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IMPACT OF TAX BURDEN ON THE CAPITAL STRUCTURE OF BRAZILIAN COMPANIES

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ABSTRACT

This study investigates the relationship between tax burden and corporate indebtedness in Brazilian companies, testing three hypotheses: first, whether the tax burden positively influences the level of overall indebtedness; second, whether it influences short-term debt; and third, whether it influences long-term debt. The analysis uses accounting data from 161 publicly traded companies across various sectors, covering the period from the fourth quarter of 2010 to the fourth quarter of 2023. totaling 8.533 observations extracted from the open data portal of the Brazilian Securities and Exchange Commission (CVM). To test the hypotheses, generalized linear models were estimated, considering overall debt (OD), short-term debt (STD), and long-term debt (LTD) as dependent variables. The tax burden (TB) was used as the explanatory variable, along with a set of control variables: profitability, current liquidity, asset turnover, firm size, economic crisis, Selic rate, GDP, and IPCA. The results indicate that the tax burden has a positive and significant relationship with all debt metrics, confirming the formulated hypotheses. Moreover, robustness tests did not indicate endogeneity, reinforcing the reliability of the findings. These results suggest that the tax burden plays a relevant role in the capital structure of Brazilian companies, providing empirical support for the Trade-Off theory.

Keywords: Tax Burden. Capital Structure. Trade-Off. Pecking Order.

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1 INTRODUCTION

The issue of taxation has always been at the center of attention for both the government and taxpayers due to its direct influence on the economy. In 2023, for example, Brazil's Gross Domestic Product (GDP) reached BRL 10.94 trillion (at current prices), and the Gross Tax Burden (GTB), defined as the ratio between tax revenue and GDP at market prices, reached 32.11 percent. This represented a decrease of 0.90 percentage points compared to the 2022 tax burden, which stood at 33.01 percent, according to the Center for Tax and Customs Studies – RFB (2023).

Laffer et al. (2022) use the Laffer Curve to illustrate the theoretical relationship between the tax rate and tax revenue, highlighting the importance of finding a balance point between taxation and revenue collection. The authors argue that excessive increases in the tax burden may lead individuals with greater purchasing power to seek legal strategies, such as hiring tax specialists, or illegal ones, such as tax evasion, ultimately resulting in a possible reduction in total government revenue.

However, some studies indicate that the classical theory advocated by Laffer may not be fully applicable to the Brazilian tax environment. For instance, Lima and Rezende (2019) found that, over a certain period, an increase in the tax burden did not necessarily lead to a reduction in tax revenue, underscoring the complexity of the topic.

Similarly, Santos et al. (2024) analyzed the relationship between tax burden and tax evasion based on the Theory of Equity. Their findings suggest that the relationship may be explained by the population's perceived lack of return on taxes paid rather than by the actual size of the tax burden, challenging the assumptions of the Laffer Curve.

Given the above, the complexity of the taxation issue becomes evident, justifying its selection as the focus of this study. Mendes and Oliveira (2016) point out that taxation is a critical factor in financing decisions, as the choice between using equity or debt capital may result in tax savings.

It is therefore also important to investigate the capital structure of companies, a relevant topic extensively explored in corporate finance literature. Researchers have sought to identify the factors that influence corporate debt levels, focusing on the Trade-Off and Pecking Order theories. The Trade-Off Theory, as proposed by authors such as Modigliani and Miller (1963), Kraus and Litzenberger (1973), and Myers (1984), argues that firms balance the tax benefits of debt—resulting from the deductibility of interest payments—against the costs of financial distress. In this context, taxation plays a fundamental role in capital structure decisions, as the tax savings derived from debt financing may encourage firms to increase leverage, provided that the financial risks do not outweigh the tax gains.

In the complex and dynamic landscape of corporate finance, it is essential to deepen the understanding of how the tax burden influences corporate capital structure. In a country like Brazil, where fiscal policies and tax rates can be particularly burdensome for organizations and society, this relationship becomes even more significant.

In light of this, the study aimed to answer the following research question: **What is the influence of the tax burden on the capital structure of Brazilian companies?**

According to Pohlmann and Iudícibus (2010), who analyzed 405 companies during the period from 2001 to 2003, the level of taxation is a determining factor in corporate indebtedness. Similarly, Fabris et al. (2021), in their analysis of 270 companies from 2010 to 2019, demonstrated a positive and significant association between the tax burden and companies' overall debt.

