized Linear Squared (GLS) method because this is an additional solution that contributes to the quality of results when there is serial autocorrelation in a panel with random effects (Baltagi, 2005). After performing the Chow Test, and the Breusch-Pagan and Hausmann tests, we decided to use models with random effects. Subsequently, the Wooldridge test for serial autocorrelation was performed, and we decided to estimate the GLS panel.

3.2.1 Dependent and independent variables

The dependent variables were BTD and ETR, which have already been systematically used in the literature. The BTD and ETR variations mentioned in section 2.2 were used as a robustness test.

Regarding the independent variable (economic uncertainty), previous literature used a series of proxies in line with the institutional environment under study and data availability (Damascena et al., 2018; França & Monte, 2020; Kang & Wang, 2021). Hence, we sought to capture an economically uncertain environment in four ways: (i) a dummy for the period of crisis (2015-2016); (ii) a dummy for decreased EMBI+; (iii) a quantitative variable with the EMBI+ logarithm; and (iii) a dummy for decreased GDP. These variations, among other things, enable assessing the consistency of effects of the variable of interest based on different measures. In this scenario, we note that the EMBI+ is an innovating tool in accounting literature addressing taxation and a proxy for economic uncertainty because it is indicated to analyze risk in emergent countries, such as Brazil (Ornelas, 2017; Soihet et al., 2016). Therefore, considering the hypotheses proposed and previous evidence, we expect a negative and significant association between uncertain environment and ETR and a positive and significant association between uncertain environment and BTD (Damascena et al., 2018; França & Monte, 2020; Kang & Wang, 2021).

Various control variables that capture other incentives to tax aggressiveness were tested to decrease endogeneity problems arising from omitting representative variables, and those presenting statistical significance or a t greater than 1 and increased R^2 were maintained (Gujarati, 2019). The rationale, operationalization, and expected signs for the variables, based on previous literature, are presented in Appendix 1 (Damascena et al., 2018; França & Monte, 2020; Kang & Wang, 2021).

Additional analyses were performed with the variations of BTD and ETR, specifically, Permanent BTD, Temporary BTD, CashETR, and Dif ETR, to verify the results' consistency. As suggested by Baltagi (2005) and Wooldridge (2011), we performed the same tests and actions were performed in the additional analyses to mitigate heteroscedasticity and residual serial autocorrelation problems.

4. Analysis of Results

A comparative analysis was initially performed between the descriptive statistics of the variables included in the model (Table 1) between the periods of expansion (pre-crisis) and recovery (post-crisis), 2013-2014 and 2017-2018, respectively, and the crisis period (recession) being 2015-2016 (Vartanian & Garbe, 2019).

BTD and ETR were higher in the crisis period; however, differences were not significant at 1% and 5% levels. This result is the first indication that an uncertain environment may not result in greater tax aggressiveness because, even though a difference was found, it was not significant. Additionally, when the subsequent period was compared to the economic uncertainty period, BTD (BTDP and BTDTE) was higher than ETR (CashETR and DifETR), which was lower than in the uncertain environment these differences were not significant neither at 1% or 5%. In principle, this result reinforces the results reported by studies addressing Brazilian data indicating no significant effects of an economically uncertain environment on tax aggressiveness practices (França et al., 2018; França & Monte, 2020). Similar to the Brazilian context, Shen et al. (2021) and Kang & Wang (2021) highlight that the fiscal pressure exerted by the government can be a factor restricting tax aggressiveness practices during a recession.

Table 1
Descriptive statistics of continuous variables concerning 2013-2018

	Pre (a)		Economic uncertainty (b)		Post (c)		t-test		
	N=315		N=270		N=303		(b-a)	(c-b)	(c-a)
	μ	σ	μ	σ	μ	σ			
BTD	0.023	0.051	0.028	0.108	0.031	0.086	+	+*	+
BTDTE	0.087	0.156	0.071	0.138	0.065	0.114	-	-**	-
BTDP	- 0.063	0.166	- 0.043	0.180	- 0.033	0.149	+*	+**	+
ETR	0.239	0.136	0.253	0.147	0.236	0.146	+	-	-*
CashETR	- 0.105	2.046	- 0.360	1.937	- 0.291	0.877	-*	+*	-
DifETR	- 0.101	0.136	- 0.087	0.147	-0.104	0.146	+	-	-*
EMBI+	217.58	13.016	364.21	17.892	270.28	2.066	+***	-***	+***
PIB	1.163	1.382	- 3.833	1.663	1.775	0.580	-***	+***	+***
ROA	0.067	0.083	0.056	0.169	0.065	0.103	-	+	-
ΔIMOB	0.038	0.641	0.030	0.223	0.056	0.216	-	+	+*
TAM	15.047	1.717	15.080	1.847	15.184	1.964	+	+	+
Payout	3.142	1.096	3.218	1.104	3.164	1.148	+	-	+
MTB	7.493	4.633	7.515	4.727	8.492	4.191	+	+	+

Note. The signs refer to the difference between the means obtained by the groups. ***, **, * Statistically significant at 1%, 5%, and 10%, respectively. NS – Statistically non-significant.

