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Article

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Do state-controlled banks pay more or less taxes? Evidence for Brazil

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Abstract

Research Question: Do Brazilian publicly-controlled banks pay less taxes than privately-controlled banks?

***Motivation*:** Common sense in society might assume that there is a principal-agent conflict whereby publicly-controlled banks would pay less taxes than privately-controlled banks. At the same time, some of the people who work in these public banks might assume that there are more aggressive tax strategies being used by private banks that are not used by public banks.

Idea: To assess whether Brazilian state-owned banks are less likely to engage in aggressive tax planning compared to their privately-controlled peers.

Data: Observations were extracted from the financial statements of banks listed on the Brazilian stock exchange for the period 2012 to 2021 (balanced panel data).

Tools: We performed multivariate regressions to identify whether the presence of state control explains the variation in effective tax rates. Three different effective tax rate formulas were used as proxies for tax aggressiveness, two of them based on revenue, the first consisting only of current income taxes and the second consisting of current and deferred income taxes, and a third proxy analyzing taxation on gross revenue. The estimations also included several control variables related to the banking sector.

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1. Introduction

This work examines the differences in tax planning or avoidance between state-owned and non-state-owned publicly traded banks. Evidence suggests that state-owned firms generally pay more taxes than purely privately owned ones (Hilling *et al.*, 2021; Bradshaw *et al.*, 2019). In essence, according to Wang (2016), tax avoidance is motivated by two main motivations, which are financial interest and social responsibility. The former is the set of actions that lead to withholding resources from the government and retaining the resources within the firm, the latter is relative to all actions involving corporate social responsibility. Since public and private firms have different internal and external motivations, it is key to understanding how this difference is related to tax avoidance behavior.

Prior research documents the dichotomy of firm managers' behavior on tax avoidance, being whether firm managers would pursue reduced taxes to benefit shareholders or pursue their interests (Wang, 2016; Crocker & Slemrod, 2005; Chen & Chu, 2005). In general, intuition says that public-owned firms are more inclined towards corporate social responsibility than private-owned, therefore their tax avoidance level would be smaller, thus managers would have two different sets of incentives for operating tax planning, and this difference can range from 1.4% up to 10% (Hilling *et al.*, 2021; Bradshaw *et al.*, 2019). Therefore, results may vary depending on managers' incentives to act more or less in the direction of shareholders' interests. We hypothesize that open capital banks are no exception.

Considering that institutional uncertainty tends to be higher in poor and emerging economies, understanding tax avoidance in this set of countries is relevant. Evidence shows that corporate tax avoidance is negatively associated with corporate social responsibility performance in emerging markets and also that firms with better corporate social responsibility performance have healthier financial performance and lower costs of bank debt, while specifically in Brazil, evidence shows that tax avoidance has a negative influence in corporate transparency (Du & Li, 2024; de Castro Moraes *et al.*, 2021). Given this body of literature, we intend to investigate tax avoidance in the banking sector, by focusing on the difference between public- and private-owned companies.

To calculate tax avoidance metrics, data from financial statements of 16 banks listed on B3, Brazilian Stock Exchange (documentary research with intentional sampling), available in the Fundamentus'[i] portal database, for the period 2012 to 2021 was used complemented with information collected from the SFN Financial Statements Center

(Brazilian Central Bank Reporting System[ii]). The chosen period comprises the largest interval made available by the tool and covers all banks that had their shares traded on B3 during the ten years analyzed (Balanced Panel Data). The research hypothesis is that state control is an explanatory variable for the effective tax rate (ETR). To achieve the aim of the study, we analyze the information in the financial statements of the banks listed on B3 from 2012 to 2021. Using balanced panel data, we seek to verify whether state control is significantly related to the presence of higher effective tax rates in state-controlled institutions. In addition to using the ETR regarding taxes on profit (i.e., the ratio of total tax expense to pretax income) as a proxy for the tax aggressiveness of entities, a common point in work on the subject, the study seeks to innovate by also verifying the effective tax rate related to taxes on revenue.

Using a sample of Brazilian banks from 2012 to 2021, we use three different measures of tax avoidance, two of them on income, the first composed only of current income taxes and the second composed of current and deferred income taxes, and a third proxy analyzing taxation on the gross receipt. The model also comprised several control variables, all linked to the banking sector and extracted from the financial statements of the banks listed in B3. We find that state-controlled banks have higher effective tax rates on income than private financial institutions and that, on the other hand, it is not possible to reach a similar conclusion regarding taxation on gross receipts.

We structured the work into five sections. After this introduction, Section 2 presents the theoretical foundation, with the main studies that used effective tax rate indicators to determine the level of tax aggressiveness; Section 3 discusses the methodology, detailing the sample used, the econometric models, and the chosen variables; Section 4 demonstrates the results found, with the conclusion of the work placed in Section 5.

2. Literature review

The first studies on ETR date back to the 1980s and 1990s, with investigations aimed at exploring the presence of a causal link between the effective taxation of North American companies and some specific characteristics of the companies. Pioneering work focused on size (Stickney & McGee, 1982; Zimmerman, 1983), capital intensity, international operations, use of natural resources, leverage, asset structure, and performance (Stickney & McGee, 1982; Gupta & Newberry, 1997).

