TAX AGGRESSIVENESS, LIFE CYCLE STAGES AND LEVEL OF INVESTMENTS: AN ANALYSIS OF THE MODERATING EFFECT ON B3 LISTED COMPANIES

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▪ Received: 03/12/2021 ▪▪ Approved: 03/28/2022 ▪▪▪ Second Approved Version: 07/26/2022

ABSTRACT

The aim of present study was to analyze the moderating effect of the life cycle stages of firms (ECV) on the relationship between tax aggressiveness and the investment level of Brazilian companies listed in B3. The research descriptive, archival and quantitative approach used quarterly data of 2012-2020 of 3,853 observations of 270 companies available in the Thomson Reuters and COMDINHEIRO databases. The data were analyzed through descriptive statistics, differences tests, correlation analysis and regression with panel data using stata 16 software. The results showed that ECV have a moderating effect on relationship between tax aggressiveness and the investment level. It was observed that in companies in the Growth, Shakeout and Decline stages, tax aggressiveness has a positive effect on the level of investments, reinforcing the importance of tax planning. The results were consistent for different proxies of investment level and tax aggressiveness, including, using the tax burden measured from the Statement of Added Value (DVA). The findings provide important insights for accountants, managers, auditors and contribute to the discussion about the use of alternative proxies to identify tax aggressiveness and its impacts Brazilian context.

Keywords: Tax Aggressiveness; Investment Level; Return on investments.

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AGRESSIVIDADE TRIBUTÁRIA, ESTÁGIOS DO CICLO DE VIDA E NÍVEL DE INVESTIMENTOS: UMA ANÁLISE DO EFEITO MODERADOR EM EMPRESAS LISTADAS NA B3

RESUMO

O presente estudo analisou o efeito moderador dos estágios do ciclo de vida das firmas (ECV) na relação entre agressividade tributária e o nível de investimentos das empresas brasileira listadas na B3. A pesquisa descritiva, documental e com abordagem quantitativa utilizou dados trimestrais do período de 2012-2020 de 3.853 observações de 270 empresas disponíveis nas bases de dados Refinitiv e COMDINHEIRO. Os dados foram analisados através de estatística descritiva, teste de diferenças entre as médias, análise de correlação e regressão com dados em painel por meio do software Stata 16. Os resultados evidenciaram que os ECV exercem um efeito moderador na relação entre a agressividade tributária e o nível de investimentos. Observou-se que em empresas nos estágios de Crescimento e de Turbulência e Declínio, a agressividade tributária tem um efeito positivo sobre o nível de investimentos, reforçando a importância do planejamento tributário sobretudo em empresas. Os resultados foram consistentes para diferentes proxies de nível de investimentos e de agressividade tributária, inclusive, utilizando-se a carga tributária medida a partir da Demonstração do Valor Adicionado (DVA). Os achados evidenciaram que a agressividade tributária tem um efeito moderador e defasado sobre o nível de investimentos, trazendo *insights* importantes para contadores, gestores, auditores e assim contribuindo para discussão sobre a utilização de *proxies* alternativas na identificação dos efeitos da agressividade tributária no contexto brasileiro.

Palavras-Chave: Agressividade Tributária. Nível de Investimentos. Retorno sobre os investimentos.

1 INTRODUCTION

The present study analyzed the moderating effect of the firms' life cycle stages (LCS) in the relationship between tax aggressiveness and the level of investments of Brazilian companies listed on B3. Tax aggressiveness consists of the effort of economic agents to reduce the tax burden through tax planning or abusive practices called tax evasion (Armstrong, Blouin & Larcker, 2012). Tax planning refers to the use of legal, administrative, and judicial provisions to reduce the tax burden of a company and can be characterized as conservative, moderate or abusive (tax evasion). According to Martinez (2017), tax planning will be more aggressive when it approaches tax evasion, in general, from abusive tax planning.

In this sense, as the tax tends to be incorporated into the prices of products and services, it ends up generating some externalities, such as (i) reduction of the purchasing capacity of consumers; (ii) reduction of the aggregate demand of the various sectors of the economy; and (iii) disincentive to investment, since, on the one hand, it reduces the potential profit of the investor to the extent that the aggregate demand is reduced, while, on the other hand, it reduces the volume of resources available for investment by the firm or shareholder, who will have a smaller distributable profit (Jaimovich & Rebelo, 2017).

According to Hill et al. (2013), tax aggressiveness enables the firm to mitigate the effects of externalities caused by taxation. From the microeconomic perspective, a firm that can reduce its tax burden is more likely to reduce its price or increase its marginal profit. By lowering the price, there may be a shift in demand among competitors, potentially increasing aggregate profit. Thus, by increasing the marginal profit, the aggregate profit also tends, ceteris paribus, to increase (Park, Ko, Jung & Lee, 2016). This increase in profit tends to generate a series of effects, such as higher: (1) reinvestment potential, (2) efficiency level, (3) return to shareholders, etc. In this regard, Goldman (2016) emphasizes that aggressive taxation is one of the ways to obtain resources to finance investments. In turn, Khurana, Moser e Raman (2018) complement that tax aggressiveness, besides financing, enables the efficiency level of investments, even for firms with managers with less managerial skills.

In recent years, several empirical studies have analyzed the implications of tax aggressiveness in the Brazilian context (Martinez et al., 2014; Martinez & Martins, 2016; Martinez, 2017; Martinez & Silva, 2017; Martinez & Reinders, 2018; Araújo et al., 2018; Chiachio et al., 2019; Araújo & Filho, 2019; Martinez et al., 2019; Costa & Amorim Júnior, 2020; Marchesi & Zanoteli, 2020; Rodrigues & Galdi, 2020; Martinez & Motta, 2020). However, only the work of Marchesi and Zanoteli (2020) analyzed the effect of tax aggressiveness on the level of investments.

Within this scope, the present study differs from previous ones in several aspects. First, it introduces the moderating effect of LCSs according to the methodology proposed by Dickinson (2011). Including LCSs in the relationship may explain the effectiveness of tax planning practices in enhancing investments. Second, it analyzed the relationship considering the lagged effect of tax aggressiveness proxies on the level of investments. And third, it used alternative proxies of tax aggressiveness from the tax burden calculated by the Value Added Statement (VAS) and adapted traditional proxies such as the Effective Tax Rate and DifETR, thus controlling the sector's behavior. This approach converges to an attempt to minimize Jacob's (2018) criticism regarding the need to develop empirical research in accounting and taxation that considers the specificities of the Brazilian tax context.

Arikan e Stulz (2016), Dickinson (2011), and Faff, Kwok, Podoski & Wong (2016) highlight that LCSs influence corporate policies on investment, financing, and production, among others. This is because LCSs delimit the strategic demands of firms (Hasan & Habib, 2017). Therefore, the analysis of their moderating effect on the relationship between tax aggressiveness and the level of investments can improve the discussion about the role of tax planning in different contexts. For example, the need for investments in firms in the growth stages differ from those in the maturity or decline stages (Dickinson, 2011), thus causing the level of investments to differ as well.

Given this context, it was sought to answer the following problem: **What is the moderation effect of the life cycle stages on the relationship between tax aggressiveness and the investment level of Brazilian companies listed on B3?** To this end, data for 2012-2020 of 3,853 observations of 270 companies in the Refinitiv and COMDINHEIRO databases were analyzed. The data were evaluated through regression analysis with panel data using Stata 16 software.

The previous literature is still controversial about the effects of tax aggressiveness. For example, according to Brooks et al. (2016), this characteristic will not necessarily result in shareholder value generation, as it stems from some factors. On the other hand, Gallemore, Maydew, and Thornock (2014), as Hanlon, Maydew, and Shevlin (2008) presented evidence that tax aggressiveness can even generate adverse effects, such as higher perceived risk due to profit variability, tax litigation risk, and reputation risk. Nevertheless, the results contribute to accountants, auditors, and managers, since they show that tax planning can potentially contribute to maintaining the firm's investment level. In addition, they offer that the effort to reduce the tax burden is more effective for firms in the turbulence and decline stages.

Moreover, the economic literature is pacified in assuming that the tax burden, in aggregate, harms the economy (Diamond & Mirrlees, 1971; Slemrod, 1990). However, at the firm level, each agent tends to react similarly. Even if we assume the existence of a market with unlimited rationality and the absence of informational asymmetry, economic agents, competing among themselves, would seek to make decisions that may even converge towards the same objective. Still, the level and type of effort, as well as the results, would not necessarily be the same. (Gokalp, Lee & Peng, 2017). Finally, the Brazilian tax system has characteristics that differentiate it from other countries (Jacob, 2018). Thus, evaluating the effect that the tax aggressiveness proxies and the LCSs have on the investment level of the firms makes it possible to verify whether the microeconomic theories tested with aggregate data are confirmed when the micro data from the financial statements are analyzed.

