Market concentration and implicit taxes: analyzing Brazilian firms

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Abstract

Purpose – This study aims to explore the interplay between market concentration and implicit tax burdens in Brazil, offering a fresh perspective on the conventional belief of perfect competition.

Design/methodology/approach – Data was sourced from Brazilian firms on the B3 stock exchange between 2011 and 2021. Multiple linear regression techniques were employed to analyze the relation of explicit tax rates to firms' pre- and post-tax returns.

Findings – Dominant firms in the market tend to bear a lower implicit tax burden and have the capacity to extend tax incentive benefits to shareholders.

Research limitations/implications – The findings highlight Brazil's intricate corporate tax fabric, particularly regarding implicit taxes. They provide a foundation for deeper inquiries into how market dominance, taxation policies, and corporate strategies converge.

Practical implications – Regulators and business leaders can harness this knowledge to recalibrate tax strategies and market regulations. Specifically, a closer examination of the dynamics that permit reduced implicit tax implications in monopolized markets is essential for equity.

Social implications – Companies with pronounced market concentration can mitigate their implicit tax burdens, potentially offloading them to consumers and suppliers. This points to potential inequities in current tax structures.

Originality/value – This research unveils nuanced insights into Brazil's multifaceted interrelations between corporate influence, taxation strategies, and market forces.

Keywords Market concentration, Implicit tax, Explicit tax, Corporate strategy

Paper type Research paper

1. Introduction

The Scholes & Wolfson (1992) framework, hereafter referred to as the S&W framework, introduces a positive microeconomic lens for understanding the role of taxes in organizational behavior, emphasizing the need for comprehensive tax planning that accounts for both explicit and implicit taxes in investment and financing decisions.

Within this framework, "explicit taxes" are those paid directly to the taxing authority, like corporate or personal income taxes, whereas "implicit taxes" are indirect costs or diminished pre-tax returns on tax-favored investments. For example, when two assets of equal risk yield identical pre-tax cash flows, the asset with more favorable tax treatment will typically command a higher price, thus lowering its pre-tax rate of return. Implicit taxes are particularly relevant in corporate activities where tax incentives, such as tax credits or accelerated depreciation, affect pre-tax rates of return and thus generate implicit taxes on investments.

Despite its foundational role in tax-accounting research, the S&W framework has predominantly been applied to explicit taxes. Scholes, Wolfson, Erickson, Maydew, & Shevlin (2009) argue that implicit taxes should be included to achieve a holistic understanding of the corporate tax burden, a perspective crucial for avoiding skewed conclusions about tax impacts on corporate decisions.

This study ventures into the relatively uncharted territory of the Brazilian market, leveraging the unique tax legislation landscape of federal, state, and municipal levels that introduces a complex array of implicit taxes. Importantly, this scenario encompasses both direct taxes, like corporate income taxes, and indirect taxes, such as VAT and excise taxes. We aim to enrich the existing body of tax-accounting research by examining the interplay between market concentration and implicit taxation among firms listed on the Brasil Bolsa Balcão (B3). Our investigation seeks to determine if firms operating within higher market concentrations, indicative of lower competition, incur reduced implicit taxes compared to their counterparts in more competitive sectors.

While the nexus between market concentration and taxation is acknowledged, its dynamics are influenced by various factors, including geographic and sector-specific contexts. Given Brazil's unique economic landscape and complex tax system, this study provides a focused analysis of how these dynamics manifest within this emerging market, addressing the significant gap in the literature concerning sector-specific variations.

Our methodology encompasses Ordinary Least Squares (OLS) and Quantile Regression (QR) analyses to elucidate these relationships. Preliminary OLS results suggest that firms with greater market concentration on the B3 exhibit lower implicit taxes, managing to convey these tax advantages to shareholders. QR analyses provide a more detailed perspective, showing that at certain quantiles, a higher market concentration is associated with reduced implicit taxes, whereas, at others, the benefits derived from tax incentives are counterbalanced by implicit taxes.

Our research advances theoretical and practical knowledge by applying the S&W framework to Brazil's emerging market. It examines the intricate interplay between market concentration and implicit taxes, highlighting essential implications for scholars and offering guidance for policymakers and corporate leaders. These insights stress the importance of crafting tax policies attuned to market conditions and aiding companies in effectively managing their tax strategies within Brazil's complex legal framework.

The paper is structured as follows: after this introduction, the second section delves into the theoretical framework and hypotheses. The third section outlines the sample selection and research design. Results and their implications are discussed in the fourth section, followed by a conclusion that encapsulates the study's contributions to both theory and practice.

2. Theoretical framework and hypotheses

Academic inquiries into the phenomena of implicit taxation have traditionally concentrated on individual investors and corporate entities. While extensive research exists on the former, the impact of implicit taxes on organizational behavior remains less explored. The literature often discusses the effects of legislative changes on implicit taxes or examines their

magnitude due to various inducements, revealing a gap in empirical studies on their influence on corporate strategy and market structure. This deficiency underscores the necessity for further research, such as the study by Erickson & Maydew (1998) on the implicit taxes of equity securities and Guenther's (1994) investigation on tax rates and pre-tax returns, to comprehend the nuanced implications of implicit taxes on corporate strategy.

