THE MODERATING EFFECT OF TAX INCENTIVES ON THE RELATIONSHIP BETWEEN EFFECTIVE TAX RATES AND CASH HOLDINGS IN BRAZILIAN NON-FINANCIAL COMPANIES LISTED ON B3

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▪ Received: 07/07/2023 ▪▪ Approved: 12/18/2024

ABSTRACT

This study investigates how tax incentives influence the relationship between effective tax rates and cash holdings of Brazilian non-financial companies listed on the B3 stock exchange from 2017 to 2021. Using a panel linear regression model with fixed effects, combined with the Generalized Method of Moments (GMM) to account for potential endogeneity, the analysis reveals that while a lower total tax burden on value added (TTVA), used as a proxy for the effective tax rate, is generally associated with higher cash holdings, tax incentives play a moderating role. Specifically, tax incentives mitigate the negative association between TTVA and cash holdings, allowing firms to benefit from such incentives to hold more cash. These results suggest that tax incentives enhance corporate financial flexibility and liquidity by reducing tax uncertainty. Additionally, firms with longer durations of tax incentives tend to reduce their cash holdings over time. This research contributes to the literature by offering empirical evidence on the complex interaction between tax incentives, effective tax rates, and cash management decisions in Brazil, providing insights for policymakers, researchers, and investors interested in the financial implications of tax policies.

Keywords: Cash holdings. Tax incentives. Effective tax rates. Tax planning Brazil.

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O EFEITO MODERADOR DOS INCENTIVOS FISCAIS NA RELAÇÃO ENTRE ALÍQUOTAS EFETIVAS DE IMPOSTOS E RETENÇÃO DE CAIXA EM EMPRESAS BRASILEIRAS NÃO FINANCEIRAS LISTADAS NA B3

RESUMO

Este estudo investiga como os incentivos fiscais influenciam a relação entre as alíquotas efetivas de impostos e as reservas de caixa das empresas brasileiras não financeiras listadas na bolsa de valores B3 de 2017 a 2021. Utilizando um modelo de regressão linear de painel com efeitos fixos, combinado com o Método Generalizado de Momentos (GMM) para tratar potenciais problemas de endogeneidade, a análise revela que, enquanto uma menor carga tributária total sobre o valor agregado (TTVA), utilizada como proxy para a alíquota efetiva de imposto, está geralmente associada a maiores reservas de caixa, os incentivos fiscais exercem um papel moderador. Especificamente, os incentivos fiscais mitigam a associação negativa entre TTVA e reservas de caixa, permitindo que empresas beneficiadas por esses incentivos mantenham mais caixa. Esses resultados sugerem que os incentivos fiscais aumentam a flexibilidade financeira e a liquidez corporativa ao reduzir a incerteza tributária. Além disso, empresas com maior duração dos incentivos tendem a reduzir suas reservas de caixa ao longo do tempo. Esta pesquisa contribui para a literatura ao fornecer evidências empíricas sobre a interação complexa entre incentivos fiscais, alíquotas efetivas de impostos e decisões de gestão de caixa no Brasil, oferecendo insights para formuladores de políticas, pesquisadores e investidores interessados nas implicações financeiras das políticas tributárias.

Palavras-Chave: Retenção de caixa. Incentivos fiscais. Agressividade fiscal; Alíquotas efetivas de impostos. Planejamento tributário. Brasil.

1 INTRODUCTION

Tax planning encompasses a range of activities, from legitimate tax-advantaged investments to aggressive strategies that may test the limits of legality (Dyreng, Hanlon, & Maydew, 2019). Tax incentives, a lawful means of maximizing tax planning effectiveness (Rezende, Dalmácio, & Rathke, 2019), are instruments often employed by governments to stimulate economic growth and reduce regional disparities. In Brazil, these incentives are usually granted in exchange for compliance with specific operational conditions, as outlined in the Federal Constitution of 1988 (Brasil, 1988) and accounting standards like CPC 07 (R1) (Comitê de Pronunciamentos Contábeis, 2010).

However, the overall tax burden significantly impacts firms' financial decisions. Globally, companies often adopt aggressive tax planning tactics to minimize their tax liability and enhance corporate value (Hanlon & Heitzman, 2010; Lanis & Richardson, 2011). Aggressive tax planning, though, can create tax uncertainty, defined as the risk of unexpected tax cash outflows or reduced tax benefits (Drake, Mills, & Thornock, 2019; Hutchens & Rego, 2015). Research in the

U.S. context has linked this tax uncertainty to increased cash holdings as a precautionary measure (Dyreng et al., 2019; Hanlon, Maydew, & Saavedra, 2017).

While firms generally prefer to retain moderate cash due to its potential negative impact on investment returns and market value (Assaf Neto, 2020), the Brazilian context presents a unique scenario. Studies have shown that Brazilian firms engaging in less aggressive tax strategies tend to hold more cash (Martinez & Salles, 2018). This finding suggests that tax incentives, by influencing tax aggressiveness, may play a role in shaping firms' cash holding decisions.

This research seeks to clarify the moderating effect of tax incentives on the relationship between effective tax rates and cash holdings of Brazilian non-financial companies listed on B3. The focus is not on mediation but exclusively on the moderating role of tax incentives, which reduce the effective tax rate and, in turn, may alleviate the need for firms to hold excess cash as a buffer against tax uncertainty.