On the other hand, Scherer et al. (2016) found a negative and non-significant correlation between the tax burden and the debt levels of 18 Brazilian companies in the construction sector between 2010 and 2014. Likewise, Gonçalves and Amaral (2019) identified a negative and non-significant correlation between the tax burden and the indebtedness of 62 privately held companies based in the state of Minas Gerais, using data from the 2009 to 2012 fiscal years. In both studies,

the correlations suggest that the tax burden does not play a relevant role in corporate debt levels. These findings underscore the need for further investigation into how the tax burden affects the capital structure of companies in the Brazilian context.

Thus, this study aims to analyze the influence of the tax burden on the capital structure of publicly traded Brazilian companies, a particularly relevant topic in countries with complex tax systems such as Brazil. The research contributes to the literature by incorporating into a single model key macroeconomic variables such as GDP, Selic rate, IPCA, and economic crisis, thereby expanding the empirical understanding of the determinants of corporate indebtedness. Additionally, it offers a snapshot of the relationship between tax burden and capital structure prior to the implementation of the tax reform, serving as a basis for future comparisons and supporting both managers and policymakers by providing evidence on how taxation influences companies' debt levels.

2 LITERATURE REVIEW

2.1 Theories on Capital Structure

Capital structure is extensively studied in corporate finance, although no definitive consensus has yet been reached in the literature (Ghani et al., 2023). The traditional theory, addressed by Durand (1952), recognized that companies could increase their debt levels up to an optimal point at which the total cost of capital would be minimized. Beyond that point, any additional use of debt would result in a continuous increase in the total cost of capital due to the growing financial risk associated with the company's liabilities.

Modigliani and Miller (1958), in turn, presented a perspective contrary to traditional theory by arguing that, in an ideal market without transaction costs, bankruptcy, information asymmetry, or differences in borrowing rates and in the absence of taxes, a company's total cost of capital remains independent of its capital structure. In this context, the value and attractiveness of an investment depend essentially on its profitability and the risk associated with the decision, rather than on the method of financing.

Following the publication of Modigliani and Miller's article proposing the capital structure irrelevance theory, Durand (1959) offered strong criticism of their assumptions, highlighting the failure to properly account for risk in their propositions, such as the risk of default or major unforeseen events. Durand emphasized the importance of adequately incorporating the element of risk or constraints in investment decisions and in determining the cost of capital, especially in a dynamic and imperfect economic environment.

Modigliani and Miller (1963) later revised their theory by considering the tax benefits of debt, emphasizing that excessive leverage increases both the risk of bankruptcy and the cost of capital. Miller (1977) revisited part of the logic behind the capital structure irrelevance proposition by showing that the tax advantage of debt may be neutralized when three types of taxes are considered: corporate income tax, dividend taxation, and interest income taxation. Thus, although debt financing offers a tax shield by reducing the company's taxable base, this benefit may be offset by the taxes imposed on creditors, resulting in a market equilibrium where the value added by leverage becomes limited (Khan et al., 2020).

According to Titman (1984), following the work of Modigliani and Miller, particularly the second paper (1963), which incorporates a real-world scenario with taxes, several studies emerged analyzing the costs associated with debt, leading to the development of the Trade-Off Theory. Kraus and Litzenberger (1973) argue that firms should balance the tax benefits of debt (interest deductibility) with bankruptcy and financial distress costs in order to determine the optimal capital structure.

The Trade-Off Theory suggests that the optimal capital structure results from a balance between the tax benefits of debt and the costs of bankruptcy or financial constraints (Myers, 1984).

Myers argues that as a company increases its debt, it enhances the tax benefits through interest deductibility but also increases financial distress. Therefore, firms should seek a level of indebtedness that maximizes their value.

The Pecking Order Theory (Myers and Majluf, 1984), on the other hand, suggests that firms follow a hierarchy in their financing decisions. First, they prefer to rely on internal financing whenever possible, as profitable firms have little incentive to increase their debt levels. When external financing becomes necessary, they follow the order: retained earnings, debt, and, as a last resort, equity issuance.