Source: study's data.

Unlike the tax aggressiveness proxies, EMBI+ and GDP presented significant differences in all the comparisons. Considering the hypotheses proposed (, the results reinforce that GDP decreased significantly ($p<0.01$) in 2015 and 2016 compared to the previous biennium, while EMBI+ increased significantly ($p<0.01$). These results reinforce that these metrics signaled to the market a time of economic uncertainty during the years in which crisis was identified and are in line with the literature. In this sense, Franzen et al. (2009), Garcia & Santos (2007), Ornelas (2017), and Soihet et al. (2016) observed that, in an unstable scenario, EMBI+ increases considerably while GDP tends to drop.

Therefore, the means for the control variables show that, even though they present means that are in line with the hypotheses, no statistical differences were found (Cabello & Pereira, 2015; Chiachio & Martinez, 2019; Garcia & Santos, 2007).

Next, Figure 1 shows how the variables BTD, ETR, and Country Risk behaved from 2013 to 2018. EMBI+ was divided by 1,000, and BTD was multiplied by 10 to facilitate visualization and make comparisons.

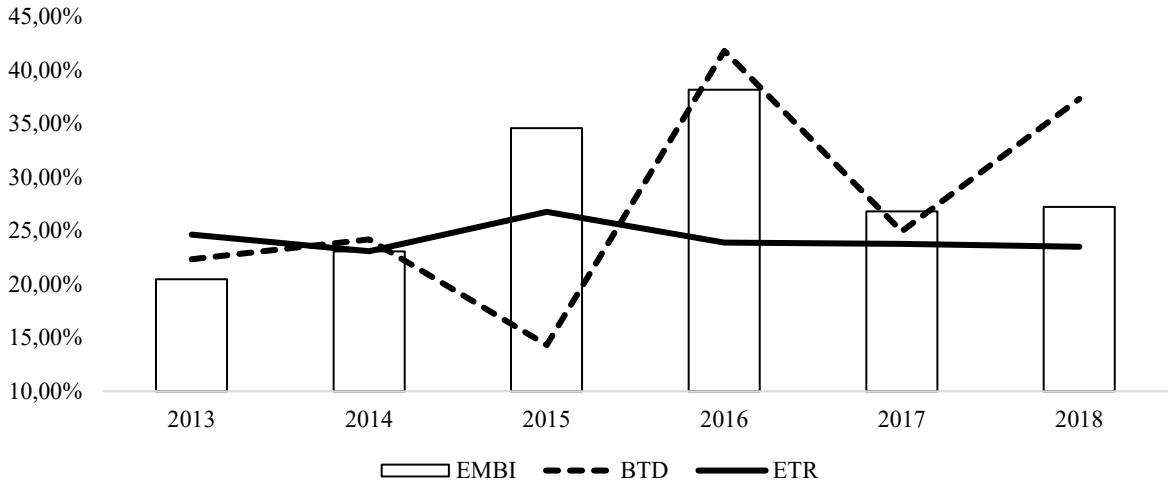

Figure 1. Progression of BTD, ETR, and EMBI+ from 2013 to 2018

Source: study's data.

Thus, BTD and Country Risk (EMBI+) presented sudden changes in the series trajectory. This result suggests a potential significant marginal effect in the crisis period for BTD and EMBI+. The graph shows that EMBI+ increased considerably in 2015 and 2016, compared to the two previous years, while in 2017 and 2018, it returned to 2013-2014 similar levels. BTD decreased in 2015 and increased significantly in 2016, while ETR remained relatively stable in the period.

The way EMBI+ behaved is coherent with a perception of risk based on various dimensions that compose the indicator. This index rises when the economic and political environments deteriorate and tends to return to its previous levels when the environment improves. The way BTD behaves may depend on the firms' and managers' greater conservatism in times of crisis, which may result in greater acknowledgment of estimates that affect accounting results but do not affect taxes, considerably increasing BTD. Like the country risk, BTD returned to levels found before the crisis (Franzen et al., 2009; Garcia & Santos, 2007; Hanlon & Heitzman, 2010; Ornelas, 2017; Soihet et al., 2016).

4.1 Analyzing the direct association between economic uncertainty and tax aggressiveness

Table 2 presents the results of the estimation of model 1, which analyzes the effect of the uncertain environment on ETR. In general terms, the models (1.1 to 1.4) presented statistical significance at 1%, showing that at least one explanatory variable was significant to explain ETR.

