

ARTICLE

Identification of the optimal level of tax practices based on corporate performance

Mirian Mara Batista da Silva¹

mirian.marab@gmail.com |  0000-0003-1669-2964

Laura Edith Taboada Pinheiro¹

ltaboada@face.ufmg.br |  0000-0002-4511-7208

Sílvia Hiroshi Nakao²

shnakao@usp.br |  0000-0003-3976-8407

ABSTRACT

The literature points to factors that both encourage and discourage companies' tax reduction practices, which suggests an optimal level of these tax practices when it comes to economic performance. Thus, this article analyzes this relationship in non-financial companies listed on Brazil's B3 stock exchange between 2010 and 2020. Using the econometric technique of the Generalized Least Squares Method (GLS) and the Inverted U-squared relationship test in 2,327 observations, the results point to a level of tax reduction practices that, once surpassed, negatively affect corporate performance. Identifying this optimal level contributes to the literature as a basis for new models. From a practical point of view, it alerts managers to the importance of balance in tax reduction practices. This study fills a gap in previous research, which did not emphasize this specific relationship.

KEYWORDS

Optimal level, economic performance, tax planning, tax avoidance, tax aggressiveness

¹Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brasil

²Universidade de São Paulo, Ribeirão Preto, SP, Brasil

Received: 04/22/2024.
Revised: 05/06/2024.
Accepted: 12/27/2024.
DOI: <https://doi.org/10.15728/bbr.2024.1992.en>



This Article is Distributed Under the Terms of the Creative Commons Attribution 4.0 International License

RESUMO

A literatura aponta fatores que estimulam e desestimulam práticas de redução de pagamento de tributos pelas empresas, o que sugere a existência de um nível ótimo dessas práticas tributárias em relação ao desempenho econômico. Assim, este artigo analisa tal relação em empresas não financeiras listadas na B3, entre 2010 e 2020. Utilizando a técnica econométrica de Método dos Mínimos Quadrados Generalizados (GMM) e o Teste da relação quadrática U invertido em 2.327 observações, os resultados apontam para um grau de práticas de redução de tributos a partir do qual afetam negativamente o desempenho corporativo. A identificação desse nível ótimo contribui com a literatura, servindo de base para novos modelos. Do ponto de vista prático, alerta os gestores sobre a importância do equilíbrio nas práticas de redução de tributos. Este estudo preenche uma lacuna na pesquisa anterior, que não enfatizava essa relação específica.

PALAVRAS-CHAVE

Nível ótimo, desempenho econômico, planejamento tributário, *tax avoidance*, agressividade tributária

1. INTRODUCTION

Tax planning in companies can enhance corporate performance. In line with this argument, Desai and Dharmapala (2006) state that tax planning can be conceptualized as a management tool institutions use to improve their performance by reducing tax expenses.

However, tax planning depends on several aspects observed in the literature, such as corporate governance (Martinez et al., 2019), information asymmetry (Garg et al., 2020), and Chief Executive Officer (CEO) remuneration (Minnick & Noga, 2010), among others. Kim et al. (2022) found that corporations' investment in tax planning can be defined according to managers' expectations regarding economic growth.

It can be understood that there are determining factors in tax planning that encourage the reduction of tax expenses, such as economic growth. However, certain factors may impose limitations, such as reputation or the risk of litigation.

This leads to the hypothesis of an optimal level of tax planning concerning economic performance. It is plausible that increasingly aggressive tax planning in pursuit of tax reduction has a limit beyond which performance deteriorates. Previous studies (Delgado et al., 2012; Santos et al., 2013) have suggested the existence of an optimal level of size, debt, and capital intensity associated with tax planning. Additionally, studies such as Kim et al. (2019) and Li et al. (2022) have related the existence of an optimal level of tax planning to the speed at which companies adjust to this level and the career trajectories of managers.

Considering that tax optimization is the legal strategy used to reduce the taxable base of companies, Assidi et al. (2016) emphasized that, although the main objective of this optimization is to create value for the organization, minimizing tax costs, in some cases, it exposed companies to financial difficulties, because they disregarded non-tax costs.

The results of this study documented that reducing the tax burden impacts corporate profitability. Such evidence shows that non-tax expenses outweighed the benefits of tax optimization, suggesting the existence of a maximum point where the use of strategies to reduce tax outlays increases the company's profitability.

Kovermann and Velte (2019) indicate the presence of an optimal level of tax planning and point out that, at such a level, there is a balance between the cost of paying and the cost of avoiding taxes. At this point, the increase in strategies to reduce taxes would lead to a rise in the non-fiscal cost of tax planning that outweighs the advantages of this practice. On the other hand, the decrease in involvement in tax planning activities would generate a higher cost of disbursement with the payment of taxes that exceeds the benefits of making such payments (Kovermann & Velte, 2019).

Confirming the presence of an optimum point concerning taxes, Hori et al. (2023) point out that tax collection, especially that associated with income tax, is an essential source for public finances, as reducing the rate of this tax compromises public investment in infrastructure. Therefore, the authors state that, as a consequence of tax evasion employed by companies, the optimum level of income tax should be much higher than the demand for public services.

Although the topic of optimal level has been studied over the years, previous research has not investigated the relationship between the optimal level of tax reduction practices and corporate performance and its main implications. Thus, this study seeks to answer the following question: Is there an optimal level of tax reduction practices concerning organizations' economic performance?

This paper uses the term "tax reduction practices" to encompass any tax reduction strategies, whether legal or not, including tax planning and tax avoidance. The term also refers to the tax assessment operation, which is included in the tax reduction process. The paper considers the optimal level to be the point at which the increase in the involvement of tax reduction practices generates a decrease in corporate performance.