The Market Timing Theory (Frank and Goyal, 2007) highlights that managers observe the current conditions of debt and equity markets. That is, financing decisions do not follow the tax benefits of debt, as proposed by the Trade-Off Theory, nor are they guided solely by a preference for internal financing, as suggested by the Pecking Order Theory. Instead, managers take advantage of periods when the firm's stock is overvalued to issue equity and raise funds at a lower cost. Conversely, when the stock is undervalued, they prefer to resort to debt financing (Couto and Ambrozini, 2023). This theory gained traction with the studies of Baker and Wurgler (2002), who showed that firms issuing more equity during periods of high stock prices maintained lower debt levels in the long run. This indicates that capital structure is largely the cumulative result of financing decisions made based on market conditions, suggesting that firms do not actively rebalance their capital structure to reach an optimal level, but rather take advantage of market timing opportunities to minimize the cost of capital.

Agency Theory, proposed by Jensen and Meckling (1976), adds to the discussion on capital structure by highlighting the conflicts between owners and managers, which stem from diverging interests. In this context, the composition of the capital structure can serve as a governance mechanism to mitigate these conflicts, since debt can act as a disciplinary tool for managers by reducing agency costs. Roberts and Sufi (2009) contribute to Agency Theory by demonstrating that creditors' influence on firms' financial decisions extends beyond managers' preferences for debt. Their findings reveal that, following the violation of restrictive covenants, creditors impose a significant reduction in debt issuance, leading to lower leverage. This indicates that capital structure decisions depend not only on managers but also on credit market constraints. Therefore, debt aversion may reflect not only concerns about bankruptcy costs but also fears of losing control over corporate decision-making.

2.2 The Influence of Taxes on Corporate Indebtedness

The main advantage of leverage lies in the possibility of tax deductibility of interest payments, making debt financing more attractive for companies subject to higher tax burdens. By simulating tax rates to capture the specificities of the tax system and the presence of non-debt tax shields, Graham (1996a, 1996b) demonstrates that companies facing higher effective tax rates tend to exhibit higher levels of indebtedness compared to those subject to lower tax burdens.

Numerous studies support this relationship, showing that companies tend to rely on debt financing whenever possible in order to maximize the tax benefits of debt (Pohlmann and Iudícibus, 2010; Marques et al., 2016; Fabris et al., 2021; Jaworski and Czerwonka, 2021; Khoa and Thai, 2021; Uddin et al., 2022). Deng et al. (2020), for example, found that companies do not respond to tax cuts, but increase their long-term leverage when taxes rise. Similarly, Heider and Ljungqvist (2015) argue that firms adjust their leverage in response to tax increases but not to tax cuts, suggesting an asymmetric effect on debt decisions. Their study also finds that this tax sensitivity varies across companies and is more pronounced in profitable firms and those with investment-grade ratings, since these firms benefit from greater marginal tax savings and face lower debt issuance costs.

Parsons and Titman (2007) conducted a comprehensive review of the literature on capital structure and highlighted that firms with higher taxable income tend to use more debt. However, they caution that empirically validating this correlation is challenging, as the relationship between the tax benefits of debt and leverage ratios is influenced by multiple factors, including the specific tax structure of each country and the dynamics of the market at the time of financing. Some studies have found a negative relationship between taxation and indebtedness, in line with the Pecking Order Theory, while others have identified a negative but statistically insignificant relationship with capital structure (Bastos et al., 2009; Dimitropoulos and Koronios, 2021; Panda et al., 2023; Szomko, 2020; Mendes and Oliveira, 2016; Gonçalves and Amaral, 2019; Ali et al., 2022).

Faulkender and Smith (2014) analyzed how variations in global tax structures affect the leverage of U.S. multinational companies. The authors found that firms with profits in low-tax jurisdictions tend to show lower levels of indebtedness and higher interest coverage ratios, reinforcing the hypothesis that the tax burden significantly affects the choice between equity and debt financing.

Studies conducted in China, such as those by Wu and Yue (2009) and Lei (2020), further support this relationship. Wu and Yue (2009) examined companies that lost tax incentives previously granted by local governments and observed that, in response to increases in corporate tax rates, these firms raised their debt levels, behavior consistent with the Trade-Off Theory. Lei (2020) analyzed 224 Chinese companies using a random effects model and identified a positive relationship between the debt tax shield and capital structure. The author also highlighted that the impact of these effects varies across different sectors of the economy.

