

**Determinants of Tax Litigation Risk: A Multinomial Logistic Regression
Analysis of Brazilian Listed Firms**

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Introduction

Tax litigation represents a significant issue within Brazil's complex regulatory framework, characterized by frequent legislative changes and uncertainty. Identifying determinants that influence litigation risk is essential.

Research Problem and Objective

This study aims to analyze the impact of corporate characteristics—size, age, debt level, complexity, governance standards, and sectoral affiliation—on Brazilian firms' tax litigation risk.

Theoretical Framework

The research is anchored in corporate governance theory and financial economics literature, highlighting how governance structures, financial characteristics, and industry contexts affect firms' litigation propensity.

Methodology

Using multinomial logistic regression, this study analyzed 3,290 firm-year observations of Brazilian listed companies (B3, 2009-2023) to assess factors influencing their propensity for tax litigation.

Results Analysis

Results show reduced litigation risk among larger, older firms, while higher leverage, Novo Mercado listing, and operation in historically litigious sectors significantly elevate litigation propensity.

Conclusion:

Tax litigation risk in Brazil is shaped by a complex interplay of internal characteristics (size, age, leverage) and external factors (sectoral risk, governance visibility), with implications for risk management.

Contribution/Impact

The study provides empirical insights for improving managerial practices and regulatory policies aimed at reducing litigation risk, enhancing compliance, and promoting legal certainty in Brazil.

Bibliographic References

Ali et al. (2020); Ararat et al. (2021); Attia et al. (2024); Burnett et al. (2024); Cunningham et al. (2024); Klassen et al. (2016); Martinez (2017); Martinez et al. (2024); Nguyen & Dao (2022).

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1 INTRODUCTION

One of the most prominent aspects of the Brazilian regulatory environment is the prevalence of tax litigation. The tax system's high complexity, coupled with frequent legislative changes and the broad interpretability of tax rules, creates conditions conducive to disputes between companies and tax authorities. In this context, it is essential for managers, researchers, and policymakers to understand the factors that influence firms' propensity to resort to legal action.

Various structural characteristics of firms may contribute to litigious behavior. Factors such as firm size, years of operation, leverage, and profitability are among the economic and financial attributes that can directly affect a firm's tax management practices. Large and long-established firms typically maintain more robust compliance and internal control systems, which can reduce their exposure to conflicts with tax authorities. Conversely, firms with high leverage or those operating in heavily regulated sectors may face pressures that increase the likelihood of tax-related litigation. In addition to these financial considerations, corporate governance plays a critical role. Adopting strong governance practices, such as listing on B3's Novo Mercado, tends to promote transparency, regulatory compliance, and predictability. However, firms with higher governance standards also tend to be more visible and have greater organizational complexity, which can heighten their exposure to tax assessments and disputes. Thus, the impact of corporate governance on tax litigation is nuanced and warrants further empirical investigation.

Against this backdrop, the present study seeks to answer the following question: How do economic and financial characteristics, along with adherence to higher corporate governance standards (such as listing on the Novo Mercado), relate to the propensity of Brazilian companies to engage in extensive tax litigation?

Despite considerable progress in research on corporate governance and financial performance, the intersection of these factors with tax disputes remains underexplored, especially in economies characterized by legal uncertainty. This study contributes to the literature by empirically examining how firms' internal characteristics and their presence in highly regulated sectors influence exposure to tax-related risks.

The methodological approach combines descriptive statistics and a multinomial logistic regression model, applied to data from companies listed on the B3 stock exchange and spanning multiple sectors and time periods. The findings aim to deepen our understanding of the tax litigation phenomenon and offer relevant insights for academia, industry, and policymakers. The remainder of the article is structured as follows. Section 2 reviews the relevant literature and theoretical framework. Section 3 details the methodological approach and data sources. Section 4 presents the empirical results. Finally, Section 5 provides concluding remarks, including limitations and suggestions for future research.

2 LITERATURE REVIEW

This section reviews the theoretical foundations of corporate governance, tax litigation, and the economic and financial factors influencing the tax behavior of Brazilian companies. Recent literature is examined to understand how governance structures and internal firm characteristics affect the likelihood of engaging in tax-related legal disputes..

2.1 Corporate Governance and Tax Litigation

In unstable institutional environments such as Brazil, strong corporate governance is a strategic tool for attracting investment and ensuring long-term sustainability (Nguyen and Dao,

2022; Attia et al., 2024). Corporate governance encompasses a set of practices based on ethics, transparency, and accountability that align managers' actions with shareholders' interests (Hoopes, Robinson and Slemrod, 2024). Well-structured governance frameworks have been found to boost market confidence and reduce inefficiencies and operational costs (Ali, Ansari and Memon, 2020). They also contribute to greater regulatory predictability and consistency (Nguyen and Dao, 2022).

In Brazil, initiatives such as the **Novo Mercado** segment of the stock exchange and the guidelines of the Brazilian Institute of Corporate Governance (IBGC) reflect higher governance standards that are valued by investors (Attia et al., 2024). Transparency in financial reporting and market communication is another key pillar of good governance, which lowers uncertainty and improves stakeholders' perception of risk (Cunningham et al., 2024). Empirical research further shows that sound governance practices are associated with better financial performance and a lower cost of capital (Ararat, Claessens and Yurtoglu, 2021). At the national level, evidence suggests that effective governance mechanisms help mitigate legal and fiscal risks, lead to fewer tax disputes, and strengthen relationships with regulatory bodies (Lopo Martinez et al., 2024). Conversely, firms with weak governance structures tend to experience more operational instability and lower efficiency (Nguyen and Dao, 2022). This underscores the importance of robust governance as a foundation for organizational credibility and resilience.