Janssen and Buijink (2000) they conclude that Dutch companies in general use tax subsidies, but they do not identify significant differences among the characteristics evaluated. Mills *et al.* (1998) study the connection between the characteristics of firms and the amount spent on tax planning, showing, in the end, that investments in

tax planning and the payment of taxes are negatively related, which denotes the effectiveness of such planning. Manzon and Plesko (2001), by observing that the distance between accounting and tax revenue considered in financial reports has increased over time, demonstrate that the result presented in the statements has less and less explanatory power for the taxable result.

Desai and Dharmapala (2006) innovate by pointing out the relationship between corporate tax avoidance and the incentives offered to managers. In the study of Hanlon and Heitzman (2010), the authors confirm that tax avoidance policies are influenced by managers' behavior; as revealed in the article, based on agency theory, managers try to achieve maximum utility by projecting the company's financial performance. Increased monitoring and incentives in governance reduce "bad practices" and, therefore, reduce tax evasion. Chen *et al.* (2010) show in their study that publicly traded family companies use tax avoidance less than other companies, concluding that in such entities, administrators avoid taking advantage of tax benefits to keep away from possible damage to reputation resulting from tax assessments.

In the opposite direction, Cheng *et al.* (2012) demonstrate that firms subject to Hedge Fund intervention experience an increase in tax avoidance. Similarly, Badertscher *et al.* (2009), using as proxies BTD - book-tax differences, DTAX - discretionary permanent differences, CETR - cash effective tax rate, and MTR - marginal tax rates demonstrate that companies under the management of private equity investment funds have a more aggressive tax policy than other companies. Khan *et al.* (2017), in turn, assess whether the presence of institutional investors (such as mutual or pension funds, insurance companies, investment firms, or other large entities that manage funds on behalf of third parties) affects the indicators of tax avoidance of investments. For the undertaking, they use data from the Russell Index over a period of 19 years, between 1988 and 2006. The results of the study demonstrate that an increase in ownership concentration has a significantly positive relationship with tax avoidance metrics.

Bradshaw *et al.* (2019), using the ETR and CETR indicators as proxies, demonstrate that control of companies by the Chinese state leads to lower tax avoidance and greater payment of taxes to the government, to the detriment of the interests of minority shareholders; they also suggest that promotions of managers in those companies are positively associated with tax rates. Finally, the authors believe that the results presented on the Chinese market are relevant to any market where the government owns companies; they also believe that in countries such as Brazil, Italy, Indonesia, and Mexico, with a fragile legal environment, the results would be repeated.

Hilling *et al.* (2021) focus their study on tax avoidance on the conflict of interests present in Swedish mixed-capital companies – they assume, ab initio, that there is no interest on the part of the state controller in encouraging the reduction of the tax

burden, unlike other shareholders – and, to do so, they collect data from all state-owned companies established in that country with annual reports published between 2000 and 2019. Similar to the study by Bradshaw *et al.* (2019), Hilling *et al.* (2021) demonstrate that there is a lower propensity for tax avoidance in Chinese companies that have state ownership, and go further: by assessing the proportion of state ownership in companies, they are able to measure the relativity of this propensity, concluding that the level of tax avoidance is a decreasing function of state ownership, with a standard deviation of increase in state property taxes paid by a company increasing by around 14%.

Fernández-Rodríguez *et al.* (2019) analyze the effect of state control on the effective tax rate of Spanish companies. From a population of 3,169 companies in the period 2008 to 2014, they demonstrate the existence of significant differences in the tax burden. In contrast to the Chinese and Scandinavian studies, they demonstrate that the ETR of state-controlled companies is lower than that of private institutions. However, they conclude that the tax benefits offered by Spanish legislation to state-owned companies exceed the tax strategies of private capital companies.

Pratama (2017) seeks to examine the characteristics of Indonesian companies and their corporate governance indicators as variables that can explain aggressive tax avoidance practices. Ultimately, they indicate that the greater the number of advisors on the board of commissioners (a type of Board of Directors), the lower the entity's ETR will be, and, at this stage, they conclude that board members tend to engage in tunneling activities, expanding the wealth of majority shareholders. On the contrary, companies audited by one of the Big Four tend to present higher ETRs. Drake *et al.* (2020), in turn, contribute to the literature by demonstrating that the write-off of provisions for deferred tax assets (valuation allowances) causes a reduction in the ETR without the administrators' intention of increasing tax avoidance, suggesting that the adjustment must be made to use measures backed by the ETR.

The studies listed indicate that company control and managerial incentives influence the indicators used to measure the aggressiveness or conservatism of the firm's tax planning. In Brazil, research on the business aspects that influence ETR is still scarce. Sampaio (2017), in an article that was restricted to surveying national and international academic production on the determining characteristics of ETR, concludes that, at the national level, this topic is little explored. Cabello (2012) analyzes profit taxation practices in the ETR of Brazilian public companies from the perspective of the theory of accounting choices. Starting from the premise that individuals act in favor of their private interests, in search of maximizing their well-being, it finds, in the end, that the companies that adopt certain practices, such as accelerated depreciation, encouraged accelerated depreciation, interest on equity, corporate reorganization, and tax incentives, individually or jointly, present ETR, on average, lower than the others.