Table 2
Statistics concerning the effect of the uncertain period on ETR during 2013-2018

ETR_{it}		1.1		1.2		1.3		1.4	
Intercept		0.204***	(0.033)	0.199***	(0.033)	0.202***	(0.030)	0.206***	(0.032)
D_{Crisis_t}	(H_1)	0.012**	(0.005)						
$D_{CountryRisk_t}$	(H_1)			0.009*	(0.005)				
$CountryRisk_{it}$	(H_1)					8.70e-05*	(4.52e-05)		
$D_{RetrGDP_t}$	(H_1)							0.008*	(0.005)
Q2_Z-Score-Altman		-0.011	(0.007)	-0.012*	(0.007)	-0.017**	(0.008)	-0.013*	(0.007)
Q3_Z-Score-Altman		-0.004	(0.007)	-0.009	(0.007)	-0.010	(0.009)	-0.006	(0.008)
Q4_Z-Score-Altman		-0.026**	(0.011)	-0.032***	(0.012)	-0.053***	(0.013)	-0.033***	(0.011)
EST_{it}		-0.159***	(0.031)	-0.155***	(0.030)	-0.149***	(0.026)	-0.157***	(0.030)
TAM_{it}		0.002	(0.002)	0.002	(0.002)	0.000	(0.002)	0.002	(0.002)
ROA_{it}		-0.067**	(0.028)	-0.073***	(0.028)	-0.097***	(0.031)	-0.074**	(0.029)
$\Delta IMOB_{it}$		0.008	(0.014)	0.010	(0.015)	0.0240	(0.016)	0.008	(0.015)
$EMPRFIN_{it}$		0.085***	(0.025)	0.080***	(0.024)	0.119***	(0.023)	0.091***	(0.024)
MTB_{it}		0.002**	(0.001)	0.002***	(0.001)	0.003***	(0.001)	0.002***	(0.001)
$PAYOUT_{it}$		0.001	(0.002)	0.001	(0.002)	0.00277	(0.002)	0.001	(0.002)
$TRAD_i$		0.027**	(0.011)	0.029***	(0.011)	0.0268***	(0.009)	0.027**	(0.011)
$N2_i$		0.011	(0.020)	0.013	(0.019)	0.001	(0.014)	0.011	(0.018)
NM_i		0.033***	(0.011)	0.034***	(0.011)	0.0329***	(0.008)	0.034***	(0.010)
Wald (x^2)		3673.32***		3825.41***		4275.94***		3833.21***	
Observations		799		799		799		799	
No of firms		201		201		201		201	
Control of Year		No		No		No		No	
Control of Sector		Yes		Yes		Yes		Yes	

Obs. ***, **, * Statistically significant at 1%, 5%, and 10%, respectively. The Generalized Least Squares (GLS) was performed with adjustments for heteroscedasticity and autocorrelation according to Gujarati (2019) and Wooldridge (2011).
Source: Study's data.

Initially, the coefficients of the proxies for economically uncertain environments presented positive and significant signs at 5% and 10%, suggesting that ETR tends to increase in times of crisis. Apparently, it creates a paradox, considering that taxation on profit suffers the effect of events that affect the calculation basis of subsequent periods. This result is similar to that observed by Damascena et al. (2018) and França et al. (2018) though, when they identified that the firms working in Brazil tended to increase the effective rate, compared to firms without restrictions or firms outside the country in periods of crisis. Similar results were reported by Dang, Fang & He (2019) in the Chinese market.

These controversial results can be explained by the conflict between the potential tax avoidance practice and the tax entity. On the one hand, governments are subject to greater fiscal pressure in times of economic uncertainty (Kang & Wang, 2021); hence, they combine efforts, providing economic stimuli and monitoring taxpayers so that revenue does not drop substantially. On the other hand though, given the risk of future litigation, taxpayers seek to decrease the tax burden, avoiding future tax penalties.

Analysis of the effect of bankruptcy risk and the proxy for financial constraint captured by Altman's Z-score showed that firms in the quartile with the highest risk of bankruptcy (Q4) tend to more frequent adopt tax aggressive measures; a decrease between 2% and 5% in ETR was found among those firms with a higher bankruptcy risk. This result is in line with the findings reported by Richardson et al. (2015), Damascena et al. (2018), Momente et al. (2017), França et al. (2018), Dang, Fang & He (2019), and Cythis, Tasios & Filos (2020), which reported that financial stress or bankruptcy are associated with greater tax aggressiveness.

Later, it was found that companies with larger inventories (EST) and returns on assets (ROA) tend to present lower ETR. These results reinforce that an economically uncertain environment by itself does not lead to tax planning practices, but the firms' economic characteristics tend to influence tax aggressiveness; the results suggest that companies with greater production capacity and higher returns tend to have more opportunities and more frequently adopt aggressive tax measures. These results corroborate the findings reported by Momente et al. (2017), and França & Monte (2020), though Damascena et al. (2018) and França et al. (2018) found divergent results in their studies.

