

Joia, Arthur José Cunha Bandeira de Mello; Barros, Lucas Ayres B. de C.; Ermel, Marcelo Daniel Araujo

Article

Taxes, leverage, and profit shifting in banks

Economies

Provided in Cooperation with:

MDPI – Multidisciplinary Digital Publishing Institute, Basel

Suggested Citation: Joia, Arthur José Cunha Bandeira de Mello; Barros, Lucas Ayres B. de C.; Ermel, Marcelo Daniel Araujo (2024) : Taxes, leverage, and profit shifting in banks, *Economies*, ISSN 2227-7099, MDPI, Basel, Vol. 12, Iss. 10, pp. 1-19, <https://doi.org/10.3390/economies12100263>

This Version is available at:

<https://hdl.handle.net/10419/329190>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.


If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

Article

Taxes, Leverage, and Profit Shifting in Banks

Arthur José Cunha Bandeira de Mello Joia ^{1,*}, Lucas Ayres Barreira de Campos Barros ² 
and Marcelo Daniel Araujo Ermel ³

¹ Receita Federal do Brasil, Joinville 89205-300, Brazil

² Departamento de Contabilidade e Atuária, Universidade de São Paulo, São Paulo 05508-220, Brazil; lucasbarros@usp.br

³ Centro de Ciências Sociais e Aplicadas, Universidade Presbiteriana Mackenzie, São Paulo 01302-907, Brazil; marcelo.ermel@mackenzie.br

* Correspondence: arthurjoia@gmail.com

Abstract: The goal of this research is to investigate whether taxation affects the leverage decisions of banks and if the response of leverage to tax increases depends on profit-shifting opportunities available to individual banks. This topic remains controversial since it is often believed that banking regulation is such an essential driver of leverage choices that little room is left for other considerations studied in the corporate finance literature. Using a difference-in-differences setup encompassing the period from 2006 to 2017, we exploit two exogenous income tax rate increases applicable to 225 Brazilian banks, employing novel identification strategies based on the intricacies of local taxation rules and on the distinctions between individual banks and financial conglomerates. We find stark differences in the behavior of banks around the two events, with a substantial increase in leverage following the first tax hike but no leverage response following the second. In addition, we find no evidence of heterogeneous effects based on the amount of profit-shifting opportunities available to individual banks. Regulatory concerns possibly became more relevant for leverage decisions during the period around the second tax hike because it coincided with the implementation of stricter capital requirements associated with the Basel III framework. Taken together, our results suggest that financial institutions balance considerations regarding the tax-shield benefits of debt against regulatory concerns specific to the banking industry when making capital structure choices.

Keywords: capital structure; bank regulation; corporate income taxation; trade-off theory; difference-in-differences; profit shifting



Citation: Joia, Arthur José Cunha Bandeira de Mello, Lucas Ayres Barreira de Campos Barros, and Marcelo Daniel Araujo Ermel. 2024. Taxes, Leverage, and Profit Shifting in Banks. *Economies* 12: 263. <https://doi.org/10.3390/economies12100263>

Academic Editor: Franz Seitz

Received: 21 June 2024

Revised: 15 August 2024

Accepted: 16 August 2024

Published: 26 September 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

It is important to study the determinants of the capital structure of banks because excessive leverage increases bankruptcy costs and systemic risk related to the financial sector. The 2008 global financial crisis triggered a revision of the regulatory and supervisory rules regarding bank liquidity risk and capital buffers (Vazquez and Federico 2015). However, it is possible that regulatory leverage limits are not as crucial to banks' capital structure as was once believed, and other factors might also be relevant. In this context, taxes might be as important to banks' leverage as they are for non-financial firms. Thus, a tax code reform might be desirable to help prevent financial crises.

Gropp and Heider (2010) present empirical evidence that regulatory dominance may be inadequate to explain banks' capital structure. These authors highlight five interrelated empirical facts, including that standard cross-sectional determinants of firms' capital structures also apply to large, publicly traded banks in the United States of America (U.S.) and Europe. Moreover, high levels of banks' discretionary capital were not explained by buffers to insure against costs related to raising equity on short notice to comply with capital requirements. Their research also found evidence that unobserved time-invariant bank fixed effects are important in explaining the variations in a bank's capital structure. Overall,

the evidence from [Gropp and Heider \(2010\)](#) shows how important it is to investigate how other factors besides banking regulation affect the capital structure of financial institutions.

How taxation affects corporate financing decisions is a classical question in the capital structure literature; it is also a complex one, given the difficulty in isolating the causal tax effects from confounding factors. [Gordon \(2010\)](#) states that time-series evidence could be helpful, but in the U.S. and other jurisdictions, tax rates have varied insignificantly over time, making it difficult to identify the size of their effects on firm behavior. Therefore, there is an opportunity to address this research question with data from countries where relevant regulatory changes allow the tax effects to be better identified.

Brazil offers an interesting setting in which to investigate this issue. First, the country is known to have a complex tax system. For example, a study covering 189 economies showed that Brazil was the country that demanded the greatest number of hours for firms to comply with their fiscal obligations ([The World Bank and PwC 2015](#)). The study highlights that tax rules are created and amended in Brazil quite frequently. This unstable legal environment provides a unique opportunity to analyze tax effects on corporate decisions, particularly in the banking industry, where the corporate tax rate has substantially changed in recent years.

In addition to rate changes, another reason that makes Brazilian data interesting is that Brazil mandates the disclosure of both unconsolidated and consolidated financial statements. [Devereux et al. \(2018\)](#) explain that unconsolidated statements are relevant since taxation is due by individual firms and not by their consolidated entities. For this reason, ignoring this issue could lead to measurement errors, considering that firms may respond to the tax rate in the location where they actually operate rather than the rate charged by the parent company's country. Financial Institution and Financial Conglomerate data are readily available and reliable because they are published by BACEN, the Brazilian Central Bank.

This study's contribution is twofold. First, we provide further evidence regarding the relevance of tax effects to banks' capital structure, which previous studies have suggested ([De Mooij and Keen 2016](#); [Milonas 2018](#); [Schandlbauer 2017](#); [Schepens 2016](#); [Sobiech et al. 2021](#)), by exploiting two distinct exogenous shocks and proposing novel identification strategies. Second, we investigate whether those effects are different for individual banks with greater profit-shifting opportunities, which is also novel to this literature.

Our empirical setting comprises two natural experiments, namely, two income tax rate increases applicable exclusively to individual banks. The first rate increase of 6 percentage points (p.p.), from 34% to 40%, took place in April 2008, while the second rate increase of 5 p.p., from 40% to 45%, was a temporary one aimed to take effect from September 2015 to December 2018. However, as explained in detail in the methodological section, we argue that these changes in the tax code did not affect all banks equally. First, Brazilian banks controlled by higher-taxed shareholders were substantially more affected by the tax hikes than those controlled by lower-taxed shareholders. For example, computing the total income tax rate applicable to the bank and its shareholders, we show that, over our sample period, the effective tax increase could be more than twice greater for banks owned by other financial institutions than for similar banks owned by individual shareholders. Second, we note that most individual banks in our sample were affiliated with broader financial conglomerates comprising several businesses and that taxation is due at the individual bank level, not at the financial conglomerate level. We argue that financial conglomerates had fewer incentives than individual banks to change their consolidated capital structure in response to an increase in the corporate income tax rate because they could rebalance the leverage of affiliated firms and shift profits from higher-taxed to lower-taxed firms, thus minimizing global tax expenses without changing their global target capital structure. Therefore, we were able to use two distinct comparison groups (i.e., entities that were less affected by the exogenous tax hikes) to help us identify the causal effect of interest under the assumption that the change in leverage of the banks that were most exposed to the tax increases (individual banks and those controlled by higher-taxed shareholders) would be

similar to the change in leverage of their respective comparison group in the absence of the tax increases (i.e., under the “parallel trends” assumption).

To the best of our knowledge, this is the first study to propose that conglomerates (financial or non-financial) can benefit from debt tax shields at the individual firm level while achieving wider capital structure goals at the conglomerate level. Other possible capital structure goals may include addressing agency costs and market timing. Such empirical investigation is made easier in the financial sector because banks are required to disclose financial statements simultaneously at the individual firm and the financial/prudential conglomerate levels. From the methodological point of view, an advantage of our setting is that it faces fewer endogeneity concerns than some previous studies since we only include banks that operate in the same jurisdiction, thus mitigating concerns related to country-level omitted variables, which are inherent in related studies using banks from distinct jurisdictions (e.g., [De Mooij and Keen 2016](#); [Hemmelgarn and Teichmann 2014](#); [Schepens 2016](#)).