Mainly based on the study by Hanlon and Heitzman (2010), Santana (2014) investigates the association between tax avoidance and corporate social responsibility. Based on a sample of 171 Brazilian companies, between 2009 and 2013 and using the ETR and BTD proxies as parameters, the conclusion was that there is a significant difference between companies certified by the BM&FBOVESPA Corporate Sustainability Index (ISE) and those not certified as socially responsible companies, demonstrating that they make less use of tax avoidance procedures. Martinez and Motta (2020) conducted a comparative analysis of tax aggressiveness between mixed capital companies and privately controlled companies listed on B3 in the period from 2009 to 2013. Using as metrics the ETR, the BTD, and the tax burden disclosed in the Statement of Value Added (TTVA), they conclude that share control by the executive branch is a determinant of less tax aggressiveness in the Brazilian market.

Medeiros *et al.* (2020) reach the opposite result. The study made an association between tax avoidance, state control, and corporate social responsibility (CSR) performance in Brazilian companies listed on B3 from 2010 to 2017. To measure the level of tax avoidance, they use the ETR and CETR proxies. Based on a sample made up of 326 observations, from which they excluded some financial institutions, they found a positive and significant relationship between tax avoidance metrics and CSR performance. However, they found that companies in which the state is the largest shareholder do not perform differently in CSR than the others. França and Monte (2018), assuming the hypothesis that privately held Brazilian companies are likely to present more aggressive ETRs than publicly traded ones, conclude that privately held Brazilian companies have lower ETRs than public companies (approximately 45.53%).

However, the work of Rodrigues and Galdi (2020) presents a divergent result, indicating that closed companies have a higher ETR, even when controlled by audit, capital intensity, inventory, leverage, profitability, and size. It is worth noting that both surveys exclude data from financial intermediation companies and banks, as tax legislation provides different treatment for these companies compared to others. Vieira (2017) contributed to the literature by constructing a work whose proposal was to verify the existence of tax management in the banking market. To this end, the researcher compares the ETR with the 40% rate, foreseen for taxes on the profits of financial institutions in the period investigated. Using size, debt, credit operations, investment, intangible assets, profitability, current tax rate, and fixed assets as proxies, he concludes that only intangible assets revealed significance, with a positive coefficient, and that there is "a need to identify other variables that can explain the behavior of the effective tax rate in the banking market".

In addition to not having abundant publications on the topic, the authors who tackled it or focused on Brazil sometimes reached opposite results. Several studies chose to exclude financial institutions from their sample because of the specificities of the

corporate and tax legislation to which these entities are subject. Therefore, this work seeks to contribute to this scientific literature by providing empirical evidence on the tax planning of state-controlled banks.

3. Methodology

3.1 Data

To calculate tax avoidance metrics, data from financial statements of 16 banks[iii] listed on the Brazilian stock exchange (B3) (documentary research with intentional sampling), available in the Fundamentus portal database, for the period from 2012 to 2021 were used, and complemented with information collected in the SFN Financial Statements Center (BACEN Reporting System[iv]). The chosen period comprises the largest interval made available by the tool and covers all banks that had their shares traded on B3 during the ten years analyzed (Balanced Panel Data). The research hypothesis is that state control is an explanatory variable for the effective tax rate.

The effective tax rate (ETR) is an indicator widely used in the literature to assess the real tax burden of companies. The most common way to calculate the ETR is to divide the total tax expense by the profit before taxes (Stickney and McGee, 1982; Gupta and Newberry, 1997). This method considers both current and deferred taxes, allowing a comprehensive view of corporate taxation. Other studies use only current taxes in the numerator of the equation (Rego, 2003; Mills *et al.*, 1998), calculating the ETR in a manner that approximates the CETR, which uses income tax paid in cash.

Several studies explore indicators related to the effective tax rate (ETR) to assess tax avoidance and corporate tax planning. In addition to the traditional ETR, which measures the tax burden on pre-tax profit, researchers such as Badertscher *et al.* (2009) use the Cash Effective Tax Rate (CETR) to capture the real impact of taxes paid in cash. Another widely used metric is the accounting-tax difference (BTD), which highlights discrepancies between accounting and taxable profit and was used by Drake *et al.* (2020) as a proxy for aggressive tax planning strategies. Additionally, the Discretionary Permanent Differences (DTAX), investigated by Khan *et al.* (2017), allows identifying managerial adjustments that influence the tax burden, reflecting tax minimization practices. In the Brazilian context, studies such as Cabello (2012) and Martinez & Motta (2015) analyze these indicators to differentiate the tax behavior of private and state-owned companies, indicating that firms under state control tend to demonstrate less tax aggressiveness. These indicators are essential to understanding corporate tax avoidance strategies.