Additionally, the variables are listed in traditional sectors (TRAD) and New Market (NM) of governance and presented a positive and statistically significant effect on ETR. In this sense, we need to consider that when having greater growth potential, managers seek third-party resources to finance investments, which affect subsequent profits. This rationale is coherent with the perspective of modern finance theory, especially from the perspective of Modigliani and Miller (1958, 1963) and Myers and Majluf (1984) as they state that there will be incentives to capture third-parties resources to finance investments and maximize future results when managing bankruptcy risk. Hence, the tax base would increase, and consequently, the ETR.

Next, the effect of a crisis environment on BTD was analyzed (Table 3). The results reinforce evidence regarding ETR because an uncertain environment does not present significant effects on BTD in two of the models. The opposite happened in the other two models (DCountryRisk and CountryRisk). The effects are controversial because in one model, the result was negative, suggesting a decrease in tax aggressiveness, and in the other, a positive effect was found, even though the coefficient was close to zero, which can be interpreted as an economically irrelevant effect.

Table 3
Statistics of the effect of a crisis environment on BTD from 2013 to 2018

ETR_{it}		1.1		1.2		1.3		1.4	
Intercept		0.0097	(0.009)	0.007	(0.015)	-0.008	(0.007)	0.009	(0.009)
D_{Crisis_t}	(H_1)	0.001	(0.001)						
$D_{CountryRisk_t}$	(H_1)			-0.004***	(0.001)				
$CountryRisk_{it}$	(H_1)					2.37e-05***	(8.44e-06)		
$D_{RetrGDP_t}$	(H_1)							0.000	(0.001)
Q2_Z-Score-Altman		-0.007***	(0.002)	-0.012***	(0.002)	-0.008***	(0.001)	-0.007***	(0.002)
Q3_Z-Score-Altman		-0.0063**	(0.003)	-0.009***	(0.002)	-0.003	(0.002)	-0.006**	(0.003)
Q4_Z-Score-Altman		-0.002	(0.004)	-0.008**	(0.004)	0.003	(0.003)	-0.002	(0.004)
EST_{it}		0.021***	(0.007)	0.019*	(0.011)	0.0283***	(0.006)	0.020***	(0.007)
TAM_{it}		-0.001	(0.001)	-0.001	(0.001)	-0.000	(0.000)	-0.001	(0.001)
ROA_{it}		0.431***	(0.014)	0.463***	(0.013)	0.440***	(0.012)	0.431***	(0.014)
$\Delta IMOB_{it}$		0.005*	(0.003)	0.006**	(0.003)	0.0152***	(0.003)	0.005*	(0.003)
$EMPRFIN_{it}$		-0.009	(0.006)	-0.004	(0.008)	-0.023***	(0.005)	-0.010	(0.006)
MTB_{it}		-0.000	(0.000)	7.17e-05	(0.000)	-0.001**	(0.000)	-0.000	(0.000)
$PAYOUT_{it}$		-0.001***	(0.000)	-0.000	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)
$TRAD_i$		-0.004	(0.003)	-0.005	(0.005)	-0.001	(0.003)	-0.004	(0.003)
$N2_i$		0.002	(0.005)	-0.004	(0.008)	0.0100***	(0.004)	0.002	(0.005)
NM_i		-0.002	(0.002)	-0.003	(0.005)	-0.000	(0.002)	-0.001	(0.003)
Wald (x^2)		1535.03***		1921.73***		3040.65***		1502.79***	
Observations		799		799		799		799	
No of firms		201		201		201		201	
Control of Year		No		No		No		No	
Control of Sector		Yes		Yes		Yes		Yes	

Note. ***, **, * Statistically significant at 1%, 5% and 10%. The Generalized Least Squares (GLS) with adjustments for heteroskedasticity and autocorrelation according to Gujarati (2019) and Wooldridge (2011).
Source: study's data

Analysis of the control variables showed that the Altman Z Score and the payout index (PAYOUT) present negative statistical significance, indicating that firms at bankruptcy risk and those with a more significant proportion of earnings distribution tended to adopt less aggressive tax planning practices. On the other hand, the inventory (EST) and return on assets (ROA) variables were positively and significantly associated at a 1% level.

The remaining variables did not consistently present significant associations, alternating according to the interest variable. They reinforce evidence found in emerging countries though, where the firms' economic characteristics influence tax aggressive planning differently over time (Momente et al., 2017; Damascena et al., 2018; França et al., 2018; Dang, Fang & He, 2019; Kang & Wang, 2021).