For this investigation, data from non-financial companies listed on the B3 stock exchange were used in an inverted U quadratic relationship test using the generalized least squares method. The significance of the quadratic term with a negative sign may indicate the possible existence of an optimal level of tax reduction practices concerning economic performance.

The main result of this study suggests the existence of a level of tax reduction practices, from which the increase of these strategies, from a certain point, negatively influences the contribution of companies' performance. This evidence emphasizes that what is interesting from a financial perspective is that the organization can maintain a positive relationship between performance and engagement in tax reduction practices. In this situation, the cost of taxes would be reduced more than the non-tax costs linked to using tax planning, which would contribute positively to business performance.

This paper contributes significantly to the literature on tax reduction strategies and corporate performance. First, it highlights the relationship between the level of tax reduction practices and corporate performance, highlighting the existence of an optimal tax level. Identifying this optimal level is an important innovation, as it allows a more careful understanding of how strategies to minimize tax payments can be optimized to maximize companies' economic performance.

Furthermore, the study provides new insights into the consequences of engaging in tax-reducing practices. It was found that corporate performance can be significantly altered as engagement in tax-reducing practices increases excessively. This finding is relevant because it suggests a tipping point where increasing tax-reducing practices ceases to be beneficial and may harm firm performance.

Another originality is the proposal of a new metric for tax planning at the firm level based on measuring the optimal level of tax reduction practices. This metric can be beneficial in studies where the limitation of the Effective Tax Rate (ETR) in cases of tax losses represents a disadvantage. The new metric will allow a more accurate analysis of a company's positioning on the scale of tax reduction practices, facilitating the identification of more effective strategies.

This study has a significant impact, providing a theoretical and empirical basis for optimizing tax reduction practices and improving corporate performance. In addition, professionals can adopt the new proposed metric to evaluate and improve tax strategies, promoting more efficient and sustainable tax management. Analyzing the optimal level of tax reduction practices can help managers communicate their tax strategies to other stakeholders and even compare them with those of competitors.

2. THEORETICAL FRAMEWORK

2.1. TAX REDUCTION PRACTICES AND THEIR RELATIONSHIPS

The study by Hanlon and Heitzman (2010) points to the lack of universally accepted concepts or constructs for tax avoidance or tax aggressiveness as the greatest challenge in research in this area. Complementing this argument, Blouin (2014) states that this lack of precise definitions results in confusion and inconsistency in measuring this variable and highlights the difficulty of knowing when legal strategies become aggressive.

Reinforcing this understanding, Hanlon and Heitzman (2010) emphasize that the term tax avoidance refers to a gradation of tax planning practices, with the extremes comprising, on one side, transactions considered lawful and, on the other, transactions associated with evasion, non-compliance, or aggressiveness strategies.

According to Harvey (2014), aggressive tax planning is expected to remain present in the business environment as long as organizations are subject to taxes and may increase or reduce the level, depending on the return desired by management from such practices. In line with this claim, Lanis and Richardson (2012) point out that managerial actions taken exclusively to reduce tax payments can generate significant costs and benefits.

Agreeing with this argument, Asiri et al. (2020, p.3) emphasize that tax planning increases the value of the company due to its ability to considerably increase cash flows due to the reduction in the amount of tax paid and "since tax expenses are typically one of the largest expenses in companies' income statements, it seems logical that the benefits of tax planning are substantial." As for relevant costs, Badertscher et al. (2013) relate them directly to the risk involved in tax planning, suggesting that more risk-averse managers tend to be more conservative in such activities.

Recent research has indicated two motivating factors for companies to engage in tax planning strategies: increased cash flow and agency conflicts. Increased cash flow occurs when tax planning practices can save funds by minimizing tax payments. The issue of agency conflicts is linked to managers' imposition of reduced transparency, aiming to make it difficult for tax authorities to analyze them. However, this decrease in corporate transparency allows management to seek private benefits (Zhang et al., 2022).

Another aspect that has dictated the tax planning movement is the sector of the economy in which companies are classified. According to Heitzman and Ogneva (2019), the sector impacts companies' tax planning activities, so much so that a premium is charged for these practices that affect organizations in the entire sector, including those that are more conservative from a tax point of view. In addition, Armstrong et al. (2019) showed that the tax behavior of competitors is a relevant determinant of a company's tax planning. Thus, the research documents that organizations respond strategically to their competitors' tax planning to avoid standing out among their peers in the sector.

Analyzing the advantages and disadvantages of tax planning, Koliass and Koumanakos (2022) highlight the relevant benefits, especially in the short term, such as higher after-tax profits and increased cash flow. The authors point out, however, that when using aggressive tax strategies, companies are exposed to significant costs, such as additional taxes and fines, which possibly generate increased uncertainty in implicit tax positions.

The benefits of the methods adopted by companies to reduce taxes are direct since there is a reduction in tax liabilities, generating an increase in cash flow and net profit. However, aggressive tax positions can require significant costs from companies and their managers, materializing, for example, in substantial resources spent on fees paid to accountants and lawyers, dedication of time by decision-makers and employees to planning and resolving inspections with the tax authorities, in addition to dollar amounts increased by interest and fines when the tax authorities manage to invalidate the planning operations, classifying them as in disagreement with the current legislation (Rego & Wilson, 2012).

Minimizing taxes can help a company maintain a higher percentage of its profits, but it exposes the organization to different risks, such as tax, reputational, and political risks. Tax risk exists when the tax authorities may disagree with the company's tax positions, imposing the payment of taxes, fines, penalties, and interest. Reputational risk is why 69% of managers do not adopt any tax planning strategy. When companies engage in tax reduction, the public may pressure politicians to act upon realizing that they are not honoring their tax commitments (Christensen et al., 2015).