We document statistically and economically significant increases in the total leverage of the most exposed banks relative to the two alternative comparison groups following the first tax hike, with point estimates ranging from around 3 p.p. to around 5 p.p., depending on the model specification. These inferences are remarkably consistent across specifications and identification assumptions, suggesting the relevance of tax considerations to banks’ capital structure decisions. They complement previous research by exploring a new jurisdiction (to the best of our knowledge, this is the first study of its kind in an emerging economy) and by employing novel identification strategies to estimate the causal effect of interest. Our analysis also suggests that financial institutions factor in investor-level taxation when making leverage decisions, as proposed by [Miller \(1977\)](#) in his seminal theoretical work applicable to corporations in general.

On the other hand, we find no evidence of an increase in leverage motivated by the second tax hike, regardless of variations in empirical specifications or identification assumptions. The first explanation for this divergence is that the second tax rate increase was temporary and due to be reverted in around three years, while the first hike was meant to be “permanent”. Since capital structure adjustments are known to be costly (e.g., [Faulkender et al. 2012](#)), the provisional character of the second tax hike may have discouraged banks from further increasing their leverage, consistent with the results reported by [Schandlbauer \(2017\)](#) in a study of U.S. banks. In addition, Brazil started the implementation of the Basel III provisions around the second tax hike, leading to a strengthening of capital requirements and potentially more stringent future regulation. During this period, capital requirement concerns possibly became more relevant for capital structure decisions, leaving little room for tax effects. In favor of this argument, we document that leverage increases caused by the second tax hike were apparently restricted to the subset of banks with the greatest regulatory slack, measured by the distance between their Basel index and the regulatory minimum. This reasoning suggests that financial institutions will balance regulatory concerns specific to the banking industry and more general financial trade-offs when making capital structure choices. Finally, we find no evidence that greater profit-shifting opportunities—proxied by each bank’s ratio of participation in controlled or affiliated domestic firms to total assets—predict a weaker tax effect.

The remainder of the paper is organized as follows. Section 2 discusses the related literature. Section 3 presents the methodological approach, the Brazilian context, identification strategies, empirical models, hypotheses, data, and variable definitions. Section 4 presents descriptive statistics, regression analyses, and main results. Section 5 presents a discussion of results, including some of their implications, as well as limitations of this study and directions for future research. Concluding remarks are presented in Section 6.

2. Related Literature

To rise to the challenge of producing compelling empirical evidence on the effects of taxation on capital structure, a promising path is to take advantage of natural experiments. [Meyer \(1995\)](#) argued that policy changes may allow the researcher to obtain exogenous

variation in the main explanatory variable; thus, policy changes are usually good sources of natural experiments, which could be useful when standard estimation procedures are ordinarily biased. Previous studies have exploited policy changes in several jurisdictions to identify the effects of taxes on capital structure choices of financial institutions and non-financial firms. For example, [Doidge and Dyck \(2015\)](#) studied the Canadian Tax Fairness Plan, which increased taxation for Canadian income trusts, showing that the mean leverage of trusts increased more than the leverage of other non-financial corporations. [Deng et al. \(2020\)](#) studied China's tax changes from 2001 to 2012 to evaluate their impact on the leverage of non-financial firms. Their results show an asymmetric relationship between the tax changes and leverage so that, at normal times, tax hikes increased leverage while tax cuts did not affect leverage levels.

Turning to the banking industry, [Schepens \(2016\)](#) studied the adoption of an Allowance for Corporate Equity (ACE) rule in Belgium, documenting that Belgian banks increased their equity share presumably in response to the ACE regulation since it effectively reduced the tax-shield advantage of debt by allowing the deductibility of a notional interest rate on banks' equity. [Sobiech et al. \(2021\)](#) use Japanese data to provide evidence consistent with the notion that taxation impacts bank behavior, including leverage and credit availability. These authors studied a tax increase from 2000 to 2002 that only affected banks with sizable activities in the Tokyo prefecture, showing that it likely caused a significant increase in bank leverage and decreased credit supply to corporate borrowers. [Bremus et al. \(2020\)](#) analyzed regulatory changes in the European Banking Union over the 2006–2014 period, when EU countries adopted bank levies (i.e., a tax on selected bank liabilities) to promote a more stable capital structure by encouraging lower leverage. The authors found that such levies were effective in reducing leverage only in countries with lower corporate income tax rates. [Schandlbauer \(2017\)](#) and [Milonas \(2018\)](#) exploited staggered changes in the taxation of banks by U.S. states to show that banks increased leverage (i.e., decreased their ratio of equity to total assets) in response to tax hikes. Furthermore, both authors show that the positive leverage response to tax increases in the U.S. was stronger for better-capitalized banks.

Other studies empirically confirm the tax sensitivity of banks' leverage, although they do not rely on natural experiments and are thus more limited in their ability to address endogeneity concerns. For example, [De Mooij and Keen \(2016\)](#) used a sample of banks from 82 countries and showed that the positive association between corporate income tax rates and leverage was about as large for banks as it was for non-financial firms; a similar result was reported by [Heckemeyer and De Mooij \(2017\)](#) using data from 69 countries.

3. Methodology

In this study, we exploit two consecutive income tax rate increases exclusively aimed at individual banks, the first of 6 p.p. effective permanently from April 2008, and the second of 5 p.p., which was planned to be temporary and effective from September 2015 to December 2018. We know of no other major economy that experienced such a high increase in the income tax rate applicable to the banking industry during this sample period.

To segregate tax effects from confounding factors, we employ two distinct identification strategies. The first strategy exploits the complexity of the Brazilian tax code, which causes otherwise similar banks to face quite different marginal tax rates depending on their ownership structure, as explained below.

In 1995, Brazil became one of the few countries ever to adopt an ACE rule—called JSCP (Juros Sobre o Capital Próprio). Similar to the Belgian case, JSCP reduced the tax-shield advantage of debt, but it did not eliminate it because the law stipulated strict limits to ACE deductions. The legislation limits ACE deductions to 50% of net income, and the interest rate applied over equity, called TJLP (Taxa de Juros de Longo Prazo), is systematically and considerably lower than the market interest rates. For instance, in 2016, the value of the TJLP rate was approximately half of the BACEN key interest rate (SELIC), the main benchmark rate in the country. In addition, unlike ACE rules in other countries, this limited

notional interest might only be deducted from the tax base if it is effectively paid out to shareholders.

Next, we show that the ACE provision combines with other features of the Brazilian tax code to produce substantial differences in the impact of the tax hikes on the marginal income tax rates applicable to otherwise similar banks. We note that the equity interest paid to shareholders under the ACE rule is taxed at the equity holder level, while regular dividend income is exempt from taxes. A numerical example helps to understand the differential impacts of a tax hike when we take into account the income tax due at the shareholder level, as argued by [Miller \(1977\)](#) (see also [Graham 2003](#)).

Consider a Brazilian bank in 2006 with 200 BRL in profits; it would be allowed, if it had enough equity, to deduct up to 100 BRL (50%) from interest expenses under the ACE rule. Thus, the bank would have a taxable income of 100 BRL. The corporate tax rate for financial institutions in 2006 was 34%; then, it would have to pay 34 BRL in taxes, and 66 BRL would remain in the bank, plus 100 BRL distributed to the bank's equity holders as interest income from equity (ACE). However, the 100 BRL ACE paid out to shareholders is considered a taxable income at the equity holder level, who would pay 15% of income tax if it was an individual investor or 34% if it was a private corporation. Therefore, assuming that the bank had sufficient equity to take advantage of the ACE rule's full deduction, the marginal income tax rate for banks owned by individual investors would be 24.50% (i.e., $(34 + 15)/200$), whereas it would be 34% $((34 + 34)/200)$ for banks owned by corporations, which is a substantial difference.

Tables 1 and 2 offer a numerical example of real income taxation in 2006 and 2017 for banks owned by the government, individual investors, private corporations, and other financial institutions. Those tables are computed under the assumption that bank equity is sufficiently high to allow the deduction of 50% of the taxable income, the cap under the Brazilian ACE rule. If equity is not sufficiently high, the amount of the benefit will decrease but not disappear.