The significance of this research lies in its ability to provide theoretical and practical implications regarding the financial behavior of firms in response to tax incentives. In a scenario where Brazil's tax reform—particularly regarding consumption—may drastically impact the incentives granted by states under the ICMS (Tax on the Circulation of Goods and Services), this study offers a framework for predicting how these changes might affect companies' cash reserves. With stricter regulations on tax benefits in the future, understanding the moderating effect of existing incentives can help forecast the potential financial adjustments firms may have to make.

Prior research has explored tax aggressiveness, tax uncertainty, and cash accumulation (Chiachio & Martinez, 2019; Dyreng et al., 2019; Hanlon et al., 2017; Lanis & Richardson, 2011; Martinez & Salles, 2018), as well as the impact of government tax incentives on economic and financial performance (Formigoni, Segura, Teixeira, Carvalho, & Marotti, 2019; Okafor, Bhattacharya, & Apergis, 2020; Silva, 2020; Rezende et al., 2019). However, no study has specifically examined the moderating role of tax incentives on the relationship between effective tax rates and cash holdings in the Brazilian context.

This study aims to fill this gap, providing empirical evidence on the moderating effect of tax incentives. By doing so, we contribute to understanding the complex interplay between tax policy, corporate tax strategies, and cash management decisions in Brazil. This research has significant implications for policymakers, tax professionals, and investors interested in the financial impact of tax incentives in emerging markets.

The remainder of this paper is organized as follows: Section 2 presents a comprehensive review of the relevant literature and develops our hypotheses. Section 3 outlines our data and methodology, while Section 4 discusses the empirical results. Finally, Section 5 concludes with a summary of our findings, acknowledges the study's limitations, and suggests avenues for future research.

2 LITERATURE REVIEW

2.1 Tax Burden, Tax Planning, and Tax Uncertainty

Tax burden refers to the state's compulsory collection from entities to fund its activities, typically measured by dividing tax collections by a country's GDP (Formigoni, 2008; IBPT, 2020). Brazil, known for its complex tax system, has one of the highest tax burdens globally (IBPT, 2020), which imposes significant compliance costs on businesses (Martinez, Ribeiro & Funchal, 2015). This high burden can influence investments, capital structure, and overall firm competitiveness (Hanlon & Heitzman, 2010). Consequently, many companies adopt aggressive tax planning practices to minimize their tax liabilities (Lanis & Richardson, 2011).

Tax planning ranges from legitimate tax strategies to aggressive approaches that may push the boundaries of legality (Dyreng et al., 2019). The distinction between these practices, particularly in Brazil, where the law differentiates legal tax avoidance from illegal evasion (Brasil, 2006), is crucial for firms. Effective tax planning optimizes a company's tax obligations while maximizing profit (Shackelford & Shevlin, 2001). However, excessive tax aggressiveness introduces tax uncertainty, defined as the risk of unexpected tax cash outflows or reduced benefits due to disputes with tax authorities or changes in legislation (Drake, Mills, & Thornock, 2019; Hutchens & Rego, 2015). This uncertainty can arise from differing interpretations of tax laws, tax audits, or legislative reforms (Dyreng et al., 2019; Martinez, 2017).

A key finding in the literature is that firms facing higher tax uncertainty tend to accumulate more cash as a precautionary measure (Hanlon et al., 2017; Dyreng et al., 2019). These studies argue that tax uncertainty creates financial risk, driving companies to hold higher cash levels to protect against potential tax liabilities. For example, Drake, Mills, and Thornock (2019) demonstrated that tax uncertainty affects investor valuation of tax avoidance, highlighting that tax risk leads firms to adopt conservative financial practices, including maintaining higher cash reserves. Similarly, Hutchens and Rego (2015) found that greater tax risk increases overall firm risk, influencing liquidity management decisions such as cash holdings. In summary, the risk associated with tax uncertainty—arising from aggressive tax planning—plays a significant role in explaining why firms might opt to retain higher cash levels. Tax uncertainty and aggressive tax strategies have increased firms' precautionary cash holdings, serving as a buffer against unforeseen tax-related expenses.

2.2 Cash Holdings

Cash holdings are a critical financial decision, often measured as the ratio of cash and equivalents to total assets. Firms typically aim to avoid excessive cash retention because it can lower investment returns and diminish market value (Assaf Neto, 2020; Dechow et al., 2008). However, certain factors, such as tax uncertainty and financing constraints, drive firms to accumulate cash as a precautionary measure.

Internationally, studies by Hanlon et al. (2017) and Dyreng et al. (2019) provide compelling evidence that firms subject to high tax uncertainty—especially those engaging in aggressive tax strategies—tend to hold larger cash reserves. For instance, Hanlon et al. (2017) found that U.S. companies classified as tax aggressive held, on average, 3.3% more cash than non-aggressive firms, with the

former maintaining 19.8% of their total assets in cash. These cash holdings act as a financial buffer, providing liquidity to manage any unexpected tax-related expenses or disputes.

In contrast, research in Brazil, where tax regulations and incentives differ from those in the U.S., has revealed distinct trends. Brazilian firms that are less tax aggressive tend to hold more cash (Martinez & Salles, 2018). According to Chiachio and Martinez (2019), firms with higher cash levels and lower financial constraints display reduced tax aggressiveness. This suggests that firms with more conservative tax strategies accumulate higher cash reserves to mitigate potential risks.

Furthermore, Qin et al. (2020) found that Chinese firms increased their cash holdings during the COVID-19 pandemic due to heightened uncertainty and financing constraints. This aligns with the broader body of literature showing that firms facing uncertain environments—whether due to tax or macroeconomic factors—tend to increase their cash reserves.