Thus, the studies presented here highlight the complexity and challenges inherent in the tactics used to reduce taxes. Hanlon and Heitzman (2010) point out the lack of universally accepted concepts as one of the biggest challenges in research on tax avoidance, a view corroborated by Blouin (2014), who emphasizes the confusion and inconsistency in measuring this variable. The gradation of tax planning practices, ranging from legal operations to evasion strategies, is reinforced by Hanlon and Heitzman (2010). Harvey (2014) and Lanis and Richardson (2012) discuss the persistence of aggressive tax planning and its significant costs and benefits. Asiri et al. (2020) highlight that tax planning can increase a firm's value by increasing cash flows, while Badertscher et al. (2013) associate costs with the risk involved. Zhang et al. (2022) identify increased cash flow and agency conflicts as motivators for tax planning. Koliass and Koumanakos (2022) highlight the short-term benefits but warn of significant costs and fiscal uncertainty.

Rego and Wilson (2012) discuss aggressive tax positions' direct and indirect costs, while Christensen et al. (2015) highlight fiscal, reputational, and political risks. In summary, the literature signals the need for a balance between the benefits and risks of tax planning, with significant implications for organizational management.

2.2. OPTIMAL LEVEL OF TAX REDUCTION PRACTICES

At the country level, optimal taxation models based on the Optimal Taxation Theory have been researched. This theory proposes that the tax system should be structured in such a way as to balance the need for revenue collection while reducing the negative impacts of taxes on economic growth and incentives in each nation (Rahman, 2023); this means that if taxes exceed this balance point, it will increase revenue, but at the same time, it will minimize growth opportunities.

Pigou (1920), Ramsey (1927), and Mirrlees (1971) were the pillars of the Optimal Taxation Theory. Pigou (1920) advocated that when there are discrepancies between trade and social welfare, the state can eliminate them by using rewards or raising taxes if it is in its interest. In other words, it is suggested that taxation should be higher on products that can cause negative externalities.

Since the effect of taxation is to transfer income initially from individuals to the state and then return some of it to rentiers and pensioners, a certain amount of revenue should be raised using proportional taxes on some or all uses of the income, with taxes on different uses being taxed at different rates. Thus, when raising revenue by proportional taxes on commodities, the taxes should be such as to decrease the output of each commodity taxed in the same proportion (Ramsey, 1927).

Mirrlees (1971) argues that if an individual's income were used as evidence of their economic potential, for everyone in society to benefit equally from a marginal increase in income through the tax system, high marginal tax rates would be necessary for higher incomes. However, the author explains that many jobs requiring high remuneration require great effort and sacrifice, so higher taxation would completely discourage these activities.

Seeking to develop a systematic theory of optimal taxation, Farhi and Gabaix (2020) considered the behavioral biases of agents and the extent to which these individuals pay attention to the tax system and react to it. In this sense, these authors emphasize that when agents have limited attention to taxes, the inverse elasticity rule proposed by Ramsey (1927) changes since optimal taxes would increase and escalate, associated with the inverse square of attention and not with the elasticity of demand. It is suggested that the less sensitive to changes in fiscal policies, the more optimal taxes can be raised without compromising revenue collection.

By including the perception of limited attention in Pigou's (1920) conclusions, who stated that taxes should be set at the value of the externality they correct, there is an increase in the amount to be paid by agents with limited attention, as they do not respond quickly to the tax and, thus, the optimal tax should be higher, to compensate for the reduced attention. Finally, by increasing the attention parameter in Mirrlees' non-linear income tax model, it is clear that if people experiencing poverty do not fully recognize the future benefits of work, the optimal would be to introduce negative marginal tax rates for low incomes. This government subsidy would encourage the agent to enter the labor market (Farhi and Gabaix, 2020).

The main characteristics of optimal taxation are listed by Sachs, Tsyvinski and Werquin (2020): a) non-linearity, since optimal taxation suggests different marginal rates for different incomes; b) progressivity, where marginal rates will depend on the valuation of the agents' well-being and income distribution preferences; c) behavioral elasticities, which highlights that the standard rule of inverse elasticity is changed, with the relevant parameter becoming the sum of the inverse elasticity of labor supply and the inverse elasticity of labor demand.

Adding financial frictions to the analysis of optimal taxation, Boar and Knowles (2024) argue that the issue of optimal taxation boils down to a three-pronged trade-off. First, raising income and wealth tax rates boosts tax revenue, especially from wealthier entrepreneurs, where this additional revenue can be passed on to workers as lower labor income taxes. Second, higher income and wealth tax rates reduce the tax base for these taxes by discouraging savings and allocating capital to projects with high return risk, meaning that large increases in these rates can reduce tax revenue.

Finally, higher capital income tax rates discourage entrepreneurship. Since workers pay a higher total tax per capita than entrepreneurs, it may be advantageous for the Government to encourage individuals to become workers rather than entrepreneurs to increase tax revenue (Boar & Knowles, 2024).

Companies also have difficulty finding the optimal level of taxation, but in the opposite direction to that of the Government, concerning maximum involvement in tax-reducing activities without compromising reputation, performance, and other aspects. Jacob (2022) highlights that a company's optimal level of tax planning decreases, for example, when exposed to stricter anti-avoidance rules.

Delgado et al. (2012) recorded non-linear behaviors between size, debt and capital intensity, and effective tax rate (ETR) when investigating determinants of tax planning. The authors documented that smaller companies tend to have a higher ETR, but this relationship remains to a certain extent. From a certain point on, as corporate size increases, tax aggressiveness also increases.