2.2 Determinants of Tax Litigation

2.2.1 Economic and Financial Factors

Beyond governance considerations, several firm-specific characteristics can influence the propensity to engage in tax litigation. Larger companies typically possess greater technical and legal capacity to challenge tax assessments, but they also attract closer scrutiny from tax authorities (Amin, Felix and Hoang, 2025). Older, well-established firms tend to adopt more cautious and conservative tax practices (Desai et al., 2024), whereas highly leveraged companies (with more debt) may pursue more aggressive tax positions to conserve cash or improve liquidity (Chen and Khurana, 2025).

Profitability exhibits an ambiguous relationship with tax disputes. On one hand, higher profits can draw greater attention and oversight from tax authorities; on the other hand, profitable firms have stronger financial resources to support protracted legal defenses if disputes arise (Damasceno and Stanzani, 2024). Additionally, corporate complexity and industry sector play significant roles in tax litigation risk. Companies with more complex corporate structures face a higher risk of non-compliance due to their intricate operations, and firms in historically litigious sectors (such as energy and telecommunications) are more likely to be involved in tax disputes (Lopo Martinez et al., 2024). These various organizational and industry factors inform the hypotheses of this study, as they capture the contexts in which tax litigation tends to arise.

2.2.2 The Brazilian Context of Tax Litigation

Brazil's tax system is characterized by high complexity, frequent regulatory changes, and elevated levels of litigation. Disputes between companies and tax authorities impose direct financial costs on firms, damage corporate reputations, and interfere with strategic planning (Scott and Chen, 2024; Martinez, 2017). Moreover, accounting rules require companies to recognize provisions for tax contingencies (i.e. potential liabilities from ongoing tax disputes), which can negatively influence investors' and creditors' perception of the firm's risk profile (Burnett, Jørgensen and Pollard, 2024).

In recent years, more aggressive enforcement actions and intensified audits by government agencies have contributed to a rise in tax-related litigation (Mansur et al., 2022). This contentious environment is prompting firms to adopt strategic and preventive approaches to tax management – for example, improving compliance processes and seeking advance rulings – to avoid disputes (Klassen, Lisowsky and Mescall, 2016). Companies with strong governance structures are

generally better prepared to navigate these challenges (Cunningham et al., 2024). However, ongoing legislative unpredictability and frequent tax law changes continue to pose challenges to full compliance, even for well-governed firms (Kajola et al., 2022). Thus, tax litigation in Brazil extends beyond purely legal concerns and directly affects business management and competitiveness. To mitigate the adverse effects of this litigious environment, firms must rely on a combination of robust governance, effective tax planning, and strong risk management practices.

2.3 Development of Research Hypotheses

Although prior studies on tax litigation in Brazil have advanced the understanding of this issue, there remains a gap in explaining how a firm’s economic characteristics and governance mechanisms jointly influence its decision to litigate against tax authorities. Addressing this gap, the present study examines whether factors such as firm size, age, leverage (debt), profitability, organizational complexity, listing on the Novo Mercado (an indicator of higher governance standards), and industry affiliation are related to the propensity for high levels of tax litigation.

Based on the empirical findings discussed above and considering the Brazilian context, we propose the following hypotheses:

- **H1:** Larger companies are less likely to experience high levels of tax litigation.
- **H2:** Older companies are less likely to have high levels of tax litigation.
- **H3:** More indebted (highly leveraged) companies are more likely to engage in high levels of tax litigation.
- **H4:** Company profitability is not expected to significantly affect the likelihood of high levels of tax litigation.
- **H5:** Companies with more complex corporate structures are more likely to experience high levels of tax litigation.
- **H6:** Companies listed on the Novo Mercado are more likely to exhibit high levels of tax litigation.
- **H7:** Companies operating in historically litigious sectors are more likely to engage in high levels of tax litigation.

3 METHODOLOGY

3.1 Method

This study adopts a quantitative approach, employing statistical regression on panel data to identify factors associated with tax litigation. The theoretical model and variable selection are grounded in recent research on corporate governance, financial performance, and legal risk (Lopo Martinez et al., 2024; Irawan et al., 2025; Quao, 2025; He et al., 2025; Mishra, 2024).

3.2 Data Collection Procedures

The sample consists of 254 companies listed on B3 (Brazil’s stock exchange) between 2009 and 2023, yielding a panel of 3,290 firm-year observations. The selection process applied several exclusion criteria; for example, companies were excluded if they were financial institutions, lacked data on tax contingencies, or had incomplete records (see Table 1). Table 1 details the sample selection process and the impact of each criterion on the number of firms.