The results have potential implications for accountants, managers, auditors, and tax agents as it will highlight the effectiveness of tax aggressiveness. Furthermore, it will enable researchers to discuss the continued use of these proposed tax aggressiveness metrics for data from countries with very different tax systems. Finally, the results listed here reinforce the importance of researching to analyze phenomena that are more present in the daily lives of managers, accountants, auditors, etc. According to Jacob (2018). Given the complexity of the Brazilian tax system, the insights brought by studies that consider its characteristics can contribute to international research.

Thus, in addition to this introduction, this paper has five other sections. Section 2 presents the literature review and the development of the hypotheses tested. Next, the methodological procedures performed in the study are presented. Subsequently, the results are analyzed and discussed. Finally, the final considerations are made, where the contributions and implications of the study are included, as well as suggestions for future research.

2 REVIEW OF THE LITERATURE

2.1 Why does aggressive taxation matter?

The microeconomic theory states that the incidence of taxes entails market imperfections that reduce the consumer's purchasing potential, harm competition when the incidence differs among competitors or markets, discourage

investments to the extent that the earning potential reduces, and, in countries with tax systems focused on consumption, as in Brazil, add proportionally higher taxation to the portion of the population with lower purchasing power (Baranova & Janickova, 2012).

Given this, firms seek ways to reduce the effects of externalities generated by governments when they exercise their power to tax and unilaterally appropriate some of the income through taxes. Alm, Liu, and Zhang (2019) observe that taxes reduce the volume of resources available to the firm to carry out its activities. This implies reducing the volume of tax expenditures, which would potentialize a greater volume of investments and improve manufacturing processes (cost reduction) and, consequently, performance.

One of the alternatives to reduce the tax burden is Tax Planning (PT). PT can be defined as using tax law sources to minimize taxpayers' tax liabilities. PT can vary in level and complexity (Moreira, 2003). At the first level, it will be simpler and consist of the complete application of the tax law to use the rules that reduce the tax burden and apply them without incurring error and, consequently, some penalties (for example, underpayment, omission of ancillary obligations, etc.). At a second level, the PT will be more complex and take advantage of "loopholes in the law" to reduce taxation. In this case, the risk of litigation between the taxpayer and the tax authorities increases because these gaps generally require additional sources of law other than the law. Finally, at the last level, which is more complex and risky, the taxpayer will adopt a tax procedure that goes beyond what is stated in the law, awaiting the tax authorities' pronouncement. Many of the cases pending for years in the Administrative Council of Tax Appeals (CARF) arise from this level of PT. A recent emblematic case was the Itaú-Unibanco merger. The process, which began in 2008, generated for Itaú a saving of 25 billion reais in taxes owed.

Martinez (2017) notes that there is a fine line between PT, properly speaking, which falls entirely within the limits of the law, and abusive prosecution. This greater or lesser propensity to extrapolate the legal limits is called tax aggressiveness. In this way, an economic agent aiming to reduce the burden of taxation and maximize the firm's value may end up resulting in an adverse effect, depending on the level of tax aggressiveness used in the PT process (Gallemore, Maydew & Thornock, 2014; Park et al., 2016).

Empirically, it is not known precisely when a firm has performed an aggressive PT that results in tax delinquency because it occurs ex-ante. However, Kubick et al. (2015) note that the more efficient the control and enforcement system is, the lower the propensity of taxpayers to incur abusive (aggressive) PT practices.

In the accounting area, many metrics are used as proxies for tax aggressiveness; however, BTD - Book Tax Differences and ETR - Effective Tax Rate stand out (Hanlon & Heitzman, 2010). The BTD consists of the difference between accounting and taxable profits. These differences result from expenses and revenues recognized in the accounting result, by competence, in the month they occur; however, the tax effect will be a posteriori (or will not have a tax effect). For example, the gains from equity equivalence or dividends received are revenues that will not be taxed on the beneficiary because they have already been taxed at the paying source; therefore, when determining the taxable income, they will be excluded from the calculation basis. Similarly, some expenses cannot be

deducted from the tax base and therefore must be added, such as, for example, fines for penalties and arbitrary expenses that are not related to the taxpayer's business (e.g., personal expenses of the board of directors, depreciation of vehicles acquired by the firm but for personal use, etc.). In addition, expenses and revenues are recognized in the comprehensive income for the period and will only generate taxable effects later. Finally, the incentives are granted that are identified in the result for the period, but the "extra" taxable effect is canceled out in the following years, such as accelerated depreciation. All these events justify the existence of a difference between accounting profit and taxable profit (BTD).

Contextualizing the present discussion, more aggressive companies will tend to present higher BTD since they will make efforts to reduce the taxable base. In turn, the smaller the taxable base, the lower the ETR. The effective tax rate (ETR) is the percentage of tax on profit (Income Tax and Social Contribution) calculated on the profit for the year before taxes. Thus, companies that have higher BTD tend to have lower ETR. Therefore, more aggressive companies tend to present higher BTD and lower ETR (Hanlon & Heitzman, 2010; Lennox, Lisowsky & Pittman, 2013). Despite several criticisms and limitations, both are the most used proxies of tax aggressiveness in national and foreign research (Martinez, 2017).

2.2 Life cycle stages, level of investments, and hypothesis development

The level of firm investment is a driver of future firm value, as it highlights the effort to maintain and expand a business's productive capacity and value generation (Li, Zhou & Li, 2019). However, this level of investment depends on the firm's LCS (Arikan & Stulz, 2016; Faff et al., 2016). From the perspective of Dickinson (2011) view, LCSs are associated with the behavior of the firm's cash flows because, depending on their stage, their self-financing capacity and their need for investments and financing change and signal to the market the ability for future economic benefits. From the previous literature, Dickinson (2011) used the predominant nomenclature to classify and characterize the LCS of firms in (i) introduction, (ii) growth, (iii) maturity, (iv) turbulence (Shake-out); and (v) decline. Based on the signs observed in the cash flows: (i) operating (OCF), (ii) investment (ICF), and financing (FCF), a metric was proposed to classify the LCS of firms, according to the following criteria (Table 1):

Table 1 - Expected signs for cash flows according to the LCSs

	Introduction	Growth	Maturity	Turbulence			Decline	
Operating Cash Flow (OCF)	-	+	+	-	+	+	-	-
Investment Cash Flow (ICF)	-	-	-	-	+	+	+	+
Financing Cash Flow (FCF)	+	+	-	-	+	-	+	-

Note: Adaptde from Dickinson (2011).

In terms of investment level, in the early stages (introduction and growth), firms have a greater need to allocate productive and strategic resources; therefore, the volume of spending on research and development, acquisition of machinery and equipment, and development of brands and patents tend to be higher (Faff et al., 2016). This demand for investments, however, grows to reduce in the maturity stage when the need for maintenance and repositioning tends to be more common, leading to the need for acquisitions of strategic shareholdings

(business combinations). Finally, in the turbulence and decline stages, the firm struggles to survive and reduce the risk of insolvency. Therefore, it must manage the need to maintain or expand the productive capacity in a context where financial restrictions and access to resources for financing the activities are low (Arikan & Stulz, 2016).

The microeconomic literature shows that taxes generate a series of negative externalities that harm the business environment and economic growth. Baranova and Janickova (2012). For example, have shown that the tax burden reduces the volume of investments because, as it reduces the purchasing capacity of consumers, it leads to the idleness of the installed manufacturing park, lower aggregate profit for the investor, and discourages reinvestment.

In addition, the reduction in the flow of available capital tends to demand greater participation of third parties as sources of financing. Lamont (1997). He documents that the availability of cash is a factor that stimulates investment in fixed assets, since the company is no longer dependent on third-party resources and shareholders. This perspective is consistent with the Pecking Order Theory, which states that companies prioritize self-financing (Operating Cash Flow), issuing debt securities, and issuing stock.

Brennan (2003) observes that the investment policy is one of the firm's main value drivers since it will provide sustainability to the business in the short and long term. Thus, companies need to maintain an investment policy that prioritizes projects with a present positive value and that makes it possible to: (i) maintain the current production level; (ii) increase production/market share; and (iii) develop products that ensure the sustainability of the business in the long term.

Therefore, since tax aggressiveness is a way of optimizing resources and generating available cash for the company, it can be deduced that more aggressive companies have more cash resources because they reduce the amount spent on taxes. Therefore, they have more significant investment potential. Goldman (2016) argues that more tax-aggressive companies tend to present higher levels of investments; however, the efficiency of this investment will depend on the monitoring structure of the firm (corporate governance). Given this argument, this study tested the following hypothesis (H1):

H1: The higher the tax aggressiveness of the companies, the higher their level of investments.

From it, the hypothesis (H2):

H2: Life cycle stages (LCS) positively moderate the relationship between tax aggressiveness and firms' investment level.