Berger's (1993) seminal work conducted an event study on regulatory frameworks, examining the impact of specific US tax inducements that awarded tax credits to organizations actively engaged in Research and Development (R&D). This study highlighted three significant outcomes: the amplification of R&D investment by corporations, considerable effects in the domain of implicit taxes, and the partial retention of these benefits by firms, with a portion distributed to shareholders. This aligns with Hemphill's (2009) examination of the R&E tax credit's effectiveness, revealing its limited impact on boosting annual industry-applied research investment in the US.

Guenther's (1994) study assessed the implications of two landmark US tax legislations—the Economic Recovery Tax Act of 1981 and the Tax Reform Act of 1986—on the theoretical foundations of implicit taxation. The empirical data highlighted a significant reduction in yields concurrent with tax rate reductions, affirming the presence of implicit taxes. This observation resonates with Cordes (1989) review, which emphasized the modest yet significant impact of the R&D tax credit on stimulating company-funded R&D spending.

In a nuanced examination, Callihan & White (1999) explored the interplay between implicit taxes, pre-tax rates of return, and organizational market structure. Their findings illuminated that surges in implicit taxes were correlated with decrements in both pre-tax rates of return and market structure attributes. However, these relationships were modulated by each firm's unique market structure characteristics, echoing broader discussions on the complexity of tax policy's impact on corporate strategy and innovation dynamics.

Post the 1986 Tax Reform Act, which substantially excised tax inducements for defense sector firms, Salbador & Vendrzyk (2006) evaluated how implicit taxes interacted with the market power wielded by these corporations. Their research suggested that enhanced market power led to diminished implicit tax burdens. However, this advantage was only partially retained by the firms, indicating the efficacy of the Act in achieving its objectives.

In a comprehensive analysis, Jennings, Weaver, & Mayew (2012) assessed the longitudinal effects of the 1986 Tax Reform Act on corporate implicit taxes. Their empirical findings indicated that the Act provoked a durable and transformative alteration in the structure of implicit taxes, aligning with the findings of Gordon & MacKie-Mason (1990), who examined the broader financial implications of the Act on firms' decisions, highlighting changes in debt/value ratios and shifts among organizational forms.

In an international context, the applicability of implicit tax theory within the Chinese market was substantiated by Zhang (2016), who elucidated the impact of government intervention on state-owned enterprises and delineated how a 2008 tax reform in China affected the competition milieu. Meanwhile, Smith (2017) employed an expansive data set of US corporations to elucidate the correlation between market competition nuances and implicit tax formation, with findings indicating that monopolistic and oligopolistic market conditions were associated with reduced implicit taxes.

Recent advancements in implicit taxation research have shed further light on the relationship between market competition and implicit taxes. Smith (2021) conducted a comprehensive analysis using an expansive data set of US corporations to explore the correlation between market competition nuances and implicit tax formation. The findings of Smith (2021) indicated that monopolistic and oligopolistic market conditions were associated with reduced implicit taxes, suggesting that firms in less competitive industries

possess greater price-setting power. Incorporating these recent findings into our study, we contribute to the existing literature by examining the interplay between market concentration and implicit taxation in the Brazilian context. This allows us to further elucidate the implications of market dominance, taxation policies, and corporate strategies, providing a comprehensive understanding of the intricate dynamics at play.

Chyz, Luna, & Smith (2021) extended this research trajectory by contrasting US multinationals' and domestic firms' implicit tax burdens, deducing that domestic entities bore significantly higher implicit taxes. This comparison underscores the complexity of tax burdens and the influence of global operations on corporate tax strategies. In a related vein, the study by Markle, Mills, & Williams (2020) delves into the interaction between implicit taxes and income shifting at a global scale, providing a critical lens through which to view the impact of market concentration on tax burdens. They analytically model and empirically test the balance between country-level tax rates and firm-level pre-tax returns, finding that implicit taxes play a substantial role in closed economies, whereas in multinational firms, the effects of income shifting predominate. Their findings suggest that analyses of income shifting might understate specific measures when ignoring the influence of implicit taxes, especially in open economies.

Building upon these discussions, Mason (1939) provided early insights into monopoly and oligopoly behavior, suggesting that firms in less competitive industries possess greater price-setting power and can retain more tax savings. This observation is pivotal for understanding how market forces in competitive industries compel companies to pass along any savings to customers. Our research aims to further explore these dynamics by examining the determinants of cross-sectional variation in implicit taxes, responding to the call for more research in this area by Shackelford & Shevlin (2001) and Hanlon & Heitzman (2010).