Regarding debt, when there is minimal debt, the deductibility of interest is probably incapable of reducing the tax burden. However, at high levels of debt, the minimization of the ETR generated by such deductibility is noticeable. Finally, there is no reduction in the tax burden at low levels of fixed assets. However, when capital intensity increases, it leads to an increase in ETR up to a level from which the increase in investment in fixed assets has, as a consequence, a decrease in ETR as a result of the deductibility of high depreciation (Delgado et al., 2012).

In the Brazilian context, Santos et al. (2013) state that there is a non-linear relationship between size and ETR. The authors suggest that larger companies, up to a certain level of company size, support a higher ETR. After this level, organizations "would be subject to lower taxation, due, for example, to political influence, obtaining tax incentives or carrying out more efficient tax planning" (Santos et al., 2013, p.199).

In the same way that Delgado et al. (2012) and dos Santos et al. (2013) comment on the divergent results of the relationships of some determinants, such as size and debt present in the literature, with organizational performance, positive and negative associations with tax planning also emerge. Rego and Wilson (2012) highlight a positive relationship between performance and tax aggressiveness, suggesting that more profitable corporations tend to have lower tax disbursements.

Araújo and Leite Filho (2019) state that the greater the tax aggressiveness, the lower the ETR and the lower the profitability of companies.

Kim et al. (2019), analyzing information from all companies with data available in the COMPUSTAT database, confirm the existence of an optimal level of tax planning and explain that organizations, in practice, encounter numerous frictions such as transaction costs and information asymmetry, which prevent them from always being at the optimal level.

Thus, due to this trade-off, the optimal level of corporate tax planning varies over time and may result from changes in tax legislation, capital structure, size, and company performance, among others (Kim et al., 2019).

In this context, the following research hypothesis is established:

H: from the optimal level, the greater the engagement in tax reduction practices, the lower the economic performance of Brazilian organizations.

3. RESEARCH METHODOLOGY

Data collected through the Refinitiv Thomson Reuters platform of non-financial companies listed on B3 from 2010 to 2020 were analyzed to achieve the objective of this study. The justification for choosing this time interval refers to the mandatory adoption of companies in the Brazilian context of the International Financial Reporting Standards (IFRS) in 2010.

As shown in Table 1, financial institutions were excluded because, according to Kim et al. (2019), they deal with different tax planning incentives. Observations related to negative net equity and missing observations were also removed from the sample, as these aspects would impair the statistical analysis of the data.

Table 1 – *Sample composition*

Sample	Initial	Exclusions	Final
Companies listed in the Thomson Reuters database	577		
Financial, funds, and others		142	
Companies with negative equity or that did not have data on all variables for at least one year.		143	
Total			292

Source: Own elaboration

Table 2 presents the operationalization and expected signs of the dependent (ROA), independent (ETRDIF), and control variables (SIZE, DEBT, GROWTH, and CRISIS) recurrently used in the literature associated with corporate performance.

Table 2 – Variables used in the investigation of the existence of the optimal level

Metric	Type		Author (Year)	Expected Signal
ROA	Dependent	$ROA = \frac{EBIT}{TA_{t-1}}$		
ETRDIF	Interest	$ETRDIF = \frac{(Tax_{34\%} - Expense\ IR/CSLL)}{ LAIR }$	Researches	(+)/(-)
SIZE	Control	$TAM = \ln TA$	Marschner, Dutra and Ceretta (2019)	(+)
DEBT	Control	$END = \frac{Long-term\ debt}{AT_{t-1}}$	Nascimento, Angotti, da Silva Macedo and Bortolon (2018)	(-)
GROWTH	Control	$CRESC = \frac{Intangible\ asset}{Total\ assets}$	Chiu, Li e Kao (2022)	(+)
CRISIS	Control	The variable is a dummy, which receives 1 in 2015, 2016 (periods of economic recession), and 2020 (the COVID-19 pandemic) and 0 in the opposite cases.	Moreno e Jones (2021)	(-)

Source: Research data

ROA – Return on Total Assets; EBIT - Operating profit; TA – Total Assets; ETRDIF- ETR Differential; SIZE – Size; DEBT – Debt; GROWTH - Growth.

ROA is one of the recurring metrics used to measure business performance. According to Soares and Galdi (2011), return on total assets refers to the profit produced by the organization related to using assets in the company's profit-generating activities.

Asiri et al. (2020) state that organizations where decision-makers engage in tax planning tend to adopt strategies that minimize tax expenses in financial statements. Regarding the relationship between ROA and tax planning practices, Araújo and Leite Filho (2019) claim that the level of tax aggressiveness harms companies' profitability.

Company size has a positive influence on performance. Larger organizations have structures more conducive to achieving their goals, including greater profitability (Pamplona & Da Silva, 2020; Marschner et al., 2019).

According to Nascimento et al. (2018), debt and performance have a negative relationship since increased leverage reduces companies' profitability.

The relationship between growth and performance occurs, for example, when company management enhances growth opportunities by increasing investment in intangible assets, thus increasing corporate performance (Chiu et al., 2022).

For Moreno and Jones (2021), the global financial crisis caused low corporate performance, negatively impacting corporate profitability.

Therefore, this study adapted the model which Caballero et al. (2014) used when investigating the presence of an optimal level of investment in working capital that maximizes the company's value, replacing working capital management with proxies of tax reduction practices.

Equation 1 shows this adjustment to investigate the existence and measure the optimal level of tax reduction practices. In other words, this optimal level would be the point at which, from that point on, the company's performance would begin to decline with the increase in involvement in tax reduction practices. Equation 1 indicates the adjusted model with the inclusion of the crisis since previous studies demonstrate this macroeconomic factor's influence on companies' performance.

$$ROA_{i,t} = \beta_0 + \beta_1 ETRDIF_{i,t} + \beta_2 ETRDIF_{i,t}^2 + \beta_3 SIZE_{i,t} + \beta_4 DEBT_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 CRISIS + \varepsilon_{i,t} \quad (1)$$

where $ROA_{i,t}$ refers to the return on assets;

$ETRDIF_{i,t}$ and $ETRDIF_{i,t}^2$ represent the involvement with tax reduction practices, measured by the differential ETR (ETRDIF);

$SIZE_{i,t}$ refers to the size of the company;

$DEBT_{i,t}$ relates to the organization's leverage;

$GROWTH_{i,t}$ associated with the opportunity for growth;

$CRISIS$ relates to periods of economic recession and the COVID-19 pandemic.