3 METHODOLOGICAL PROCEDURES

3.1 Sample, data collection and treatment

The descriptive nature study, documentary, and quantitative approach used quarterly data from 2012 to 2020 of Brazilian companies listed on B3 and available in the Refinitiv and COMDINHEIRO databases. The data were analyzed using descriptive statistics, a test of the difference between means, correlation analysis, and regression with panel data. Initially, the sample was composed of 563 companies, being excluded: (i) 133 from the financial sector and others, (ii) 132 that did not have enough data to calculate the tax aggressiveness proxies, and (iii) 28 companies that had pre-tax losses (negative IRR) or their observations were classified as outliers. The outliers were identified from the distribution of the explained and normalized variables. Those observations larger or smaller than +/- 3σ were eliminated. To control for significant data effects of the remaining observations, all observations were winsorized between 1% and 99%. At the end of the data treatment using the Stata 16 software, 270 companies were left with 3,853 company/quarter observations. It is noteworthy that the regressions were estimated with unbalanced panels, which reduced the number of observations and companies considered in the estimation.

3.2 Empirical Model

For the analysis of the research hypotheses, an econometric approach with panel data was used, which considers the study of the effect of tax aggressiveness proxies on the level of investments (H1), as well as the moderating effect of LCSs on the relationship between tax aggressiveness and the level of investments (H2). Figure 1 summarizes the research design used in the paper and stems from the adaptation of previous studies, such as Asiri et al. (2020).

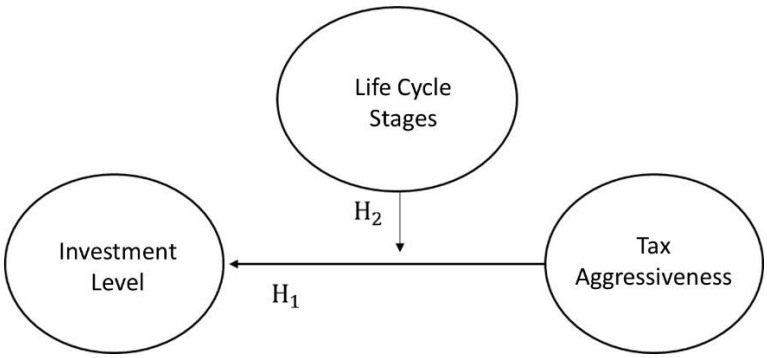

Figure 1 – Research design
Source: Adapted from Asiri et al. (2020).

Models with panel data with fixed effects and year controls were estimated. According to Baltagi (2005) and Wooldridge (2011), after the estimation, tests were performed to evaluate the existence of heteroscedasticity and autocorrelation problems, while reducing possible biases arising from these problems analysis with robust clustered standard errors in the firm was used. Additionally, they were estimated by Generalized Least Square (GLS), as proposed by Baltagi (2005), to evaluate the consistency of the coefficients. However, the results remained stable.

The model presented in equation (1) was used to analyze hypotheses 1 and 2. Specifically, the dependent variable was the Level of investment, and the explanatory variables of interest were: Tax Aggressiveness (TaxAgg); Life Cycle

Stages (LCS_{it}); and the interaction between the two. The variables were detailed in sections 3.2.1 to 3.2.3 and Table 2.

$$\begin{aligned} \mathrm{InvLev_{it}} = {} & \beta_0 + \beta_1 \mathbf{TaxAgg_{it-1}} + \sum_{\mathbf{i=1}}^{\mathbf{4}} \mathbf{D_n LCS_{it}} + \boldsymbol{\beta_2} \mathbf{TaxAgg_{it-1}} * \mathbf{D_{jt} LCS_{it}} + \beta_3 \mathrm{FDL_{it}} \\ & + \beta_4 \mathrm{ROE_{it}} + \beta_5 \mathrm{QTobin_{it}} + \beta_6 \mathrm{CFO_{it-1}} + \beta_7 \Delta \mathrm{Rev_{it-1}} + \beta_8 \mathrm{Size}_{t-1} \\ & + \sum_{\mathrm{i=1}}^{9} \mathrm{D_n Year_t} + \varepsilon \end{aligned} \quad (1)$$

3.2.1 Dependent Variables

In line with previous literature, the explained variable of interest, Level of investments (NivInv), was operationalized from the growth of fixed assets (ΔImob), and is presented in equation (2).

$$\Delta \mathrm{FixedAssets} = \frac{(FixedAssets_{it} - FixedAssets_{it-1} + Deprec_{it})}{FixedAssets_{it-1}} \quad (2)$$

In which:

$\mathrm{FixedAssets}_{it}$= Fixed asset balance in t_0
$\mathrm{FixedAssets}_{it-1}$= Fixed asset balance in t_{-1}
Deprec_{it}= depreciation recognized in t_0

Additionally, according to Mcnichols e Stubben (2008) and Biddle, Hilary, and Verdi (2009), the residuals of equations 3 and 4, respectively, are used as proxies for under/overinvestment.

$$\Delta \mathrm{FixedAssets}_{it} = \beta_o + \beta_1 FCO_{it} + \beta_2 QTobin_{it} + \varepsilon_{it} \quad (3)$$

n which:

$\Delta \mathrm{FixedAssets}_{it}$= Asset growth of the period
CFO_{it}= Operating cash flow for the period divided by total assets
QTobin_{it}= Tobin's Q in the period

$$\Delta \mathrm{FixedAssets}_{it} = \beta_o + \beta_1 \Delta Rev_{it-1} + \beta_2 QTobin_{it-1} + \varepsilon_{it} \quad (4)$$

In which:

$\Delta \mathrm{FixedAssets}_{it}$= Fixed asset growth in the period
Rev_{it-1}= Revenue growth in the previous period
QTobin_{it-1}= Tobin's Q in the previous period

3.2.2 Independent Variables

3.2.2.1 Proxies of tax aggressiveness

To evaluate hypothesis 1 (H1)we used as proxies of tax aggressiveness (TaxAgg) the Effective Tax Rate (ETR), the Differential ETR (DifETR), and the Tax Burden (TaxBurd). The ETR and the DifETR have been systematically used in works, such as the research of Martinez, Ribeiro, and Funchal (2019) and Marchezi and Zanoteli (2020). These rates are measured from equations 5 and 6, respectively.

$$\mathrm{ETR}_{it} = \frac{IRPJ_{it} + CSLL_{it}}{EBT_{it}} \quad (5)$$

In which:

IRPJ_{it}= Income tax recognized in the income statement for the year
CSLL_{it}= Social contribution on profit recognized in the income statement for the year
EBT_{it}= Profit before tax for the year

$$\mathrm{DifETR}_{it} = ETR_{it} - 0{,}34 \quad (6)$$

In which:

ETR_{it}= Effective tax rate calculated according to equation 5
$0{,}34$ = Nominal rate of IRPJ and CSLL

The tax burden (CTrib) is a proxy that reduces a problem of tax specificities of the Brazilian context, which demands attention as argued by Jacob (2018). Specifically, this metric considers all taxes levied on operations developed by firms, reducing the omission of consumption and property taxes observed in the other proxies (ETR and DifETR). The CTrib was calculated according to equation 7.

$$\mathrm{TaxBurd}_{\mathrm{it}} = \frac{\mathrm{FedTax}_{\mathrm{it}} + \mathrm{StateTax}_{\mathrm{it}} + \mathrm{MunTax}_{\mathrm{it}}}{\mathrm{GVA}_{\mathrm{it}}} \quad (7)$$

In which:
$FedTax_{it}$= Federal taxes reported in the Value Added Statement (VAS).
$StateTax_{it}$= State taxes reported in the Value Added Statement (VAS).
$MunTax_{it}$= Municipal taxes reported in the Value Added Statement (VAS).
GVA_{it}= Gross Value Added reported in the Value Added Statement (VAS).

For variables ETR and TaxBurd, the coefficients are expected to be significant and negative, because the lower (higher aggressiveness), the higher the level of investments. In turn, for Differential ETR (DifETR) a positive and statistically significant sign is expected.

Moreover, additional tests were performed considering the ETR, the differential ETR and the abnormal CTrib calculated according to equations 8, 9

and 10. Using this metric reduces another limitation of tax aggressiveness proxies, disregarding sector characteristics in terms of taxation. In this way, the greater or lesser aggressiveness results from the comparison with the sector's median. In this sense, more aggressive companies would have ETR, DifETR and CTrib lower than the sector medians.

$$\text{ETRAbnormal}_{it} = ETR_{it} - MedSetETR_{it} \quad (8)$$

$$\text{DifETRAbnormal}_{it} = DifETR_{it} - MedSetDifETR_{it} \quad (9)$$

$$\text{TaxBurdAbnormal}_{it} = TaxBur_{it} - MedSetTaxBurd_{it} \quad (10)$$

In which:

MedSet ETR, DifETR and TaxBurd = median by sector/year of ETR, DifETR and TaxBurd.