The literature also indicates that corporate responses to taxation may vary according to ownership structure and corporate governance. Jin (2021) developed a theoretical model based on the Trade-Off Theory and found that corporate debt is inversely related to tax aggressiveness. However, this relationship is conditioned by the firm's profitability and is more pronounced in state-controlled firms than in privately held ones.

Empirical evidence on the relationship between taxation and indebtedness has also been found in various countries. Sheikh and Qureshi (2014) analyzed Pakistani companies and found that the tax burden positively affects both total and short-term debt ratios. Similarly, Lee and Kuo (2014) observed that higher corporate tax rates function as a "shield" for interest payments, thus encouraging leverage. Moreover, the authors found an inverse relationship between leverage and managerial ownership, suggesting that managerial control influences financing decisions.

In the European context, Hartmann-Wendels et al. (2012) investigated the influence of taxes on the capital structure of 86,173 non-financial German firms between 1973 and 2008. Using Graham's methodology to estimate marginal tax rates, the authors confirmed a positive and statistically significant relationship between the marginal tax benefit of debt and firms' leverage levels. Faccio and Xu (2015) analyzed the impact of taxes on capital structure in 29 OECD countries between 1981 and 2009 and concluded that corporate and personal taxation significantly influence leverage decisions, proving to be as relevant as other traditional variables in financial literature.

In Brazil, Fonseca et al. (2020) investigated the tax benefits of debt in 259 non-financial companies from 2008 to 2018 using dynamic panel data regression. Their results indicate that, although taxation encourages indebtedness, Brazilian companies do not fully take advantage of the tax benefits of debt, even in the face of the country's high tax burden.

Based on the theoretical framework presented, this study aims to examine the relationship between tax burden and capital structure by formulating the following hypotheses:

Hypothesis 1: There is a positive relationship between the level of overall indebtedness and the tax burden.

Hypothesis 2: There is a positive relationship between the level of short-term indebtedness and the tax burden.

Hypothesis 3: There is a positive relationship between the level of long-term indebtedness and the tax burden.

According to the Trade-Off Theory, interest on debt provides a tax benefit by reducing the taxable base, making debt financing more attractive for companies with higher income tax rates. However, rather than relying solely on the figures reported in the Income Statement, this study adopts the tax burden extracted from the Statement of Value Added (SVA), following the approach used by Prudêncio Tinoco et al. (2014) and Scherer et al. (2016), as it more comprehensively reflects the taxation borne by companies. Bubanić (2023) emphasizes that the nominal income tax rate does not take into account tax incentives and exemptions that affect the tax base, and therefore does not reflect the effective tax burden faced by companies.

3 METHODOLOGICAL PROCEDURES

3.1 Sample Definition and Data Collection

The population of this study consists of 161 publicly traded companies from various sectors, registered with the Brazilian Securities and Exchange Commission (CVM), covering 53 quarters and totaling 8,533 observations. The following documents, available on the CVM website, were used: (i) Standardized Financial Statements – DFP; (ii) Quarterly Information Form – ITR; and (iii) Company Registration Form – FCA. The financial statements analyzed were the Balance Sheet (BS), the Income Statement (IS), and the Statement of Value Added (SVA). Data collection and processing were conducted using the Python programming language within the Google Colab environment, and the analysis was performed using econometric models in the R statistical software.

The data cover the period from 2010 to 2023, and the time frame was selected based on the availability of data on the CVM platform, as well as the full convergence of Brazilian companies to international standards (IFRS) in 2010 (Gelbcke et al., 2018). Financial sector companies were excluded due to their specific characteristics. Outliers, defined as values that deviated significantly from the mean, were removed. This included companies with limited data for only a few periods, such as those that were delisted or had their registration canceled. Only companies with complete data for the entire period were considered, ensuring a more consistent and balanced dataset, although still subject to residual outliers.

3.2 Description of Variables

The variables used in this study were defined based on the methodologies applied in the literature addressing tax burden and corporate indebtedness, as presented in Table 1.