We evaluated the Effective Tax Rate based on three variables: we calculated ETR, ETRc, and ETRr. ETRc was computed by dividing current income tax by pretax income (Rego, 2002; Mills *et al.*, 1998). To calculate the ETR, the deferred income tax is added to the current taxes, and then the division is carried out by the pretax income. In this way, we seek to insert the impact of temporary differences into the model, in a similar way to Gomes (2012), with the identification of long-term tax management.

The variable ETRr is calculated by dividing taxes on revenue by the sum of the Gross Result from Financial Intermediation and Revenue from Services. In addition to taxes on profit, whose effective rate is demonstrated through the variables ETR and ETRc, financial institutions also pay taxes on their revenue. Revenue from financial intermediation and revenue from the provision of services is subject to taxes in Brazil. When these are combined, the rates reach approximately 9.65%.

To complement the model, we defined the following independent and control variables: a) ROA (return on assets) – Net Profit divided by Total Assets; b) ROE (Return on Equity) – Net Profit divided by the value of its total shareholders' equity; c) IEO (Operational Efficiency Index) - (Personnel Expenses + Other Administrative Expenses) / (Gross Result of Financial Intermediation - Allowance for Doubtful Debts + Service Provision Revenue + Equivalence Result + Other Rec. and Expenses. Operational); d) ICP (Own Capital Immobilization Index) – Sum of the Intangible Assets, Investments, and Fixed Assets accounts divided by the PL; e) TAM (size) – Natural Logarithm of Total Assets; f) REC (revenue size) – Natural Logarithm of the Gross Result of Financial Intermediation plus Revenue from the provision of services and banking fees; g) INV – Investments divided by Total Assets; h) MEP – results of the equity method divided by EBT (earnings before taxes); i) INT – Intangible assets divided by Total Assets; j) YEAR: categorical variable that demonstrates the impacts on the dependent variable of each year individually. Finally, to identify the institutions whose control is state-owned, the dummy variable EST (D_i^{EST}) was created, with the banks being divided into two groups: nine private banks and seven controlled by the Union or by federal states.

Among the indicators used in the evaluation of financial institutions, ROA, ROE, IEO, and ICP are commonly used by investors and are related to the company's profitability, efficiency, and capital structure. Companies with greater profitability are expected to present higher amounts of taxable revenue and, therefore, higher ROA and ROE; it is also assumed that institutions with high IEO can use lower amounts of deductible expenses in their tax calculation bases. The ICP, in turn, observes the level of capital that is free from investments of a permanent nature (Calçado, 2013), so that financial institutions with less fixed capital have more assets designated for sources of revenue generation.

Studies by Minnick and Noga (2010) and Pratama (2017) demonstrate that the larger the company, the higher its ETR. To control the effects of the company's size, we inserted the variables TAM and REC, which consider the possible effects of the entity's size on its effective tax rate. The INV, MEP, and INT variables seek to control possible effects on effective tax rates that are caused by temporary differences giving rise to deferred tax assets and liabilities or specific rules provided for in tax legislation.

The INV variable measures the ratio between the assets recorded in the investment subgroup, excluding the "Other Investments" portfolio, and total assets. Investments in subsidiaries and associates are evaluated using the equity method, with the results of the equity method excluded from the bases for calculating taxes; differently, the portfolio – excluded – of "Other Investments", whose assets cannot be measured based on net equity, is valued at the acquisition cost deducted from the provision for losses, which is intended to adjust its value to the price of the market, as provided for in Central Bank of Brazil Circular 1273/87.

As a complement, the MEP variable was inserted, which, using data from the Income Statement, measures the proportion of the financial institution's equivalence results over the respective EBT. Both the INV and MEP variables verify whether any lower ETR was caused due to the rule provided for in the legislation, which does not prescribe taxation on equivalence gains or losses given that they have already been taxed or deducted in the invested companies.

The INT variable measures the proportion of the intangible subgroup over total assets. The amounts recorded as intangible assets can be amortized, using deductible quotas from income tax calculation bases. In the same way as Vieira (2017), we consider both intangibles and their respective accumulated amortization-reducing accounts.

We present descriptive statistics in Table 1. Observing the Effective Tax Rates, it is possible to identify that the 90th percentile is almost twice the value of the maximum value, meaning that there is a considerable dispersion at the higher end of the distribution of values. In addition, the minimum value is closer to the median than the maximum values, showing some evidence that ETR values are closer to negative values than to positive ones, and that banks generally have negative Effective Tax Rates.

Table 1. Descriptive statistics

	Mean	SD	Median	Min	10th Percentile	90th Percentile	Max	Observations
ETR	-0.0000	1.0031	-0.2065	-1.6788	-0.8156	1.4317	2.6658	160
ETRc	-0.0000	1.0031	0.3330	-2.4906	-1.4609	0.9330	1.2276	160