4.2 Analyzing the moderation effect of economic uncertainty on the determinants of tax aggressiveness

The analysis of moderation of economic uncertainty on ETR and BTD determinants (Table 4) reinforce evidence reported in Tables 2 and 3. However, it also shows important complementary results that reinforce hypothesis 2 concerning the moderating effect played by economic uncertainty. Firms with greater financial restrictions tend to present lower ETR and, therefore, greater tax aggressiveness. These results are in line with Damascena et al. (2018), França et al. (2018), Dang, Fang & He (2019), and Kang & Wang (2021), which also report the moderating effect of economic uncertainty.

Table 4

Statistics of models with the moderating effect of the uncertain environment on the ETR and BTD determinants between 2013-2018

ETR_{it}		**2.1**		**2.2**		**2.3**		**2.4**	
Q2_Z-Score-Altman*IE	(H_2)	-0.045***	(0.014)	0.006	(0.013)	-0.001***	(0.000)	-0.027***	(0.010)
Q3_Z-Score-Altman*IE	(H_2)	-0.052***	(0.018)	-0.024	(0.016)	-0.001***	(0.000)	-0.064***	(0.012)
Q4_Z-Score-Altman*IE	(H_2)	-0.150***	(0.031)	-0.072***	(0.025)	-0.001***	(0.000)	-0.136***	(0.020)
SIZ_{it}* IE	(H_2)	-0.006**	(0.003)	-0.002	(0.003)	-2.63e-05	(2.94e-05)	-7.67e-05	(0.002)
ROA_{it}* IE	(H_2)	-0.045	(0.052)	-0.048	(0.057)	0.000	(0.000)	-0.014	(0.038)
$\Delta IMOB_{it}$* IE	(H_2)	0.034	(0.026)	-0.004	(0.017)	0.000	(0.000)	0.002	(0.015)
$FINLOAN_{it}$* IE	(H_2)	-0.029	(0.035)	-0.090***	(0.022)	-7.52e-05	(0.000)	-0.072***	(0.014)
MTB_{it}* IE	(H_2)	0.008***	(0.002)	0.004*	(0.002)	5.52e-05**	(2.36e-05)	0.007***	(0.002)
$PAYOUT_{it}$* IE	(H_2)	0.020***	(0.003)	0.019***	(0.002)	0.000***	(3.06e-05)	0.020***	(0.002)
BTD		**2.1**		**2.2**		**2.3**		**2.4**	
Q2_Z-Score-Altman* IE	(H_2)	-0.006*	(0.003)	-0.011***	(0.004)	-3.51e-05	(2.61e-05)	-0.006*	(0.004)
Q3_Z-Score-Altman* IE	(H_2)	-0.015**	(0.006)	-0.020***	(0.006)	-7.28e-05	(4.56e-05)	0.004	(0.006)
Q4_Z-Score-Altman* IE	(H_2)	-0.021**	(0.010)	-0.013	(0.008)	-0.000**	(7.21e-05)	0.021**	(0.010)
SIZ_{it}* IE	(H_2)	-0.000	(0.001)	0.000	(0.001)	-1.03e-05*	(5.94e-06)	-0.000	(0.001)
ROA_{it}* IE	(H_2)	0.131***	(0.028)	0.119***	(0.030)	0.001***	(0.000)	0.127***	(0.031)
$\Delta IMOB_{it}$* IE	(H_2)	-0.017**	(0.008)	-0.005	(0.006)	-0.000**	(5.92e-05)	-0.028***	(0.007)
$FINLOAN_{it}$* IE	(H_2)	0.024**	(0.009)	0.011	(0.010)	0.0001*	(6.89e-05)	0.050***	(0.011)
MTB_{it}* IE	(H_2)	0.001	(0.001)	0.001	(0.001)	8.96e-06	(5.71e-06)	-0.002***	(0.001)
$PAYOUT_{it}$* IE	(H_2)	-0.003***	(0.001)	-0.003***	(0.001)	-2.03e-05***	(6.36e-06)	-0.003***	(0.001)
Observations		799		799		799		799	
No. of firms		201		201		201		201	
Type of panel		EA		EA		EA		EA	
Control of Year		No		No		No		No	
Control of Sector		Yes		Yes		Yes		Yes	

Note. ***, **, * Statistically significant at 1%, 5%, and 10%. **IE** – Proxy for economic uncertainty in each model. Generalized Least Squares (GLS) was used with adjustment for heteroscedasticity and autocorrelation, according to Gujarati (2019) and Wooldridge (2011).

Source: Study's data.

This moderation shows that companies with greater growth potential (MTB) and payout index (PAYOUT) are less encouraged to adopt tax aggressiveness practices. Hence, these results suggest that managers in firms with greater potential for growth and shareholder remuneration have fewer incentives to act aggressively in times of economic uncertainty.