Table 1
Description of the Variables Used in the Study

Variables	Description	Metric	Authors
Dependent Variables			
OD	Overall Debt	(Current Liabilities + Non-Current Liabilities) / Total Assets	Pamplona e Silva (2020); Marques et al. (2016); Bastos et al. (2009); Lerner e Flach (2022); Fiirst et al. (2018); Leite e Silva (2019).
STD	Short-Term Debt	Current Liabilities / Total Assets	Pamplona e Silva (2020); Marques et al. (2016); Bastos et al. (2009); Lerner e Flach (2022); Fiirst et al. (2018); Leite e Silva (2019).
ELP	Long-Term Debt	Non-Current Liabilities / Total Assets	Pamplona e Silva (2020); Marques et al. (2016); Bastos et al. (2009); Lerner e Flach (2022); Fiirst et al. (2018); Leite e Silva (2019).
Independent Variable			
TB	Tax Burden	Taxes, Fees, and Contributions / Gross Revenue (SVA)	Jaworski e Czerwonka (2021); Khoa e Thai (2021); Uddin et al. (2022).

Control Variables			
PROF	Profitability	Net Income / Net Revenue	Pohlmann e Iudícibus (2010); Scherer et al. (2016).
AIR	Asset Immobilization Ratio	(Investments + Property, Plant and Equipment + Intangible Assets) / Total Assets	Gonçalves e Amaral (2019); Ali et al. (2022); Heckenbergerová e Honková (2023).
CL	Current Liquidity	Current Assets / Current Liabilities	Ali et al. (2022); Czerwonka e Jaworski (2022); Ghani et al. (2023).
AT	Asset Turnover	Net Revenue / Total Assets	Nurlaela et al. (2019); Kusumadewi et al. (2023).
FS	Firm Size	Log (Total Assets)	Ali et al. (2022); Czerwonka e Jaworski (2022); Ghani et al. (2023).
CRISIS	Economic Crisis	0: Expansion period	Fundação Getúlio Vargas (FGV, 2023); Jin (2021).
SELIC	SELIC Rate	1: Recession period	Hussain et al. (2020); Faccio e Xu (2015).
GDP	Gross Domestic Product	Average Quarterly SELIC Interest Rate	Jaworski e Czerwonka (2021); Rehan (2022); Pamplona e Silva (2020).
IPCA	Inflation	Quarter-over-Quarter GDP Variation	Jaworski e Czerwonka (2021); Rehan (2022); Pamplona e Silva (2020).

Source: Prepared by the authors based on the theoretical framework.

3.3 Modelo Econométrico

The econometric model adopted in this study was the Generalized Linear Model (GLM), given its greater flexibility compared to traditional linear regression. Initially, a panel data regression model was used, combining cross-sectional and time-series information. However, due to the limitations of linear regression, such as the assumptions of normally distributed errors and homoscedasticity, the GLM with Gamma distribution and log link function was chosen. This approach is more appropriate for the study's dependent variables, which are continuous, asymmetric, and strictly positive.

The choice of GLM was motivated by the advantages of this model in producing more robust estimates and interpretations that align with the nature of the data. As highlighted by Fox (2016), the strict assumptions of linear models are rarely met in practice, which justifies the use of more flexible alternatives. Moreover, studies such as those by Wu (2005) and Otieno and Ngwenya (2015) demonstrate that the GLM represents an improvement over ordinary least squares (OLS) regression, offering a unified framework capable of handling non-constant variance and other characteristics present in the data analyzed. The equations were defined as follows.

$$\sqrt{OD} = e^{(\beta_0 + \beta_1 TB + \beta_2 PROF + \beta_3 GIA + \beta_4 CL + \beta_5 AT + \beta_6 TF + \beta_7 CRISIS + \beta_8 SELIC + \beta_9 GDP + \beta_{10} IPCA + \varepsilon)} \quad \textit{(Equation 1)}$$

$$\sqrt{STD} = e^{(\beta_0 + \beta_1 TB + \beta_2 PROF + \beta_3 GIA + \beta_4 CL + \beta_5 AT + \beta_6 TF + \beta_7 CRISIS + \beta_8 SELIC + \beta_9 GDP + \beta_{10} IPCA + \varepsilon)} \quad \textit{(Equation 2)}$$

$$\sqrt{LTD} = e^{(\beta_0 + \beta_1 TB + \beta_2 PROF + \beta_3 GIA + \beta_4 CL + \beta_5 AT + \beta_6 TF + \beta_7 CRISIS + \beta_8 SELIC + \beta_9 GDP + \beta_{10} IPCA + \varepsilon)} \quad \textit{(Equation 3)}$$

To reinforce the robustness of the results, an endogeneity check of the explanatory variables was conducted using the Hausman test and the Two-Stage Least Squares (2SLS) model with an instrumental variable. The results indicated no evidence of endogeneity, confirming the suitability of the GLM for the proposed analysis. Additionally, the sample was segmented into two groups — Production Sector and Services and Consumption Sector — to verify whether the relationship between tax burden and indebtedness holds when the model is applied to subgroups. This approach makes it possible to assess potential differences in the effect of the tax burden on indebtedness across distinct economic sectors, thereby strengthening the analysis of the results.