	Mean	SD	Median	Min	10th Percentile	90th Percentile	Max	Observations
ETRr	0.0000	1.0031	0.1650	-2.4710	-1.7131	1.1526	1.6378	160
ICP	0.0000	1.0031	-0.0608	-1.3189	-1.2597	1.5076	1.9447	160
IEO	0.0000	1.0031	0.0872	-2.3098	-1.4546	1.2522	1.9791	160
INT	0.0000	1.0031	-0.2752	-1.0050	-1.0001	1.6519	2.1961	160
INV	0.0000	1.0031	-0.3301	-0.5496	-0.5494	0.4160	3.7090	160
MEP	0.0000	1.0031	-0.3614	-1.0177	-0.7597	1.4695	2.7267	160
REC	-0.0000	1.0031	-0.1618	-1.7688	-1.2769	1.6757	1.8391	160
ROA	-0.0000	1.0031	-0.1933	-0.8284	-0.6175	0.3361	3.7469	160
ROE	0.0000	1.0031	0.1015	-2.1154	-1.3762	1.2285	1.5742	160
TAM	0.0000	1.0031	-0.3424	-1.2162	-1.0160	1.7389	1.9333	160

Source: Elaborated by authors.

To identify the heterogeneity between the subsamples of public and private banks, we show some descriptive statistics in Table 2. Mean Effective Tax Rates are different for the two groups (approximately 0.15 for private banks and -0.19 for public banks), being positive for private and negative for public. We also performed the Welch Two Sample t-test on the Effective Tax Rates (ETR) and showed that the mean values between the two subsamples are statistically different, providing further evidence that there are heterogeneities in ETRs between the two groups that could be captured by our modeling. Thus, there is evidence that the two groups are different in terms of Effective Tax Rates.

Table 2. Descriptive statistics for the two subsamples

Private Banks								
	Mean	SD	Median	Min	10th percentile	90th percentile	Max	Observations
ETR	0.1549	1.1106	0.0436	-1.6788	-0.9733	2.1544	2.6658	90
ETRc	0.4484	0.7886	0.6954	-2.4906	-0.4904	1.0667	1.2276	90
ETRr	-0.0984	1.2836	0.1734	-2.4710	-2.2945	1.5768	1.6378	90
ICP	0.4623	1.0247	0.6135	-1.3189	-1.1828	1.8774	1.9447	90
IEO	-0.1389	1.2900	-0.0916	-2.3098	-2.1947	1.8981	1.9791	90
INT	-0.3390	0.7870	-0.7657	-1.0050	-1.0050	0.6969	2.1961	90
INV	0.3493	1.2276	-0.1126	-0.4951	-0.4552	3.4880	3.7090	90
MEP	0.2551	1.1297	-0.1210	-1.0177	-0.9150	2.1355	2.7267	90
REC	-0.0703	1.1126	-0.0986	-1.7688	-1.6670	1.6361	1.8391	90
ROA	0.1387	1.3029	-0.1737	-0.8284	-0.7512	3.2365	3.7469	90
ROE	-0.2877	1.0584	0.0079	-2.1154	-1.8891	1.0049	1.5742	90
TAM	0.1337	1.0155	-0.2477	-1.1020	-0.9598	1.7111	1.9333	90
EST	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90

Public Banks

Private Banks								
	Mean	**SD**	**Median**	**Min**	**10th percentile**	**90th percentile**	**Max**	**Observations**
	Mean	SD	Median	Min	10th percentile	90th percentile	Max	Observations
ETR	-0.1992	0.8099695	-0.374070	-1.67885	-0.730484	0.444527	2.66585	70
ETRc	-0.5765	0.9575879	-0.563920	-2.49063	-1.948257	0.556132	1.22769	70
ETRr	0.1265	0.4057836	0.165040	-1.29217	-0.464201	0.579979	0.84745	70
ICP	-0.5944	0.5718	-0.7308	-1.3189	-1.3001	0.2695	0.9383	70
IEO	0.1787	0.3384	0.1459	-0.8203	-0.2242	0.6245	1.2479	70
INT	0.4358	1.0849	0.2692	-1.0050	-0.9035	2.0002	2.1961	70
INV	-0.4491	0.1046	-0.4720	-0.5496	-0.5496	-0.3007	-0.1572	70
MEP	-0.3279	0.6916	-0.5317	-1.0177	-0.7478	0.3675	2.7267	70
REC	0.0904	0.8409	-0.1812	-1.1320	-0.8133	1.7645	1.8391	70
ROA	-0.1784	0.2674	-0.2168	-0.6645	-0.4583	0.1259	0.5570	70
ROE	0.3699	0.7918	0.2548	-1.5033	-0.5679	1.5685	1.5742	70
TAM	-0.1719	0.9670	-0.4256	-1.2162	-1.2162	1.9325	1.9333	70
EST	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	70

Note: We performed Welch Two Sample t-test on the Effective Tax Rates (ETR). The test statistics was 2.3313 and the p-value was 0.021, thus not rejecting the alternative hypothesis of the true difference in means not being equal to 0.

Source: Elaborated by authors.

3.2 Statistical model and techniques

We based the research on combined time series and cross-sectional data originating from the financial statements of the entities analyzed. After data collection and processing, we performed a multicollinearity test. Then, similarly to Gomes (2012), we used the steps proposed by Bressan (2009): 1 - Estimation of the pooled model; 2 - Estimation of the model with fixed effects; 3 - Application of the Chow test to evaluate the use of fixed versus pooled effects (F test); 4 - Estimation of the model with random effects; 5 - Application of the Breusch-Pagan test to evaluate the use of models with random versus pooled effects (LM Test); 6 - Application of the Hausman test to evaluate the use of models with fixed effects versus models with random effects.