$\varepsilon_{i,t}$ is the error term of the model.

In this context, the optimal level would be proven by the inversion of the $ETRDIF^2$ signal.

3.1. INVERTED U QUADRATIC RELATIONSHIP TEST ACCORDING TO LIND AND MEHLUN (2010) AND ECONOMETRIC APPROACH

Most studies that analyze non-linear relationships include a quadratic term in the model and analyze the behavior of the linear and non-linear elements. If the linear term is significant and has a positive coefficient and the quadratic term is negative, it can be inferred that there is a curvilinear relationship.

However, Lind and Mehlum (2010) argue that this criterion is weak, especially considering that a relationship may be convex but linear in significant data values. Therefore, a non-linear specification may mistakenly generate an extreme point and a U-shape. For these authors, for the U-shape to be confirmed, it is necessary and sufficient to evaluate (1) whether the coefficients of the linear and non-linear terms are contrary and significant; (2) whether the slope at the ends of the data range is sufficiently steep; and (3) whether the estimated extreme point is within the range of the linear term.

Therefore, the confirmation of significance and the visualization of the coefficient signs were due to the model of Equation 1. Then, the inflection point was estimated by solving equation 1 as a function of the ETRDIF proxy.

$$Optimal\ level = \frac{-\beta_1}{2\beta_2} \quad (2)$$

With this estimated point, it was verified whether it was within the range of the ETRDIF variable. Thus, to confirm the existence of the inverted U shape, the slope at the ends of the range was verified. The test hypotheses are:

$$H_0: (\beta_1 + 2\beta_2 ETRDIF_{min} \leq 0) \cup (\beta_1 + 2\beta_2 ETRDIF_{max} \geq 0) \quad (3)$$

$$H_1: (\beta_1 + 2\beta_2 ETRDIF_{min} > 0) \cup (\beta_1 + 2\beta_2 ETRDIF_{max} < 0) \quad (4)$$

The rejection of the null hypothesis attests to an inverted U shape.

The recursion evidenced in this study is linked to the need to include past information on the corporate performance proxy in the proposed econometric model. Thus, appropriate modeling is necessary to address the endogeneity problem inherent to the variables that comprise the model proposed in this study. The econometric literature highlights the Instrumental Variables model and the Generalized Least Squares Method (GLS) as techniques capable of addressing endogeneity.

The choice of appropriate instrumental variables required by the Instrumental Variables model makes it challenging to implement such an approach. The GLS model presents itself as a robust alternative for reproducing consistent estimators in the presence of this endogeneity problem. The GLS approach presents two possible types of modeling: GLS in Differences and Systemic GLS (Roodman, 2009). According to the author, the difference between the two methodologies is linked to the greater robustness of Systemic GLS compared to GLS in Differences, which, due to the differentiation used in this approach to estimate the parameters, can cause a marked imbalance in the panel and the consequent loss of information.

A limitation of GLS arises from the temporality and number of observations used. It is known that the best estimate of the parameters is achieved when there is a large number of observations and a small temporality (Baum, 2006).

In this sense, if the GLS results fit the three criteria proposed by Lind and Mehlum (2010) and the null hypothesis of the test that refers to a linear or U-shape is rejected, it can be stated that when engagement in tax reduction practices exceeds the optimal level, the economic performance of Brazilian organizations tends to decrease.

4. RESULTS AND DISCUSSIONS

4.1. DESCRIPTIVE STATISTICS

Table 3 below presents the descriptive statistics associated with the data that make up this study.

Table 3: Descriptive statistics of the variables sampled from 2010 to 2020

Variables	Minimum	Maximum	Average	Standard Deviation	CV
ROA	-0,9587	1,0723	0,0825	0,1115	135,1515%
SIZE	16,4297	27,6184	21,7184	1,7965	8,2718%
DEBT	0	3,3476	0,3898	0,2667	68,4197%
GROWTH	-0,3426	0,8558	0,0854	0,1503	175,9953%
ETRDIF	-62,1572	168,1508	0,1271	4,1738	3.283,87%
ETRDIF2	0	28274,7	17,4297	577,7413	3.314,6945%

Source: Own elaboration

ROA – Return on Total Assets; SIZE – Tamanho; DEBT – Debt;

GROWTH- Growth; ETRDIF - ETR Differential; ETRDIF2- Quadratic Term of ETR Differential

The coefficient of variation shows a high dispersion concerning the average values of the sampled data, which can be explained by the high variability of these characteristics in the companies included in this research's sample. Considerable disproportions are expected when analyzing accounting variables of organizations of different sizes and economic sectors, such as observed in the growth opportunity proxy (GROWTH) data, which demonstrates high variability, confirming the heterogeneity of the sample.

4.2. ANALYSIS OF THE EXISTENCE AND ESTIMATION OF THE OPTIMAL LEVEL OF TAX REDUCTION PRACTICES

Table 4 indicates an optimal level, suggesting the inverted U shape by demonstrating the significant and positive linear term and the significant and negative non-linear element. Thus, there would be an extreme point from which the increase in tax planning would reduce performance.