Table 1. Brazilian Income Tax Example by Type of Controlling Shareholder in 2006.

| Owner | State-Owned | Individual Investor | Private Corporation | Financial Institution |
|---|-------------|---------------------|---------------------|-----------------------|
| Bank Income (A) | 200.00 | 200.00 | 200.00 | 200.00 |
| ACE Deduction (B) = (A) × 50% | 100.00 | 100.00 | 100.00 | 100.00 |
| Bank Taxable Income (C) = (A) − (B) | 100.00 | 100.00 | 100.00 | 100.00 |
| Bank Tax Rate 2016 (D) | 34.00% | 34.00% | 34.00% | 34.00% |
| Bank Corporate Income Tax (E) = (C) × (D) | 34.00 | 34.00 | 34.00 | 34.00 |
| Investor Taxable Income (F) = (B) | 100.00 | 100.00 | 100.00 | 100.00 |
| Investor Tax Rate 2016 (G) | 0.00% | 15.00% | 34.00% | 34.00% |
| Investor Income Tax (H) = (F) × (G) | 0.00 | 15.00 | 34.00 | 34.00 |
| Total Taxation (I) = (E) + (H) | 34.00 | 49.00 | 68.00 | 68.00 |
| Total Tax Rate (J) = (I)/(A) | 17.00% | 24.50% | 34.00% | 34.00% |

Tables 1 and 2 make it easier to understand how the tax rate increase affected banks and their shareholders operating in the same business environment in significantly different ways. Government-owned banks had their real marginal income tax rate increased from 17% to 22.5%, a 5.5 p.p. increase. At the same time, the increase was from 34% to roughly 47% or approximately 13 p.p. for banks owned by other financial institutions. The increase for banks owned by individual investors was 5.5 p.p. in the period, whereas it was 7.325 p.p. for banks owned by private corporations. Therefore, banks controlled by higher-taxed shareholders were substantially more impacted by the tax hike and had more incentives to adjust their capital structure than similar banks controlled by lower-taxed shareholders.

Table 2. Brazilian Income Tax Example by Type of Controlling Shareholder in 2017.

| Owner | State-Owned | Individual Investor | Private Corporation | Financial Institution |
|---|-------------|---------------------|---------------------|-----------------------|
| Bank Income (A) | 200.00 | 200.00 | 200.00 | 200.00 |
| ACE deduction (B) = (A) × 50% | 100.00 | 100.00 | 100.00 | 100.00 |
| Bank Taxable Income (C) = (A) – (B) | 100.00 | 100.00 | 100.00 | 100.00 |
| Bank Tax Rate 2016 (D) | 45.00% | 45.00% | 45.00% | 45.00% |
| Bank Corporate Income Tax (E) = (C) × (D) | 45.00 | 45.00 | 45.00 | 45.00 |
| Investor Taxable Income (F) = (B) | 100.00 | 100.00 | 100.00 | 100.00 |
| Investor Tax Rate 2016 (G) | 0.00% | 15.00% | 37.65% | 48.65% |
| Investor Income Tax (H) = (F) × (G) | 0.00 | 15.00 | 37.65 | 48.65 |
| Total Taxation (I) = (E) + (H) | 45.00 | 60.00 | 82.65 | 93.65 |
| Total Tax Rate (J) = (I)/(A) | 22.50% | 30.00% | 41.33% | 46.83% |

The second identification strategy uses the same tax rate increases as exogenous shocks, but this time, the financial conglomerates are used as the comparison group. Thus, we contrast individual banks with the financial conglomerates to which they belong. We expect that the capital structure of these entities would evolve similarly (i.e., following ‘parallel trends’) in the absence of exogenous shocks to the tax rate. The rationale is that taxation is due at the individual bank level and not at the conglomerate level. In addition, financial conglomerates, particularly those with investments outside of the banking sector, could plausibly take advantage of tax increases by shifting debt across affiliated firms subjected to heterogeneous tax schedules in order to maximize global after-tax profits while preserving global capital structure targets. In other words, conglomerates have fewer incentives to change their consolidated (i.e., global) capital structure in response to an increase in the corporate income tax rate.

We use the first and second identification strategies, which are novel in the literature, to test our main hypothesis: H1—the corporate income tax rate positively affects the leverage of banks. The empirical model is shown in Equation (1):

$$Lev_{i,t} = \beta_0 + \beta_1 T_{i,t} + \beta_2 Post_t + \beta_3 G_i + \delta^T X_{i,t} + \varepsilon_{i,t} \quad (1)$$

The dependent variable is leverage ($Lev_{i,t}$) and it changes for each bank/financial conglomerate (represented by i) in each semester (represented by t). For each regression, there is a group dummy variable (G_i) indicating the most affected firms according to the identification strategy (i.e., banks controlled by higher-taxed shareholders or individual banks); a dummy variable that indicates whether the period is before or after the tax increase ($Post_t$); and a treatment dummy variable ($T_{i,t}$) obtained by the multiplication of G_i and $Post_t$. There is also a set of control variables ($X_{i,t}$) described below. Finally, $\varepsilon_{i,t}$ represents the idiosyncratic error term. According to H1, we expect that $\beta_1 > 0$. Equation (1) parameters were estimated using ordinary least squares (OLS) adapted to unbalanced panel data with errors clustered at the bank level. Alternatively, we employed the within-group fixed effects estimator (FE) with errors clustered at the bank level.

In additional analyses, we augment Equation (1) to test a second hypothesis, which has not yet been addressed in the related literature: H2—the positive relationship between leverage and the corporate income tax rate is weaker for individual banks with greater profit-shifting opportunities. Our proxy for profit-shifting opportunities is domestic participation, defined as the ratio of the bank’s participation (i.e., shareholdings) in controlled or affiliated domestic firms to total assets. The rationale is that such participation provides greater scope for the bank to explore non-debt tax shield strategies related to profit shifting, thus reducing the incentive to use leverage as a tax shield. The empirical model is shown in Equation (2):

$$Lev_{i,t} = \alpha_0 + \alpha_1 T_{i,t} + \alpha_2 Post_t + \alpha_3 G_i + \alpha_4 (DP_{i,t} \times T_{i,t}) + \alpha_5 DP_{i,t} + \alpha_6 (Post_t \times DP_{i,t}) + \alpha_7 (G_i \times DP_{i,t}) + \gamma^T X_{i,t} + u_{i,t} \quad (2)$$

In Equation (2), we add to Equation (1) domestic participation ($DP_{i,t}$) and its interactions with $T_{i,t}$, $Post_t$, and G_i . According to H2, we expect that $\alpha_1 > 0$ and $\alpha_4 < 0$.

The population of interest comprises the banks and financial conglomerates operating in Brazil. Data were mostly collected from the BACEN website. The period of analysis encompasses the years 2006 through 2017; therefore, we collected data from two years before the tax rate change in 2008 until two years after the second tax rate increase in 2015. Data were available on all active Brazilian banks during these twelve years, comprising 225 banks and a total of 4258 bank-semester observations.

The data on financial conglomerates collected for this study followed the accounting standards mandated by BACEN, which present some advantages despite limiting comparability with studies from other jurisdictions. The most obvious is related to trustworthiness, considering that this information is subjected to auditing from BACEN, which regulates and monitors the Brazilian financial system. In addition, BACEN enforces the presentation of the data following a homogenous chart of accounts that must be observed by all financial institutions, rendering all statements comparable.

Data were also collected on the main shareholders of each financial institution; however, not all banks are required to disclose this information; hence, there is no consolidated data source containing this information for all Brazilian banks. To overcome this problem, we collected the information from various data sources, mostly and when possible, from public statements released by the financial institutions or documents released by the BACEN, especially in a yearly summary of all ownership changes of financial institutions. For the few financial institutions for which it was not possible to gather data about the main shareholder in one of those official sources, shareholder information was collected from business newspapers. Table 3 describes the main variables used in the analyses, including the controls.

Table 3. Variable Descriptions.

| Variable | Description |
|--------------------------|---|
| Leverage | (Total Debt)/(Total Assets). |
| Higher-Taxed Shareholder | Dummy variable equal to 1 when the main shareholder is subject to a higher income tax. |
| Bank Institution | Dummy variable equal to 1 for an individual bank institution and zero for a financial conglomerate. |
| Size | Ln (Total assets in 2006 BRL). |
| Collateral | ((Cash and equivalents) + (interbank investments) + (long-term investments) + (tangible assets not leased))/(total assets). |
| Profitability | (Result before taxes – participation in profits)/(total assets). |
| Regulatory Distance | Distance between the financial/prudential conglomerate's Basel index and the regulatory minimum. |
| Regulatory Constraint | Dummy variable equal to 1 if the financial/prudential conglomerate's Basel index is close to or below the regulatory minimum. |
| Riskiness | (Operations with risk levels D, E, F, G, and H)/(total assets). |
| Foreign Investments | (Foreign investments)/(total assets). |
| Domestic Participation | (Domestic participation)/(total assets). |

We use only book leverage because most banks are not publicly traded; thus, it is not possible to obtain equity market value. In the related literature, several studies also use book leverage (e.g., [De Mooij and Keen 2016](#); [Gu et al. 2015](#); [Hemmelgarn and Teichmann 2014](#); [Lin et al. 2014](#)). The higher-taxed shareholder dummy variable divides the banks into two groups. The first one (dummy equal to 1) is composed of banks whose main shareholder was subject to a higher income tax rate on ACE revenues during most of

the sample period, and the second group is composed of banks whose main shareholder was subject to a lower income tax rate. The main shareholder is defined as the one with the greatest amount of voting shares within the bank's control group. The higher-taxed shareholder group comprises Brazilian domestic corporations, including other financial institutions, which are subject to a 34% corporate income tax rate besides the financial institutions' surcharge. In contrast, the lower-taxed group comprises banks controlled by all levels of the Brazilian government, which are exempt from taxation by the Brazilian Constitution's reciprocal immunity rule on income, or by individual investors, which are subject to a fixed 15% income tax on ACE revenues. We also include banks controlled by foreign investors in the lower-taxed group, in light of the high taxation of Brazilian firms and considering that foreign investors may benefit from tax avoidance structures unavailable to domestic investors. In any case, our conclusions are maintained if we exclude foreign-controlled banks from the sample.