We performed statistical analysis to verify the relationship between dependent and independent variables, correlating state control and ETR, according to the multivariate regression models below:

$$ETR_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 IEO_{it} + \beta_4 ICP_{it} + \beta_5 TAM_{it} + \beta_6 REC_{it} + \beta_7 INV_{it} + \beta_8 MEP_{it} + \beta_9 INT_{it} + \beta_{10} D_i^{EST} + \varepsilon_{it} \quad (1)$$

$$ETR_c = \beta_0 + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 IEO_{it} + \beta_4 ICP_{it} + \beta_5 TAM_{it} + \beta_6 REC_{it} + \beta_7 INV_{it} + \beta_8 MEP_{it} + \beta_9 INT_{it} + \beta_{10} D_i^{EST} + \varepsilon_{it} \quad (2)$$

$$ETR_r = \beta_0 + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 IEO_{it} + \beta_4 ICP_{it} + \beta_5 TAM_{it} + \beta_6 REC_{it} + \beta_7 INV_{it} + \beta_8 MEP_{it} + \beta_9 INT_{it} + \beta_{10} D_i^{EST} + \varepsilon_{it} \quad (3)$$

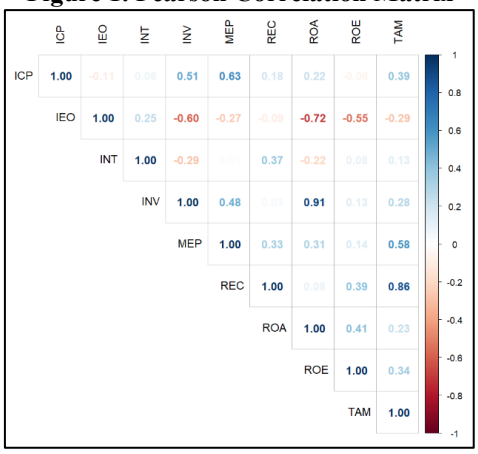
Analyzing Equations (1) through (3), we expect that $\boldsymbol{\beta_{10} > 0}$ in every one of them, since state-owned firms tend to pay more taxes. Considering that public-owned firms are more inclined towards corporate social responsibility than private-owned, their tax avoidance level would be smaller, thus managers would have two different sets of incentives for operating tax planning, and this difference can range from 1.4% up to 10%, as in Hilling *et al.* (2021) and Bradshaw (2019). Therefore, we expect that state control positively affects Effective Tax Rates of every kind.

4. Results

4.1 Testing variables and choosing regression models

After collection, the data underwent initial treatment, in particular: the data frame was fully winsorized at 5% and 95%, with the consequent transformation of outliers, then normalized using the MIN-MAX procedure and standardized using the application of the Z-Score (obtaining a mean of zero and a standard deviation of 1). Once the early stage was completed, the first test carried out aimed to examine the presence of any high correlation between the explanatory variables. The tolerance level established was 0.7. According to the Pearson Correlation Matrix presented below, the correlation was above the ceiling for the variables TAM x REC and ROA x INV. Figure 1 presents the Pearson correlation matrix.

Figure 1. Pearson Correlation Matrix



Source: Elaborated by authors.

Next, we used the VIF - Variation Inflation Factor test to detect the presence of multicollinearity, with a value greater than 10 for the variables INV, REC, ROA, and TAM, the same ones that had already been highlighted in the previous test. Although some degree of multicollinearity is expected, significant collinearities should be avoided, since, according to Greene (1997), the higher the correlation between the regressors, the lower the precision of the estimators.

To support the decision regarding which variables should be maintained, the best subset selection procedure was carried out in Software R, to identify the set of variables whose regressions present the highest adjusted R^2. The procedure led to the choice of the INV and TAM variables, with the consequent exclusion of the REC and ROA variables. We performed a new VIF test and this time no predictor variable presented a result greater than 3, see Table 3, leaving the issue of multicollinearity resolved.

Table 3. Variation Inflation Factor test

Variable	VIF
ICP	2.14
IEO	2.61
INT	1.26
INV	2.55
MEP	2.24
ROE	1.77
TAM	1.73

Source: Elaborated by authors.

In the next step, we applied Chow test (F test), Breusch-Pagan (LM test), and Hausman test. Note that the EST dummy variable does not vary over time and, in this case, the fixed effects estimator excludes the variable, which ended up making its analysis using this model unfeasible. Ultimately, the test results demonstrated that the most suitable model for regressions 1 and 3 is the pooled model, while for regression 2 (ETRc) it is the model with random effects.

4.2 Validation tests of the chosen regression models

After defining the regression models and best subset selection analyses, we subjected the chosen models to new validation tests. The Breusch-Godfrey/Wooldridge test identifies the presence of serial correlation in the errors of a regression model, which can bring misleading conclusions to research (Breusch, 1978). The tests carried out approved the null hypothesis that there are no serial correlation problems in the models.