Even though the analysis confirms the hypothesis that economic uncertainty plays a moderating role on the BTD determinants, the results were inconsistent in terms of expected signs. These relationships were found in previous studies and reinforce the weaknesses of BTD as a proxy for tax aggressiveness. There are different explanations, but the main one concerns the fact that differences between accounting and tax results may arise from earnings management going beyond the intention of decreasing taxation. Companies with higher ROA and greater financial indebtedness tend to have higher BTD though, suggesting greater aggressiveness. This result reinforces what Damascena et al. (2018), Momente et al. (2017), and Dang, Fang & He (2019) report, though they used ETR as a proxy for tax aggressiveness.

5. Conclusion

This study presents an analysis of the association between economic uncertainty and tax aggressiveness, and it also sought to investigate whether economic uncertainty plays a moderating role in the determinants of tax aggressiveness. Hence, an econometric approach was adopted to assess the hypothesis that firms tend to present higher levels of aggressiveness when facing an uncertain environment and whether this environment plays a moderator role on tax aggressiveness determinants.

The data collected from 252 firms listed on the B3 concerning 2013-2018 showed that, in general, an economically uncertain environment is not associated with greater tax aggressive planning. However, economic uncertainty was found to moderate the effect of tax aggressiveness determinants. For instance, firms with greater financial restrictions tend to be more aggressive in an economically uncertain environment, as well as larger companies with higher returns and a larger proportion of loans and financing. These results are partially in line with studies conducted in emergent countries such as in Latin America and China, as reported by Damascena, França, Leite Filho & Paulo (2018), Momente et al. (2017), Dang, Fang & He (2019), and Kang & Wang (2021). Furthermore, the results were consistent for different tax aggressiveness proxies and specifications and were robust for heteroscedasticity and serial correlation of residuals.

This study reinforces the importance of tax planning as a strategy to decrease tax burden; however, it shows that an economically uncertain environment is not associated with avoiding taxation in the Brazilian context, as noted by Richardson, Taylor & Lanis (2015). Various factors possibly explain this behavior, such as the profile of the firms analyzed – in general, large companies that are leaders in their sectors –, and the risk of litigation, because, as reported by Kang & Wang (2021), governments experience fiscal pressure and need to ensure revenue to maintain public expenses, which leads to greater tax surveillance, discouraging the adoption of aggressive practices. Additionally, this context reinforces the weakness of BTD as a proxy for tax aggressiveness because signs sometimes are inverted or not significant, showing inconsistent results.

This study's results contribute to accounting, auditing, taxation professionals, and policymakers, as it shows that firms do not increase their levels of tax aggressiveness during times of economic uncertainty. This study also fills a gap in the Brazilian literature addressing tax aggressiveness, showing a lack of association between an uncertain, recessive environment, while the firms' financial features are more significant to explain aggressive tax planning. Firms with higher indebtedness and bankruptcy risk are more likely to behave more aggressively from a tax perspective.

Despite its significant contributions, this study did not assess the causal relationship between economic uncertainty and tax aggressiveness. Additionally, it is necessary to understand the extent to which the inconsistent results regarding BTD do not occur because of earnings management practices. Another necessary advancement, in line with Kang & Wang (2021), would be assessing the extent to which more rigorous monitoring influences the firms' tax aggressive practices, especially in a context of economic uncertainty. Finally, we need to understand how the relationships observed in this study occur in non-listed firms, especially those in specific markets. Overcoming these limitations demands future studies to understand better the results presented here.

References

Baltagi, B. H. (2005). *Econometrics Analysis of Panel Data* (Third). John Wiley & Sons, Inc.

Billor, N., Hadi, A. S., & Velleman, P. F. (2000). BACON: Blocked adaptive computationally efficient outlier nominators. *Computational Statistics & Data Analysis*, *34*(3), 279–298. https://doi.org/10.1016/S0167-9473(99)00101-2

Cabello, O. G., & Pereira, C. A. (2015). Efeitos das Práticas de Tributação do Lucro na Effective Tax Rate (ETR): Uma Abordagem da Teoria das Escolhas Contábeis. *Advances in Scientific and Applied Accounting*, *8*(3), 356–373. https://doi.org/10.14392/ASAA.2015080305

Carvalho, V. G. de, Paulo, E., & Tavares, A. de L. (2014). *Gerenciamento Tributário: Proxies Utilizadas pelas Pesquisas no Período 2000 a 2012*. *5*(3), 19.