4 DATA ANALYSIS AND RESULTS

4.1 Descriptive Statistics

Table 2 presents the descriptive statistics of the variables used in the investigation of the impact of the tax burden on the capital structure of Brazilian companies. The sample consists of 8,533 observations.

Table 2

Descriptive Statistics of the Sample

Variables	No. of Observations	Mean	Standard Deviation	Minimum	Maximum
Dependent Variables					
OD	8.533	0.70	0.48	0.04	5.06
STD	8.533	0.32	0.35	0.01	3.24
LTD	8.533	0.60	0.20	0.03	0.99
Independent Variable					
TB	8.533	0.14	0.16	0.00	6.46
Control Variables					
PROF	8.533	0.06	1.95	-11.34	126.55
AIR	8.533	0.45	0.22	0.00	0.98
CL	8.533	1.87	1.52	0.01	40.28
AT	8.533	0.41	0.40	0.00	4.50
FS	8.533	6.57	0.79	1.87	9.02
CRISIS	8.533	0.43	0.50	0.00	1.00
SELIC	8.533	0.01	0.00	0.00	0.01
GDP	8.533	0.02	0.03	-0.06	0.10
IPCA	8.533	0.01	0.01	-0.01	0.03

Source: Research data.

Overall Debt (OD) has a mean of 0.70 and a standard deviation of 0.48, ranging from 0.04 to 5.06. Short-Term Debt (STD) has a mean of 0.32 and a standard deviation of 0.35, with minimum and maximum values of 0.01 and 3.24, respectively. Long-Term Debt (LTD) shows a mean of 0.60 and a standard deviation of 0.20, with values ranging from 0.03 to 0.99.

Tax Burden (TB) presents a mean of 0.14 and a standard deviation of 0.16, with minimum and maximum values of 0.00 and 6.46, respectively. These results indicate heterogeneity in the tax burden borne by the companies in the sample.

Profitability (PROF) shows high dispersion, with a standard deviation of 1.95 and a range from –11.34 to 126.55. This behavior may be attributed to significant differences in profitability across companies of different sectors and sizes. Current Liquidity (CL) also exhibits wide variation, with values ranging from 0.01 to 40.28, which may reflect the diversity of working capital management strategies.

The variable indicating economic recession (CRISIS), coded as 0 for periods of expansion and 1 for periods of recession, has a mean of 0.43 and a standard deviation of 0.50, indicating a balanced distribution of these periods within the sample.

The macroeconomic variables show relatively limited variation. The SELIC **rate** has a mean of 0.01 and a standard deviation close to zero, indicating stability over the periods analyzed. GDP has a mean of 0.02 and a standard deviation of 0.03, ranging from –0.06 to 0.10, reflecting periods of economic contraction and growth. The IPCA presents a mean of 0.01 and varies between –0.01 and 0.03, indicating fluctuations in inflation levels over time.

The descriptive analysis provided an initial overview of the sample's characteristics. In the next section, inferential analysis will be conducted to assess the impact of the explanatory variables on corporate indebtedness and to verify the robustness of the results.

4.2 Inferential Statistics

Before estimating the regression model, it is essential to check for multicollinearity among the explanatory variables, as high correlation can compromise the accuracy of the estimates. The analysis of the Variance Inflation Factor (VIF) revealed values ranging from 1.027 to 1.521, indicating a low risk of multicollinearity in the model. According to Fávero and Belfiori (2023, p. 583), although many authors consider multicollinearity to be problematic when the VIF exceeds 10, there are situations in which values above 4 may already indicate a significant amount of shared variance between an explanatory variable and the others. In the present study, the VIF values are below this more conservative threshold, suggesting that multicollinearity does not pose a significant concern. Thus, the model's coefficients can be interpreted with greater confidence, allowing the analysis of the regression results to proceed, as presented in Table 3.