The bank institution dummy variable splits banks, and their financial conglomerates such that data from individual banks are coded 1 and data from their respective financial conglomerate are coded 0. The collateral variable measures the assets available to secure loans and is computed as the ratio of assets available as collateral to total assets. We included fixed assets and long-term investments in shares and bonds, similar to previous studies (e.g., [Gropp and Heider 2010](#)). Profitability measures the return on invested assets and is computed as the ratio of results before taxes deducted by participation in profits to total assets. The reason for deducting participation in profits is that they are usually expenses with employees and management and thus should not be treated as profit because they are not due to the owners, according to Brazilian law. The dummy variable regulatory constraint aims to identify the banks and financial conglomerates that are restrained by their regulatory capital requirements under the Basel Accords, as they were implemented in Brazil. The dummy variable is equal to 1 when the Basel index of the financial conglomerate or the prudential conglomerate is at least 5 p.p. lower than the regulatory minimum for the semester. Therefore, this dummy variable has the same value for all individual banks affiliated with the same financial/prudential conglomerate in each semester. This has not appeared in previous studies. However, it is analogous to proxies for bankruptcy adopted previously (e.g., [Graham et al. 1998](#)). In additional analyses, we also use regulatory distance, a continuous measure of the distance between the financial/prudential conglomerate's Basel index and the regulatory minimum.

Riskiness is measured by the ratio of non-performing loans to total assets. BACEN defines non-performing loans as those classified with a risk level of either C, D, E, F, G or H so that H represents the greatest risk. Payments on all such loans were delayed by 60 days or more. For this paper, using a bank-level measure of riskiness is preferable because taxation is due at the bank rather than at the conglomerate level, and we compare individual banks with their respective conglomerates. Finally, the foreign investments variable is defined as the ratio of foreign investments to total assets.

4. Results

4.1. Descriptive Statistics

Table 4 shows the summary statistics for selected variables. The mean (median) leverage is 69.50% (81.82%) for the full sample of individual banks. The mean leverage remained relatively stable during the twelve-year sample period and peaked in 2009 at 70.61%. Financial conglomerates presented an even higher leverage level, with a mean of 82.15% and a median of 87.03%. The standard deviation of leverage was substantially lower for financial conglomerates than for individual banks. Previous studies reported comparable leverage figures for the banking industry. For example, [Gu et al. \(2015\)](#) collected data from the 100 largest multinational commercial banks worldwide; using the Bankscope database for the period from 1997 to 2011, these authors found a mean leverage of 86.57%. Other statistics shown in Table 4 are very much in line with the ones reported

by Gu et al. (2015), including mean profitability and mean riskiness, as measured by the proportion of non-performing loans.

Table 4. Summary Statistics.

| Variable | Banks | | | Financial Conglomerates | | |
|----------------------------|-------|--------|-----------|-------------------------|--------|-----------|
| | Mean | Median | Std. Dev. | Mean | Median | Std. Dev. |
| Leverage | 0.70 | 0.82 | 0.28 | 0.82 | 0.87 | 0.14 |
| Assets | 21.26 | 1.61 | 84.52 | 38.16 | 3.49 | 118.23 |
| Debt | 18.91 | 1.04 | 79.12 | 34.72 | 2.92 | 108.57 |
| Net Assets | 2.35 | 0.26 | 7.43 | 3.42 | 0.46 | 10.05 |
| Size | 21.08 | 21.20 | 2.28 | 22.02 | 21.97 | 2.17 |
| Collateral | 0.24 | 0.17 | 0.23 | 0.19 | 0.15 | 0.17 |
| Profitability | 0.01 | 0.01 | 0.07 | 0.01 | 0.01 | 0.04 |
| Basel | 0.32 | 0.18 | 0.53 | 0.24 | 0.18 | 0.23 |
| Riskiness | 0.04 | 0.02 | 0.05 | 0.03 | 0.02 | 0.04 |
| Foreign Investments (%) | 0.33 | 0 | 1.14 | 0.06 | 0 | 0.28 |
| Domestic Participation (%) | 5.03 | 0.26 | 12.99 | 1.45 | 0.40 | 2.86 |

Note. This table shows means, medians, and standard deviations of selected variables considering the full sample of either individual banks or financial conglomerates. Variables are described in Table 3, except for Assets (total assets in BRL Billions), Debt (total liabilities in BRL Billions), Net Assets (assets minus liabilities, in BRL Billions), and Basel (regulatory capital or Basel index). Foreign Investments and Domestic Participation are in percentage.

Other interesting figures relate to the regulatory capital under Basel II and Basel III. The median level of regulatory capital for financial conglomerates was 0.1759, and it was surprisingly stable for a period during which minimum capital requirements increased from 0.11 to 0.13. It is important to highlight that the median Basel index was consistently above the regulatory requirements. The mean Basel index was higher than the median for every year studied, with a global mean of 0.2443 for financial conglomerates. Foreign investments remained stable and low during the sample period. In fact, its median value was zero for both banks and financial conglomerates. The mean value was smaller than 1%. This finding confirms the [Basel Committee on Banking Supervision \(2013\)](#) statement that Brazilian banks were focused predominantly on domestic banking activities.

Table 5 shows bivariate correlations between selected variables using the full sample of individual banks. As expected, leverage positively correlates with size and foreign investments, while it negatively correlates with profitability and the Basel index. Interestingly, banks with greater domestic participation tend to have lower leverage in our sample, which is compatible with the argument that such banks have greater profit-shifting opportunities and lower incentives to use debt as a tax shield.

Table 5. Correlation Matrix—Individual Banks.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|-----------------------------|-----|------|-------|-------|-------|-------|-------|-------|
| Leverage (1) | 1 | 0.46 | −0.18 | −0.37 | −0.18 | 0.16 | 0.11 | −0.38 |
| Size (2) | | 1 | −0.23 | −0.19 | −0.01 | −0.04 | 0.31 | 0.1 |
| Basel (3) | | | 1 | 0.07 | 0.03 | −0.07 | −0.04 | −0.05 |
| Collateral (4) | | | | 1 | 0.08 | −0.25 | −0.03 | −0.08 |
| Profitability (5) | | | | | 1 | −0.15 | −0.01 | 0.12 |
| Riskiness (6) | | | | | | 1 | −0.07 | −0.13 |
| Foreign Investments (7) | | | | | | | 1 | 0.09 |
| Domestic Participations (8) | | | | | | | | 1 |

Note. This table shows bivariate correlations between selected variables using the full sample of individual banks. Variables are described in Table 3, except for Basel (regulatory capital or Basel index).

4.2. Regression Analysis

The regression analysis employs two alternative identification strategies within a difference-in-differences design using panel data. The first identification strategy compares

banks owned by higher- and lower-taxed shareholders, whereas the second identification strategy compares individual banks with their financial conglomerates.

Table 6 shows the estimation results of models based on Equations (1) and (2) using the identification strategy exploiting differences in shareholder taxation to assess the impact of the first income tax hike of 6 p.p., effective from April 2008. The regression specification shown in the first column features controls for size, profitability, and riskiness, including collateral, which are common in previous studies of the banking industry (De Mooij and Keen 2016; Gropp and Heider 2010; Schepens 2016). In the model shown in the second column, we include the regulatory constraint dummy and size squared in order to capture the potentially non-linear relationship between size and leverage. The models shown in the third and fourth columns additionally include foreign investments and domestic participation, which, to the best of our knowledge, have not been used in the extant empirical capital structure literature.