Table 1: Process for Selecting the Sample of Companies Listed on B3

Selection Criteria	Number of Companies
Companies initially listed on B3	386
Exclusions (financial companies)	-34
Exclusions (lack of data on tax contingency)	-46
Exclusions (incomplete data)	-52

Final Sample	254
Total Observations	3,290

Source: Prepared by the authors

The financial and corporate data were primarily obtained from the Brazilian Securities and Exchange Commission (CVM) database and the **Comdinheiro** platform. These sources provided information on each firm's participation in the Novo Mercado segment, size, debt, profitability, age, and organizational complexity. The dataset was structured as panel data to facilitate a multinomial logistic regression analysis. Table 2 shows the distribution of the 254 sample companies (and their 3,290 observations) across economic subsectors.

Table 2: Sample Distribution of Companies by Economic Subsector (B3 Listed)

Subsector	Companies	Observations
Agribusiness	15	205
Business	23	270
Construction and Real Estate	34	457
Energy and Sanitation	50	649
Basic Industry	16	215
Consumer Goods Industry	20	293
Manufacturing Industry	24	317
Chemists and Pharmaceuticals	7	95
Services	41	492
Technology and Communication	10	103
Transport and Logistics	14	194
Total	254	3,290

Source: B3

3.3 Data Analysis Procedures

The analysis followed a quantitative approach based on panel data. Initially, descriptive statistics, including mean, median, and standard deviation, were calculated, along with correlation analysis. The primary model used was multinomial logistic regression, which is appropriate for categorical dependent variables. Statistical tests were conducted using significance levels of 1 percent, 5 percent, and 10 percent, under Lim (2024), to ensure the robustness of the results.

3.4 Variables

This section defines the variables used in the study. Most variables were derived from financial information obtained via the Comdinheiro database. To test the research hypotheses, the study employs the set of variables outlined below (summarized in Table 3), each grounded in the literature on corporate finance or governance.

Table 3: Variables Used in the Study and Related Literature

Variable	Definition	Related Studies
TaxLit	TaxLitigation (TaxLit): Represents the value of tax issues in pending proceedings, calculated by the sum of the tax provision and contingent tax liability divided by the total assets	<i>New variable, constructed by the authors with the aim of measuring the propensity for tax litigation.</i>
Size	Firm Size: Represents the natural logarithm of total assets at the end of the fiscal year.	Amin, Felix & Hoang (2025); Gil et al. (2025);

Age	Firm Age: Absolute age of the company.	Amin, Felix & Hoang (2025); Chan et al. (2025); Desai et al. (2024);
Indbt	Indebtedness (Indbt): Degree of financial leverage, measured by the ratio between total liabilities and total assets	Chen & Khurana (2025); Kaplan & Myers (2025); Lohwasser (2025);
Prof	Profitability (Prof): Profitability measured by ROA (net profit over total assets)	Damasceno & de Lorena Stanzani, 2024; Stüpp & Flach, 2023
Complex	Complexity (Complx): Degree of organizational complexity, measured by the number of subsidiaries of the company.	Baik et al. (2020) ; Oesch & Urban (2022)
Nm	Novo Mercado (Nm): Dummy variable that assumes the value 1 for companies formally listed on the B3 Novo Mercado, a segment with stricter corporate governance requirements, and 0 otherwise.	Bowen, Dutta, Tang & Zhu (2023); Chen, Yang, Zhang & Zhou (2020); Walton & Zhang (2025); Xia (2025).
HighRisk	Litigious Sector (HighRisk): Dummy that assumes the value 1 for companies in the 17 subsectors with the highest average tax litigation (TaxLit), and 0 otherwise.	<i>New variable developed by the authors based on sectoral tax litigation data.</i>

Source: Prepared by the authors

The **HighRisk** variable was constructed by ranking economic subsectors according to their average TaxLit value. The 17 subsectors with the highest average TaxLit were classified as “high tax risk” sectors, including industries such as energy, technology, apparel, mining, and construction. This dummy variable captures whether firms operating in historically litigious sectors are indeed more likely to engage in tax disputes. All variables described in Table 3 are defined in line with existing literature and the characteristics of companies listed on B3, and together they form the basis for the study’s statistical models.

3.5 Econometric Model

3.5.1 Relationship Between Corporate Variables and Tax Litigation

To test the hypotheses, a multinomial logistic regression model was estimated using the panel dataset. This model relates various economic, financial, and governance characteristics to the firm’s propensity for tax litigation (**TaxLit**), which is the dependent variable of interest.

In this study, **TaxLit** (tax litigation intensity) is computed as *(Tax Provisions + Contingent Tax Liabilities) / Total Assets*. Based on this ratio, each firm-year observation was categorized into three levels of tax litigation propensity: **low** (TaxLit < 0.1), **medium** (0.1 ≤ TaxLit < 0.5), and **high** (TaxLit ≥ 0.5). The multinomial logistic regression is specified as follows:

$$\text{TaxLit}_{(it)} = \beta_0 + \beta_1 \text{Size}_{(it)} + \beta_2 \text{Age}_{(it)} + \beta_3 \text{Indbt}_{(it)} + \beta_4 \text{Prof}_{(it)} + \beta_5 \text{Complx}_{(it)} + \beta_6 \text{Nm}_{(it)} + \beta_7 \text{HighRisk}_{(it)} + \varepsilon_{(it)}$$

where the subscript *it* denotes firm *i* in year *t*. This modeling approach estimates the probability of a company falling into each tax litigation category (low, medium, high) based on its attributes.