It is noteworthy that the tax aggressiveness proxies were used with a lag. This decision was made because investment level estimation models such as the one used by Biddle, Hilary, and Verdi (2009) consider that past decisions or events explain the current investment level, such as, for example, the revenue level and the generated operational cash flow, among others. Therefore, considering that tax aggressiveness is a cash generation strategy and that the level of investments is aligned with the strategy and investment decisions of the firm, it is reasonable to follow the logic observed in Biddle, Hilary, and Verdi (2009) for the estimation of the level of investments. Furthermore, studies such as that of Marchesi and Zanoteli (2020) have evidenced that the contemporaneous effect is non-significant and inconsistent.

3.2.2.2 Life Cycle Stage Proxies (LCS)

To evaluate hypothesis 2 (H2) we used the metric proposed by Dickinson (2011), presented in Section 2.2, and which consisted of a vector of dummies with n-1 extension, varying between Growth (Growth), Maturity (MAT), Turbulence (TURB), and Decline (DECL). Specifically, Dickinson (2011) argues that an increasing relationship is expected between the Introduction and Growth stages, with trend reversal starting at the Maturity stage which would act as an upper bound on the level of investments. The interaction between tax aggressiveness proxies and LCSs is observed to evaluate the moderating effect of life cycle stages.

3.2.2.3 Control Variables

Considering the complexity inherent in social phenomena and line with previous studies (Chiachio et al., 2019; Araújo & Filho, 2019; Martinez et al., 2019; Costa & Amorim Junior, 2020; Marchesi & Zanoteli, 2020; Rodrigues & Galdi, 2020; Martinez & Motta, 2020), control variables were used that can influence the level of investments and, therefore, were intended to control possible effects and reduce problems arising from omissions of representative variables. The operationalization of each variable was presented in Table 2.

Table 2
Summary table with the control variables used in the models

Acronym	Description	Operationalization	S.E
FDL	Financial Debt Level	$\left({}^{TL_{it}}/_{TA_{\mathrm{it}}}\right)$	(+)
ROE_{it}	Return on Assets	${}^{NP_{it}}/_{TA_{\mathrm{it}}}$	(+)
QTobin_{it}	Tobin's Q	$(SMV_{it} + TL_{it}) \,/_{\mathrm{TA_{it}}}$	(+)
CFO_{it}	Return on Assets	$\left({}^{\mathrm{CFO}_{it}}/_{\mathrm{TA}_{\mathrm{it}}}\right)$	(+)
$\Delta\mathrm{Rev}_{\mathrm{it}}$	Revenue Growth	$ln\left(\frac{\mathrm{Rev}_{\mathrm{it}}}{\mathrm{Rev}_{\mathrm{it-1}}}\right)$	(-)
Size_{it}	Size	$\ln(\mathrm{TA}_{\mathrm{it}})$	(-)
LCS_{it}	Life Cycle Stage	*Dummy* variable that takes value 1 for each life cycle stage (birth, growth, maturity, turbulence, and decline) of the ith firm at time t, defined according to Dickson (2011) and 0 for the others.	(+/-)
$Year_{\mathrm{t}}$	Fixed effect of the year	Dummy variable that assumes value 1 for each year and 0 for the others.	(+/-)

Note: TL - Total Liabilities; TA - Total Assets; NP - Net Profit; SMV - Stock Market Value; CFO - Operating Cash Flow; Rev - Net Revenues.

4 DATA ANALYSIS AND RESULTS

4.1 Descriptive Statistics

Initially, the descriptive statistics of the variables used in the models were analyzed (Table 3). The data were grouped by tertiles of the Tax Loads ($TaxBurd_{it}$). This segregation is helpful to verify the differences between the extremes (1st and 3rd) and the values around the median, considering that a proxy of tax aggressiveness was used to compare each metric about the median of the sector/year. This primary analysis presents initial indications that the values below or above the medians, in general, differ and may be associated with higher/lower tax aggressiveness. Thus, it was observed that, in general, there are differences among the tertiles, which suggests primary evidence that tax aggressiveness may contribute to the level of investments. For example, it was found that companies with lower tax burdens (1st tercile) have a higher average growth of fixed assets (ΔFixedAssets) higher than those companies with higher tax burdens (3rd tercile). The same occurred with the abnormal investment level.

Table 3
Descriptive statistics of the variables used in the models

	1st Quarter < Med (N = 1258)			2nd Quarter Med (N = 1315)			3rd Quarter > Med (N = 1280)		
	μ	σ	CV	μ	σ	CV	μ	σ	CV
$\Delta\mathrm{FixedAsset}_{it}$ [23]	0.040	0.042	1.054	0.037	0.027	0.730	0.036	0.031	0.846
$\Delta\mathrm{FixedAssetAbnormal}_{it}$ [23]	0.002	0.039	21.000	-0.001	0.022	-37.904	-0.001	0.027	-21.667

ETR_{it} [123]	0.318	1.669	5.242	0.252	0.147	0.586	0.629	7.074	11.239
DifETR_{it} [123]	-0.578	0.202	-0.350	-0.591	0.144	-0.244	-0.640	0.174	-0.272
$TaxBurd_{it}$ [123]	0.178	0.081	0.456	0.302	0.109	0.361	0.481	0.183	0.379
$\mathrm{ETRAbnormal}_{it}$ [123]	-0.578	0.202	-0.350	-0.591	0.144	-0.244	-0.640	0.174	-0.272
$\mathrm{DifETRAbnormal}_{it}$ [123]	0.025	0.194	7.774	0.012	0.136	11.631	-0.037	0.173	-4.655
$\mathrm{TaxBurdAbnormal}_{it}$ [123]	-0.143	0.071	-0.499	-0.020	0.064	-3.263	0.161	0.145	0.904
FDL_{it} [2]	0.539	0.208	0.385	0.524	0.205	0.392	0.560	0.290	0.519
ROE_{it} [123]	0.061	0.060	0.980	0.066	0.049	0.746	0.066	0.064	0.979
CFO_{it} [13]	0.080	0.067	1.186	0.086	0.075	1.155	0.090	0.080	1.124
QTobin_{it} [13]	1.692	32.497	19.207	0.466	0.877	1.881	0.668	1.441	2.158
MTB_{it} [13]	5.405	83.535	15.454	2.262	1.916	0.847	2.941	3.548	1.206
$\Delta\mathrm{NR}_{it}$ [123]	0.030	0.077	2.590	0.022	0.050	2.238	0.017	0.059	3.456
$Size_{it}$ [23]	22.336	1.610	0.072	22.391	1.517	0.068	22.131	1.650	0.075

Note: [1] Dunn's test showed a significant difference between the 1st and 2nd tertile. [2] Dunn's test demonstrated a significant difference between the 2nd. and 3rd. [3] Dunn's Test showed a significant difference between 1st. and 3rd. Tertile. $\Delta\mathrm{Imob}_{it}$: Increase in the firm's fixed assets/year. $\Delta\mathrm{ImobAnormal}_{it}$Difference in the increase of the firm's Fixed Assets/year relative to the sector median/year; ETR_{it}*Effective Tax Rate*; BTD_{it}: *Book Tax Differences;* $\mathrm{TaxBurd}_{it}$Firm's Tax Load/year; $\mathrm{ETRAnormal}_{it}$: Difference of firm's ETR/year relative to industry median/year; $\mathrm{DifETRAnormal}_{it}$: Difference of firm's ETR/year relative to industry median/year; $\mathrm{CTRibAnormal}_{it}$Difference of the firm's CTrib/year relative to the sector median/year; FDL_{it}: Overall Indebtedness level of the firm/year; ROE_{it}Return on Equity of the firm/year; CFO_{it} Cash Flow from Operations of the firm/year QTobin_{it}Firm's Tobin Q/year MTB_{it}Firm's *Market To* Book/year; $\Delta\mathrm{NR}_{it}$Firm's Net Revenue Growth/year; Size_{it}: Firm's size/year.
Source: Prepared by authors.

In both cases, the differences between these groups were statistically significant. Similarly, the means of the tax aggressiveness proxies were different between the groups and statistically significant in most cases. For example, the average ETR of firms with lower tax burdens (TaxBurd) was 31.8%, while for those with the highest TaxBurd was 62.9%. The average TaxBurd for the 1st tercil was 17.8%, while for the 3rd tercil it was 36.1%. The abnormal tax aggressiveness (Abnormal ETR, Abnormal DifETR, and Abnormal TaxBurd), measured by the difference between each proxy and the median of the sector/year, it is observed that, in general, the averages between the groups presented significant differences.