Table 6. Regression Results. Exogenous shock: 2008 tax rate increase; Comparison group: Lower-taxed shareholders.

| Leverage | (1) | (2) | (3) | (4) |
|----------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Treatment (Group \times Post) | 0.0515 ** (0.0212) | 0.0598 *** (0.0193) | 0.0585 *** (0.0194) | 0.0505 ** (0.0208) |
| DP \times Treatment | | | | 0.3430 (0.2337) |
| DP \times Group | | | | −0.7837 *** (0.2426) |
| Group (Higher-Taxed Shareholder) | −0.1045 *** (0.0333) | −0.0969 *** (0.0334) | −0.0480 * (0.0263) | −0.0170 (0.0271) |
| Size | 0.0548 *** (0.0069) | 0.4231 *** (0.0971) | 0.3397 *** (0.0847) | 0.3640 *** (0.0855) |
| Size squared | | −0.0086 *** (0.0022) | −0.0067 *** (0.0019) | −0.0072 *** (0.0019) |
| Collateral | −0.3116 *** (0.0712) | −0.2767 *** (0.0706) | −0.3561 *** (0.0691) | −0.3553 *** (0.0691) |
| Profitability | −1.5036 *** (0.3300) | −1.6120 *** (0.3220) | −1.1430 *** (0.2082) | −1.1063 *** (0.1986) |
| Regulatory Constraint | | 0.0551 ** (0.0240) | 0.0573 *** (0.0185) | 0.0544 *** (0.0183) |
| Riskiness | 0.0834 (0.3218) | 0.0076 (0.2889) | −0.2454 (0.1986) | −0.2500 (0.1931) |
| Domestic Participation (DP) | | | −0.8236 *** (0.0796) | −0.1778 (0.2295) |
| Foreign Investments | | | 0.8640 * (0.5016) | 0.7652 (0.5628) |
| Constant | −0.3256 ** (0.1558) | −4.2415 *** (1.0649) | −3.3036 *** (0.9421) | −3.6030 *** (0.9514) |
| Time Dummies | yes | yes | yes | yes |
| Number of Observations | 1378 | 1378 | 1378 | 1378 |
| Number of Banks | 197 | 197 | 197 | 197 |
| F | 17.71 *** | 23.04 *** | 30.26 *** | 35.75 *** |
| R ² | 0.4050 | 0.4501 | 0.5862 | 0.5995 |
| Adjusted R ² | 0.3993 | 0.4440 | 0.5810 | 0.5936 |
| Root MSE | 0.2161 | 0.2079 | 0.1805 | 0.1778 |

Note. This table shows the estimation results of models based on Equations (1) and (2) using the April 2008 tax rate increase as the exogenous shock and data encompassing eight semesters around the event. Variables are described in Table 3. The Group (Higher-Taxed Shareholder) dummy is equal to 1 when the shareholder holding the greatest amount of voting shares within the bank's control group is a Brazilian domestic corporation, and it is equal to 0 otherwise. DP stands for Domestic Participation. The models are estimated via OLS. Standard errors are presented in parenthesis, with errors clustered at the bank level. *, **, *** denote $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

The estimates from Table 6 show that the difference-in-differences (i.e., treatment) coefficient estimates are economically relevant and statistically significant at the 5% or 1% levels in all regressions, suggesting that banks with higher-taxed shareholders increased their leverage levels more than banks with lower-taxed shareholders in response to the income tax hike, which is compatible with our hypothesis H1. The fourth column of Table 6

shows the estimates corresponding to Equation (2). It shows that the estimated effect of the first tax hike is not significantly different for banks with higher domestic participation, which is incompatible with hypothesis H2. In other words, the evidence from Table 6 does not support the claim that the positive relationship between leverage and the corporate income tax rate is weaker for individual banks with greater profit-shifting opportunities.

Table 7 shows estimation results of models based on Equations (1) and (2) exploiting the same natural experiment. The only difference is the identification strategy since we now use financial conglomerates as the comparison group. The main results from Table 7 are remarkably consistent with those from Table 6, although the identification strategies employed are quite different. In particular, Table 7 shows that the difference-in-differences (i.e., treatment) coefficient estimates, though smaller than those reported in Table 6, are still economically relevant and statistically significant at the conventional levels, in most cases at the 5% level. These results suggest that individual banks increased their leverage more than financial conglomerates in response to the 2008 income tax hike, which is again compatible with H1. In contrast, and similarly to Table 6, the estimates in Table 7 are incompatible with H2.

Table 7. Regression Results. Exogenous shock: 2008 tax rate increase; Comparison group: Financial conglomerates.

| Leverage | (1) | (2) | (3) | (4) |
|-----------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Treatment (Group \times Post) | 0.0304 * (0.0163) | 0.0326 ** (0.0154) | 0.0403 ** (0.0156) | 0.0378 ** (0.0174) |
| DP \times Treatment | | | | 0.1407 (0.3313) |
| DP \times Group | | | | −0.0176 (0.2024) |
| Group (Bank Institution) | −0.0938 *** (0.0224) | −0.0943 *** (0.0215) | −0.0408 ** (0.0179) | −0.0405 ** (0.0181) |
| Size | 0.0485 *** (0.0059) | 0.4310 *** (0.0798) | 0.2745 *** (0.0662) | 0.2744 *** (0.0673) |
| Size squared | | −0.0087 *** (0.0018) | −0.0053 *** (0.0015) | −0.0053 *** (0.0015) |
| Collateral | −0.3044 *** (0.0692) | −0.2677 *** (0.0700) | −0.3663 *** (0.0676) | −0.3666 *** (0.0678) |
| Profitability | −1.5784 *** (0.3334) | −1.6817 *** (0.3257) | −1.1387 *** (0.1884) | −1.1381 *** (0.1895) |
| Regulatory Constraint | | 0.0296 (0.0199) | 0.0248 * (0.0143) | 0.0247 * (0.0143) |
| Riskiness | −0.4642 * (0.2630) | −0.3889 * (0.2323) | −0.5766 *** (0.1537) | −0.5772 *** (0.1555) |
| Domestic Participation (DP) | | | −0.8792 *** (0.0693) | −0.8633 *** (0.1919) |
| Foreign Investments | | | 1.0218 ** (0.4321) | 1.0230 ** (0.4329) |
| Constant | −0.1177 (0.1358) | −4.2860 *** (0.8971) | −2.5013 *** (0.7459) | −2.5001 *** (0.7580) |
| Time Dummies | yes | yes | yes | yes |
| Number of Observations | 1383 | 1383 | 1383 | 1383 |
| Number of Banks | 130 | 130 | 130 | 130 |
| Number of Financial Conglomerates | 74 | 74 | 74 | 74 |
| F | 16.31 *** | 22.40 *** | 34.19 *** | 32.01 *** |
| R ² | 0.4170 | 0.4622 | 0.6425 | 0.6425 |
| Adjusted R ² | 0.4114 | 0.4563 | 0.6380 | 0.6373 |
| Root MSE | 0.1939 | 0.1864 | 0.1521 | 0.1522 |

Note. This table shows the estimation results of models based on Equations (1) and (2) using the April 2008 tax rate increase as the exogenous shock and data encompassing eight semesters around the event. Variables are described in Table 3. The Group (Bank Institution) dummy is equal to 1 for individual banks, and it is equal to 0 for financial conglomerates. DP stands for Domestic Participation. The models are estimated via OLS. Standard errors are presented in parenthesis, with errors clustered at the bank level. *, **, *** denote $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

Table 8 shows the results of estimations using the same model specifications and identification strategy underpinning the results shown in Table 6. Similarly, the estimates

from Table 9 are based on the same model specifications and identification strategy underpinning the estimates in Table 7. The only difference is that the regressions presented in Tables 8 and 9 assess the second income tax increase of 5 p.p., which was overtly temporary and expected to be effective from September 2015 to December 2018. The results from Tables 8 and 9 combined are clear: There is no evidence of any effect of the temporary tax hike on the leverage of the banks in our sample, which is incompatible with hypothesis H1. If anything, contrary to H1, in most regressions, the sign of the difference-in-differences (i.e., treatment) coefficient estimate is negative. However, it is only statistically significant at the conventional levels in some of the regressions using the first identification strategy, whereas in all of the regressions shown in Table 9, adopting the second identification strategy, the estimates are non-significant at the conventional levels. Similar to the inference based on Tables 6 and 7, the results shown in Tables 8 and 9 do not offer evidence in support of hypothesis H2.