Drawing on foundational research on the relationship between market structure and tax burdens, this study investigates the implicit tax implications for firms listed on the Brasil Bolsa Balcão (B3) operating within concentrated market environments. Specifically, we propose two hypotheses:

H1. Firms listed on the B3 operating in industries with higher market concentration experience lower implicit tax burdens compared to firms in less concentrated industries.

H2. Firms listed on the B3 operating in industries with higher market concentration are better able to retain benefits from tax inducements due to lower implicit tax incidences.

These hypotheses are grounded in the work of Smith (2017, 2021), who found a significant relationship between market concentration and a firm's ability to manage its implicit tax rate. This study extends Smith's findings by examining this phenomenon within the context of the B3 and the specific tax incentives present in the Brazilian market.

Furthermore, while most studies employ Ordinary Least Squares (OLS) regression models, the methodology has limitations in capturing relationships outside the conditional mean of the dependent variable. In contrast, Quantile Regression (QR), as Delgado, Fernández-Rodríguez, & Martínez-Arias (2014) underscored, offers an expanded analytical purview by describing relationships across specified quantiles in the conditional distribution of the dependent variable. This methodological approach is pivotal for understanding the diverse impacts of market concentration on Effective Tax Rates (ETR) across the distribution spectrum, offering insights into the nuanced relationship between tax policy, market structure, and corporate financial strategies (Armstrong, Blouin, & Larcker, 2012).

In consonance with Armstrong et al.'s insights, forthcoming analyses will be fortified by utilizing Quantile Regression, allowing for a more nuanced understanding of the relationship between market concentration and Effective Tax Rates (ETR) across the distribution spectrum. This approach aligns with the comprehensive analysis provided by Smith (2017, 2021), which delineates the varying impacts of market competition on implicit tax burdens, thus offering a robust framework for examining the hypotheses concerning firms listed on the B3.

3. Sample selection and research design

The sample selection utilized data from the financial statements of Brazilian companies listed on the Brasil Bolsa Balcão [B][3], spanning from 2011 to 2021. The year 2011 opens this period due to Brazilian companies' complete adoption of the International Financial Reporting Standards (IFRS).

For our sample selection, the COMDINHEIRO platform was strategically chosen due to its comprehensive coverage and specialized focus on the Brazilian market, which offered an unparalleled depth of local corporate financial data essential for our analysis. Recognizing the importance of data integrity, we implemented a meticulous validation process: financial data for each company sourced from COMDINHEIRO was systematically cross-referenced with official disclosures and financial reports made available by the Brasil Bolsa Balcão (B3), ensuring accuracy and reliability. By excluding financial institutions and companies with pre-tax losses, negative equity, negative net income, or insufficient data for variable formation, we further refined our sample to include only those entities with robust and relevant financial information.

Therefore, the decision to employ COMDINHEIRO was based not only on its specific utility for Brazilian market data but also on a rigorous cross-verification process that underpins the validity of our research data. This approach allowed us to construct a data set that is both comprehensive and precise, providing a solid foundation for our investigation into the dynamics of market concentration and implicit taxes within Brazil. Due to a considerable number of observations with missing data and to avoid a sample with limited data, the research was conducted using short and unbalanced panel data, meaning that not all data was available for every company every year. Table 1 illustrates the formation and composition of the observations.

3.1 Research design

Research that seeks to gain evidence of the presence of implicit taxes analyzes the relationship between the explicit tax rate and firms' pre-tax rate of return. On the other hand, research that seeks to learn about what happens to the benefits obtained from using tax incentives analyzes the relationship between the explicit tax rate and the after-tax rate of

Table 1. Observations formation process and composition

Total initial comments	3,675
Exclusion of remarks with pre-tax losses	(756)
Exclusion of observations with negative equity	(64)
Exclusion of observations with negative net income	(44)
Exclusion of observations with missing data	1,305
Total final remarks	1,506

Sources: COMDINHEIRO Platform; table prepared by the authors

return of firms. Thus, adapting the models defined by Smith (2017), the multiple linear regression econometric models to be used will be as follows:

$$ETR_{i,t} = \beta_0 + \beta_1 PTROE_{i,t} + \beta_2 CR4_{i,t} + \beta_3 PTROE_{i,t} x\, CR4_{i,t} + \sum \beta_k CONTROL_{i,t} + \varepsilon \quad (1)$$

$$ETR_{i,t} = \beta_0 + \beta_1 ROE_{i,t} + \beta_2 CR4_{i,t} + \beta_3 ROE_{i,t} x\, CR4_{i,t} + \sum \beta_k CONTROL_{i,t} + \varepsilon \quad (2)$$

In the models employed, the dependent variable traditionally used to measure the Effective Tax Rate (ETR) has been supplanted by the Effective Tax Rate on Profit (GAAPETR). This metric, as established by Hanlon & Heitzman (2010), calculates the Total Expense with Taxes on Profit divided by Profit Before Taxes and is widely recognized for assessing a company's level of tax aggressiveness. A lower GAAPETR rate suggests that the company has been more effective in reducing its explicit tax burden compared to those with a higher rate. While companies making a loss have been excluded from the sample, it is important to clarify that companies with deferred tax liabilities from previous periods of loss, which may be offset in the current period, are not explicitly addressed in our study.