We applied the Wooldridge test to verify the existence of unobserved time or individual effects; its null hypothesis is the non-correlation between errors in the same group. Due to the tests applied, at a significance level of 5%, it was possible to accept the null hypothesis, that is, there is no correlation between the errors. The Pesaran test was used to check whether there is cross-sectional dependence; its null hypothesis predicts that residuals across individuals are not correlated. The tests applied demonstrated that there was no cross-sectional dependence in the 03 regressions carried out.

Finally, we applied the Breusch-Pagan test to verify the homoscedasticity of the residuals; for a significance level of 5%, we found that the regression models returned heteroscedastic residuals. We then opted to use White's (1980) estimator – heteroskedasticity consistent estimator –, with changes from Arellano (1987), which allows the production of valid estimators in the presence of heteroskedasticity, which, according to Uchôa (2012), is the most common solution for such cases.

It should be noted that the normality hypothesis was relaxed, considering, on the one hand, the possibility of assuming the assumption of asymptotic normality of the observed sample (N = 160) and, on the other, that the non-normality of the residuals would not affect the BLUE properties of the model, but only the delimitation of confidence intervals for possible predictions, a situation that is not included in the objectives of this research.

4.3 Modelling and Results

After completion of the validation tests, the final models used to apply the regressions were:

$$ETR_{it} = \beta_0 + \beta_1 ICP_{it} + \beta_2 INV_{it} + \beta_3 INT_{it} + \beta_4 MEP_{it} + \beta_5 ROE_{it} + \beta_6 TAM_{it} + \beta_7 D_i^{EST} + \beta_8 IEO_{it} + \sum_{j=1}^{9} \beta_{8+j} D_t^{ANO} + \varepsilon_{it} \quad (4)$$

$$ETRc_{it} = \beta_0 + \beta_1 ICP_{it} + \beta_2 INV_{it} + \beta_3 INT_{it} + \beta_4 MEP_{it} + \beta_5 ROE_{it} + \beta_6 TAM_{it} + \beta_7 D_i^{EST} + \beta_8 IEO_{it} + \sum_{j=1}^{9} \beta_{8+j} D_t^{ANO} + \varepsilon_{it} \quad (5)$$

$$ETRr_{it} = \beta_0 + \beta_1 ICP_{it} + \beta_2 INV_{it} + \beta_3 INT_{it} + \beta_4 ROE_{it} + \beta_5 TAM_{it} + \beta_6 D_i^{EST} + \beta_7 IEO_{it} + \sum_{j=1}^{9} \beta_{7+j} D_t^{ANO} + \varepsilon_{it} \quad (6)$$

To execute the regression models, the panel data estimators from Croissant and Millo (2008) were used, generating the covariance matrix of the robust estimators, à la White, with the Arellano method (White, 1980; Arellano, 1987) and adjustments proposed by Cribari–Neto (2004). Table 4 presents the estimation results.

Table 4. Regression models of bank ownership on tax avoidance

	Model 1 (Pooled)	Model 2 (Random Effect)	Model 2 (Pooled Model)
	ETR_{it}	$ETRc_{it}$	$ETRr_{it}$
(Intercept)	0.2075 (0.2479)	-0.0666 (0.2247)	0.1689 (0.1967)
ICP_{it}	-0.1227 (0.1652)	0.2466	0.0918
		(0.1448)	(0.1914)
INV_{it}	-0.2533*** (0.0746)	0.1488	-0.4358*** (0.1092)
		(0.0946)	
IEO_{it}	-0.0044 (0.1581)	0.1025	-0.2063
		(0.1362)	(0.1620)
MEP_{it}	0.6740*** (0.1794)	-0.1758	
		(0.1376)	
ROE_{it}	0.2050* (0.1112)	0.1482	0.0669
		(0.1318)	(0.0937)
TAM_{it}	0.0498	0.1918*	-0.2700*** (0.0706)
	(0.0711)	(0.1121)	
INT_{it}	-0.0209 (0.0821)	-0.1209	0.0180
		(0.1279)	(0.0938)
D_i^{EST}	-0.3951*** (0.1652)	-0.7222** (0.3436)	-0.1009
			(0.3461)
$Year$ (2013)	-0.0705 (0.2307)	0.4001	0.1641
		(0.2996)	(0.1775)
$Year$ (2014)	-0.0977 (0.2529)	0.3887	-0.0219
		(0.3001)	(0.3039)
$Year$ (2015)	0.2703	0.3476	-0.5518
	(0.3683)	(0.2882)	(0.4486)
$Year$ (2016)	-0.2210 (0.2295)	0.0208	-0.2680
		(0.2973)	(0.3578)
$Year$ (2017)	-0.1811 (0.2772)	0.8613*** (0.3267)	-0.1975
			(0.3520)
$Year$ (2018)	-0.1769 (0.2449)	0.7430*** (0.2583)	-0.2654
			(0.3637)
$Year$ (2019)	0.3373	0.4704	-0.1395
	(0.3456)	(0.3597)	(0.3690)
$Year$ (2020)	0.0255	0.1664	-0.1041
	(0.2886)	(0.3566)	(0.3629)
$Year$ (2021)	-0.2322 (0.2462)	0.4246	0.1363
		(0.3237)	(0.2968)
Observations	160	160	160
R^2	0.488	0.314	0.219
Adjusted R^2	0.427	0.232	0.131
F Statistic	7.977***	65.129***	2.504***
	(df = 17; 142)	(df = 17, 142)	(df = 16; 143)

Note: The significance codes are 0.01'***' 0.05 '**' 0.1'*'.