Table 8. Regression Results. Exogenous shock: 2015 (temporary) tax rate increase; Comparison group: Lower-taxed shareholders.

| Leverage | (1) | (2) | (3) | (4) |
|----------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Treatment (Group \times Post) | −0.0359 (0.0217) | −0.0374 * (0.0213) | −0.0415 ** (0.0204) | −0.0467 * (0.0239) |
| DP \times Treatment | | | | −0.0298 (0.2266) |
| DP \times Group | | | | −1.0515 *** (0.3334) |
| Group (Higher-Taxed Shareholder) | −0.1146 *** (0.0379) | −0.1144 *** (0.0381) | −0.0332 (0.0288) | −0.0076 (0.0312) |
| Size | 0.0515 *** (0.0073) | 0.3090 *** (0.0802) | 0.3164 *** (0.0694) | 0.3303 *** (0.0674) |
| Size squared | | −0.0061 *** (0.0018) | −0.0061 *** (0.0015) | −0.0064 *** (0.0015) |
| Collateral | −0.1883 ** (0.0836) | −0.1455 * (0.0831) | −0.2227 *** (0.0812) | −0.2218 *** (0.0806) |
| Profitability | −0.2200 * (0.1194) | −0.2022 (0.1267) | −0.1633 ** (0.0765) | −0.1569 ** (0.0707) |
| Regulatory Constraint | | 0.0341 (0.0228) | 0.0311 * (0.0186) | 0.0317 * (0.0186) |
| Riskiness | 0.8532 *** (0.2839) | 0.8211 *** (0.2704) | 0.4381 ** (0.1969) | 0.3904 ** (0.1969) |
| Domestic Participation (DP) | | | −0.9927 *** (0.1400) | −0.0309 (0.2886) |
| Foreign Investments | | | 0.2983 (0.7006) | 0.3753 (0.6571) |
| Constant | −0.3255 * (0.1693) | −3.0479 *** (0.8882) | −3.1500 *** (0.7867) | −3.3115 *** (0.7640) |
| Time Dummies | yes | yes | yes | yes |
| Number of Observations | 1361 | 1361 | 1361 | 1361 |
| Number of Banks | 185 | 185 | 185 | 185 |
| F | 11.73 *** | 12.60 *** | 17.63 *** | 15.91 *** |
| R ² | 0.3427 | 0.3718 | 0.5243 | 0.5350 |
| Adjusted R ² | 0.3363 | 0.3647 | 0.5183 | 0.5281 |
| Root MSE | 0.2311 | 0.2261 | 0.1969 | 0.1944 |

Note. This table shows the estimation results of models based on Equations (1) and (2) using the tax rate increase expected to be effective from September 2015 to December 2018 as the exogenous shock and data encompassing eight semesters around the enactment of the law. Variables are described in Table 3. The Group (Higher-Taxed Shareholder) dummy is equal to 1 when the shareholder holding the greatest amount of voting shares within the bank's control group is a Brazilian domestic corporation, and it is equal to 0 otherwise. DP stands for Domestic Participation. The models are estimated via OLS. Standard errors are presented in parenthesis, with errors clustered at the bank level. *, **, *** denote $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

Table 9. Regression Results. Exogenous shock: 2015 (temporary) tax rate increase; Comparison group: Financial conglomerates.

| Leverage | (1) | (2) | (3) | (4) |
|-----------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Treatment (Group \times Post) | −0.0222 (0.0182) | −0.0195 (0.0176) | −0.0265 (0.0175) | −0.0225 (0.0195) |
| DP \times Treatment | | | | −0.2895 (0.3105) |
| DP \times Group | | | | 0.0947 (0.3337) |
| Group (Bank Institution) | −0.0928 *** (0.0303) | −0.0959 *** (0.0294) | −0.0320 (0.0262) | −0.0332 (0.0285) |
| Size | 0.0433 *** (0.0069) | 0.2478 *** (0.0844) | 0.2893 *** (0.0779) | 0.2897 *** (0.0784) |
| Size squared | | −0.0047 ** (0.0018) | −0.0055 *** (0.0017) | −0.0055 *** (0.0017) |
| Collateral | −0.2511 *** (0.0825) | −0.2036 ** (0.0856) | −0.2797 *** (0.0819) | −0.2795 *** (0.0823) |
| Profitability | −0.2408 ** (0.1170) | −0.2138 * (0.1184) | −0.1395 *** (0.0486) | −0.1389 *** (0.0484) |
| Regulatory Constraint | | 0.0189 (0.0204) | 0.0225 (0.0154) | 0.0226 (0.0155) |
| Riskiness | 0.4821 ** (0.2203) | 0.4241 * (0.2206) | 0.0950 (0.1607) | 0.0944 (0.1606) |
| Domestic Participation (DP) | | | −1.0579 *** (0.1415) | −1.1550 *** (0.2899) |
| Foreign Investments | | | 0.6785 (0.7564) | 0.6773 (0.7564) |
| Constant | −0.1121 (0.1633) | −2.3361 ** (0.9673) | −2.8001 *** (0.9050) | −2.8030 *** (0.9118) |
| Time Dummies | yes | yes | yes | yes |
| Number of Observations | 1305 | 1305 | 1305 | 1305 |
| Number of Banks | 115 | 115 | 115 | 115 |
| Number of Financial Conglomerates | 70 | 70 | 70 | 70 |
| F | 9.47 *** | 10.44 *** | 13.64 *** | 13.56 *** |
| R ² | 0.3361 | 0.3539 | 0.5633 | 0.5634 |
| Adjusted R ² | 0.3294 | 0.3464 | 0.5576 | 0.5566 |
| Root MSE | 0.2197 | 0.2169 | 0.1784 | 0.1786 |

Note. This table shows the estimation results of models based on Equations (1) and (2) using the tax rate increase expected to be effective from September 2015 to December 2018 as the exogenous shock and data encompassing eight semesters around the enactment of the law. Variables are described in Table 3. The Group (Bank Institution) dummy is equal to 1 for individual banks, and it is equal to 0 for financial conglomerates. DP stands for Domestic Participation. The models are estimated via OLS. Standard errors are presented in parenthesis, with errors clustered at the bank level. *, **, *** denote $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

We envision two potential causes for the muted average response to the 2015 income tax increase. The first is that it was overtly temporary. Indeed, this interpretation is consistent with the results reported by Schandlbauer (2017), who studied staggered tax increases in U.S. states, documenting that temporary surcharge tax increases had no effect on banks' leverage decisions, in contrast to the positive response to other tax hikes "...believed to be of a more permanent nature" (Schandlbauer 2017, p. 100). The second possibility is that around 2015 banks in Brazil were more concerned with the increased regulatory strictness associated with the ongoing implementation of the Basel III accord. Although we are unable to fully account for the motivations of the banks in our sample, we provide additional evidence below that is consistent with heightened regulatory concern. Specifically, we run regressions similar to those presented in Table 6 (2008 tax hike) and Table 8 (2015 tax hike) but including the interaction of regulatory distance (distance between the financial/prudential conglomerate's Basel index and the regulatory minimum) with the treatment dummy. Results are shown in Table 10.

Table 10. Regression Results. Exogenous shocks: 2008 and 2015 tax rate increases; Comparison group: Lower-taxed shareholders.

| Leverage | 2008 Tax Increase | 2015 Tax Increase |
|--|-------------------------|-------------------------|
| Treatment (Group \times Post) | 0.0437 * (0.0236) | −0.0832 *** (0.0234) |
| Treatment \times Regulatory Distance | 0.0360 (0.0671) | 0.3234 *** (0.0897) |
| Group (Higher-Taxed Shareholder) | −0.0581 ** (0.0286) | −0.0590 ** (0.0294) |
| Regulatory Distance | −0.0674 (0.0542) | −0.1556 *** (0.0396) |
| Group \times Regulatory Distance | 0.0589 (0.0801) | 0.1420 (0.0942) |
| Constant | −2.8349 *** (0.9367) | −2.4961 *** (0.7581) |
| Time Dummies | yes | yes |
| Other controls | yes | yes |
| Number of Observations | 1378 | 1361 |
| Number of Banks | 197 | 185 |
| F | 34.23 *** | 17.31 *** |
| R ² | 0.5973 | 0.5670 |
| Adjusted R ² | 0.5910 | 0.5610 |
| Root MSE | 0.1782 | 0.1881 |

Note. This table shows the estimation results of models including the interaction of the Treatment dummy and Regulatory Distance comparing the two tax rate increases. The omitted controls are Size, Size squared, Collateral, Profitability, Riskiness, Domestic Participation, and Foreign Investments. Variables are described in Table 3. The Group (Higher-Taxed Shareholder) dummy is equal to 1 when the shareholder holding the greatest amount of voting shares within the bank's control group is a Brazilian domestic corporation, and it is equal to 0 otherwise. The models are estimated via OLS. Standard errors are presented in parenthesis, with errors clustered at the bank level. *, **, *** denote $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

The coefficients of interest pertain to the interaction treatment \times regulatory distance. As shown in Table 10, the estimates are remarkably different when comparing the two regressions. The small and non-significant coefficient estimate of treatment \times regulatory distance in the context of the 2008 tax increase shows that the leverage response to that tax hike (represented by the coefficient estimate of treatment) did not materially depend on how distant the conglomerate's Basel index was from the regulatory minimum. In sharp contrast, however, the leverage response to the 2015 tax hike was strongly conditioned by regulatory distance. The interaction estimate is statistically significant at the 1% level and almost ten times greater in magnitude in the context of the second tax increase. Combining the estimates for treatment and its interaction with regulatory distance, these results imply that the second tax hike was expected to increase leverage only for banks with very high values of regulatory distance, that is, those with the greatest regulatory slack (comprising around 12% of banks in our sample immediately before 2015). In addition, the difference between the estimates of treatment \times regulatory distance in the two regressions is statistically significant at the 5% level, and similar results were obtained after replacing regulatory distance with the actual Basel index of each financial/prudential conglomerate. Taken together, these results suggest that regulatory concerns played a greater role during the period around the second tax hike, possibly muting the leverage response of many banks.