Table 4 – *Influence of levels of tax reduction practices on performance in the period 2010 to 2020 – Full sample*

ROA	ETRDIF Coef.	ETRDIF ² Coef.	SIZE Coef.	DEBT Coef.	GROWTH Coef.	CRISIS Coef.
	0,0014**	-0,0000**	0,0044	0,0443**	-0,1328	-0,0065
Validation statistics of the proposed model						
		AR1			-0,44	
		AR2			-1,63	
		Sargan			63,01***	
		Hansen			22,80	
		Dif-Hansen			21,90	

Source: Research data. The following symbols represent the statistical significance of the tests: *10%, **5%, ***1%. ROA – Return on Total Assets; ETRDIF - ETR Differential; ETRDIF² - Quadratic Term of ETR Differential, SIZE – Size; DEBT – Debt; GROWTH - Growth.

However, Lind and Mehlum (2010) state that this condition is necessary but insufficient to guarantee the inverted U shape. Performing the test in Stata, it is clear that there is an inverted U shape since the coefficients of the variables related to tax reduction practices (linear and quadratic terms) are significant and contrary, the initial slope is positive, and the final slope is negative, demonstrating that the slope at the ends is steep. The estimated maximum point of 76.69 is within the ETRDIF proxy range, from -62.1572 to 168.1508.

This result is significant to highlight that this extreme point cannot be considered as the value from which performance decreases because with 94.72% of the sample having values between -1 and 1 as the content of the ETRDIF variable, it is expected that the reduction in ROA will occur before the involvement in tax reduction practices reaches 76.69. It is noted then that the optimal level was distorted by the upper value of the range, confirming the need to exclude the extreme deciles since Armstrong et al. (2015) and Armstrong et al. (2019) suggest that companies that seek efficient tax planning would not fit into the extreme positions. Table 5 presents the results of the U test in Stata for the entire sample.

Table 5 – *Lind and Mehlum inverted U test on the entire sample from 2010 to 2020*

	Lower Limit	Upper Limit
Interval	-62,1572	168,1508
Inclination	0,0025	-0,0016
p-value	0,0119	0,0088
The general test for the presence of the inverted U shape: p-value: 0.0119 - Extreme point: 76.69		

Source: Own elaboration

Therefore, tests were performed to define the percentage to be excluded, evaluating which result would be closest to the range of the variable of interest for most of the sample. After concluding that 3% of the extreme percentiles should be excluded, it was found that the coefficients of the linear and non-linear terms are significant and contrary, as indicated in Table 6, suggesting the shape of an inverted U.

Table 6 – Influence of tax reduction practice levels on performance in the period 2010 to 2020 – Considering the exclusion of extreme percentiles

ROA	ETRDIF Coef.	ETRDIF ² Coef.	SIZE Coef.	DEBT Coef.	GROWTH Coef.	CRISIS Coef.
	0,1122***	-0,3944***	-0,0005	0,0743***	-0,2194***	-0,0033
Validation statistics of the proposed model						
	AR1				-2,68***	
	AR2				-0,03	
	Sargan				62,49***	
	Hansen				17,14	
	Dif-Hansen				13,91	

Source: Research data

The following symbols represent the tests' statistical significance: *10%, **5%, and ***1%.

ROA – Return on Total Assets; ETRDIF - ETR Differential; ETRDIF² - Quadratic Term of ETR Differential, SIZE – Size; DEBT – Debt; GROWTH - Growth.

Continuing the inverted U test, it can be seen in Table 7 that the slope is steep, that the maximum point, which is 0.1422, is within the range of the proxy for tax reduction practices [-0.3522, 0.3439], and that the null hypothesis of the test, which refers to a linear or U-shape, was rejected, with a p-value of 0.0162.

Table 7 – Lind and Mehlum inverted U test for the period 2010 to 2020 – Considering the exclusion of extreme percentiles

	Lower Limit	Upper Limit
Interval	-0,3522	0,3439
Inclination	0,3900	-0,1591
p-value	0	0,0162

The general test for the presence of the inverted U shape: p-value: 0.0162 - Extreme point: 0.1422

Source: Own elaboration

The existence of the inverted U shape and, consequently, the optimum level is confirmed by meeting all the criteria established by Lind and Mehlum (2010). Therefore, the research hypothesis that, from the optimum level, the greater the engagement in tax reduction practices, the lower the economic performance of Brazilian organizations was not rejected.

This result of confirming the existence of the optimal level of tax reduction practices is in line with Dyreng et al. (2008), who suggest the existence of this level when they state that the different levels of tax planning suggest each company's particular search for an ideal level. Kim et al. (2019) also highlight the existence of an optimal level of tax reduction practices by concluding that organizations below the optimal level of tax planning tend to adjust to this point more quickly than companies above the optimal level.

The suggestion of a reduction in economic performance which comes after involvement in tax reduction practices passes a specific point confirms the existence of an optimal level of tax reduction practices.

In this study, considering the data from the sampled companies, the optimal level of tax reduction practices is 0.1422. This suggests that, when calculating their engagement in tax reduction practices, organizations below this level can be considered conservative compared to those above this number. The further the variable related to tax reduction practices is from this point, either upward or downward, the more conservative or more aggressive the company tends to be and, consequently, the more significant the impact on corporate performance that can be observed.

Thus, estimating the optimal level of tax reduction practices allows company managers to verify how far their tax strategies are from where the balance between costs and benefits occurs. According to the capital structure literature, such as Pamplona and Da Silva (2020), the closer the organization operates to the optimal level of debt, the more competitive and the more positive the results will be. Similarly, it can be inferred that tax reduction practices are no different; that is, the closer to the optimal level, the more savings related to tax reduction companies will have, favoring performance, with the minimization of significant costs.

Naturally, this can vary from company to company and also depending on the environmental conditions in which the organization operates.