In Model 1, the pre-tax rate of return (PTROE) is calculated by dividing pre-tax accounting profit by equity. Researchers use the PTROE variable to examine its relationship with the explicit tax rate (ETR). The relationship between these variables reveals the implicit tax burden faced by businesses or individuals:

- *Negative relationship:* If ETR and PTROE have a negative relationship, it means when ETR decreases (lower taxes), PTROE increases. This indicates that lower taxes lead to higher profitability, suggesting a lower implicit tax burden.
- *Positive relationship:* Conversely, if ETR and PTROE have a positive relationship, it means that when ETR decreases, PTROE also decreases. In this case, lower taxes result in lower profitability, suggesting a higher implicit tax burden.

In Model 2, the rate of return after taxes (ROE) is calculated by dividing net income by equity. Researchers use the ROE variable to examine its relationship with ETR. This relationship provides insights into whether the benefits of tax incentives are retained by firms (and distributed to shareholders):

- *Negative relationship:* If ETR and ROE have a negative relationship, ROE increases when ETR decreases. In this case, lower taxes lead to higher profitability after taxes, suggesting benefits from tax incentives are retained by firms (and distributed to shareholders).
- *Positive relationship:* Conversely, if ETR and ROE have a positive relationship, it means that when ETR decreases, ROE also decreases. In this case, lower taxes lead to lower profitability after taxes, suggesting benefits from tax incentives are not retained by firms.

In summary, examining the relationship between ETR and PTROE or ROE helps us understand the implicit tax burden and whether benefits from tax incentives are retained by firms (and distributed to shareholders).

The variable CR4 is a dummy variable representing the market concentration index, which measures the extent to which a few dominant players control an industry. A higher market concentration ratio (CR4) suggests that a few major players have a significant market share, making the market more imperfect and closer to a monopoly-like situation. Conversely, a lower market concentration ratio indicates a more competitive industry, with more firms having relatively equal market shares.

In essence, the CR4 variable helps gauge the level of competition within an industry by assessing the degree of market power held by the top firms. A high CR4 implies less competition and greater market power for the dominant firms, while a low CR4 suggests a more competitive environment with increased market participation from various firms.

Following the procedures outlined in Smith (2017), the market concentration index (CR4) was calculated by summing the four largest total revenues for each sector each year and dividing the result by the total sales of the respective sector. Subsequently, the average annual CR4 for each sector was computed.

Sectors with a CR4 greater than or equal to the average annual CR4 were classified as having high market concentration (less competition), while sectors with a CR4 lower than the average annual CR4 were considered to have low market concentration (more competition). Consequently, the dummy variable CR4 is assigned a value of 1 for firms in sectors with higher market concentration and a value of 0 for firms in sectors with lower market concentration. The sectors considered in this study are those proposed by Brasil Bolsa Balcão [B][3], as provided in the COMDINHEIRO platform database. Table 2 below shows these sectors and the annual CR4 for each industry.

The interaction variables between PTROE and CR4 and ROE and CR4 will be the variables of interest in this study. A negative relationship between the dependent variable ETR and the interaction between PTROE and CR4 (PTROE x CR4) suggests that firms with high market concentration have lower implicit taxes than firms with low market concentration. On the other hand, a positive relationship between the dependent variable ETR and the interaction between PTROE and CR4 (PTROE x CR4) suggests that firms with higher market concentration have higher implicit taxes than firms with low market concentration.

Table 2. Annual CR4 of each sector

Sector/Year	2011	2012	2013	2014	2015	2016
Industrial goods	0.37660	0.38047	0.37557	0.39834	0.44438	0.44801
Cyclic consumption	0.38244	0.36264	0.34823	0.36318	0.34062	0.35713
Non-cyclical consumption	0.90046	0.90104	0.83958	0.84590	0.86548	0.77570
Basic materials	0.74131	0.72657	0.72992	0.72054	0.70565	0.71108
Oil and gas	0.99681	0.99584	0.99489	0.99437	0.99506	0.99578
Health	0.62354	0.61725	0.60181	0.60545	0.59103	0.62255
Information technology	1.00000	0.99536	0.99452	0.98149	0.97237	0.98441
Public utility	0.34246	0.36479	0.31835	0.30197	0.29298	0.34781
CR4 Medium	0.67045	0.66800	0.65036	0.65141	0.65095	0.65531
Sector/Year	2017	2018	2019	2020	2021	
Industrial goods	0.41538	0.39660	0.36108	0.39682	0.37731	
Cyclic consumption	0.37465	0.36910	0.33427	0.37780	0.37779	
Non-cyclical consumption	0.76749	0.75293	0.66241	0.65207	0.64702	
Basic materials	0.70837	0.70950	0.63720	0.65317	0.65797	
Oil and gas	0.99503	0.99396	0.99030	0.98768	0.98440	
Health	0.59241	0.59734	0.60951	0.55495	0.56676	
Information technology	0.98054	0.87078	0.79847	0.71932	0.70643	
Public utility	0.31216	0.28008	0.27471	0.26726	0.26850	
CR4 Medium	0.64325	0.62129	0.58349	0.57613	0.57327	