Table 3
Estimation of the Generalized Linear Model (GLM)

Predictors	**Variáveis Dependentes**					
	OD *(Equation1)*		**STD** *(Equation2)*		**LTD** *(Equation3)*	
	Coefficients	**Standard Error**	**Coefficients**	**Standard Error**	**Coefficients**	**Standard Error**
Intercept	0.3746***	(0.031)	0.6372***	(0.029)	-0.6330***	(0.012)
TB	0.1227***	(0.024)	0.2256***	(0.022)	0.2134***	(0.009)
PROF	0.0163***	(0.002)	0.0100***	(0.001)	-0.0030***	(0.000)
AIR	-0.1416***	(0.015)	-0.5887***	(0.014)	0.5382***	(0.006)
CL	-0.1104***	(0.002)	-0.1151***	(0.002)	-0.0199***	(0.000)
AT	0.0106	(0.008)	0.1498***	(0.008)	0.1005***	(0.003)
FS	-0.0493***	(0.004)	-0.1384***	(0.003)	0.0233***	(0.001)
CRISIS	0.0317***	(0.006)	0.0336***	(0.006)	0.0063*	(0.002)
SELIC	-5.0765***	(1.182)	-5.0391***	(1.095)	0.2501	(0.475)
GDP	-0.0713	(0.101)	-0.5588***	(0.094)	0.2725***	(0.040)
IPCA	-0.6813	(0.498)	-0.5355	(0.461)	-0.4865*	(0.200)
Observations	**8.533**		**8.533**		**8.533**	
AIC	**-5.604**		**-11.370**		**-16.516**	
Nagelkerke R^2	**0.337**		**0.568**		**0.608**	

Legend: *** significant at 0.1%. ** significant at 1%. * significant at 5%. '.' significant at 10%.
Source: Research data.

Table 3 presents the estimated coefficients and their respective standard errors, allowing for the assessment of the magnitude and statistical significance of the effects of the explanatory variables. The intercept was statistically significant in all three models. Since the models were estimated using a GLM with Gamma distribution and log link function, the coefficients were originally obtained on the natural logarithmic scale. To interpret them on the original scale of the variables, the inverse transformation of the link function must be applied, that is, $(e^{\beta})^2$. Thus, the expected values of overall debt (OD), short-term debt (STD), and long-term debt (LTD), in the absence of predictors, are 2.11 $(e^{0.3746})^{2.}$ 3.57 $(e^{0.6372})^2$ AND 0.28 $(e^{-0.6330})^{2.}$ respectively.

The estimated coefficients for tax burden (TB) indicate a positive and statistically significant impact on all forms of indebtedness analyzed, providing empirical support for the study's three hypotheses. The transformed coefficient for overall debt (OD) is 1.278 [$(e^{0.1227})^2$], confirming Hypothesis 1 by indicating that an increase in the tax burden is associated with a higher level of total corporate debt. This effect remains when the forms of indebtedness are analyzed separately. For short-term debt (STD), the coefficient of 1.570 [$(e^{0.2256})^2$] confirms Hypothesis 2, suggesting that companies increase their use of current liabilities in response to a high tax burden. In the case of long-term debt (LTD), the coefficient of 1.532 [$(e^{0.2134})^2$] supports Hypothesis 3,

indicating that taxation also encourages the raising of funds through long-term debt instruments. These findings support the idea that companies resort to debt financing as a response to higher tax burdens, seeking to maximize tax benefits. This result is consistent with the Trade-Off Theory, which predicts the use of debt to take advantage of tax savings associated with interest payments, and with the studies by Pohlmann and Iudícibus (2010), Marques et al. (2016), Fabris et al. (2021), Jaworski and Czerwonka (2021), and Khoa and Thai (2021), reinforcing the role of taxation as an incentive for corporate indebtedness.

Among the control variables, profitability (PROF) has a positive impact on OD and STD, but a negative impact on LTD, suggesting that more profitable companies tend to reduce their long-term debt levels. The asset immobilization ratio (AIR) shows a negative relationship with OD and STD, but a positive one with LTD, indicating that firms with higher asset immobilization rely more on long-term debt. Current liquidity (CL) has a negative effect on all forms of indebtedness, suggesting that companies with greater liquidity reduce their need for debt financing. Asset growth (AT) positively influences STD and LTD, while firm size (FS) reduces OD and STD, but has a slight positive impact on LTD.