Subsequently, the correlation matrix was analyzed (Table 4). Generally, the correlations were statistically significant at the 1%, 5%, and 10% levels; however, they can be classified as weak for the most part. In the meantime, it is emphasized that the correlations between the tax aggressiveness proxies (ETR, DifETR, TaxBurd) and the investment level proxies were configured as expected and reinforce the hypothesis that the higher the tax aggressiveness, the higher the investment potential since it was observed that the lower the ETR, TaxBurd and their variations, the higher the investment potential is, and, therefore, the higher the investment potential will be. ΔFixedAssets. Furthermore, it should be noted that the three investment level proxies showed strong correlations, which corroborates their similarity. However, the ETR, one of the main aggressiveness proxies used in the literature, did not present a significant correlation with the TaxBurd, reinforcing the need to use alternative proxies that capture the Brazilian specificities, as suggested by Jacob (2018). This observation contributes to the discussion and suggests that not considering indirect taxes in the debate on aggressiveness may generate the

omission of relevant behaviors of indirect taxes, besides the fact that metrics such as ETR or BTD do not capture them.

Table 4

Pearson's correlation matrix between the variables used in the models

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta\text{FixedAsset}_{it}$	(1)	1							
NAI_{it}	(2)	0.89***	1						
$TaxBurd_{it}$	(3)	-0.03**	-0.087***	1					
ETR_{it}	(4)	-0.00	0.003	0.014	1				
DifETR_{it}	(5)	-0.07***	-0.066***	-0.18***	-1.000***	1			
ETRAbnormal_{it}	(6)	0.003	0.003	0.0148	0.980***	-0.157***	1		
$\text{DifETRAbnormal}_{it}$	(7)	-0.061***	-0.067***	-0.168***	-0.968***	0.968***	-0.209 ***	1	
$\text{TaxBurdAnormal}_{it}$	(8)	-0.089***	-0.099***	0.883***	0.017	-0.186***	0.0170	-0.191***	1
FDL_{it}	(9)	0.058***	0.081***	0.056***	0.013	-0.134***	0.002	-0.102***	0.042***
ROE_{it}	(10)	-0.102***	-0.075***	-0.014	-0.056***	0.314***	-0.058***	0.284***	-0.010
QTobin_{it}	(11)	0.009	0.030*	-0.027*	0.001	-0.067***	0.002	-0.069***	-0.050***
MTB_{it}	(12)	0.013	0.046***	-0.024	0.001	-0.071***	0.001	-0.073***	-0.048***
ΔNRev_{it}	(13)	0.150***	0.148***	-0.077***	0.075***	-0.016	0.075***	-0.005	-0.083***
$Size_{it}$	(14)	0.184***	0.075***	0.169***	-0.006	-0.021	-0.006	-0.021	-0.056***
CFO_{it}	(15)	0.200***	0.136***	0.029*	-0.033**	0.071***	-0.043***	0.085***	-0.007
LCS_{it}	(16)	-0.096***	-0.116***	0.036**	0.059***	0.050***	0.063***	0.035**	0.046***
		(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
FDL_{it}	(9)	1							
ROE_{it}	(10)	-0.187***	1						
QTobin_{it}	(11)	-0.020	-0.044***	1					
MTB_{it}	(12)	0.012	-0.060***	0.996***	1				
ΔNRev_{it}	(13)	-0.003	0.004	-0.125***	-0.121***	1			
$Size_{it}$	(14)	0.170***	-0.165***	-0.099***	-0.089***	0.050***	1		
CFO_{it}	(15)	-0.160***	0.386***	0.428***	0.320***	-0.023	0.039**	1	
LCS_{it}	(16)	-0.114***	0.154***	-0.003	-0.010	-0.148***	-0.053***	0.192***	1

Source: Prepared by authors.

4.2 The effect of ETR, differential ETR, and the tax burden on the level of investment

To obtain evidence about the hypotheses raised in Section 2.2, the models presented in Table 5 were analyzed for the proxy asset growth and the different proxies of tax aggressiveness (ETR, DifETR and TaxBurd) were calculated according to equation 2. It was observed that the three models were statistically significant, and that higher tax aggressiveness tends to be associated with higher investments. Furthermore, it was found that higher ETR (-0.005**) and TaxBurd (-0.027***) tend to reduce the growth of fixed assets. On the other hand, the more significant the difference between the effective and the nominal tax rate (DifETR | -0.011***), the lower the level of investments. These results reinforce the hypothesis that tax aggressiveness positively affects the level of investments (H1). Thus, it is noteworthy that, unlike the previous literature (Marchesi & Zanoteli, 2020)this effect occurs with a lag of one period, thus evidencing that the effort to generate cash from Tax Planning tends to be associated with increases in fixed assets in the subsequent period (t+1).

It is also observed that the Growth (Grow) and Decline (Decl) LCSs were statistically significant, with negative signs in all models. Specifically, in model 3, which considers the tax burden (TaxBurd) as a proxy for aggressiveness, the Turbulence stage (Turb) was also statistically significant. This result shows that, in general, the LCSs are associated with lower levels of investment as the stages evolve, which converges with the theoretical expectation (Dickinson, 2011).

To obtain evidence about the moderation effect of the LCSs (H2) we observe that companies with higher tax aggressiveness and classified in the stages of Growth, Turbulence and Decline tend to present higher fixed asset growth in the subsequent period. This result is interesting, especially for companies classified in the Turbulence and Decline stages, which generally seek to reverse the various financial constraints. The evidence shows that in these LCSs, tax planning practices can have a more significant impact on cash generation and future investment levels.

Table 5
Statistics of the models used to test the effect of tax aggressiveness on the level of investments

		$\Delta\text{FixedAssets}_{it}$ (1)		$\Delta\text{FixedAssets}_{it}$ (2)		$\Delta\text{FixedAssets}_{it}$ (3)	
Intercept	?	**0.427*** **	**(0.143)**	**0.437*** **	**(0.146)**	**0.447*** **	**(0.142)**
ETR_{it-1}	(-)	**-0.005****	**(0.002)**				
DifETR_{it-1}	(+)			**0.011*** **	**(0.004)**		
$TaxBurd_{it-1}$	(-)					**-0.027*** **	**(0.009)**
$Growth_{it}$	(-)	**-0.006****	**(0.003)**	**-0.012*** **	**(0.004)**	**-0.010****	**(0.004)**
Mat_{it}	(-)	-0.004	(0.003)	-0.002	(0.004)	-0.007	(0.004)
Turb_{it}	(-)	-0.003	(0.003)	-0.006	(0.005)	**-0.009****	**(0.004)**
Decl_{it}	(-)	**-0.006***	**(0.003)**	**-0.011****	**(0.005)**	**-0.016*** **	**(0.005)**
$Growth_{it} * \text{TaxAgg}_{it-1}$	(+)	**0.006*** **	**(0.002)**	**-0.013****	**(0.006)**	**0.016****	**(0.007)**
$\text{Mat}_{it} * \text{TaxAgg}_{it-1}$	(+)	0.001	(0.003)	0.002	(0.005)	0.009	(0.007)
$\text{Turb}_{it} * \text{TaxAgg}_{it-1}$	(+)	0.005	(0.003)	-0.007	(0.007)	**0.019****	**(0.008)**
$\text{Decl}_{it} * \text{TaxAgg}_{it-1}$	(+)	0.003	(0.002)	**-0.010***	**(0.005)**	**0.032*** **	**(0.009)**
FDL_{it}	(+)	**0.038****	**(0.016)**	**0.038****	**(0.016)**	**0.040****	**(0.016)**
ROE_{it}	(-)	-0.040	(0.025)	-0.043	(0.027)	-0.029	(0.025)

QTobin_{it}	(+)	**0.002****	**(0.001)**	**0.002****	**(0.001)**	**0.002***	**(0.001)**
CFO_{it-1}	(+)	**0.033****	**(0.015)**	**0.032****	**(0.015)**	**0.034****	**(0.015)**
$\Delta\mathrm{Rec}_{it-1}$	(-)	**-0.021****	**(0.009)**	**-0.020****	**(0.009)**	**-0.021*****	**(0.008)**
$Size_{it-1}$	(-)	**-0.019*****	**(0.007)**	**-0.019*****	**(0.007)**	**-0.019*****	**(0.007)**
Remarks			3,188		3,167		3,243
R^2			0.067		0.070		0.070
No. of companies			229		227		230
Panel Type			EF		EF		EF
Sector Control			No		No		No
Year Control			Yes		Yes		Yes

Note: Robust standard errors for correction of serial autocorrelation and heteroscedasticity (Wooldridge, 2011) in parentheses - *** p<0.01, ** p<0.05, * p<0.1. . $\Delta\mathrm{Imob}_{it}$: Increase in firm's fixed assets/year. DFSI_{it}: Difference of the firm's Fixed Asset increase/year relative to the industry median/year; ETR_{it}*Effective Tax Rate*; BTD_{it}: *Book Tax Differences;* $\mathrm{TaxBurd}_{it}$Tax burden of the firm/year; NivEnd_{it}: Overall Indebtedness level of the firm/year; ROE_{it}Firm's Return on Equity/year; CFO_{it} Firm's Cash Flow from Operations/year QTobin_{it}Firm's Tobin's Q per year MTB_{it}Firm's *Market To* Book/year; $\Delta\mathrm{RL}_{it}$Firm's Net Revenue Growth/year; Tam_{it}: Firm's size/year.
Source: Prepared by authors.