2.3 Tax Incentives and Their Impact on Cash Holdings

Tax incentives are tools used by governments to promote economic growth and reduce regional disparities. In Brazil, the Federal Constitution of 1988 (Brasil, 1988) grants tax incentives to companies that meet specific operational requirements, including exemptions, reductions, or deferrals. These incentives are often tied to local, state, or federal development goals, such as stimulating investment in underdeveloped regions.

Research highlights the positive impact of these incentives on firms' performance. For instance, Formigoni (2008) emphasized that when properly applied, tax incentives represent a renunciation of public revenue in favor of the taxpayer. These incentives provide firms with additional resources, enabling them to enhance their competitiveness and invest in growth opportunities. Internationally, Okafor et al. (2020) demonstrated that firms receiving public credit or tax incentives performed better during the 2008 global financial crisis, illustrating the stabilizing effect of such benefits.

In the Brazilian context, Formigoni et al. (2019) and Rezende et al. (2019) found that firms benefiting from tax incentives exhibit more favorable economic and financial outcomes, such as higher cash reserves and greater operational efficiency. These findings support the view that tax incentives reduce a firm's tax burden and influence cash management decisions by enabling companies to accumulate cash for future investments or safeguard against financial risks.

2.4 Implicit Taxes and the Theory of Fiscal Neutrality

Implicit taxes are those paid indirectly through lower pre-tax returns on investments or activities that benefit from lower explicit tax rates (Shackelford & Shevlin, 2001). According to the theory of fiscal neutrality, reductions in explicit taxes (e.g., through tax incentives) may be counterbalanced by increases in implicit taxes, resulting in no net tax benefit for the firm (Scholes & Wolfson, 1992). This means that, although firms may enjoy explicit tax reductions, they might

experience a decrease in their pre-tax profitability, effectively negating the expected tax savings.

At the corporate level, implicit taxes can arise in various ways, particularly through government policies like tax incentives. For instance, firms that benefit from specific tax exemptions or reductions may face higher costs elsewhere, such as increased competition or price adjustments that erode the benefits of the lower tax burden (Silva, 2020). Silva's (2020) study supports the implicit tax theory, predicting that companies with the lowest explicit tax rates tend to face higher implicit taxes, thereby reducing the expected financial advantages of explicit tax reductions.

Understanding implicit taxes is critical in the context of Brazil, where tax incentives are often used to promote regional development. The literature suggests that implicit taxes can dilute the impact of tax incentives on a firm's overall financial performance, including cash holdings. If implicit taxes are significant, companies may not see the expected cash flow benefits from tax incentives, affecting their decision-making regarding cash retention. This concept directly ties into fiscal neutrality, which predicts that firms with explicit tax benefits may experience no substantial net gain due to the implicit costs associated with those benefits.

2.5 Moderation Studies

Moderation analysis explores how a moderator variable affects the strength or direction of the relationship between two other variables (Prado, 2014; Vieira, 2009). This study examines tax incentives as a potential moderator in the relationship between tax burden and cash holdings. This approach aligns with accounting research exploring the interactive effects of independent variables on key financial outcomes (Dyreng et al., 2019; Hanlon et al., 2017).

The role of tax incentives as a moderator is particularly relevant in understanding how firms manage their cash holdings in response to tax policies. Studies like Hanlon et al. (2017) and Dyreng et al. (2019) provide a foundation by analyzing how firms with different levels of tax aggressiveness hold cash differently. For instance, Hanlon et al. (2017) found that companies employing more aggressive tax strategies tend to hold higher levels of cash as a precaution against potential tax-related risks, including audits or future tax obligations. However, the moderating effect of tax incentives—particularly those that reduce the effective tax rate—has not been thoroughly investigated in the Brazilian context.

This research seeks to uncover whether tax incentives weaken the negative relationship between tax burden and cash holdings by introducing them as a moderator. The hypothesis is that firms with access to tax incentives are less likely to hold excessive cash because the reduced effective tax rates diminish the need for precautionary liquidity. In this sense, tax incentives can alleviate concerns over tax uncertainty, reducing the financial pressures that drive cash accumulation.

Based on the literature review, the following hypothesis is proposed:

H1: Tax incentives moderate the relationship between tax burden and firms' cash holdings, such that firms with tax incentives have lower tax burdens and higher cash retention levels.

This moderation approach is crucial because it highlights the complex interaction between tax policies, corporate financial strategies, and cash management practices. The findings are expected to contribute to a deeper understanding of how tax incentives shape financial decision-making, particularly in emerging markets like Brazil.

3 METHODOLOGY

3.1 Data Selection and Sample

This study uses data from the Economática® database and the annual financial statements of Brazilian companies listed on B3 from 2017 to 2021. The sample is restricted to non-financial companies, excluding those classified as part of the financial sector according to B3's economic classification. The decision to limit the data from 2017 to 2021 was due to the broad and reliable availability of tax incentive data during this period.

The data on tax incentives were manually collected by searching the annual financial statements published by the companies, specifically the explanatory notes. A textual search was conducted in the notes for terms such as "tax incentives," "tax benefits," "tax exemptions," and "tax reductions" to identify whether the company utilized any tax incentive in that year. The data for the composition of the TTVA (total tax burden disclosed in the Value-Added Statement - VAS) were also manually collected in the VAS section, as this information is not available in a structured database.