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*(2), 160–181. https://doi.org/10.1590/1982-7849rac2019180234

Damascena, L. G., França, R. D., Leite Filho, P. A. M., & Paulo, E. (2018). Restrição Financeira, Taxa Efetiva de Impostos Sobre o Lucro e os Efeitos da Crise nas Empresas de Capital Aberto Listadas no B3. *Revista Universo Contábil*, *13*(4), 155. https://doi.org/10.4270/ruc.2017430

Dang, D., Fang, H., & He, M. (2019). Economic policy uncertainty, tax quotas and corporate tax burden: Evidence from China. *China Economic Review*, *56*, 101303. https://doi.org/10.1016/j.chieco.2019.101303

Edwards, A., Schwab, C., & Shevlin, T. (2016). Financial Constraints and Cash Tax Savings. *The Accounting Review*, *91*(3), 859–881. https://doi.org/10.2308/accr-51282

Ferreira, F. R., Martinez, A. L., Costa, F. M. da, & Passamani, R. R. (2012). Book-tax differences e gerenciamento de resultados no mercado de ações do Brasil. *Revista de Administração de Empresas*, *52*(5), 488–501. https://doi.org/10.1590/S0034-75902012000500002

França, R. D. de, Damascena, L. G., Duarte, F. C. de L., & Leite Filho, P. A. M. (2018). *Influência da restrição financeira e da crise financeira global na Effective Tax Rate de empresas latino-americanas*. *12*(1), 16. https://doi.org/10.3232/GCG.2018.V12.N1.05

França, R. D. de, & Monte, P. A. do. (2020). Efeitos da Reputação Corporativa na Tax Avoindance de Empresas de Capital Aberto. *Revista Universo Contábil*, *15*(4), 109–126. https://doi.org/10.4270/ruc.2019430

Franzen, A., Meurer, R., Gonçalves, C. E. S., & Seabra, F. (2009). Determinantes do fluxo de investimentos de portfólio para o mercado acionário brasileiro. *Estudos Econômicos (São Paulo)*, *39*(2), 301–328. https://doi.org/10.1590/S0101-41612009000200003

Garcia, R., Monte-Mor, D., & Tardin, N. (2019). Can accounting-based and market-based indicators predict changes in the risk rating of brazilian banks? *Review of business management*, *21*(1), 152–168. https://doi.org/10.7819/rbgn.v21i1.3968

Garcia, R., & Santos, A. R. dos. (2007). *A influência do índice de risco-país nas decisões de investimento em condições de instabilidade política e econômica momentânea*. 16.

Gujarati, D. (2019). *Econometria: Princípios, Teoria e Aplicações Práticas*. Saraiva.

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

Kang, W., & Wang, J. (2021). Corporate tax effects of economic policy uncertainty. *Accounting & Finance*, *61*(S1), 2577–2600. https://doi.org/10.1111/acfi.12677

Lietz, G. M. (2013). Tax Avoidance vs. Tax Aggressiveness: A Unifying Conceptual Framework. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2363828

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., & Silva, R. da. (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

Modigliani, F., & Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, *48*(3), 261–297.

Modigliani, F., & Miller, M. H. (1963). Corporate Income Taxes and the Cost of Capital: A Correction. *The American Economic Review*, *53*(3), 433–443.

Momente, T. T., Rezende, A. J., Silva, J. M. da, & Dalmácio, F. Z. (2017). *Nível de Planejamento Tributário em Épocas de Crise no Mercado Brasileiro*. *XI Congresso Anpcont*, 20.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, *13*(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

Oreiro, J. L. (2017). A Grande Recessão Brasileira: Diagnóstico e Uma Agenda de Política Econômica. *Estudos Avançados*, *31*(89), 75–88. https://doi.org/10.1590/s0103-40142017.31890009

Ornelas, J. R. H. (2017). *Risco, Dívida e Alavancagem Soberana* (457º ed). Banco Central do Brasil. https://www.bcb.gov.br/pec/wps/port/TD457.pdf

Paula, L. F. de, & Pires, M. (2017). Crise e perspectivas para a economia brasileira. *Estudos Avançados*, *31*(89), 125–144. https://doi.org/10.1590/s0103-40142017.31890013

Richardson, G., Taylor, G., & Lanis, R. (2015a). 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

Richardson, G., Taylor, G., & Lanis, R. (2015b). 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

Schineller, L. M., Mukherji, J., & Brandazza, D. D. (2018). *Quais os desafios do Brasil após as eleições presidenciais?* 6.

Shen, H., Hou, F., Peng, M., Xiong, H., & Zuo, H. (2021). Economic policy uncertainty and corporate tax avoidance: Evidence from China. *Pacific-Basin Finance Journal*, *65*, 101500. https://doi.org/10.1016/j.pacfin.2021.101500

Slemrod, J. (2007). Cheating Ourselves: The Economics of Tax Evasion. *The Journal of Economic Perspectives*, *21*(1), 25–48.

Soihet, E., Ribeiro, T. C., & Safins, M. A. (2016). Risco-País Brasileiro no período 2002-2010: Uma análise macroeconômica e econométrica por meio da metodologia VAR (vetor-autoregressivo). *A Economia em Revista - AERE*, *23*(2), 39. https://doi.org/10.4025/aere.v23i2.18676

Vartanian, P. R., & Garbe, H. de S. (2019). *The Brazilian Economic Crisis during the Period 2014-2016: Is There Precedence of Internal or External Factors?* 21.