What can be concluded from the result is that the hypotheses H1 e H2 were confirmed; therefore, tax aggressiveness contributes to the increase in the level of investments in fixed assets in the subsequent period. Consistent with the microeconomic literature cited, the tax burden is a factor restricting the level of investments. Complementarily, the significance of the LCSs shows that over time, firms tend to reduce the level of investment throughout their evolution, but in the stages of growth, turbulence, and decline, tax planning practices have greater potential to contribute to and maximize the growth of fixed assets in the subsequent period. The dummy coefficient for companies classified in the maturity stage showed consistency in terms of expected sign and intensity (Growth<Matur< Turb/Decl), however, it was not statistically significant. Finally, the dummy coefficient for the decline stage presented a negative and statistically significant coefficient, which shows that these companies tend to offer lower levels of investment. These results reinforce those found by Simone, Klassen e Seidman (2018), Goldman (2016), Jacob, Mmichaely and Müller (2018) and Marchesi and Zanoteli (2020). However, different from these works, it was observed that there is a lag in the relationship and that the LCSs moderate the relationship between tax aggressiveness and the level of investments.

When the control variables were analyzed, it was found that only ROE did not present statistical significance, although the signs observed were consistent with the expected relationship. What was verified was that the higher the level of indebtedness (FDL_{it}), growth potential ($QTobin_{it}$) and self-financing capacity (CFO_{it}), the higher the investment level tends to be in the subsequent period ($\Delta FixedAssets_{(it+1)}$). In turn, larger companies with higher revenue growth (ΔRev_{it}) tend to present lower investment levels. The results observed concerning the control variables are consistent with previous literature since the availability of resources (own or third party) and the growth potential stimulate investment in internal projects. However, when the firm presents higher growth rates and size, they have fewer incentives to increase investment levels (Brennan, 2003; Lamont, 1997).

4.3 The ETR effect, the ETR differential and the abnormal tax burden on the level of investment

Subsequently, we sought to evaluate whether the differences in tax aggressiveness proxies (ETR, DifETR, and TaxBurd) in the sector are associated with lower levels of investment (Table 6). What was observed was that the models, in general, were statistically significant at the 1% level, with the expected signs being observed. On this occasion, it was observed that the control variables FDL_{it}, $QTobin_{it}$, $CFO_{(it-1)}$, $\Delta Rev_{(it-1)}$ e $Size_{(it-1)}$ presented statistical significance in all of them.

Table 6
Statistics of the models used to test the effect of tax aggressiveness on the level of investments

		$\Delta\text{FixedAssets}_{it}$ (4)		$\Delta\text{FixedAssets}_{it}$ (5)		$\Delta\text{FixedAssets}_{it}$ (6)	
Intercept	?	**0.445*** **	**(0.145)**	**0.452*** **	**(0.146)**	**0.442*** **	**(0.142)**
$\text{ETRAbnormal}_{it-1}$	(-)	-0.000	(0.001)				
$\text{DifETRAbnormal}_{it-1}$	(+)			0.008	(0.005)		
Abnormal_{it-1}	(-)					**-0.034*** **	**(0.011)**
Growth_{it}	(-)	**-0.004***	**(0.003)**	**-0.005***	**(0.003)**	**-0.005** **	**(0.002)**
Mat_{it}	(-)	-0.004	(0.003)	-0.004	(0.003)	**-0.004***	**(0.003)**
Turb_{it}	(-)	-0.002	(0.003)	-0.002	(0.003)	**-0.003**	**(0.002)**
Decl_{it}	(-)	**-0.006***	**(0.003)**	**-0.006***	**(0.003)**	**-0.007** **	**(0.003)**
$Growth_{it} * \text{TaxAgg}_{it-1}$	(+)	6.34e-05	(0.001)	-0.001	(0.007)	**0.019** **	**(0.008)**
$\text{Mat}_{it} * \text{TaxAgg}_{it-1}$	(+)	0.000	(0.001)	0.004	(0.006)	**0.019** **	**(0.009)**
$\text{Turb}_{it} * \text{TaxAgg}_{it-1}$	(+)	-0.001	(0.001)	0.001	(0.008)	**0.015***	**(0.008)**
$\text{Decl}_{it} * \text{TaxAgg}_{it-1}$	(+)	**-0.002*** **	**(0.001)**	-0.004	(0.007)	**0.040*** **	**(0.010)**
FDL_{it}	(+)	**0.041** **	**(0.016)**	**0.042** **	**(0.017)**	**0.041** **	**(0.016)**
ROE_{it}	(-)	-0.025	(0.025)	-0.031	(0.026)	**-0.027**	**(0.025)**
QTobin_{it}	(+)	**0.002***	**(0.001)**	**0.002***	**(0.001)**	**0.002***	**(0.001)**
CFO_{it-1}	(+)	**0.035** **	**(0.015)**	**0.033** **	**(0.015)**	**0.034** **	**(0.015)**
ΔRev_{it-1}	(-)	**-0.021** **	**(0.008)**	**-0.020** **	**(0.008)**	**-0.021** **	**(0.008)**
$Size_{it-1}$	(-)	**-0.019*** **	**(0.007)**	**-0.020*** **	**(0.007)**	**-0.019*** **	**(0.007)**
Remarks			3,208		3,189		3,243
R^2			0.068		0.070		0.069
No. of companies			229		225		230
Panel Type			EF		EF		EF
Sector Control			No		No		No
Year Control			Yes		Yes		Yes

Note: Robust standard errors for correction of serial autocorrelation and heteroscedasticity (Wooldridge, 2011) in parentheses - *** p<0.01, ** p<0.05, * p<0.1.; . ΔImob_{it}: Increase in the firm's fixed assets/year; ETRAnormal_{it} Difference of firm's ETR/year from industry median/year ; $\text{DifETRAbnormal}_{it}$: Dif ETR of the firm/year relative to the industry median/year; $\text{TaxBurdAnormal}_{it}$ Difference of the firm's TaxBurd/year relative to the sector median/year; FDL_{it}: Overall Indebtedness level of the firm/year; ROE_{it}Return on Equity of the firm/year; CFO_{it} Cash Flow from Operations of the firm/year QTobin_{it}Firm's Tobin Q/year MTB_{it}Firm's *Market To* Book/year; ΔRev_{it}Firm's Net Revenue Growth/year; Size_{it}: Firm's size/year.
Source: Prepared by authors.

It has been found that firms with more debt, higher growth potential, and greater self-financing capacity tend to have higher investments in the subsequent period. On the other hand, companies with higher growth in revenue and size tend to present lower levels of investments in the following periods. Meanwhile, it is worth

noting that model (4), which used $TaxBurd_{it}$ as a proxy for tax aggressiveness, all variables were statistically significant. The results observed in model 6 reinforce the hypothesis that companies with higher tax burdens ($TaxBurdAnormal_{it}$) about the sector's median tend to present a lower level of investments (H1). Furthermore, it was observed that as life cycle stages evolve and investment levels reduce, but that, in the meantime, LCSs moderate the relationship between tax burden and investment level positively. This means that, despite the tendency for investment levels to decrease as the LCSs evolve, for the most tax aggressive companies, investment levels increase, which reinforces hypothesis 2 analyzed in the present study, thus corroborating, in part, the studies of Simone, Klassen e Seidman (2018), Goldman (2016), Jacob, Mmichaely e Müller (2018) e Marchesi e Zanoteli (2020).

4.4 Robustness, sensitivity, and additional analyses

To analyze the sensitivity and robustness of the results, robustness tests and additional analyses were performed with other investment level metrics (Table 7), based on authors such as McNichols and Stubenn (2008) and Biddle, Hillary and Verdi (2009). The results show that, in general terms, the signs observed in the coefficients are the same and so is the significance level. Notably, using the investment level proxies of M&S (2008) and BHV(2009), the LCSs were statistically significant in both. However, in moderation, only the growth stage remained persistent. Nevertheless, the expected signs were the same as in Tables 4 and 5.

It was also analyzed whether the observed relations were sensitive to other proxies of tax aggressiveness and to other groupings of LCS. To do so, we sought to test the abnormal tax aggressiveness measured by the difference between each tax aggressiveness proxy (ETR, DifETR and TaxBurd) about the median of the sector/year. What was found was that the signs already observed were persistent; however, only the abnormal DifETR and the abnormal TaxBurd were statistically significant (at the 1% level). This result reinforces hypothesis 1 that companies with higher tax aggressiveness, compared to their industry peers, tend to have higher investments.