Companies that provided data for only some of the empirical model's variables in at least one year were removed from the sample. Non-qualitative variables were winsorized at the 1st and 99th percentiles to mitigate the influence of extreme values and potential outliers. The final sample consisted of 1,230 observations from 203 companies, forming an unbalanced panel, as presented in Table 1.

Table 1
Composition of the sample

Description	N° companies	No. observations
Total Initial	344	1720
Exclusion without information (-)	24	328
Oultiers exclusion (-)	9	113
TTVA exclusion (-)	8	49
Final Sample	**303**	**1230**

Source: Prepared by the authors.

3.2 Regression Models

This research aims to identify the moderating effect of tax incentives on the relationship between the effective tax rate and the cash liquidity of companies. We estimate this effect using variations of the following regression models (Equation 1 and Equation 2), adapted from Hanlon et al. (2017):

$$\text{CASH HOLDINGS}_{i,t} = \beta_0 + \beta_1 iFISCAL_{i,t} + \beta_2 TTVA_{i,t} + \beta_3 TTVA_{i,t} * iFISCAL_{i,t} + \sum_{k=4-13}^{N} \beta_k X_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\text{CASH HOLDINGS}_{i,t} = \beta_0 + \beta_1 iFISCAL_{i,t} + \beta_2 TTVA_{i,t} + \beta_3 TTVA_{i,t} * iFISCALfederal_{i,t} + \beta_4 TTVA_{i,t} * iFISCALstate_{i,t} + \beta_5 TTVA_{i,t} * iFISCALmunicipal_{i,t} + \sum_{k=6-15}^{N} \beta_k X_{i,t} + \varepsilon_{i,t} \quad (2)$$

The dependent variable **CASH HOLDINGS** represents the ratio between cash and cash equivalents to total assets. It measures the level of cash accumulation in the year when tax incentives were utilized. The variable **TTVA** represents the effective tax rate on added value and captures taxes on profit and revenue (Chiachio & Martinez, 2019). **EBIT** (operating profit) was used as the profitability measure in the denominator to calculate the TTVA, instead of profit before tax. This approach is consistent with previous studies that argue that EBIT better reflects the company's true profitability in operations before accounting for tax management strategies that affect the taxable profit.

The variable **iFISCAL** is a dummy variable where 1 indicates the presence of some tax incentive (federal, state, or municipal), and 0 suggests otherwise.

In **Equation 1**, we measure the interactive effect between tax incentives and the effective tax rate in general terms (**iFiscal*TTVA**), where we do not distinguish the origin of the tax incentive by governmental entity (federal, state, or municipal). On the other hand, in **Equation 2**, we estimate it specifically (**iFiscalfederal*TTVA**, **iFiscalstate*TTVA**, and **iFiscalmunicipal*TTVA**). We predict that in Equation 1, $\boldsymbol{\beta_3}$ will be positive and significant, and in Equation 2, $\boldsymbol{\beta_3}$, $\boldsymbol{\beta_4}$, and $\boldsymbol{\beta_5}$ will be positive and significant. To avoid multicollinearity problems, in Equation 2, we include only the variable **iFiscal**, which aggregates all tax incentives, instead of specific indicator variables for federal, state, and municipal incentives.

In line with previous studies (e.g., Bates et al., 2009; Hanlon et al., 2017), we include several control variables for factors that may influence cash holdings, such as company performance (**ROE** and **ROA**), leverage (**FINLEV**), cost of debt (**Kt**), overall liquidity (**GenLIQ**), accounting loss (**LOSS**), net working capital (**WC**), and the company's growth opportunities (**MTB**). We also include **TiROE**, a measure of implicit taxes adapted from Silva (2020), to assess whether implicit taxes offset the benefits of tax incentives. Regarding the "implicit taxes" variable (**TiROE**), the goal is to identify the pre-tax tax burden to verify whether the company benefited from the reduction in explicit tax burden. Implicit taxes tend to be higher for companies with lower explicit tax rates, negating the benefits of explicit tax reductions (Silva, 2020).

The decision to receive tax incentives is endogenously determined and not random; therefore, it may be influenced by observable and unobservable factors affecting the companies' cash holdings. If these factors are not properly

controlled, our econometric models may produce biased estimates due to selection bias. Suppose the observable and unobservable factors that determine the choice of tax incentives, and consequently the selection of our sample, are correlated with cash holdings. In that case, the error term in Equation 1 (outcome equations) may be correlated with the explanatory variables, leading to an endogeneity problem due to selection bias. We address this issue using the Heckman selection model approach (1979). In the first stage of this procedure, we model the decision (probability) of obtaining tax incentives using the probit model described in Equation 2.

$$PR(iFISCAL) = \beta_0 + MTB_1 + ROA_2 + FINLEV_3 + ROE_4 + SIZE_5 + WC_6 + Kt_7 + TiROE_8 + LOSS_9 + YEAR_{(10-14)} + SECTOR_{(15-22)} + \varepsilon \quad (3)$$