Source: Prepared by the authors

A negative relationship between the dependent variable ETR and the interaction between ROE and CR4 (ROExCR4) suggests that firms with high market concentration can retain the benefits of using tax incentives. On the other hand, a positive relationship between the dependent variable ETR and the interaction between ROE and CR4 (ROExCR4) suggests that firms with higher market concentration cannot retain the benefits obtained from using tax incentives.

This paper will use the following control variables: SIZE, LEV, IMOB, and INT. First, the variable SIZE (size of firms) is calculated as the natural logarithm of total assets. Second, the variable LEV (leverage) is calculated by dividing long-term debt by total assets. Third, the variable IMOB (companies' fixed assets ratio) is calculated by dividing total fixed assets by total assets. Finally, the variable INT (intangibles companies' rate) is calculated by dividing total intangible assets by total assets. The summary and form of calculation of all variables used in the developed models are summarized in Table 3 below.

4. Analyses of results and discussion

After collecting the data in the COMDINHEIRO platform, they were treated in Excel to generate the variables and the respective short and unbalanced panels. Soon after, the statistical tests were started in Software R, version 4.2.2.

4.1 Descriptive statistics

Table 4 below presents the descriptive statistics for GAAPETR, PTROE, and ROE variables.

Analyzing the results of the descriptive statistics, we observed that in the taxes levied on profit (GAAPETR), the average explicit tax rate of firms with high market concentration (low competition) is lower than the average explicit tax rate of firms with low market concentration (high competition). We also observed that in the first quartile and at the median, the average explicit tax rates of firms with high market concentration (low competition) are lower than the

Table 3. Calculations and meanings of model variables

Variables	Significance	Determination
GAAPETR	Dependent variable that determines the effective tax rate on profit	Total tax expense on profit / profit before taxes
PTROE	Independent variable that determines the pre-tax rate of return	Profit before taxes/shareholders' equity
ROE	Independent variable that determines the rate of return after taxes	Net income/shareholders' equity
PTROExCR4	Interaction variable	PTROE multiplied by CR4
ROExCR4	Interaction variable	ROE multiplied by CR4
SIZE	Control variable that determines the size of the company	Natural logarithm of total assets
LEV	Control variable that determines the leverage of the company	Long-term debt/total assets
IMOB	Control variable that determines the detention rate of the company	Fixed assets/total assets
INT	Control variable that determines the rate of intangibles in the company	Intangible assets/total assets
CR4	*Dummy* variable	Assumes 1 for firms with high market concentration and zero for firms with low market concentration

Source: Prepared by the authors

Table 4. GAAPETR Descriptive statistics

Items	High concentration Comments = 367			Low concentration Observations = 1,139		
	GAAPETR	PTROE	ROE	GAAPETR	PTROE	ROE
Average	0.26396	0.29713	0.24896	0.27460	0.20723	0.16028
1st Quartile	0.11642	0.07462	0.05836	0.15688	0.09525	0.07705
Median	0.23078	0.14462	0.11620	0.25133	0.17224	0.13663
3rd Quartile	0.32892	0.29051	0.22433	0.32340	0.26622	0.20538
Standard deviation	0.21755	0.61185	0.57403	0.24184	0.17117	0.13040

Sources: Software R, version 4.2.2; table prepared by the authors

average explicit tax rates of firms with low market concentration (high competition), which suggests that at these points in the distribution firms with high market concentration (low competition) are using tax incentives more intensively than firms with low market concentration (high competition). In the third quartile, explicit tax rates are equal across firms of both concentrations. This suggests that firms of both concentration groups use tax incentives with the same intensity at these distribution points.

Implicit taxes are conceptualized as lower pre-tax rates of return on investments in tax-favored assets (Scholes et al., 2009). In the descriptive statistics of GAAPETR, it is observed that at the mean and third quartile, the pre-tax rates of return (PTROE) of firms with high market concentration (low competition) are higher than the pre-tax rates of return (PTROE) of firms with low market concentration (high competition). These results suggest that at these points of the distribution, firms with high market concentration (low competition) bear lower implicit taxes than firms with low market concentration (high competition). On the other hand, we note that in the first quartile and the median, the pre-tax rates of return (PTROE) of firms with high market concentration (low competition) are lower than the pre-tax rates of return (PTROE) of firms with low market concentration (high competition). These results suggest that at these points in the distribution, firms with high market concentration (low competition) bear higher implicit taxes than firms with low market concentration (high competition).