The sensitivity to clustering of LCSs was also verified. To this end, groupings were performed comparing the Turbulence and Decline stages and the Growth and Maturity stages concerning the others. Consistent with what has been observed in previous literature (Hasan & Habib, 2017), the operationalization of the LCSs, using these groupings, made it possible to verify if the results are sensitive to the stages characterized as a target by competitors (Growth and Maturity) and those LCSs closest to the risk of insolvency (Turbulence and Decline).

Since Tables 5 and 6 show that the growth, turbulence, and decline stages presented statistical significance in the primary model, this analysis reinforces the evidence already. It was verified that the general models explained statistical importance, that the signs observed were the same and that the dummies for the LCSs were significant, especially in the model that uses the TaxBurd as a proxy for tax aggressiveness. However, the interactions kept their signs, but the significance did not. Nevertheless, it was observed that the t-statistic was more significant than one and that the R^2 suffered a slight improvement with its maintenance. Econometric manuals suggest that, under these conditions, maintaining the variable in the model is recommended (Wooldridge, 2011).

Table 7
Robustness test statistics for different investment level proxies

Panel A - Statistics of the variables of interest using McNichols and Stuben's (2008) model for estimating the level of investments

		M& S(2008)		M& S(2008)		M& S(2008)	
Intercept	?	**0.350*** **	**(0.132)**	**0.359*** **	**(0.134)**	**0.337*** **	**(0.126)**
ETR_{it-1}	(-)	**-0.002****	**(0.001)**				
DifETR_{it-1}	(+)			**0.011***	**(0.006)**		
$TaxBurd_{it-1}$	(-)					-0.014	(0.009)
$Growth_{it}$	(-)	**-0.008*** **	**(0.002)**	**-0.016*** **	**(0.006)**	**-0.011*** **	**(0.004)**
Mat_{it}	(-)	**-0.006*** **	**(0.002)**	**-0.008***	**(0.005)**	**-0.012*** **	**(0.004)**
Turb_{it}	(-)	**-0.010*** **	**(0.003)**	**-0.016****	**(0.006)**	**-0.009***	**(0.005)**
Decl_{it}	(-)	**-0.007***	**(0.004)**	**-0.008**	**(0.007)**	**-0.012***	**(0.007)**
$Growth_{it} * \mathrm{TaxAgg}_{it-1}$	(+)	**0.005***	**(0.003)**	**-0.016***	**(0.008)**	**0.016****	**(0.008)**
$\mathrm{Mat}_{it} * \mathrm{TaxAgg}_{it-1}$	(+)	-0.003	(0.002)	-0.002	(0.007)	**0.017****	**(0.008)**
$\mathrm{Turb}_{it} * \mathrm{TaxAgg}_{it-1}$	(+)	0.004	(0.008)	-0.011	(0.010)	0.000	(0.013)
$\mathrm{Decl}_{it} * \mathrm{TaxAgg}_{it-1}$	(+)	**0.003****	**(0.001)**	-0.002	(0.010)	0.016	(0.013)
Other controls		Yes		Yes		Yes	

Panel B - Statistics of the variables of interest using the model of Bidlle, Hillary and Verdi (2009) for estimating the level of investments

		BHV(2009)		BHV(2009)		BHV(2009)	
Intercept	?	**0.350*** **	**(0.132)**	**0.359*** **	**(0.134)**	**0.337*** **	**(0.126)**
ETR_{it-1}	(-)	**-0.002****	**(0.001)**				
DifETR_{it-1}	(+)			**0.011***	**(0.006)**		
$\mathrm{TaxBurd}_{it-1}$	(-)					-0.014	(0.009)
$Growth_{it}$	(-)	**-0.008*** **	**(0.002)**	**-0.016*** **	**(0.006)**	**-0.011*** **	**(0.004)**
Mat_{it}	(-)	**-0.006*** **	**(0.002)**	**-0.008***	**(0.005)**	**-0.012*** **	**(0.004)**
Turb_{it}	(-)	**-0.010*** **	**(0.003)**	**-0.016****	**(0.006)**	**-0.009***	**(0.005)**
Decl_{it}	(-)	**-0.007***	**(0.004)**	**-0.008**	**(0.007)**	**-0.012***	**(0.007)**
$Growth_{it} * \mathrm{TaxAgg}_{it}$	(+)	**0.005***	**(0.003)**	**-0.016***	**(0.008)**	**0.016****	**(0.008)**
$\mathrm{Mat}_{it} * \mathrm{TaxAgg}_{it}$	(+)	-0.003	(0.002)	-0.002	(0.007)	**0.017****	**(0.008)**
$\mathrm{Turb}_{it} * \mathrm{TaxAgg}_{it}$	(+)	0.004	(0.008)	-0.011	(0.010)	0.000	(0.013)
$\mathrm{Decl}_{it} * \mathrm{TaxAgg}_{it}$	(+)	**0.003****	**(0.001)**	-0.002	(0.010)	0.016	(0.013)
Other controls		Yes		Yes		Yes	

Source: Prepared by authors.

Finally, a tax aggressiveness metric was used, consisting of the difference between GVA and the tax burden (TaxBurd) calculated by the difference between 1 and the TaxBurd. This variable was called Gross Value-Added Surplus (GVAS). It captures the Gross Value Added generated in addition to the Tax Burden and how much higher or lower the tax burden was, and therefore, how taxing it was. The results for this variable were consistent in explaining the level of investment for the three investment level proxies already mentioned ($\Delta FixedAssets_{it}$, M&S and BHV). The evidence reinforces hypothesis (1) that the lower the taxation, the higher the potential for investment in fixed assets in the subsequent period, regardless of the investment level proxy used. Similarly, it was found that LCSs moderate the relationship (H2).

5 FINAL CONSIDERATIONS

The present study analyzed the moderating effect of the stages of the firms' life cycle (LCS) on the relationship between tax aggressiveness and the level of investments of Brazilian companies listed on B3. The descriptive, documentary research with a quantitative approach used quarterly data from 2012-2020 of 3,853 observations from 270 companies in the Refinitiv and COMDINHEIRO databases. Data were analyzed using descriptive statistics, test the difference between means, correlation, and regression analysis with panel data using Stata 16 software. The results showed that tax aggressiveness is associated with a higher level of investments, as reported by Simone, Klassen e Seidman (2018), Goldman (2016), Jacob, Mmichaely e Müller (2018) e Marchesi e Zanoteli (2020). However, despite the aggressiveness contributing to cash generation, the benefits generated in terms of investment level occur in the subsequent period. Moreover, as Dickinson (2011) and Habib and Hassan (2017) suggested, LCSs moderate the relationship between aggressiveness and investment level. This means that the benefits of tax planning (tax aggressiveness) are more significant for firms in the Growth, Turbulence, and Decline stages.

These results are relevant to the discussion, especially modeling tax aggressiveness effects. The evidence was consistent for different modeling and using the LCS directly or as a moderator variable, given its significance in the various models. Furthermore, the results reinforce the role of tax planning in improving the companies' future performance drivers, especially for those in the stages of Growth, Turbulence, and Decline.

Despite the contributions, the study has limitations that can be addressed in future studies, such as (i) use of data from unlisted companies; (ii) no breakdown of the tax burden between income and consumption taxes; and (iii) analysis of the moderating effect of taxes on value drivers.

The results obtained in this study raised questions requiring further analysis for a better understanding of the effect of tax aggressiveness in the Brazilian context: (i) Could the lagged relationship between tax aggressiveness and the level of investment be associated with the company's strategy?

REFERENCES

Alm, J., Liu, Y., & Zhang, K. (2019). Financial constraints and firm tax evasion. *International Tax and Public Finance, 26*(1), 71–102. https://doi.org/10.1007/s10797-018-9502-7

Araújo, R. A. de M., & Leite Filho, P. A. M. (2019). Reflexo do Nível de Agressividade Fiscal sobre a Rentabilidade de Empresas Listadas na B3 e NYSE. *Revista Universo Contábil, 14*(4), 115. https://doi.org/10.4270/ruc.2018430

Araújo, R. A. de M., Santos, L. M. da S., Leite Filho, P. A. M., & Camara, R. P. de B. (2018). Agressividade Fiscal: Uma comparação entre empresas listadas na NYSE e BM&FBOVESPA. *Enfoque: Reflexão Contábil, 37*(1), 39. https://doi.org/10.4025/enfoque.v37i1.32926

Arikan, A. M., & Stulz, R. M. (2016). Corporate Acquisitions, Diversification, and the Firm's Life Cycle: Corporate Acquisitions, Diversification, and the Firm's Life Cycle. *The Journal of Finance, 71*(1), 139–194. https://doi.org/10.1111/jofi.12362

Armstrong, C. S., Blouin, J. L., & Larcker, D. F. (2012). The incentives for tax planning. *Journal of Accounting and Economics, 53*(1–2), 391–411. https://doi.org/10.1016/j.jacceco.2011.04.001