Table 2
Description of the Variables in the Empirical Model

Variables	Description
CASH HOLDING	Dependent variable - measures liquidity relative to total assets: cash and cash equivalents / total assets, adapted for annual liquidity to assess the effect of tax incentives on cash in the year they were utilized (Dyreng, Hanlon & Maydew, 2008; Hanlon et al., 2017) in year *t*.
iFISCAL	Moderating variable composed of dummy variables, where 1 represents companies that benefited from any tax incentive and 0 represents those that did not during the study period (Formigoni, 2008). This also includes dummy variables for federal, state, and municipal tax incentives in year *t*.
TIF	Tax incentive duration - continuous variable for the number of years the company benefited from tax incentives during the study period (Formigoni, 2008) in year *t*.
TTVA	Value-added tax rate: total tax burden in the Value Added Statement / total added value (Chiachio & Martinez, 2019) in year *t*.
ROE	Return on Equity - Net Profit / Equity (Assaf Neto, 2021) in year *t*.
ROA	Return on Assets - Operating profit / total assets (Assaf Neto, 2021).
TíROE	Implicit taxes - measures the return on equity before taxes - adapted ROE variable: Profit before tax (EBT) / Equity (Silva, 2020) in year *t*.
Kt	Cost of debt - financial expenses / total debt (Martinez & da Silva, 2017) in year *t*.
FINLEV	Financial leverage - Economática® index in year *t*.
GenLIQ	General liquidity - Current assets plus long-term receivables / current liabilities plus non-current liabilities (Assaf Neto, 2021) in year *t*.
MTB	Ratio of market value to book value of the company.
LOSS	Dummy variable where 1 identifies if the company reported an accounting loss during the period and 0 otherwise.
WC	Net working capital scaled by total assets in year *t*.
SIZE	Natural logarithm of total assets in year *t*.
INVMILLS	Inverse Mills ratio calculated based on the coefficient estimates from Equation (3).

Source: Prepared by the authors.

4 ANALYSIS OF RESULTS

4.1 Descriptive Statistics

Table 3 shows, in absolute figures and percentages, the companies that received incentives between 2017 and 2021 at federal, state and municipal level:

Table 3
Descriptive Statistics – Tax Incentives

Description	Period	Companies with incentives		Companies without incentives		Grand total	
		N	Line %	n	Line %	n	%
Year	2017	139	67,15%	68	32,85%	207	100,00%
	2018	153	69,23%	68	30,77%	221	100,00%
	2019	172	67,45%	83	32,55%	255	100,00%
	2020	176	65,43%	93	34,57%	269	100,00%
	2021	176	63,31%	102	36,69%	278	100,00%
	5 YEARS	190	62,71%	113	37,29%	303	100,00%
		Frequency	%				
Jurisdiction	FEDERAL	145	61,44%				
	STATE	86	36,44%				
	MUNICIPAL	5	2,12%				
	Total	236	100,00%				

Source: Prepared by the authors.

The sample consisted of 303 companies, of which 190 (62.71%) benefited from some kind of tax incentive during the period studied. Federal incentives accounted for 61.44% over the five years, followed by state incentives with 36.44% and, to a lesser extent, municipal incentives with 2.12%. Forty-six companies enjoyed federal and state incentives simultaneously. The number of companies seeking tax incentives increased from 139 in 2017 to 176 in 2021, representing a considerable growth of 26.62%.

Table 4 shows the descriptive statistics for companies with and without tax incentives, along with the mean and standard deviation of the total sample and the results of the t-tests comparing the means of the two groups.

Table 4
Descriptive statistics and differences in means/PROPORTION between companies with and without tax incentives

	With Incentives (N=816)	No incentive (N =414)	Total	Difference of Averages	P-value
CASH HOLDING	0,086	0,079	0,084	0,007	**0,066**
TTVA	32,174	32,536	32,296	-0,361	0,379
ROE	0,157	0,130	0,148	0,027	0,156
ROA	4,575	0,285	3,131	4,290	**0,000**
TiROE	0,177	0,134	0,162	0,043	**0,082**
Kt	0,570	1,022	0,722	-0,452	**0,033**
FINLEV	2,047	2,486	2,195	-0,439	0,212

GenLIQ	1,140	0,994	1,091	0,146	**0,036**
MTB	2,611	2,641	2,621	-0,030	0,437
WC	0,127	-0,069	0,061	0,196	**0,000**
LOSS	0,161	0,372	0,232	-0,211	**0,000**
INVMILLS	0,467	0,760	0,566	-0,293	**0,000**

Notes: *i)* the description of the variables can be found in Table 2; *ii)* the Table shows descriptive statistics for companies with and without tax incentives and for the entire sample; *iii)* the "Difference in Means" column shows the difference in means between companies with and without tax incentives; and *iv)* the "p-value" column indicates the level of statistical significance of the difference in means and proportion.

Source: Prepared by the authors.

Statistical analysis reveals that companies that benefit from tax incentives have significantly higher cash holdings (8.6%) than those that don't (7.9%), with an average difference of 0.007 percentage points ($p < 0.10$). This suggests that tax incentives can influence companies' cash management decisions, potentially leading them to retain more cash.

The effective tax rate (TTVA) is not significantly affected by tax incentives, as there is no statistical difference between the two groups ($p = 0.379$). This suggests that although tax incentives can influence cash liquidity, they do not necessarily translate into a significant reduction in the overall tax burden for these companies.

Concerning profitability, companies with tax incentives report a significantly higher return on assets (ROA) than those without incentives ($p < 0.001$), indicating that these companies are more profitable for their shareholders. At the same time, the pre-tax return on equity (TIROE) is also significantly higher for companies with incentives ($p < 0.10$), suggesting a lower implicit tax burden, according to Shackelford and Shevlin (2001).

In addition, the cost of third-party capital (Kt) is significantly lower and general liquidity AND working capital are significantly higher for companies with incentives. This indicates that companies benefiting from tax incentives may have a stronger financial position, with lower debt levels and greater capacity to meet their short-term obligations. On the other hand, the proportion of losses reported over the time series analyzed is significantly higher in the group of companies without tax incentives. It can also be seen that, overall, the results suggest that tax incentives can play a role in influencing the liquidity and financial structure of Brazilian companies. However, the impact on the effective tax rate is not statistically significant and there is some evidence of a potential trade-off between explicit and implicit taxes.