In the case of after-tax returns (ROE), the literature on implicit taxes informs us that the ROE analysis aims to verify whether companies can retain the benefits obtained through tax incentives. Thus, an analysis of ROE within the scope of descriptive statistics is inappropriate.

This study employs two estimation methods, Ordinary Least Squares (OLS) and Quantile Regression (QR), to provide a more comprehensive and robust analysis. The joint use of these approaches is especially relevant in the Brazilian context, where variability and heterogeneity across sectors are significant. In this way, we aim to identify average relationships and understand specific variations that may be critical for policy formulation and corporate strategies.

4.2 Multivariate ordinary least squares analysis
Before the beginning of the tests, all data were *winsorized* in the 1st and 99th percentiles due to the existence of outliers. In the correlations, values were not tabulated for brevity, and the results showed a low correlation between the independent variables, which suggests the absence of multicollinearity. *Variance Inflation Factor* (VIF) tests were also performed to

verify collinearity. Favero, Belfiore, Takamatsu, & Suzart (2014) clarified that a VIF of less than five suggests the lack of multicollinearity between the independent variables.

The results showed that the VIF statistics of the independent variables are much smaller than five, indicating no multicollinearity issues. The Breusch-Pagan Lagrange multiplier test yielded a Chi-squared value of 1.1639 with a p-value of 0.2807, suggesting no significant heteroscedasticity. Wooldridge's test for unobserved individual effects presented a z-value of 0.85033 and a p-value of 0.3951, indicating that unobserved individual effects are not statistically significant. The F test for individual effects revealed an F-statistic of 1.3607 with a significant p-value of 0.001347, strongly suggesting individual effects. Finally, the Hausman test resulted in a Chi-squared value of 8.0431 with a p-value of 0.3288, recommending the fixed effects model due to the non-rejection of its hypothesis. Together, these results indicated that the best model to be considered would be the fixed effects model. Table 5 displays the results obtained by running MQO.

Table 5 also presents the results of the Ordinary Least Squares (OLS) relative to the tests performed. The following analysis refers to the variable of interest - interaction between pre-tax rate of return (PTROE) and market concentration (CR4)—which assumes a value equal to 1 for companies with high market concentration (low competition) and zero for companies with low market concentration (high competition).

The results show that, on average, there is a negative and statistically significant relationship at the 10% level (p-value = 7.72%) between the explicit tax rate (GAAPETR) and the interaction (PTROE x CR4). This result suggests that, on average, firms with high market concentration have lower implicit taxes than firms with low market concentration, corroborating our first prediction.

A negative relationship between the effective tax rate and the pre-tax rate of return indicates that as the tax rate on profit is reduced, the pre-tax rate increases. From the result presented, for firms with high market concentration, the average one-unit reduction in GAAPETR causes an average 0.12322 unit increase in the pre-tax rate of return.

Table 6 presents the Ordinary Least Squares (OLS) results for the tests performed concerning the interaction between the after-tax rate of return (ROE) and market concentration (CR4), which takes a value equal to 1 for firms with high market concentration (low competition) and zero for firms with low market concentration (high competition).

The results show that, on average, there is a negative and statistically significant relationship at the 5% level (p-value = 3.40%) between the explicit tax rate (GAAPETR) and the interaction (ROE x CR4). This result suggests that, on average, firms with high market concentration can retain the benefits obtained from using tax incentives, corroborating our second prediction.

Table 5. Multivariate MQO analysis

Variables	Coefficient	t-value	p-value
PTROE	−0.10152	−2.6870	0.00730
PTROExCR4	−0.12322	−1.7680	0.07729
CR4	0.03011	1.2881	0.19792
SIZE	−0.00613	−1.2218	0.22199
LEV	0.24369	5.0654	4.663e-07
IMOB	0.05555	1.5118	0.13083
INT	0.10236	2.5926	0.00963

Sources: Software R, version 4.2.2; table prepared by the authors

Table 6. Multivariate MQO analysis

Variables	Coefficient	*t*-value	*p*-value
ROE	−0.12388	−2.8441	0.00452
ROExCR4	−0.19040	−2.1221	0.03401
CR4	0.03756	1.6010	0.10962
SIZE	−0.00631	−1.2595	0.20807
LEV	0.24887	5.1877	2.468e-07
IMOB	0.05663	1.5497	0.12146
INT	0.09831	2.4927	0.01280

Sources: Software R, version 4.2.2; table prepared by the authors

A negative relationship between the effective tax rate and the after-tax rate of return indicates that as the tax rate on profit is reduced, the after-tax rate of return increases. From the results presented, it follows that for firms with high market concentration, an average one-unit reduction in GAAPETR causes an average 0.19040 unit increase in the after-tax rate of return. Since this result suggests that these firms can retain the benefits obtained from using tax incentives, these benefits can thus be transferred to the shareholders of these firms.