5. Discussion

This study aims to contribute to the understanding of how taxes affect the capital structure of banks, as proposed by the trade-off theory. One innovation of this research is to consider profit-shifting opportunities available to banks and financial conglomerates, which might reduce the effect of taxes on capital structure decisions. In addition, complementing previous efforts and following Miller's (1977) seminal work, we exploit heterogeneity in investor-level taxation to develop our first identification strategy. Specifically, we note that

Brazil's ACE rule (Allowance for Corporate Equity) allows banks to reduce their taxable corporate income, but it increases the taxation due at the investor level. Therefore, because the ACE rule only reduces taxation by the difference between the corporate tax rate and the rate applicable to its investors, a corporate income tax rate increase affects Brazilian banks with higher-taxed equity holders more heavily. It is important to highlight that, as argued in the capital structure literature, firms should also consider investor-level taxation in their decision-making process (Graham 2003; Miller 1977). Alternatively, our second identification strategy exploits the fact that taxation is due at the individual bank level and that financial conglomerates have fewer incentives than individual firms to change their capital structure in response to changes in corporate taxes.

The empirical analysis includes four main regressions encompassing an eight-semester period around each of the two exogenous income tax hikes and featuring two comparison groups assumed to be less affected by the exogenous shocks, i.e., banks with lower-taxed shareholders or financial conglomerates. In the first regression setting, there are 197 banks; in the second, 185 banks; in the third, 130 banks and 74 financial conglomerates; and in the fourth, 115 banks and 70 financial conglomerates. All regression models are similar in that they are based on a difference-in-differences setup in which two comparable groups are differentially affected by the same tax rate increase.

The regressions include carefully chosen covariates to increase the precision of the estimates and reduce concerns over violations of the parallel trends assumption, which underlies causal inference in difference-in-differences setups. For example, most previous studies use some proxy for size, such as the logarithm of total assets, to explain leverage decisions (e.g., De Mooij and Keen 2016; Gropp and Heider 2010; Heckemeyer and De Mooij 2017; Lin et al. 2014). Based on this literature, a positive association between size and leverage is expected, and this expectation was confirmed in all of the regression models. In all specifications also including size squared, we find evidence of a non-linear relationship between size and leverage, with significantly negative coefficient estimates for size squared, consistent with previous research (De Mooij and Keen 2016; Hemmelgarn and Teichmann 2014). Similarly, most of the extant literature documents a negative association between profitability and leverage, as in Heckemeyer and De Mooij (2017). Our findings corroborate this prediction, particularly for the first period of analysis. However, it must be highlighted that profitability measured as net operating income is not as suited for the banking industry, considering that funding costs include interest expenses. Nevertheless, results are similar when we use the alternative proxies documented in the literature.

Regardless of the regression specification, our main results clearly indicate that the leverage of Brazilian banks increased in response to the 2008 tax rate increase. The point estimates obtained using the first identification strategy show that banks with higher-taxed shareholders increased their leverage by approximately 5 p.p. relative to banks controlled by lower-taxed shareholders. Similarly, estimates using the second identification strategy show that banks increased their leverage by approximately 3 p.p. relative to financial conglomerates. These estimates are economically significant, considering the tax hike of 6 p.p. and the overall mean leverage in the sample of about 70%.

The first tax rate increase took place during a particularly turbulent period for the banking industry globally, the 2008 international banking crisis. For that reason, we carefully assessed how this crisis could potentially affect our inferences. First, there is clear evidence that the crisis and its aftermath were much softer on the financial systems of emerging markets (e.g., Shehzad and De Haan 2013). In particular, Brazilian banks had little exposure to foreign assets or troubled mortgage-backed securities. Second, we employed two alternative comparison groups which, in principle, should have been affected by the crisis similarly to the "treated" banks. Therefore, our inferences would only be biased if the "treatment" and comparison groups were affected by the crisis in substantially different ways regarding their capital structure policies. This concern is clearly more plausible in the context of our first identification strategy since it exploits the heterogeneity in the ownership structure of banks. In particular, we note that government-controlled banks

were assigned to the lower-taxed shareholder group. There is evidence that during financial crises government-controlled banks tend to increase loan operations relative to private banks, which often face loan contractions (e.g., [Brei and Schclarek 2013](#)). Indeed, this pattern was documented in Brazil in the wake of the 2008 financial crisis ([Coleman and Feler 2015](#)). However, there is no evidence that this behavior affected banks' capital structure. Moreover, it is logical to presume that if there was an effect on capital structure, it would be the increase of the leverage of government-controlled banks in order to induce more lending. This possible effect would bias our inferences against hypothesis H1 when we implemented the first identification strategy, i.e., it would lead to an underestimation of the true effect of the first tax hike. Therefore, our conclusions supporting H1 are unlikely to be explained away by countercyclical policies adopted by government-controlled banks during the financial crisis; quite the opposite, they might hold despite such policies. An analogous argument applies to foreign-controlled banks, which were probably more affected by the crisis than domestic banks. These banks were also assigned to the comparison group (lower-taxed banks), and we found no evidence of the effects of the crisis on the capital structure of the subsidiaries of foreign banks operating in Brazil. In any event, our conclusions are robust to excluding foreign-controlled banks from our sample. In addition, as explained above, we included a set of covariates, which alleviates endogeneity concerns stemming from the possibility that the 2008 crisis differentially affected banks with certain characteristics, for example, size and profitability. Finally, we note that our conclusions are remarkably similar when we employ the second identification strategy, i.e., using financial conglomerates as the comparison group, which is quite different from the previous strategy and does not rely on ownership structure or other bank characteristics.

Applying the same strategies to the 2015 tax rate increase, we found no evidence of a positive response of leverage, i.e., our results are incompatible with H1 during this period. Therefore, the evidence regarding the impact of exogenous tax hikes on the capital structure of banks in Brazil is mixed. Our first explanation for this divergence relates to differences in the design of the 2008 and 2015 regulatory changes; the 2015 tax hike was announced as a temporary change, taking effect only through December 2018, while the 2008 increase had no such provisional character. It is well documented in the literature that adjusting the capital structure of both non-financial firms and financial institutions in the direction of either higher or lower leverage levels is a costly activity (e.g., [Faulkender et al. 2012](#); [Gropp and Heider 2010](#)). Therefore, it could be rational for banks to eschew further (costly) leverage increases in response to an income tax rate change that was due to be reversed. The second (noncompeting) explanation relates to the substantial change in banking regulation that took place partly in response to the 2008 financial crisis. Capital requirements in Brazil under Basel III were strengthened during the latter part of our sample period, from 2014 to 2017, affecting larger banks and systemically important financial institutions (SIFIs) especially. Such a stricter regulatory context was arguably much less favorable to any tax effect on leverage. Indeed, we provide evidence consistent with this argument, showing that only banks with the greatest regulatory slack (i.e., with a Basel index substantially above the regulatory minimum) were expected to increase their leverage in response to the 2015 tax hike while no such conditioning was found in the context of the 2008 tax hike.

In all of the empirical analyses, we found no support for hypothesis H2. Specifically, there is no evidence in our data that the relationship between leverage and the corporate income tax rate is moderated by the amount of domestic participation—the ratio of each individual bank's shareholdings in controlled or affiliated domestic firms to total assets, which proxies for profit-shifting opportunities. However, higher domestic participation predicts a lower degree of leverage, especially for banks assigned to the higher-taxed shareholder category. A possible explanation for this result is that profit-shifting opportunities among affiliated firms were indeed relevant to determining capital structure policies but were of second-order importance in the context of an income tax rate increase applicable to the banking sector as a whole. The inferences reported in this study are robust to variations

of the empirical specification or estimation method, including the omission of covariates and the estimation of regressions, including bank fixed effects.

This study contributes to the debate about the taxation of banking activities. While it might be fair to expect higher contributions from the banking industry, avoiding tax schemes that stimulate higher leverages and thus lead to greater systemic risk could be desirable. In this context, it is useful to understand how effective the Brazilian ACE rule is in reducing the tax advantage of debt. In Brazil, the ACE rule is often viewed as a tax subsidy for the wealthy instead of an economic neutrality rule and a possibly useful tool to achieve other regulatory goals, such as lowering the systemic risk associated with banking activities. In this study, we found evidence that the ACE rule, at least in the period around the first tax hike, stimulated a lower leverage increase for banks, in particular those with lower-taxed controlling shareholders. Thus, a tax incentive such as an ACE rule may benefit society by lowering bank leverage and thus increasing banks' capital buffers. Perhaps there is an opportunity to use taxation to mitigate the risk of future financial crises in complement to direct banking regulation.