Source: Elaborated by the authors.

The results for the MEP variable - in Model 1 - support the initial conjecture, that is, given the rules provided for in the legislation, which does not prescribe taxation on equity gains or losses, companies with proportionally more relevant equity results tend to present lower effective tax rates. This fact may be related to business decentralization policies, with investments in subsidiaries and affiliates subject to lower tax rates. Operating in this way, the controlling banking institution earns income from equivalence already taxed in other companies in the conglomerate, at lower rates, and removes from itself a portion of the high percentages of income taxes required in the financial sector.

Since one of the conditions for regular tax planning is the presence of business interest, that is, an operation cannot be constituted with the exclusive purpose of reducing tax payments, additional studies are necessary to ascertain whether the annulment of the effects of the result of equity equivalence would be sufficient to equalize the ETR observed in privately controlled institutions with those under state control, and if there is an eminently business purpose of the subsidiaries and affiliates constituted by the analyzed banks.

The INV variable, on the other hand, presented a p-value of 0.0008 and a negative estimator, that is, the greater the proportion of investments in the company's total assets, the ETR tends to be. In the proposed regression, the other variables did not show statistical relevance of less than 5%, in the same way as the calendar years considered, which we individually treated in the model as categorical variables. Returning the analysis to the research hypothesis, we observed that state control, represented in the model by the dummy variable EST (D_i^{EST}), is an explanatory variable for the effective tax rate, with significance at the 5% level (*p-value* 0.0180) and negatively correlated, that is, the presence of state control indicates greater tax expenditure (account with a debit balance) and higher effective tax rates.

Continuing the application of the regression equations, for the explained variable ETRc (Model 2), the t-test of the coefficients presented the following results: Law No. 13,169 of 2015 increased the income taxes rate from 40% to 45%, in the period between September 1, 2015, and December 31, 2018, which should lead to an increase in current tax expenses. However, in the 2017 calendar year, ten out of the sixteen banks analyzed presented ETRc in an amount lower than their average (measured over the ten years analyzed), so we can even consider years in which expenditure on current taxes presented a credit balance. In the following year, the number of institutions in this situation rose to 13, an indication of the presence of lower real profit/adjusted results, or even tax losses in the income statements, and may explain the significance presented in the YEAR variable about current taxes, especially in the 2017 and 2018 financial years. Once again, state control is negatively correlated with effective tax rate, reassuring the idea that public-owned firms are more inclined towards corporate social responsibility than private-owned,

thereby dedicating less time to tax planning activities, which is shown by the significance at the 5% level (*p-value* 0.0373).

Finally, the results of the t-test of the coefficients for the explained variable ETRr (Model 3): When we began to investigate the explanatory variables of taxes on revenue, company size emerged as a relevant indicator, with the TAM variable presenting a significance level of 1%. The generated estimator, with a negative sign, indicates that the size of the financial institution leads to a higher effective tax rate on revenue, corroborating, albeit on another aspect of taxation, the considerations of Minnick and Noga (2010) and Pratama (2017).

The result may also be associated with the theory of political costs by Watts and Zimmerman (1978, apud Pagliarussi *et al.*, 2011), according to which larger companies are subject to greater visibility, supervision by interest groups, and regulation by the State. Again, the INV variable was significant for the model, signaling that the greater the share of investments in the company's total assets, the higher the proportion of taxes on revenue tends to be. The results presented by Model 3 do not allow us to confirm that state control significantly influences the ETRr variable.

5. Conclusions

The work proposed to analyze the possible effects of state control on the effective tax rate of financial institutions listed on the Brazilian Stock Exchange (B3). Given the different conclusions in works with similar proposals, three distinct ETR indicators were used in this project on a single database, which covered the period of 10 years (2012 to 2021) and covered the same companies throughout all exercises covered (balanced panel).
The mltiple regression models used demonstrated that state control is related to higher effective taxation rates when affecting the company's results, which may be one of the factors justifying the trading of state-owned companies' shares with lower multiples than those of their competitors subject to private control. Based on the results found, it is not possible to assert that state control significantly influences taxation on revenue.

Considering the limitations of this work, new research and analyses can be carried out in search of the determining factors of the effective tax rates of financial institutions and possible influences of size, investments, and Equity Equivalence Results on tax expenses incurred by the banking sector. On a complementary basis, further investigation may also be proposed to measure the degree of influence of higher ETRs on the market value of state-owned companies.

Furthermore, studies can be carried out to evaluate the effect of state control on the effective tax rate and its respective impact on the market value of energy or sanitation concessionaires, segments that, like banking, have specific regulations and are composed of various companies under private or state control.

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