In summary, the analyses in Tables 5 and 6 reveal significant economic implications. Firms with high market concentration enjoy both reduced explicit tax rates and increased pre-tax profitability, thereby raising questions about the fairness of the current tax system and market efficiency. Moreover, these firms are particularly effective at retaining the benefits of tax incentives, which they can channel directly to shareholders, thus solidifying their strong positions in the market. These findings are consistent with existing literature and suggest that market concentration can offer firms advantages in both taxation and profitability. These outcomes may prompt policymakers to reevaluate the fairness and efficacy of current tax incentives, as they seem to benefit already dominant firms, potentially exacerbating market imbalances disproportionately.

4.3 Multivariate quantile regression analysis

Because MQO only describes the relationship between the independent variables and the conditional mean of the dependent variable, any connection between the independent variables and the dependent variable is measured through a change in a central location. Thus, MQO would not capture any existing relationship between the independent and dependent variables if that relationship is located elsewhere in the sample.

Therefore, tests were also performed using Quantile Regression (QR) to examine other points of the distribution, what happens with the implicit taxes, and to find out the destination of the benefits obtained using the tax incentives at these different points of the distribution.

Table 7 presents the results of the quantile regression relative to the tests performed concerning the interaction between pre-tax rate of return (PTROE) and market concentration (CR4), which assumes a value equal to 1 for companies with high market concentration (low competition) and zero for companies with low market concentration (high competition).

The displayed table shows that for taxes on profit (GAAPETR), the quantiles 0.10, 0.30, 0.40, 0.50, and 0.90 showed no results with statistical significance, suggesting that at these points in the distribution, the implicit taxes are not statistically different across the market concentration groups under study. However, for the remaining quantiles, the results show a

Table 7. Results of PTROExCR4 interactions

Quantil	Intercept	Coefficient	*t*-value	*p*-value
0.20	0.09587	−0.01395	−1.72261	0.08517
0.60	0.35483	−0.01489	−1.84978	0.06454
0.70	0.38791	−0.01683	−2.14925	0.03177
0.80	0.41946	−0.01709	−1.87161	0.06145

Sources: Software R, version 4.2.2; table prepared by the authors

negative and significant relationship between the explicit tax rate and the interactions at the 5% level for the 0.70 quantiles and the 10% level for the 0.20, 0.60, 0.70, and 0.80 quantiles. These results suggest that at these points in the distribution, firms with high market concentration have lower implicit taxes than firms with low market concentration, corroborating our first prediction.

A negative relationship between the effective tax rate and the pre-tax rate of return indicates that as the tax rate on profit is reduced, the pre-tax rate of return increases. From the results presented, we have that for firms with high market concentration, a one-unit reduction in GAAPETR causes an increase in the pre-tax rate of return of (i) 0.01395 unit in the 0.20 quantile, (ii) 0.01489 unit in the 0.60 quantiles, (iii) 0.01683 unit in the 0.70 quantiles, and (iv) 0.01709 unit in the 0.80 quantiles.

Table 8 presents the quantile regression results related to the tests performed concerning the interaction between the rate of return after taxes (ROE) and the market concentration (CR4), which assumes a value equal to 1 for companies with high market concentration and zero for companies with low market concentration. Therefore, only the results of the quantiles in which the interactions were statistically significant are presented.

The table displayed shows that for taxes on profit (GAAPETR), the quantiles 0.10, 0.40, 0.80, and 0.90 showed no results with statistical significance, suggesting that at these points in the distribution, the implicit taxes are eliminating any benefit obtained from the use of tax incentives. However, at quantiles 0.20, 0.30, 0.50 (median), 0.60, and 0.70, the results show a negative and significant relationship between the explicit tax rate and the interactions at the 1% level for quantiles 0.20 and 0.60, and the 10% level for quantiles 0.30, 0.50, and 0.70. These results suggest that at these points in the distribution, the benefits obtained from using tax incentives by firms with high market concentration are retained by these firms (transferred to their shareholders), corroborating our second prediction.

A negative relationship between the effective tax rate and the after-tax rate of return indicates that as the tax rate on profit is reduced, the after-tax rate of return increases. From

Table 8. Results of ROExCR4 interactions

Quantil	Intercept	Coefficient	*t*-value	*p*-value
0.20	0.10376	−0.02581	−2.74636	0.00610
0.30	0.15674	−0.02277	−1.84295	0.06553
0.50	0.32472	−0.02035	−1.92130	0.05488
0.60	0.35365	−0.02357	−2.60716	0.00922
0.70	0.38760	−0.01516	−1.73974	0.08211

Sources: Software R, version 4.2.2; table prepared by the authors

the results presented, it can be seen that for firms with high market concentration, reducing GAAPETR by one unit causes an increase in the after-tax rate of return of (i) 0.02581 unit in the 0.20 quantile, (ii) 0.02277 unit in the 0.30 quantile, (iii) 0.02035 unit in the 0.50 quantile, (iv) 0.02357 unit in the 0.60 quantiles, and (v) 0.01516 unit in the 0.70 quantiles.