Wang, H., Liang, P., & Deng, J. (2018). Economic Cycle, Accounting Conservatism and Financial Constraints. In J. Xu, M. Gen, A. Hajiyev, & F. L. Cooke (Orgs.), *Proceedings of the Eleventh International Conference on Management Science and Engineering Management* (p. 1737–1751). Springer International Publishing. https://doi.org/10.1007/978-3-319-59280-0_146

Wooldridge, J. (2011). *Econometric Analysis of Cross Section and Panel Data*. MIT-Massachussets Institute Technology.

Appendix 1

Variables adopted in the regression models

Acronym	Description	Operationalization	Expected signal		Previous Studies
		Dependent Variables – Proxies for tax aggressiveness			
BTD	*Book Tax Differences*	$\left\{\left[\text{LAIR}_{it} - \frac{(\text{IR}_{it} + \text{CSLL}_{it})}{0{,}34}\right] / \text{AT}_{it}\right\}$			Ferreira et al. (2012), Momente et al. (2017).
ETR	Effective Tax Rate	$\left\{(\text{IR}_{it} + \text{CSLL}_{it}) / \text{LAIR}_{it}\right\}$			Cabello e Pereira (2015).
		Independent variables – proxies for economic uncertainty			
			BTD	ETR	
Crise	Economic crisis environment	Dummy assumes value 1 for the years of crises; 0 otherwise.	+	-	Damascena et al. (2018), França et al. (2018), Momente et al. (2017), Paula & Pires (2017).
RiscoPais	Country Risk	$\ln\left(\frac{\text{EMBI}_t}{\text{EMBI}_{t-1}}\right)$	+	-	Franzen et al. (2009), Ornelas (2017), Soihet et al. (2016).
ΔPIB	Variation in Gross Domestic Product	$\left[(\text{GDP}_t - \text{GDP}_{t-1}) / \text{GDP}_{t-1}\right]$	+	-	Momente et al. (2017), Vartanian e Garbe (2019).
RetrPIB	Retraction of Gross Domestic Product	Dummy assuming value 1 for the years in which GDP decreased in relation to the previous year; 0 otherwise.	+	-	Oreiro (2017), Vartanian & Garbe (2019).
		Independent variables – Controls			
Alt	Altman's Z-Score	Continuous variables with Altman Z-Score (1979) adapted by Martins and Ventura (2020)	+	-	Martinez (2019), Martins & Ventura (2020)
Est	Inventory	$\left(\frac{\text{Estoques}_{it}}{\text{AT}_{it}}\right)$	+	-	(França & Monte, 2020)
Tam	Size	Natural logarithm of total assets	+	-	Momente et al. (2017), Chiachio & Martinez (2019)
ROA	Return on assets	$\left\{\frac{\text{LAIR}}{\left[(\text{AT}_{it} + \text{AT}_{it-1}) / 2\right]}\right\}$	-	+	Momente et al. (2017), França et al. (2018), Chiachio & Martinez (2019)
ΔImob	Fixed Asset Growth	$\ln\left(\frac{\text{Imob}_{it}}{\text{Imob}_{it-1}}\right)$	+	-	Chiachio & Martinez (2019)
EmprFin	LT Loans and Financing	$\ln\left(\frac{\text{Emprest. Fin LP}_{it}}{\text{AT}_{it}}\right)$	+	-	Momente et al. (2017), Damascena et al. (2018); França et al. (2018); Chiachio & Martinez (2019)
MTB	*Market To Book*	$\left(\frac{\text{VMA}_{it}}{\text{PL}_{it}}\right)$	-	+	Momente et al. (2017)
PayOut	*Payout Index*	$\left(\frac{\text{Dividendos}_{it} + \text{JSCP}_{it}}{\text{LL}_{it}}\right)$	+	-	Damascena et al. (2018)
NivGov	Governance Level	Dummy assumes value 1 for the ith governance level; 0 otherwise.	+/-	+/-	Martinez & Fonseca (2020)
SegEcon	Economic segment	Dummy assumes value 1 for the ith governance level; 0 otherwise.	+/-	+/-	Cabello & Pereira (2015).

Note. S.E.-Expected sign; LAIR – Profit before Income Tax and CSLL; IR – Income Tax; IRD – Deferred Income Ta; CSLL – Social Contribution on Tax; EMBI +- Emerging Markets Bond Index; PIB – Gross Domestic Product; AT – Total Assets; Imob – Fixed Assets; PT –Total Liabilities; VMA – Market Value of Shares; PL – Shareholders' Equity; Emprest. Fin LP – Long Term Loans and Financing; JSCP – Interest on Equity; LL – Net Income.