Macroeconomic variables also influence corporate indebtedness. The CRISIS variable, representing periods of recession, increases all forms of debt, reflecting the need for firms to seek external financing during times of instability. The SELIC rate has a significant negative impact on OD and STD, but does not affect LTD, suggesting that the cost of credit mainly influences short-term borrowing. GDP has a negative effect on STD and a positive effect on LTD, while the IPCA reduces indebtedness in all equations, indicating that inflation may discourage borrowing. These results reinforce the complexity of firms' capital structure and the importance of the economic context in shaping financing strategies.

4.3 Robustness Test

To test the robustness of the results and the potential endogeneity of the tax burden, additional analyses were conducted. The low correlation between the explanatory variables and the model residuals suggests the absence of endogeneity. Furthermore, the application of the Two-Stage Least Squares (2SLS) model, using the variable HIGHER_TB, which indicates whether there was an increase in the tax burden compared to the previous period as an instrument for TB, confirmed the relevance of the instrument. The p-value was below 0.05 in the weak instrument test, indicating that it is appropriate for explaining the endogenous variable. The Wu-Hausman test produced a p-value of 0.81 (> 0.05), suggesting that the TB variable is not endogenous, thus reinforcing the adequacy of the GLM used in the main analysis.

Additionally, the Hausman test compared the coefficients of the original model with those estimated using instrumental variables. The Hausman statistic was lower than the critical value of the chi-square distribution at the 95% confidence level, leading to the non-rejection of the null hypothesis of exogeneity. These results indicate no evidence of endogeneity bias in the TB variable, ensuring greater reliability of the conclusions regarding the impact of the tax burden on corporate indebtedness.

Finally, the sample was divided into two groups: the Production Sector (Industrial Goods, Basic Materials, Oil, Gas, and Biofuels) and the Services and Consumption Sector (Communications, Cyclical Consumption, Non-Cyclical Consumption, Health, Information Technology, Utilities, and Others). In both models, the tax burden coefficient remained positive and significant, indicating that, regardless of the sector, there is a positive impact of the tax burden on corporate indebtedness. This result reinforces the conclusions of the initial models and enhances the robustness of the findings.

5 CONCLUSIONS

This study aimed to analyze the influence of the tax burden on the capital structure of Brazilian companies. To this end, econometric models were estimated to assess the impact of taxation on different forms of indebtedness. The results indicated that the tax burden has a positive and significant effect on overall, short-term, and long-term debt, suggesting that companies resort to debt financing as a strategy to reduce the impact of taxation on their profits.

The findings of this study are consistent with the Trade-Off Theory, which predicts that firms use debt to benefit from tax savings associated with interest payments. Moreover, the results corroborate previous research identifying taxation as a key factor in corporate financing decisions. Control variables such as profitability, asset immobilization, and current liquidity also showed significant influence on capital structure, reinforcing the complexity of this decision-making process.

Additional tests confirmed the robustness of the results, with no evidence of endogeneity in the estimated models. The segmentation of the sample into two groups — the Production Sector and the Services and Consumption Sector — showed that the influence of the tax burden on indebtedness persists across different economic segments, strengthening the overall validity of the study's conclusions.

Given these results, this study contributes to the literature by incorporating, within a single model, relevant macroeconomic variables and by empirically demonstrating the role of the tax burden in the capital structure of Brazilian companies. The practical implications suggest that changes in tax policy, such as those arising from the ongoing reform, may significantly impact this structure, influencing the cost of capital and the financial planning of firms. These findings are relevant for both corporate managers and policymakers, as they highlight how changes in the tax system can generate indirect effects on corporate indebtedness and financial health.

The main limitation of the study lies in the sample, which includes only companies listed on the stock exchange (B3), restricting the generalizability of the results. Future research may consider privately held firms, small and medium-sized enterprises, companies from other sectors such as finance, and institutional variables such as ESG practices.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding this submitted work.

CONTRIBUTIONS OF THE AUTHORS

Roles	1ª author	2º author
Conceptualization	♦	♦
Data Curation	♦	
Formal Analysis	♦	
Funding Acquisition		
Investigation	♦	
Methodology	♦	♦
Project Administration		♦
Resources		
Software		
Supervision		♦
Validation	♦	♦
Visualization	♦	
Writing – Original Draft	♦	
Writing – Review & Editing	♦	♦