The multivariate analysis results suggest that firms with high market concentration (low competition) bear a lower implicit tax burden than firms with high market concentration (high competition), even though they use tax incentives more intensively than their peers. The results also suggest that firms with high market concentration (low competition) can retain (pass on to shareholders) the tax benefits obtained by reducing their explicit tax rates, i. e. the implicit taxes do not eliminate the benefits received using tax incentives.

The results corroborate the hypotheses proposed in this study. Moreover, they align with what was found by Smith (2017), who received evidence that implicit taxes are lower when markets are less competitive, that is, when more monopolistic or oligopolistic powers are present. As a result, few firms control the market, implicit taxes are lower, and firms can retain the benefits arising from tax incentives.

5. Conclusions and implications

This paper enriches the existing body of literature by delving into the intricate dynamics of implicit taxes, market concentration, and corporate power within the unique fiscal landscape of Brazil, an emerging market. By harnessing empirical data, our study unveils that firms in more concentrated markets experience reduced implicit tax burdens while maximizing the utilization of tax incentives. This revelation is pivotal for policymakers and industry stakeholders, highlighting the structural fiscal imbalances that may inadvertently bolster corporate dominance and dampen competitive vitality.

At the core of this research is an analysis of implicit taxation, a concept where preferential tax treatments are theoretically offset by reduced pre-tax returns, an equilibrium predicated on the ideal of perfect market competition—an ideal seldom met in practice. Implicit taxation assumes that the benefits derived from lower explicit taxes are negated by a corresponding decrease in pre-tax rates of return, effectively nullifying any perceived financial advantage. This study challenges this conventional wisdom by investigating the real-world effects of market concentration on the burden of implicit taxes, thereby addressing the gap between theoretical expectations and the complexities of economic reality.

This research extends the discourse on the interaction between market concentration and implicit taxation, building upon and broadening the scope of findings presented by Smith (2021). Smith's investigation into the complex interplay of market structures and fiscal policies serves as a foundation for our examination of similar dynamics within Brazil's distinct economic milieu. By synthesizing the insights from Smith's study with our empirical data, we highlight the universally significant influence of market concentration on tax strategies and economic behavior, emphasizing Brazil's particular case as an illustrative example. This enriched perspective encourages a comprehensive analysis transcending geographical boundaries, advocating for a more sophisticated understanding of tax systems and market behaviors. It invites ongoing research to unravel the varied effects of market concentration on fiscal frameworks in different regulatory environments, underlining the critical role of context-specific strategies for policy formulation and corporate governance.

The empirical findings substantiate that firms in highly concentrated markets (signifying lower competition) utilize tax incentives more robustly and endure a comparatively diminished implicit tax burden. Furthermore, the data reveal that such firms are more adept at transferring the benefits of tax incentives to their shareholders. Intriguingly, this capability is rendered possible by the market power these firms wield, allowing them to externalize the

burden of implicit taxes onto consumers and suppliers through product pricing mechanisms and input acquisition strategies. These insights underscore significant theoretical and practical implications, urging a reconsideration of tax incentive policies to prevent reinforcing market concentration and compromising competition.

From a policy perspective, this research signals the urgency for a nuanced evaluation of tax incentives' distributive impacts, particularly in emerging economies like Brazil. The study suggests that the current fiscal framework might inadvertently perpetuate market dominance, highlighting the necessity for policy reforms that foster a more equitable and competitive market structure.

The practical implications of this study are twofold: firstly, it offers policymakers evidence-based recommendations to refine tax incentives in a way that fosters equitable market competition. Secondly, it provides strategic insights for businesses on leveraging tax incentives without exacerbating market concentration, thereby suggesting a balanced approach to corporate tax strategy.

Acknowledging the limitations of our study, notably its restricted sample size and the potential impact of data exclusions on the robustness of our findings. To build on this foundational work, future research could broaden the scope to include a wider array of industries, examining the effects of market concentration levels on implicit tax burdens more comprehensively. It is also imperative to investigate the influence of tax incentives and disincentives on corporate strategies, including investment decisions, pricing models, and strategies for market engagement and withdrawal. An exploration of the longitudinal impact of tax policy changes on market concentration and corporate power across different emerging economies would be invaluable. Moreover, comparative analyses between emerging and developed markets are essential to enhance our understanding of implicit tax theory's relevance across varied economic contexts.

By spotlighting the relationship between implicit taxes, market concentration, and corporate power in Brazil, this paper makes a novel theoretical contribution to the global discourse on implicit tax theory and its application in emerging markets. It calls for policymakers and business leaders to heed these findings in designing and implementing tax policies that not only foster healthy market competition but also guard against the entrenchment of corporate power. This investigation serves as a clarion call for a critical reassessment of fiscal frameworks to ensure they support the principles of fair competition and economic vitality, particularly in the evolving landscapes of emerging markets.

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