Asiri, M., Al-Hadi, A., Taylor, G., & Duong, L. (2020). Is corporate tax avoidance associated with investment efficiency? *The North American Journal of Economics and Finance, 52*, 101143. https://doi.org/10.1016/j.najef.2020.101143

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

Baranova, V., & Janickova, L. (2012). Taxation of Corporations and Their Impact on Economic Growth: The Case of EU Countries. *Journal of Competitiveness, 4*(4), 96–108. https://doi.org/10.7441/joc.2012.04.07

Biddle, G. C., Hilary, G., & Verdi, R. S. (2009). How does financial reporting quality relate to investment efficiency? *Journal of Accounting and Economics, 48*(2–3), 112–131. https://doi.org/10.1016/j.jacceco.2009.09.001

Brennan, M. J. (2003). Corporate Investment Policy. In *Handbook of the Economics of Finance* (Vol. 1, p. 167–214). Elsevier. https://doi.org/10.1016/S1574-0102(03)01007-0

Brooks, C., Godfrey, C., Hillenbrand, C., & Money, K. (2016). Do investors care about corporate taxes? *Journal of Corporate Finance, 38*, 218–248. https://doi.org/10.1016/j.jcorpfin.2016.01.013

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

Costa, F. M. da, & Amorim Júnior, R. L. (2020). Reorganizações Societárias e Agressividade Tributária. *Revista Evidenciação Contábil & Finanças, 8*(3), 5–22. https://doi.org/10.22478/ufpb.2318-1001.2020v8n3.51368

De Simone, L., Klassen, K., & Seidman, J. K. (2018). The Effect of Income-Shifting Aggressiveness on Corporate Investment. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3232036

Diamond, P. A., & Mirrlees, J. A. (1971). Optimal Taxation and Public Production I: Production Efficiency. *The American Economic Review, 61*(1), 8–27.

Dickinson, V. (2011). Cash Flow Patterns as a Proxy for Firm Life Cycle. *The Accounting Review, 86*(6), 1969–1994. https://doi.org/10.2308/accr-10130

Faff, R., Kwok, W. C., Podolski, E. J., & Wong, G. (2016). Do corporate policies follow a life-cycle? *Journal of Banking & Finance, 69*, 95–107. https://doi.org/10.1016/j.jbankfin.2016.04.009

Gallemore, J., Maydew, E. L., & Thornock, J. R. (2014). The Reputational Costs of Tax Avoidance. *Contemporary Accounting Research, 31*(4), 1103–1133. https://doi.org/10.1111/1911-3846.12055

Gokalp, O. N., Lee, S.-H., & Peng, M. W. (2017). Competition and corporate tax evasion: An institution-based view. *Journal of World Business, 52*(2), 258–269. https://doi.org/10.1016/j.jwb.2016.12.006

Goldman, N. C. (2016). *The effect of tax aggressiveness on investment efficiency* [Dissertation of Doctor in Philosophy, University of Arizona]. http://hdl.handle.net/10150/612100

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

Hanlon, M., Maydew, E. L., & Shevlin, T. (2008). An unintended consequence of book-tax conformity: A loss of earnings informativeness. *Journal of Accounting and Economics, 46*(2–3), 294–311. https://doi.org/10.1016/j.jacceco.2008.09.003

Hasan, M. M., & Habib, A. (2017). Corporate life cycle, organizational financial resources and corporate social responsibility. *Journal of Contemporary Accounting & Economics, 13*(1), 20–36. https://doi.org/10.1016/j.jcae.2017.01.002

Hill, M. D., Kubick, T. R., Brandon Lockhart, G., & Wan, H. (2013). The effectiveness and valuation of political tax minimization. *Journal of Banking & Finance, 37*(8), 2836–2849. https://doi.org/10.1016/j.jbankfin.2013.04.002

Jacob, M. (2018). A note on tax research. *Revista Contabilidade & Finanças, 29*(78), 339–342. https://doi.org/10.1590/1808-057x201890280

Jacob, M., Michaely, R., & Müller, M. A. (2019). Consumption Taxes and Corporate Investment. *The Review of Financial Studies, 32*(8), 3144–3182. https://doi.org/10.1093/rfs/hhy132

Jaimovich, N., & Rebelo, S. (2017). Nonlinear Effects of Taxation on Growth. *Journal of Political Economy, 125*(1), 265–291. https://doi.org/10.1086/689607

Khurana, I. K., Moser, W. J., & Raman, K. K. (2018). Tax Avoidance, Managerial Ability, and Investment Efficiency. *Abacus, 54*(4), 547–575. https://doi.org/10.1111/abac.12142

Kubick, T. R., Lynch, D. P., Mayberry, M. A., & Omer, T. C. (2015). Product Market Power and Tax Avoidance: Market Leaders, Mimicking Strategies, and Stock

Returns. *The Accounting Review, 90*(2), 675–702. https://doi.org/10.2308/accr-50883

Lamont, O. (1997). Cash Flow and Investment: Evidence from Internal Capital Markets. *The Journal of Finance, 52*(1), 83–109. https://doi.org/10.1111/j.1540-6261.1997.tb03809.x

Lennox, C., Lisowsky, P., & Pittman, J. (2013). Tax Aggressiveness and Accounting Fraud. *Journal of Accounting Research, 51*(4), 739–778. https://doi.org/10.1111/joar.12002

Li, C., Zhou, P., & Li, Y. (2019). Managerial overconfidence, overinvestment, and R&D spillover. *Managerial and Decision Economics, 40*(7), 858–861. https://doi.org/10.1002/mde.3051

Marchesi, R. F., & Zanoteli, E. J. (2020). Agressividade Fiscal e Investimentos no Mercado Acionário Brasileiro. *Advances in Scientific and Applied Accounting, 1*(1), 065–083. https://doi.org/10.14392/asaa.2020130304

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., Lessa, R. C., & Moraes, A. D. J. (2014). Remuneração ds Auditores Perante a Agressividade Tributária e Governança Corporativa no Brasil. *Revista Contabilidade e Controladoria, 6*(3). https://doi.org/10.5380/rcc.v6i3.34593

Martinez, A. L., & Martins, V. A. M. (2016). Alavancagem Financeira e Agressividade Fiscal no Brasil. *Revista de Contabilidade da UFBA, 10*(3), 4. https://doi.org/10.9771/rc-ufba.v10i3.18383

Martinez, A. L., & Motta, F. P. (2020). Agressividade fiscal em sociedades de economia mista no Brasil. *Revista Contemporânea de Contabilidade, 17*(43), 136–148. https://doi.org/10.5007/2175-8069.2020v17n43p136

Martinez, A. L., & Reinders, A. P. G. S. (2018). Qual o Efeito da Agressividade Tributária na Rentabilidade Futura? Uma Análise das Companhias Abertas Brasileiras. *Revista de Gestão e Contabilidade da UFPI, 5*(1), 3. https://doi.org/10.26694/2358.1735.2018.v5ed16485

Martinez, A. L., Ribeiro, A. C., & Funchal, B. (2019). Sarbanes Oxley Act and Taxation: A study of the effects ob the tax aggressiveness of Brazilian firms. *Contabilidade Vista & Revista, 30*(1), 16. https://doi.org/doi.org/10.22561/cvr.v30i1.4525

Martinez, A. L., & Silva, R. F. (2017). Agressividade Fiscal e o Custo de Capital de Terceiros no Brasil. *Revista de Gestão, Finanças e Contabilidade, 7*(1), 240–251. https://doi.org/10.18028/2238-5320/rgfc.v7n1p240-251

McNichols, M. F., & Stubben, S. R. (2008). Does Earnings Management Affect Firms' Investment Decisions? *The Accounting Review, 83*(6), 1571–1603. https://doi.org/10.2308/accr.2008.83.6.1571

Moreira, A. M. (2003). *Elisão e Evasão Fiscal—Limites ao Planejamento Tributário*. Revista da Associação Brasileira de Direito Tributário, 18.

Park, J., Ko, C. Y., Jung, H., & Lee, Y.-S. (2016). Managerial ability and tax avoidance: Evidence from Korea. *Asia-Pacific Journal of Accounting & Economics, 23*(4), 449–477. https://doi.org/10.1080/16081625.2015.1017590

Rodrigues, D. V., & Galdi, F. C. (2020). Taxa de imposto efetiva nas empresas brasileiras: Uma comparação entre as companhias abertas e fechadas. *Revista Contemporânea de Contabilidade, 17*(42), 57–69. https://doi.org/10.5007/2175-8069.2020v17n42p57

Slemrod, J. (1990). Optimal Taxation and Optimal Tax Systems. Journal of Economic Perspectives, 4(1), 157–178. https://doi.org/10.1257/jep.4.1.157

Wooldridge, J. (2011). *Econometric Analysis of Cross Section and Panel Data* (2a.). MIT-Massachussets Institute Technology.