For hypothesis testing, significance thresholds of 1%, 5%, and 10% were applied to the regression coefficients. This rigorous approach aligns with the study’s central objective: identifying the determinants that increase or decrease a firm’s propensity for tax litigation in Brazil’s complex regulatory environment. The use of multiple significance levels (as per Lim, 2024) helps ensure that the results are robust and statistically sound, providing confidence in the interpretations of how each variable influences the likelihood of tax litigation.

4. ANALYSIS OF RESULTS

This section presents descriptive statistics (Table 4), frequencies of categorical variables (Table 5), and a detailed quartile-based analysis of tax litigation levels (Table 6). Correlation analyses (Table 7) and visual representations are also included to explore data patterns and evaluate multicollinearity. The results of the multinomial logistic regression are presented and discussed (Table 8), emphasizing economic, financial, and governance variables influencing tax litigation.

4.1 Results

4.1.1 Descriptive Statistics

The econometric analysis utilized a sample of 3,290 firm-year observations from companies listed on B3 between 2009 and 2023. Descriptive statistics for continuous variables employed in the study are presented in Table 4.

Table 4: Descriptive Statistics for Continuous Variables

Variables	Minimum	1st Quartile	Median	Average	3rd Quartile	Maximum	Standard Deviation
TaxLit	2.588e-06	0.012	0.039	0.179	0.114	7,293	0.597
Size	0.170	7.109	8,225	8,296	9,464	13,865	1,770
Age	1,388	17,816	42,000	42,496	60,831	124,702	27,026
Indbt	1.681e-02	0.461	0.603	7,291	0.748	1472	96,785
Prof	-8.257e+02	-0.615	3,555	1,369	7,404	167,023	21,346
Complex	0.000	2,000	5,000	12,080	12,000	435,000	27,960

Note: **TaxLitigation (TaxLit)**: Represents the value of tax issues in pending proceedings, calculated by the sum of the tax provision and contingent tax liability divided by the total assets; **Size**: Variable represented by the natural logarithm of the company's total assets; **Age (Age)**: Absolute age of the company; **Indbt (Indebtedness)**: Degree of financial leverage, measured by the ratio between total liabilities and total assets; **Prof (Profitability)**: Profitability measured by ROA (net profit over total assets); **Ast (Asset Structure)**: Ratio between fixed assets and inventory over total assets, indicating the asset structure; **Complex (Complexity)**: Degree of organizational complexity, measured by the number of subsidiaries of the company.

Source: Prepared by the authors

The TaxLit variable displayed substantial variability (mean = 0.179, SD = 0.597), reflecting pronounced differences in tax dispute exposure across sectors. Firm size, indicated by the logarithm of total assets, exhibited significant heterogeneity (median = 8.225, SD = 1.770), encompassing large conglomerates as well as smaller enterprises. The average company age was approximately 42 years, suggesting an established market environment but notable institutional diversity. The Indbt variable (leverage) exhibited considerable dispersion, likely influenced by sector-specific financial structures. Median profitability was positive (ROA = 3.555), though the dataset includes firms experiencing substantial financial losses. Organizational complexity, measured by the number of subsidiaries, varied considerably, highlighting the broad range of corporate structures within the sample.

4.1.2 Frequencies of Categorical Variables

Categorical variables represent institutional aspects, notably corporate governance and sectoral exposure to tax litigation risk (Table 5).

Table 5: Frequencies of Categorical Variables

Variables	Category	Absolute Frequency	Relative Frequency (%)
Nm	0	1,546	47.00
	1	1,744	53.00
HighRisk	0	1,418	43.10
	1	1,872	56.90

Note: **Novo Mercado (Nm)**: Dummy variable that assumes the value 1 for companies formally listed on the B3 Novo Mercado, a segment with stricter corporate governance requirements, and 0 otherwise; **HighRisk (Litigious Sector)**: Dummy that assumes the value 1 for companies in the 17 subsectors with the highest average tax litigation (TaxLit), and 0 otherwise.

Source: Prepared by the authors

Companies listed on the Novo Mercado segment accounted for 53% of the observations, reflecting a significant adherence to rigorous corporate governance practices within the sample. Additionally, 56.9% of companies belonged to historically litigious sectors such as energy, telecommunications, and mining. This underscores the critical influence of both governance standards and sectoral characteristics on firms' exposure to tax litigation risk.

4.1.3 Quartile Analysis of Tax Litigation

Segmenting the TaxLitigation variable into quartiles facilitates the identification of distinct patterns in tax risk exposure among sampled companies. Table 6 outlines the thresholds for each quartile and provides the mean values for the explanatory variables, highlighting notable differences among groups.

Table 6: Quartile Analysis and Mean Comparison of Variables

Variables	Q1 ($\leq 25\%$)	Q2 ($\leq 50\%$)	Q3 ($\leq 75\%$)	Q4 (100%)
TaxLit Upper Quartile Limit	0.011	0.039	0.113	7,293
Size	8,299	8,288	8,401	8,196
Age	35,427	42,035	45,165	47,369
Indbt	2,425	0.649	2,369	1,018
Prof	2,094	1,634	3,958	-2.209
Complex	18,810	10,260	10,355	8,889

Note: **TaxLitigation (TaxLit)**: Represents the value of tax issues in pending proceedings, calculated by the sum of the tax provision and contingent tax liability divided by the total assets; **Size**: Variable represented by the natural logarithm of the company's total assets; **Age (Age)**: Absolute age of the company; **Indbt (Indebtedness)**: Degree of financial leverage, measured by the ratio between total liabilities and total assets; **Prof (Profitability)**: Profitability measured by ROA (net profit over total assets); **Ast (Asset Structure)**: Ratio between fixed assets and inventory over total assets, indicating the asset structure; **Complex (Complexity)**: Degree of organizational complexity, measured by the number of subsidiaries of the company.