4.2 Correlation Matrix

The purpose of the correlation matrix is to establish the relationship between the variables proposed for the regression model. In the case of the variables considered in this study, there was no significant correlation between the independent tax incentive variable (iFISCAL) and cash accumulation (CASH HOLDINGS). Between the TTVA variable, which represents the tax burden of companies in general, and the dependent variable CASH HOLDINGS, the correlation was significant, but negative. There was no significant correlation between the independent variables TTVA and iFISCAL.

In addition, there were many significant correlations between the variables in the model, but few higher than 0.7, indicating less possibility of incurring multicollinearity problems. Appendix A presents Table 5, which shows the correlation matrix between the variables.

4.3 REGRESSION RESULTS

The main objective of the regressions was to estimate the moderating effect of tax incentives (iFISCAL) on the relationship between the tax burden (TTVA) and cash liquidity. This was achieved by including interaction terms (*iFiscalfederal*TTVA*, *iFiscalstate*TTVA* and *iFiscalmunicipal*TTVA*) in the main model. We made our estimates using panel data models, the *pooled* MQO and the dynamic panel based on the Generalized Method of Moments (GMM). The former serves as a basic reference for our analysis and allows comparison with previous studies that predominantly use this type of inferential approach. The latter is especially useful for addressing concerns about endogeneity in our estimates.

Our original data presented problems of heteroscedasticity and spatial and serial autocorrelation. We therefore estimated the standard errors of the coefficients of the *pooled* MQO model robustly using the Driscoll-Kraay estimator as proposed in Driscoll and Kraay (1998).

We used the GMM-sys model to deal with potential endogeneity problems and capture the temporal dynamics of the variables under analysis. We implemented the model using the *xtdpdgmm* command in the Stata software. The lagged explanatory variables were used as GMM instruments and the sector and year variables were included as IV instruments. The model was specified in level. We used the Hansen test to assess the validity of the instruments and the Arellano-Bond test to verify the absence of serial correlation in the residuals. Table 6 shows the results of the regressions.

Table 6
Regression Results

VARIABLES	Pooled MQO		DYNAMIC GMM	
iFISCAL	0.00779	0.00602	0.100*	0.107***
	(0.00654)	(0.00843)	(0.0586)	(0.0333)
TTVA	-0.000336***	-0.000484***	-0.00106**	-0.000460**
	(5.67e-05)	(3.83e-05)	(0.000433)	(0.000197)
iFISCAL*TTVA	0.000425***	-	0.000975**	-
	(4.75e-05)	-	(0.000480)	-
iFiscalstate*TTVA	-	0.000568***	-	0.000456**
	-	(2.57e-05)	-	(0.000212)
iFiscalmunicipal*TTVA	-	-0.000593	-	-0.00190*
	-	(0.000424)	-	(0.00106)
iFiscalfederal*TTVA	-	0.000576***	-	0.000468**
	-	(3.36e-05)	-	(0.000204)
TIF	-0.00601***	-0.00751***	-0.0302**	-0.0302***
	(0.00116)	(0.00136)	(0.0134)	(0.00823)

MTB	0.00164***	0.00135**	0.000918	-0.000389
	(0.000362)	(0.000547)	(0.00206)	(0.000891)
ROA	-7.05e-05	-9.39e-05	-0.000692	-0.000340
	(0.000103)	(0.000128)	(0.000859)	(0.000374)
FINLEV	-9.13e-05	-0.000118	-0.000479	-1.13e-05
	(0.000225)	(0.000262)	(0.000615)	(0.000227)
TiROE	0.0121***	0.0136***	0.111	0.00694
	(0.00233)	(0.00316)	(0.0803)	(0.00716)
ROE	-0.00594	-0.00685	-0.0619	-0.00497
	(0.00616)	(0.00752)	(0.0989)	(0.00827)
Kt	-0.000207	-0.000250	-0.000435	-0.000925
	(0.000146)	(0.000183)	(0.000829)	(0.000663)
LOSS	0.00776*	0.00904**	0.00979	0.0169*
	(0.00459)	(0.00436)	(0.0166)	(0.00922)
WC	0.0575***	0.0575***	0.0782***	-0.000546
	(0.00255)	(0.00375)	(0.0287)	(0.00855)
INMILLS	-0.00337	-0.00256	0.0612	-0.0368**
	(0.00550)	(0.00636)	(0.0664)	(0.0174)
Constant	0.0978***	0.103***	0.0335	0.0454***
	(0.00482)	(0.00596)	(0.0595)	(0.0175)
Observations	1230	1230	894	894
Number of groups	303	303	279	279
R-squared	0.193	0.205		
Fixed effect of sector and year	YES	YES	YES	YES
Arellano-Bond test for autocorrelation of first difference residuals:				
First-order autocorrelation (p-value)			0.012	0.006
Second-order autocorrelation (p-value)			0.988	0.131
Sargan-Hansen overidentification restriction test:				
2-step weighting matrix (p-value)			0.819	0.469
3-step weighting matrix (p-value)			0.581	0.289

Notes: i) standard errors in brackets; ii) *** p<0.01, ** p<0.05, * p<0.1; iii) the continuous variables are wisorized at 1% and 99%; and iv) the *Pooled* model has the standard errors of the coefficients estimated robustly using the *Driscoll-Kraay* estimator. v) the description of the variables can be found in Table 2; vi) the coefficients of the sectors and years have been suppressed due to space.