5. CONCLUSION

This study aimed to investigate the existence of an optimal level of tax reduction practices from the perspective of the economic performance of non-financial companies listed on B3. The results suggest a level of tax reduction practices (0.1422) from which the intensification of these strategies negatively influences companies' performance.

It was found that companies with greater involvement in tax reduction practices are more profitable up to a certain point. However, it was noted that companies that were less aggressive in their tax reduction practices were more profitable than the more aggressive ones, indicating a decrease in corporate performance when the level of involvement in tax reduction practices exceeds a specific limit.

In this sense, theoretical, practical, and social implications can be highlighted. Identifying an optimal level of tax reduction practices provides a theoretical basis for developing new models incorporating this quadratic relationship. These models can contribute to predicting the impact of tax strategies on corporate performance, offering more robust data for managerial decision-making. In addition, the research paves the way for studies investigating how the optimal level of tax reduction practices varies across different sectors of the economy. This observation can identify sectors where tax reduction practices are more or less effective, helping to develop the corporate literature.

The evidence suggests that managers need to balance tax reduction practices. Companies should adopt tax strategies that maximize tax benefits without exceeding the optimal level, thus avoiding potential litigation risks and tax penalties. Using a new metric based on the optimal level of tax reduction practices can help evaluate and adjust these strategies, promoting more efficient tax management.

Companies can use the study results to improve communication with stakeholders, including investors, regulators, and the community. Transparency in tax reduction practices and clear communication about the strategies adopted can strengthen the organization's trust and reputation. Many tax disputes can increase risk perception in the business environment, discouraging investment and affecting GDP.

Regarding social implications, it is suggested that companies that adopt tax reduction practices within the optimal level tend to avoid excessively aggressive strategies that may be classified as tax evasion; this contributes to greater tax compliance and optimization of the tax collection process.

A limitation of this study is related to the proxy of tax reduction practices associated with income tax and social contributions since these taxes are not the only ones that can be managed. Furthermore, when suggesting that the optimal level of tax reduction practices is 0.1422, the data from the companies and period sampled were considered, which prevents generalization.

Believing that the results indicate a trend of conduct that can be explored in future research, it is recommended that the classification of tax reduction practices be used under the optimal level as a metric to test other relationships, such as foreign direct investment, sectors of the economy, and the companies' participation in an index, such as the Standard & Poor's 500, among others, this will deepen the understanding of the effects of tax reduction practices in other contexts and provide significant insights for business management.

REFERENCES

- Araújo, R. A.M., & Leite Filho, P. A. M. (2019). Reflexo do nível de agressividade fiscal sobre a rentabilidade de empresas listadas na B3 e NYSE. *Revista Universo Contábil*, 14(4), 115–136.
- Armstrong, C. S., Blouin, J. L., Jagolinzer, A. D., & Larcker, D. F. (2015). Corporate governance, incentives, and tax avoidance. *Journal of Accounting and Economics*, 60(1), 1–17.
- Armstrong, C. S., Glaeser, S., & Kepler, J. D. (2019). Strategic reactions in corporate tax planning. *Journal of Accounting and Economics*, 68(1), 101232, 1–26.
- Asiri, M., Al-Hadi, A., Taylor, G., & Duong, L. (2020). Is corporate tax avoidance associated with investment efficiency? *The North American Journal of Economics and Finance*, 52(101143), 1–22.
- Assidi, S., Aliani, K., & Omri, M. A. (2016). Tax optimization and the firm's value: Evidence from the Tunisian context. *Borsa Istanbul Review*, 16(3), 177–184.
- Badertscher, B. A., Katz, S. P., & Rego, S. O. (2013). The separation of ownership and control and corporate tax avoidance. *Journal of Accounting and Economics*, 56(2-3), 228–250.
- Baum, C. F. (2006). An introduction to modern econometrics using Stata. *Stata Press*.
- Blouin, J. (2014). Defining and measuring tax planning aggressiveness. *National Tax Journal*, 67(4), 875–899.
- Boar, C., & Knowles, M. (2024). Optimal taxation of risky entrepreneurial capital. *Journal of Public Economics*, 234, 105100.
- Caballero, S.B., García-Teruel, P. J., & Martínez-Solano, P. (2014). Working capital management, corporate performance, and financial constraints. *Journal of Business Research*, 67(3), 332–338.
- Chiu, J., Li, Y. H., & Kao, T. H. (2022). Does organization capital matter? An analysis of the performance implications of CEO power. *The North American Journal of Economics and Finance*, 59, 101382.