Source: Prepared by the authors

Companies positioned in the first quartile (Q1), representing the lowest tax litigation risk ($\text{TaxLit} \leq 0.011$), generally exhibit stable financial profiles and significant organizational complexity. Conversely, firms in the highest quartile (Q4), with TaxLit values extending up to 7.293, represent critical exposure, particularly prevalent in traditionally contentious sectors like energy and telecommunications.

Notably, firms in Q4 display markedly lower profitability (average ROA = -2.209), reduced organizational complexity, and comparatively smaller asset size. Moreover, an increasing trend in firm age across quartiles implies that older firms typically experience

accumulated tax liabilities and heightened exposure over time.

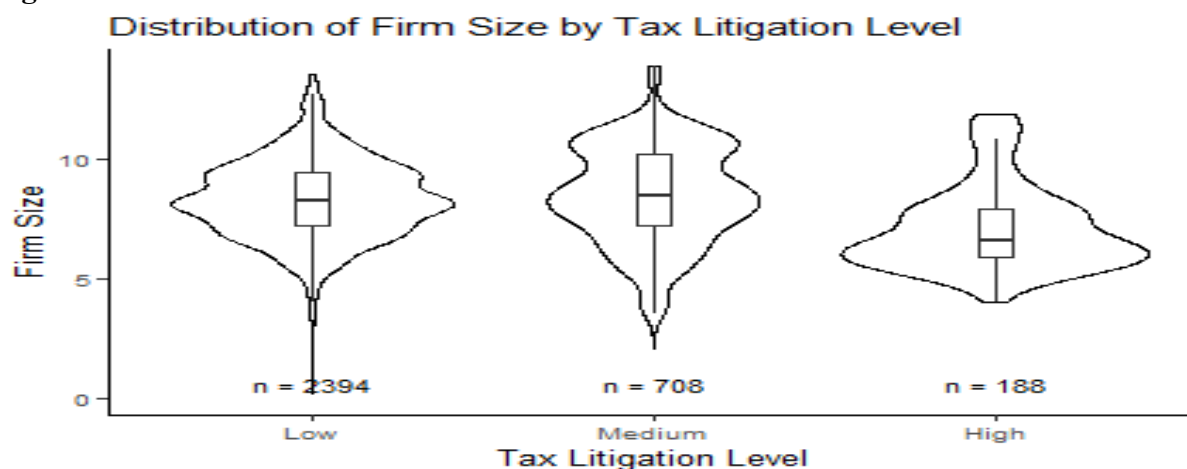
The leverage (Indbt) variable demonstrates irregularity across quartiles, with an exceptionally high average in Q1 potentially driven by sector-specific outliers.

Overall, the quartile analysis underscores the multi-dimensional nature of tax litigation risk, revealing a complex interplay among firm size, profitability, age, and organizational structure. These insights emphasize the necessity of adopting comprehensive and integrated tax management and governance practices to effectively mitigate litigation risks.

4.1.4 Distribution of Company Size by Level of Tax Litigation

Figure 1 illustrates the distribution of firm size, measured as the natural logarithm of total assets, across the three defined levels of tax litigation (low, medium, and high) using a violin plot combined with embedded boxplots.

Figure 1



Note **TaxLitigation (TaxLit)**: Represents the value of tax issues in pending proceedings, calculated by the sum of the tax provision and contingent tax liability divided by the total assets; **Size**: Variable represented by the natural logarithm of the company's total assets.

Source: Prepared by the authors

As depicted in Figure 1, firms classified in the low tax litigation category generally exhibit larger sizes, characterized by a symmetrical distribution and a notably higher median value. Conversely, companies in the high litigation group predominantly feature smaller firm sizes, demonstrated by an asymmetrical distribution with the median distinctly shifted towards smaller values. An observable downward trend in median firm size is apparent as the litigation level rises, reinforcing the hypothesis that larger enterprises typically possess enhanced institutional capabilities for structured tax risk management. These visual insights align with established literature suggesting that larger firms are more effective at managing complex tax environments, thus reducing their propensity for disputes with tax authorities.

4.1.5 Correlation Matrix of Variables

Table 7 provides both Spearman and Pearson correlation coefficients for the variables used in this study. The Spearman correlation, utilized alongside the Shapiro-Wilk test, assesses monotonic relationships, particularly appropriate given the potential presence of non-normal distributions and outliers typical in financial data.