Source: Prepared by the authors.

As shown in Table 6, the coefficient of the iFISCAL variable is positive, but only statistically significant in the GMM model. However, the TTVA variable is negative and significant in any model, as expected in the Brazilian scenario. When we analyze the interaction between the tax incentive and the effective tax rate on value added in the scenario in which the company adopts a tax incentive of any origin (municipal, state or federal), the coefficient of the variable iFISCAL*TTVA is positive and significant in any model, suggesting the presence of a moderating effect. On the other hand, the segmented analysis indicates that the coefficients of the interaction terms iFiscalstate*TTVA and *iFiscalfederal*TTVA* are positive and

negative in all the models. Still, at the municipal level the interaction is negative, but only significant in the GMM model. These results support our hypothesis and suggest that tax incentives moderate the relationship between the effective tax rate and companies' cash maintenance capacity.

Concerning the other variables, it was documented that only the tax incentive time (TIF) showed statistical significance in all the models and with a negative sign. The MTB and TiROE variables were only significant in the MQO model, suggesting they are sensitive to endogeneity problems. The LOSS and WC variables showed statistical significance in the OLS models and in at least one GMM model, indicating that, in general, correcting for potential endogeneity problems does not change the nature of the variables.

The INMILLS variable is only statistically significant in the model that separates the origin of the tax incentive. Still, overall, it suggests that selection bias is not a major problem for our inferences regarding the variables of interest. It should be noted that the untabulated results show that our selection model (equation 3) has reasonable discriminatory power, with an ROC curve of 0.749.

Concerning the diagnosis of the dynamic GMM model, the Arellano-Bond test for autocorrelation of lagged first-difference residuals with a significance level of less than 5% is expected in dynamic models due to the inclusion of the lagged dependent variable as an explanatory variable. On the other hand, the most relevant diagnosis is the absence of second-order serial correlation, which indicates the dynamic behavior of the CASH HOLDING variable. Furthermore, Sagan's overidentification tests with p-values greater than 10% suggest that our models are well-instrumented and adopt valid instruments. Therefore, we can assume that endogeneity is not relevant in our estimates using sys-GMM.

4.4 Additional Tests and Sensitivity Analysis

We used a non-parametric regression using kernel smoothing methods with a local linear estimator and the cross-validation method to complement our analysis. This model is useful when we do not assume a specific functional form a priori for the relationship between the explanatory variables and CASH HOLDING. In addition, we used a quantile regression of the median as a robustness test to check whether the results obtained in the linear regression hold when analyzing the central effect or are sensitive to outliers. Table 7 summarizes the results.

Table 7
Additional Test

VARIABLES	QUANTITY		NON-PARAMETRIC	
iFISCAL	0.0165	0.0187*	0.00758	0.0108
	(0.0113)	(0.00960)	(0.0111)	(0.00931)
TTVA	-0.000293**	-0.000395***	-0.000418*	-0.000541***
	(0.000140)	(0.000109)	(0.000214)	(0.000141)
iFISCAL*TTVA	0.000346*	-	0.000477**	-
	(0.000181)	-	(0.000235)	-
iFiscalstate*TTVA	-	0.000480***	-	0.000691***

	-	(0.000120)	-	(0.000131)
iFiscalmunicipal*TTVA	-	0.000614	-	-0.00186**
	-	(0.00131)	-	(0.000745)
iFiscalfederal*TTVA	-	0.000386***	-	0.000572***
	-	(0.000109)	-	(0.000150)
Observations	1230	1230	1230	1230
Number of groups	303	303	0.171	0.205
R-squared	0.105	0.117	0.105	0.205
Fixed effect of sector and year	YES	YES	YES	YES

Notes: i) standard errors in brackets; ii) *** p<0.01, ** p<0.05, * p<0.1; iii) continuous variables are scaled at 1% and 99%; and iv) information on the other variables has been suppressed due to lack of space; v) the description of the variables can be found in Table 2.

Source: Prepared by the authors.

As we can see, the results for our variables of interest do not change compared to those observed in Table 6. The non-parametric regression column confirms the negative and significant sign for one of the iFiscalmunicipal*TTVA interactions and remains qualitatively the same for the other interactions. Taken together, the values documented in Table 7 suggest that our main results are robust to outliers and independent of the functional form assumed.

Additionally, following Hanlon et al. (2017), we adopted the following alternative metrics for measuring the CASH HOLDING variable: (a) log of cash/sales ratio, (b) log of cash/assets ratio. The untabulated results of these new regressions show no qualitative change for our variables of interest, giving robustness to our initial inferences.

5 CONCLUSIONS AND IMPLICATIONS

This study aimed to assess the impact of government-granted tax incentives on the tax burden of Brazilian non-financial companies listed on the B3 stock exchange and their cash and cash equivalents levels from 2017 to 2021. Specifically, it examined the moderating effect of tax incentives on the relationship between the Total Tax Burden from the Value-Added Statement (TTVA) and cash holdings. The research offers robust evidence on the moderating role of tax incentives in corporate cash management decisions by employing advanced econometric techniques, including panel linear regression models with fixed effects and dynamic GMM estimators.