The methodological approach of this study might lead to fewer endogeneity concerns compared with closely related papers because it exploited natural experiments including only Brazilian banks, thus avoiding concerns about country-level omitted variables. Although previous studies used country-level controls (De Mooij and Keen 2016; Hemmelgarn and Teichmann 2014; Schepens 2016), it is very difficult to include all potentially relevant variables. In addition, we used BACEN data, which is a reliable source because it follows strict disclosure rules. Another advantage of this database is that it includes all Brazilian banks and financial conglomerates; therefore, the analyses are not limited to traded banks. Nevertheless, our study is subject to important limitations. First, the banks in any of the two comparison groups could also be affected, albeit to a lesser degree, by the exogenous tax hikes. Therefore, they do not stand as "control groups" in the sense of being strictly unaffected by the exogenous shocks. Second, we cannot completely rule out the possibility that mean leverage would have evolved differently in the comparison and "treatment" groups in the absence of the income tax hikes, even after the inclusion of control variables. Third, our proxies have limitations. For example, the proxy for profit-shifting opportunities does not discriminate between domestic participations that are used for tax planning purposes and those that are not. Finally, while using a single-country empirical setting and exploiting peculiarities such as the Brazilian ACE rule may have enhanced the internal validity of our analysis, it necessarily limited its external validity, such that our findings might not be directly applicable to banks in other regulatory settings. Thus, future research might improve our understanding of the topics addressed in this study by applying analogous methodological approaches to different jurisdictions.

6. Concluding Remarks

Taken together, our evidence is consistent with the argument that the capital structure policies of financial institutions are influenced by standard considerations of the costs and benefits of debt, similar to non-financial firms, at least up to the point when regulatory capital and related concerns typical of the banking sector become the dominant factor. In particular, this study shows that banks might respond to exogenous income tax increases in strikingly different ways, depending on the context. Our evidence is consistent with and complements related empirical research in other jurisdictions, such as the U.S., Japan, and European countries (e.g., Bremus et al. 2020; Milonas 2018; Schandlbauer 2017; Sobiech et al. 2021). For example, Bremus et al. (2020) show that specific banking regulations might interact with corporate income taxation to determine bank leverage in Europe, while Schandlbauer (2017) suggests that income tax increases are less likely to affect the leverage of U.S. banks when they are perceived to be temporary and when banks are inadequately capitalized. Further research might help to understand how banks navigate opposing forces and manage to strike a balance between regulatory concerns and the pursuit of corporate finance policies similar to their non-financial counterparts.

Author Contributions: Conceptualization, A.J.C.B.d.M.J. and L.A.B.d.C.B.; methodology, A.J.C.B.d.M.J. and L.A.B.d.C.B.; software, A.J.C.B.d.M.J.; validation, A.J.C.B.d.M.J., L.A.B.d.C.B. and M.D.A.E.; formal analysis, A.J.C.B.d.M.J.; data curation, A.J.C.B.d.M.J.; writing—original draft preparation, M.D.A.E. and L.A.B.d.C.B.; writing—review and editing, M.D.A.E., A.J.C.B.d.M.J. and L.A.B.d.C.B.; supervision, L.A.B.d.C.B.; project administration, A.J.C.B.d.M.J. and L.A.B.d.C.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Not applicable.

Data Availability Statement: The complete dataset is available on the Zenodo platform and may be accessed at <https://doi.org/10.5281/zenodo.11882863>.

Conflicts of Interest: The authors declare no conflicts of interest.

References

- Basel Committee on Banking Supervision. 2013. Regulatory Consistency Assessment Programme (RCAP) Assessment of Basel III Regulations in Brazil. Available online: https://www.bis.org/bcbs/implementation/l2_br.pdf (accessed on 15 August 2024).
- Brei, Michael, and Alfredo Schclarek. 2013. Public Bank Lending in Times of Crisis. *Journal of Financial Stability* 9: 820–30. [\[CrossRef\]](#)
- Bremus, Franziska, Kirsten Schmidt, and Lena Tonzer. 2020. Interactions between Bank Levies and Corporate Taxes: How Is Bank Leverage Affected? *Journal of Banking & Finance* 118: 105874. [\[CrossRef\]](#)
- Coleman, Nicholas, and Leo Feler. 2015. Bank Ownership, Lending, and Local Economic Performance during the 2008–2009 Financial Crisis. *Journal of Monetary Economics* 71: 50–66. [\[CrossRef\]](#) [\[PubMed\]](#)
- De Mooij, Ruud A., and Michael Keen. 2016. Debt, Taxes, and Banks. *Journal of Money, Credit and Banking* 48: 5–33. [\[CrossRef\]](#)
- Deng, Kebin, Yushu Zhu, Tom Smith, and Alan McCrystal. 2020. Tax and Leverage: Evidence from China. *China Economic Review* 62: 101479. [\[CrossRef\]](#)
- Devereux, Michael P., Giorgia Maffini, and Jing Xing. 2018. Corporate Tax Incentives and Capital Structure: New Evidence from UK Firm-Level Tax Returns. *Journal of Banking & Finance* 88: 250–66. [\[CrossRef\]](#)
- Doidge, Craig, and Alexander Dyck. 2015. Taxes and Corporate Policies: Evidence from a Quasi Natural Experiment. *The Journal of Finance* 70: 45–89. [\[CrossRef\]](#)
- Faulkender, Michael, Mark J. Flannery, Kristine Watson Hankins, and Jason M. Smith. 2012. Cash Flows and Leverage Adjustments. *Journal of Financial Economics* 103: 632–46. [\[CrossRef\]](#)
- Gordon, Roger H. 2010. Taxation and Corporate Use of Debt: Implications for Tax Policy. *National Tax Journal* 63: 151–74. [\[CrossRef\]](#)
- Graham, John R. 2003. Taxes and Corporate Finance: A Review. *Review of Financial Studies* 16: 1075–1129. [\[CrossRef\]](#)
- Graham, John R., Michael L. Lemmon, and James S. Schallheim. 1998. Debt, Leases, Taxes, and the Endogeneity of Corporate Tax Status. *The Journal of Finance* 53: 131–62. [\[CrossRef\]](#)
- Gropp, Reint, and Florian Heider. 2010. The Determinants of Bank Capital Structure. *Review of Finance* 14: 587–622. [\[CrossRef\]](#)
- Gu, Grace Weishi, Ruud De Mooij, and Tigran Poghosyan. 2015. Taxation and Leverage in International Banking. *International Tax and Public Finance* 22: 177–200. [\[CrossRef\]](#)
- Heckemeyer, Jost H., and Ruud A. De Mooij. 2017. Taxation and Corporate Debt: Are Banks Any Different? *National Tax Journal* 70: 53–76. [\[CrossRef\]](#)
- Hemmelgarn, Thomas, and Daniel Teichmann. 2014. Tax Reforms and the Capital Structure of Banks. *International Tax and Public Finance* 21: 645–93. [\[CrossRef\]](#)
- Lin, Shannon, Naqiong Tong, and Alan L. Tucker. 2014. Corporate Tax Aggression and Debt. *Journal of Banking & Finance* 40: 227–41. [\[CrossRef\]](#)
- Meyer, Breed D. 1995. Natural and Quasi-Experiments in Economics. *Journal of Business & Economic Statistics* 13: 151–61. [\[CrossRef\]](#)
- Miller, Merton H. 1977. Debt and Taxes. *The Journal of Finance* 32: 261. [\[CrossRef\]](#)
- Milonas, Kristoffer. 2018. Bank Taxes, Leverage, and Risk. *Journal of Financial Services Research* 54: 145–77. [\[CrossRef\]](#)
- Schandlbauer, Alexander. 2017. How Do Financial Institutions React to a Tax Increase? *Journal of Financial Intermediation* 30: 86–106. [\[CrossRef\]](#)
- Schepens, Glenn. 2016. Taxes and Bank Capital Structure. *Journal of Financial Economics* 120: 585–600. [\[CrossRef\]](#)
- Shehzad, Choudhry Tanveer, and Jakob De Haan. 2013. Was the 2007 Crisis Really a Global Banking Crisis? *The North American Journal of Economics and Finance* 24: 113–24. [\[CrossRef\]](#)
- Sobiech, Anna L., Dimitris K. Chronopoulos, and John O. S. Wilson. 2021. The Real Effects of Bank Taxation: Evidence for Corporate Financing and Investment. *Journal of Corporate Finance* 69: 101989. [\[CrossRef\]](#)

- The World Bank, and PwC. 2015. Paying Taxes 2015: The Global Picture. The Changing Face of Tax Compliance in 189 Economies Worldwide. Available online: https://documents1.worldbank.org/curated/en/758831468126901094/pdf/952190WP0Box380C00Paying0Taxes02015.pdf?_gl=1*1hdnofc*_gcl_au*MTYxNjcxNjI5MC4xNzI1NjUyMTMw (accessed on 15 August 2024).
- Vazquez, Francisco, and Pablo Federico. 2015. Bank Funding Structures and Risk: Evidence from the Global Financial Crisis. *Journal of Banking & Finance* 61: 1–14. [CrossRef]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.