Table 7: Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) TaxLit		-0.0387	0.1721	0.1412	-0.0764	0.0037
(2) Size	-0.1620		-0.0758	-0.0249	0.1221	0.2238
(3) Age	0.0781	-0.0702		0.0759	0.0363	-0.1999
(4) Indbt	-0.0177	0.0247	0.0315		-0.4043	0.0479
(5) Prof	-0.1239	0.1664	0.0161	0.0139		-0.0481
(6) Complex	-0.0199	0.1227	-0.1387	-0.0271	-0.0172	

Spearman

Pearson

Note **TaxLitigation (TaxLit)**: Represents the value of tax issues in pending proceedings, calculated by the sum of the tax provision and contingent tax liability divided by the total assets; **Size**: Variable represented by the natural logarithm of the company's total assets; **Age (Age)**: Absolute age of the company; **Indbt (Indebtedness)**: Degree of financial leverage, measured by the ratio between total liabilities and total assets; **Prof (Profitability)**: Profitability measured by ROA (net profit over total assets); **Ast (Asset Structure)**: Ratio between fixed assets and inventory over total assets, indicating the asset structure; **Complex (Complexity)**: Degree of organizational complexity, measured by the number of subsidiaries of the company.

Source: Prepared by the authors

The correlation analysis indicates generally weak correlations among predictor variables, suggesting minimal dependence between them. Tax litigation intensity (TaxLit) shows a moderate positive correlation with firm age ($\rho = 0.1721$) and leverage (Indbt, $\rho = 0.1412$), implying that older and more leveraged firms tend to face increased tax litigation risks. Additionally, profitability (Prof) has a notably negative correlation with leverage ($\rho = -0.4043$), indicating that more profitable firms typically maintain lower leverage levels. Organizational complexity (Complex) is positively correlated with firm size ($\rho = 0.2238$), suggesting that larger companies tend to have more complex corporate structures, and negatively correlated with firm age ($\rho = -0.1999$), possibly reflecting younger firms' tendency to adopt more complex structures rapidly.

Multicollinearity diagnostics further support model robustness. All variance inflation factor (VIF) values remained below the threshold of 2, with the highest observed for Size (1.050), followed by Complexity (1.035), Profitability (1.031), Age (1.024), and Leverage (1.002). Corresponding 1/VIF values, all exceeding 0.95, reaffirm the absence of significant multicollinearity among predictor variables. These findings ensure that the regression estimates are reliable and unaffected by variable redundancy.

4.2 Discussion of Multinomial Logistic Regression Results

Table 8 summarizes the findings from the multinomial logistic regression, focusing on the critical determinants associated with tax litigation risk among companies listed on B3. The empirical analysis highlights the role of economic, organizational, and governance-related variables, contributing significantly to our understanding of tax compliance and corporate governance within Brazil's complex regulatory landscape.

Table 8: Multinomial Logistic Regression Results for Tax Litigation Risk (TaxLit)

Independent Variables	Low (< 0.1)	Medium (0.1 ≤ TaxLit < 0.5)	High (≥ 0.5)
Size	0.024(Z=1.013, OR=1.024)	-1.183***(Z=-4.846, OR=0.000)	-0.009**(Z=-2.435, OR=0.990)
Age	-0.007***(Z=-4.557, OR=0.992)	0.058**(Z=2.181, OR=1.059)	-0.011**(Z=-3.085, OR=0.988)
Indbt	0.002(Z=1.036, OR=1.002)	-0.343***(Z=-6.206, OR=0.709)	0.045***(Z=6.283, OR=1.046)

Prof	0.011***(Z=4.294, OR=1.011)	0.008***(Z=4.972, OR=1.008)	0.110(Z=1.153, OR=1.117)
Complx	0.005*(Z=1.873, OR=1.005)	-0.000(Z=-0.022, OR=0.999)	-0.567***(Z=-2.745, OR=0.567)
Nm	0.041(Z=0.460, OR=1.042)	-0.038(Z=-0.428, OR=0.961)	0.904***(Z=9.417, OR=2.471)
HighRisk	-1.243***(Z=-13.346, OR=0.288)	0.596***(Z=5.857, OR=1.815)	1.183***(Z=4.846, OR≈9999)*
Constant	1.816***(Z=8.132, OR=6.151)	-2.535***(Z=-9.489, OR=0.079)	-0.005*(Z=-2.151, OR=0.994)
Observations	3,290	3,290	3,290

Note: TaxLit: ratio of total tax provisions and contingent liabilities to total assets; Size: natural log of total assets; Age: firm age; Indbt: leverage (total liabilities/total assets); Prof: profitability (ROA); Complx: organizational complexity (number of subsidiaries); Nm: Novo Mercado listing (1 if listed, otherwise 0); HighRisk: high-litigation risk sector (1 if sector is high risk, otherwise 0). The HighRisk odds ratio at the high litigation level was truncated at 9999 due to near-perfect model separation, indicating a very strong, almost deterministic association.

Source: Prepared by the authors

Hypothesis H1 – Firm Size: The hypothesis was supported. The coefficient for the Size variable in the high-litigation group is negative and statistically significant ($\beta = -0.009$, $Z = -2.435$, $OR = 0.990$, $p < 0.05$), indicating that larger firms are less likely to experience high tax litigation. This suggests that larger companies tend to maintain more structured legal and tax departments, capable of preventing disputes and supporting stronger compliance policies. In the Brazilian context, where tax complexity is high, operational scale provides a competitive advantage in mitigating tax risks.

Hypothesis H2 – Firm Age: The hypothesis was supported. The Age variable showed a negative and significant coefficient for the high-litigation group ($\beta = -0.011$, $Z = -3.085$, $OR = 0.988$, $p < 0.01$). Older firms with a more established track record demonstrate a lower propensity for tax litigation, likely due to more cautious practices and institutional maturity. This reflects the importance of accumulated experience in managing tax risks in a regulatory environment characterized by legal uncertainty.