- Christensen, D. M., Dhaliwal, D. S., Boivie, S., & Graffin, S. D. (2015). Top management conservatism and corporate risk strategies: Evidence from managers' personal political orientation and corporate tax avoidance. *Strategic Management Journal*, 36(12), 1918–1938.
- Delgado, F. J., Fernandez-Rodriguez, E., & Martinez-Arias, A. (2012). Size and other determinants of corporate effective tax rates in US listed companies. *International Research Journal of Finance and Economics*, 98, 160–165.
- Desai, M. A., & Dharmapala, D. (2006). Corporate tax avoidance and high-powered incentives. *Journal of Financial Economics*, 79(1), 145–179.
- Dyreng, S. D., Hanlon, M., & Maydew, E. L. (2008). Long-run corporate tax avoidance. *The Accounting Review*, 83(1), 61–82.
- Farhi, E., & Gabaix, X. (2020). Optimal taxation with behavioral agents. *American Economic Review*, 110(1), 298–336.
- Garg, M., Khedmati, M., Meng, F., & Thoradeniya, P. (2020). Tax avoidance and stock price crash risk: mitigating role of managerial ability. *International Journal of Managerial Finance*, 18 (1), 1–27.
- Hanlon, M., & Heitzman, S. (2010). A review of tax research. *Journal of Accounting and Economics*, 50(2–3), 127–178.
- Harvey, J. R. (2014). Corporate tax aggressiveness-recent history and policy options. *National Tax Journal*, 67(4), 831–850.
- Heitzman, S. M., & Ogneva, M. (2019). Industry tax planning and stock returns. *The Accounting Review*, 94(5), 219–246.
- Hori, T., Maebayashi, N., & Morimoto, K. (2023). Tax evasion and optimal corporate income tax rates in a growing economy. *Macroeconomic Dynamics*, 27(3), 743–769.
- Jacob, M. (2022). Real effects of corporate taxation: A Review. *European Accounting Review*, 31(1), 269–296.
- Kim, J., McGuire, S., Savoy, S., & Wilson, R. (2022). Expected economic growth and investment in corporate tax planning. *Review of Accounting Studies*, 27(2), 745–778.
- Kim, J., McGuire, S. T., Savoy, S., Wilson, R., & Caskey, J. (2019). How quickly do firms adjust to optimal levels of tax avoidance? *Contemporary Accounting Research*, 36(3), 1824–1860.
- Kolias, G., & Koumanakos, E. (2022). CEO duality and tax avoidance: Empirical evidence from Greece. *Journal of International Accounting, Auditing and Taxation*, 47, 100465.
- Kovermann, J., & Velte, P. (2019). The impact of corporate governance on corporate tax avoidance. A literature review. *Journal of International Accounting, Auditing and Taxation*, 36, 100270.
- Lanis, R., & Richardson, G. (2012). Corporate social responsibility and tax aggressiveness: An empirical analysis. *Journal of Accounting and Public Policy*, 31(1), 86–108.
- Li, N., Shevlin, T., & Zhang, W. (2022). Managerial career concerns and corporate tax avoidance: Evidence from the inevitable disclosure doctrine. *Contemporary Accounting Research*, 39(1), 7–49.
- Lind, J. T., & Mehlum, H. (2010). With or without U? The appropriate test for a U-shaped relationship. *Oxford Bulletin of Economics and Statistics*, 72(1), 109–118.
- Marschner, P. F., Dutra, V. R., & Ceretta, P. S. (2019). Alavancagem financeira e rentabilidade nas empresas brasileiras listadas na B3. *Revista Universo Contábil*, 15(2), 44–58.

- Martinez, A. L., Ribeiro, A. C., & Funchal, B. (2019). The Sarbanes Oxley Act and taxation: a study of the effects on the tax aggressiveness of Brazilian firms. *Revista Contabilidade Vista & Revista*, 30(1), 27–42.
- Minnick, K., & Noga, T. (2010). Do corporate governance characteristics influence tax management? *Journal of Corporate Finance*, 16(5), 703–718.
- Mirrlees, J. A. (1971). An exploration in the theory of optimum income taxation. *The Review of Economic Studies*, 38(2), 175–208.
- Moreno, A., & Jones, M. J. (2021). Impression management in corporate annual reports during the global financial crisis. *European Management Journal*, 40(4), 503–517.
- Nascimento, J. C. H. B., Angotti, M., da Silva Macedo, M. A., & Bortolon, P. M. (2018). As relações entre governança corporativa, risco e endividamento e suas influências no desempenho financeiro e no valor de mercado de empresas brasileiras. *Advances in Scientific and Applied Accounting*, 11(1), 166–185.
- Pamplona, E., & da Silva, T.P. (2020). Influência da estrutura de capital no desempenho de empresas brasileiras sob a ótica não linear. *Estudios Gerenciales*, 36(157), 415–427.
- Pigou, A. (1920). *The Economics of Welfare*. Macmillan.
- Rahman, M. M. (2023). Impact of taxes on the 2030 agenda for sustainable development: evidence from organization for economic co-operation and development (OECD) countries. *Regional Sustainability*, 4(3), 235–248.
- Ramsey, F. P. (1927). A Contribution to the Theory of Taxation. *The Economic Journal*, 37(145), 47–61.
- Rego, S. O., & Wilson, R. (2012). Equity risk incentives and corporate tax aggressiveness. *Journal of Accounting Research*, 50(3), 775–810.
- Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GLS in Stata. *Stata Journal*, 9(1), 86–136.
- Sachs, D., Tsyvinski, A., & Werquin, N. (2020). Non-linear tax incidence and optimal taxation in general equilibrium. *Econometrica*, 88(2), 469–493.
- Santos, M. A. C., Cavalcante, P., & Rodrigues, R. N. (2013). Tamanho da firma e outros determinantes da tributação efetiva sobre o lucro no Brasil. *Advances in Scientific and Applied Accounting*, 179–210.
- Soares, E. R., & Galdi, F. C. (2011). Relação dos modelos DuPont com o retorno das ações no mercado brasileiro. *Revista Contabilidade & Finanças*, 22(57), 279–298.
- Zhang, L., Zhang, Z., Zhang, P., & Wang, X. (2022). Defend or remain quiet? Tax avoidance and the textual characteristics of the MD&A in annual reports. *International Review of Economics & Finance*, 79, 193–204.

AUTHOR'S CONTRIBUTION

Mirian Mara Batista da Silva: conceptualization, project administration, data curation, methodology, investigation, writing – original draft.

Laura Edith Taboada Pinheiro: project administration, formal analysis, supervision, writing – review & editing.

Sílvio Hiroshi Nakao: project administration, formal analysis, supervision, validation, writing – review & editing.

DATA AVAILABILITY STATEMENT

The datasets related to this article will be available upon request to the author.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

EDITOR-IN-CHIEF

Marcia Juliana d'Angelo 

ASSOCIATE EDITOR

Verônica de Fátima Santana 