The analysis revealed that most companies (62.71%) benefited from tax incentives during the study period, with federal incentives being the most prevalent at 61.44%. While there was an increase in the number of companies reporting tax incentives in their explanatory notes over the period, this growth was more gradual than initially expected. The total increase was 26.62%, reflecting a consistent, albeit not drastic, rise in adopting these incentives. Notably, 2020 saw a sharp increase in cash retention rates, likely driven by precautionary liquidity measures in response to the COVID-19 pandemic, a trend consistent with the findings of Qin et al. (2020) for Chinese companies.

The statistical evidence supports the hypothesis that tax incentives moderate the relationship between TTVA and cash holdings. While companies with a lower TTVA typically hold more cash, this relationship becomes positive in the presence of tax incentives. This indicates that tax incentives can mitigate the negative effect of the tax burden on cash holdings by reducing tax uncertainty and enhancing financial flexibility. In this way, tax incentives act as a financial buffer, allowing companies to hold more cash, which can be strategically deployed for future investment opportunities.

The results also show that non-financial publicly traded Brazilian companies benefiting from tax incentives tend to retain more cash than those that do not, regardless of their effective tax rates. However, as the duration of the tax incentive increases, the amount of cash retained tends to decrease, indicating that companies may initially boost cash reserves when tax incentives are first received but gradually utilize these funds for investments or other financial commitments over time.

Interestingly, the study uncovers differential effects based on the source of tax incentives. Federal and state tax incentives demonstrate a positive moderating effect, while municipal incentives negatively impact some models. This distinction highlights the importance of considering the hierarchical structure of tax incentives in policy design and corporate strategy.

These results have significant implications for various stakeholders. For corporate managers, the study underscores the importance of sophisticated tax planning that considers not only immediate tax savings but also the long-term effects on cash management and financial flexibility. Policymakers can glean insights into the effectiveness of tax incentives in shaping corporate behavior, potentially informing more targeted and efficient incentive designs. Investors and analysts may find value in these findings when assessing Brazilian firms' financial health and cash management practices, particularly considering their tax incentive profiles.

The study's methodological rigor, including its use of the Heckman selection model to address potential endogeneity issues, enhances the reliability of its findings. The robustness of results across different model specifications and sensitivity analyses further strengthens the study's contributions to the accounting and finance literature.

While this research significantly advances our understanding of the relationship between tax incentives and cash holdings in the Brazilian context, it also opens avenues for future research. Exploring the specific mechanisms through which tax incentives influence cash management decisions, investigating potential industry-specific effects, and extending the analysis to other emerging markets could further enrich our knowledge.

In conclusion, this study contributes to the academic discourse on corporate tax strategies and cash management. It offers practical insights for business leaders, policymakers, and investors navigating Brazil's complex tax incentives landscape. As economies continue using tax incentives as economic development tools, understanding their multifaceted impacts on corporate financial decisions becomes increasingly crucial.

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Appendix A

Table 5
Pearson Correlation Matrix

	CASH HOLDING	IFISCAL	TIF	TTVA	ROE	ROA	TiROE	Kt	FINLEV	GenLIQ	MTB	LOSS	CAPGIRO	INVMILLS
CASH HOLDING	1	0,044	-0,014	-0,080**	0,026	0,103**	0,043	-0,065*	0,000	0,203**	0,160**	-0,053	0,295**	-0,138**
IFISCAL	0,044	1	0,050	0,037	-0,021	0,016	0,019	-0,002	0,005	-0,021	0,044	-0,037	0,067*	-0,096**
TIF	-0,014	0,050	1	0,014	0,005	0,153**	0,014	-0,067*	-0,022	0,050	-0,055	-0,184**	0,194**	-0,416**
TTVA	-0,080**	0,037	0,014	1	0,062*	-0,121**	0,102**	-0,056	-0,010	-0,073*	-0,073*	0,055	-0,051	0,064*
ROE	0,026	-0,021	0,005	0,062*	1	0,201**	0,809**	-0,031	-0,051	-0,005	0,077**	-0,204**	0,010	-0,078**
ROA	0,103**	0,016	0,153**	-0,121**	0,201**	1	0,227**	-0,126**	0,016	0,217**	0,168**	-0,679**	0,407**	-0,506**
TiROE	0,043	0,019	0,014	0,102**	0,809**	0,227**	1	-0,049	-0,041	0,007	0,075**	-0,254**	0,037	-0,105**
Kt	-0,065*	-0,002	-0,067*	-0,056	-0,031	-0,126**	-0,049	1	-0,020	-0,024	-0,066*	0,126**	-0,240**	0,117**
FINLEV	0,000	0,005	-0,022	-0,010	-0,051	0,016	-0,041	-0,020	1	-0,007	0,154**	-0,027	0,013	0,058*
GenLIQ	0,203**	-0,021	0,050	-0,073*	-0,005	0,217**	0,007	-0,024	-0,007	1	0,013	-0,164**	0,325**	-0,151**
MTB	0,160**	0,044	-0,055	-0,073*	0,077**	0,168**	0,075**	-0,066*	0,154**	0,013	1	-0,102**	0,154**	0,011
LOSS	-0,053	-0,037	-0,184**	0,055	-0,204**	-0,679**	-0,254**	0,126**	-0,027	-0,164**	-0,102**	1	-0,337**	0,562**
CAPGIRO	0,295**	0,067*	0,194**	-0,051	0,010	0,407**	0,037	-0,240**	0,013	0,325**	0,154**	-0,337**	1	-0,581**
INVMILLS	-0,138**	-0,096**	-0,416**	0,064*	-0,078**	-0,506**	-0,105**	0,117**	0,058*	-0,151**	0,011	0,562**	-0,581**	1