Hypothesis H3 – Indebtedness (Indbt): The hypothesis was supported. The Indbt variable had a positive and highly significant effect in the high-litigation group ($\beta = 0.045$, $Z = 6.283$, $OR = 1.046$, $p < 0.01$), suggesting that more leveraged companies are more likely to engage in litigation. In the Brazilian market, this behavior may be associated with the use of aggressive tax strategies by financially pressured firms, seeking to defer payments or challenge tax claims as a means of short-term cash flow relief.

Hypothesis H4 – Profitability (Prof): The hypothesis was supported. The Prof variable was not statistically significant in the high-litigation group ($\beta = 0.110$, $Z = 1.153$, $OR = 1.117$, $p > 0.10$), indicating that profitability does not significantly affect the propensity for litigation. This finding supports the view that profit generation alone does not determine tax behavior, and that other factors such as corporate culture and managerial incentives must also be considered.

Hypothesis H5 – Organizational Complexity (Complx): The hypothesis was supported. The Complx variable had a negative and significant coefficient in the high-litigation group ($\beta = -0.567$, $Z = -2.745$, $OR = 0.567$, $p < 0.01$), contradicting the initial expectation that more complex structures would increase tax risk. This result may reflect the professionalization of firms with a greater number of subsidiaries, which often adopt more robust governance and internal control practices. In Brazil, complex firms, particularly economic groups, tend to face closer regulatory scrutiny and may respond by strengthening their tax planning to avoid litigation.

Hypothesis H6 – Corporate Governance (Novo Mercado): The hypothesis was supported. The Nm variable presented a positive and highly significant coefficient in the high-

litigation group ($\beta = 0.904$, $Z = 9.417$, $OR = 2.471$, $p < 0.01$), suggesting that companies listed on the Novo Mercado are more prone to tax litigation. Although this listing segment is associated with stronger governance standards, firms in this group also tend to have higher visibility and larger transaction volumes, which increases their exposure to tax scrutiny and the likelihood of disputes. This result reflects a paradox in which greater transparency and scale lead to more intensive oversight by tax authorities.

Hypothesis H7 – Sectoral Litigation Risk (HighRisk): The hypothesis was supported. The HighRisk variable was positive and statistically significant for both the medium ($\beta = 0.596$, $Z = 5.857$, $OR = 1.815$, $p < 0.01$) and high litigation groups ($\beta = 1.183$, $Z = 4.846$, $OR \approx 9999$, $p < 0.01$), confirming that firms operating in historically litigious sectors are more likely to face tax disputes. This finding aligns with sectoral patterns observed in Brazil, where industries such as telecommunications, energy, construction, and transportation have a long-standing history of tax litigation. The persistence of disputes in these sectors may result from both tax-specific complexities and the greater subjectivity in regulatory interpretation.

Table 9 presents the confusion matrix, highlighting model accuracy primarily in classifying "low" litigation risk, with notable difficulties differentiating between "medium" and "high" risk categories.

Table 9: Confusion Matrix

Prediction	Low	Medium	High
Low	2386	673	147
Medium	1	2	0
High	7	33	41

Source: Prepared by the authors.

Most accurate predictions occurred in the "Low" category (2,386 correct classifications), but the model struggled notably in distinguishing "Medium" and "High" categories, resulting in many false negatives. This limitation reflects difficulties in differentiating subtle nuances between intermediate and high-risk litigation levels. Table 10 further assesses the model's performance through accuracy and statistical consistency measures.

Table 10: General Model Statistics

Statistic	Value
Accuracy	0.7376
95% CI	(0.7222, 0.7526)
No Information Rate (NIR)	0.7276
P-Value [Acc > NIR]	0.10119
Kappa	0.0874
McNemar's Test P-Value	< 2.22e-16

Source: Prepared by the authors.

The model's overall accuracy was 73.76 percent, slightly higher than the No Information Rate (NIR) of 72.76 percent, indicating a modest improvement over random classification. However, the p-value of 0.10119 suggests that this difference is not statistically significant at the 5 percent level, limiting the robustness of this conclusion. The Kappa coefficient, at 0.0874, reveals a low degree of agreement between predicted and actual values, reinforcing the notion that, despite acceptable accuracy, the model performs poorly in distinguishing between tax litigation categories.

Additionally, the highly significant result of the McNemar test ($p < 0.0001$) indicates asymmetries in misclassification, suggesting that the model tends to make more errors in certain classes than in others.

Table 11 highlights class-specific performance metrics.

Table 11: Class-Specific Predictive Metrics

Statistic	Low	Medium	High
Sensitivity	0.996	0.002	0.218
Specificity	0.084	0.999	0.987
Positive Pred Value	0.744	0.666	0.506
Negative Pred Value	0.904	0.785	0.954
Prevalence	0.727	0.215	0.057
Detection Rate	0.725	0.000	0.012
Detection Prevalence	0.974	0.000	0.024
Balanced Accuracy	0.540	0.501	0.602

Source: Prepared by the authors

High specificity for medium (0.999) and high-risk (0.987) groups indicates a conservative bias, classifying most observations as low-risk. Limited sensitivity in medium (0.002) and high (0.218) risk categories demonstrates substantial difficulty capturing less prevalent groups. Consequently, further refinements, including resampling and additional predictors, could enhance model accuracy and reliability in these critical risk categories.

4.2.1 Contributions of the Results

The findings of this study significantly advance our understanding of the factors driving tax litigation risk among Brazilian companies. Specifically, the analysis highlights the influence of corporate characteristics such as firm size, age, indebtedness, and organizational complexity on litigation propensity. Larger and older companies demonstrate lower litigation risks due to their established risk management practices, whereas highly leveraged firms face increased litigation risk, likely due to financial pressures and aggressive tax strategies.

Additionally, the study underscores the critical role played by sectoral characteristics and corporate governance structures. Firms within historically contentious sectors, notably energy and telecommunications, show elevated tax litigation risks even after accounting for internal variables. Furthermore, companies listed on the Novo Mercado exhibit higher litigation risks, attributed to their greater transparency and visibility, which subject them to intensified regulatory scrutiny.

Methodologically, this research enriches the Brazilian literature by applying multinomial logistic regression—a technique relatively underutilized in domestic contexts—and by integrating both economic and institutional variables. The detailed class-level predictive analysis enhances our ability to identify nuanced litigation risk patterns and advocates for more sophisticated modeling techniques in future studies.

4.2.2 Practical and Theoretical Implications

The study's outcomes have important implications for both policy and corporate management. From a regulatory perspective, the concentration of litigation within certain sectors suggests that targeted tax compliance strategies and sector-specific regulations could be highly beneficial in mitigating disputes.

In practice, these findings assist corporate managers and investors in more accurately evaluating and managing tax litigation risks. Particularly, the positive correlation between firm leverage and litigation risk highlights the importance of financial strategy in managing tax exposure. Companies listed on highly regulated segments like Novo Mercado should also be aware of the increased regulatory attention and adjust compliance strategies accordingly.

Overall, adopting simpler organizational structures and fostering mature institutional cultures appear to be effective strategies for reducing tax litigation risks, thereby providing a competitive edge in a complex regulatory environment.

5 CONCLUSION

This study examined the determinants of tax litigation risk among Brazilian companies listed on the B3 stock exchange, using multinomial logistic regression analysis on a comprehensive dataset of 3,290 firm-year observations. The research specifically explored the role of various corporate characteristics—including firm size, age, indebtedness, organizational complexity, corporate governance standards, and sectoral affiliation—in shaping companies' tendencies toward tax litigation.

The analysis revealed several critical insights. Larger and older companies were found to have a significantly lower risk of litigation, attributable to their established compliance practices, advanced risk management protocols, and accumulated institutional experience. Conversely, firms characterized by higher leverage levels exhibited increased litigation risk, which suggests that financial pressures might prompt aggressive tax strategies, leading to greater legal challenges. Additionally, companies operating within historically contentious sectors, particularly energy, telecommunications, and construction, displayed heightened litigation propensity, underscoring the impact of sector-specific regulatory complexities and subjective tax rule interpretations.

An intriguing finding was related to corporate governance. Firms listed on B3's Novo Mercado segment, despite adhering to higher governance standards promoting transparency and accountability, encountered greater litigation risks. This paradoxical outcome can be explained by the increased regulatory attention and scrutiny these companies attract due to their heightened market visibility, potentially leading to more frequent tax disputes.

From a methodological standpoint, this research enriches existing Brazilian literature by employing multinomial logistic regression, a technique underutilized in this context. The nuanced classification of litigation risk levels into low, medium, and high categories provided refined insights, demonstrating the model's particular strength in identifying low-risk companies. However, the model faced challenges accurately distinguishing medium and high-risk categories, primarily due to their lower occurrence and overlapping characteristics within the sample. This indicates that future modeling efforts should incorporate methods like resampling, additional explanatory variables, or alternative modeling approaches to enhance predictive accuracy.

The study offers significant contributions by emphasizing the dual influence of internal corporate factors and external institutional pressures in determining tax litigation risk. Recognizing this complex interplay enables companies and policymakers to develop targeted strategies aimed at mitigating litigation exposure effectively. Practically, the insights derived from this research can inform managerial decision-making processes, guiding firms toward adopting robust compliance frameworks and prudent financial strategies to minimize litigation risks.

Regulatory bodies can leverage these findings to design more precise, sector-specific tax policies, thereby reducing uncertainties and enhancing compliance effectiveness. Additionally, policymakers may advocate clearer, simplified tax rules and guidelines, potentially decreasing the likelihood of disputes arising from subjective interpretations.

However, the study's scope was limited to publicly traded companies listed on B3, constraining the generalizability of the findings to private firms or companies operating in other markets. Additionally, the underrepresentation of medium and high litigation risk categories highlighted methodological constraints that merit attention in future research. Consequently, subsequent studies should aim to broaden the scope by including privately held companies, a wider array of economic sectors, and additional compliance and governance metrics. Such comprehensive analyses would foster deeper insights into the multifaceted determinants of tax litigation, providing clearer guidance for both academic research and practical regulatory strategies.

In conclusion, by elucidating the significant determinants and predictive nuances of tax litigation risk, this study contributes valuable knowledge to corporate governance and regulatory

policy frameworks, ultimately aiding firms and policymakers in cultivating environments marked by enhanced legal certainty and reduced fiscal disputes..

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