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Abstract

Tax havens represent the largest financing hub for financial institutions. For banks, they account for more than 20% of all cross-borders banking debt worldwide. Yet, our understanding of the underlying drivers remains limited. Drawing on a unique global dataset covering major international banks and tax havens – and employing a novel approach to isolate regulatory arbitrage – this paper finds that the location of cross-border intra-group debt held by multinational banks is shaped by tax considerations, even when regulatory differences are taken into account. For the first time, we provide direct evidence of profit shifting via debt shifting on a global scale, overcoming a key limitation of existing studies which typically rely on single-country data. Based on our sample data, we show that the magnitude of "excess" offshore banking debt globally recorded in tax havens is significant.

Keywords: Profit shifting, Debt shifting, Multinational banks, Taxation, Intragroup transactions

JEL classification: H26 G21 F23 F34

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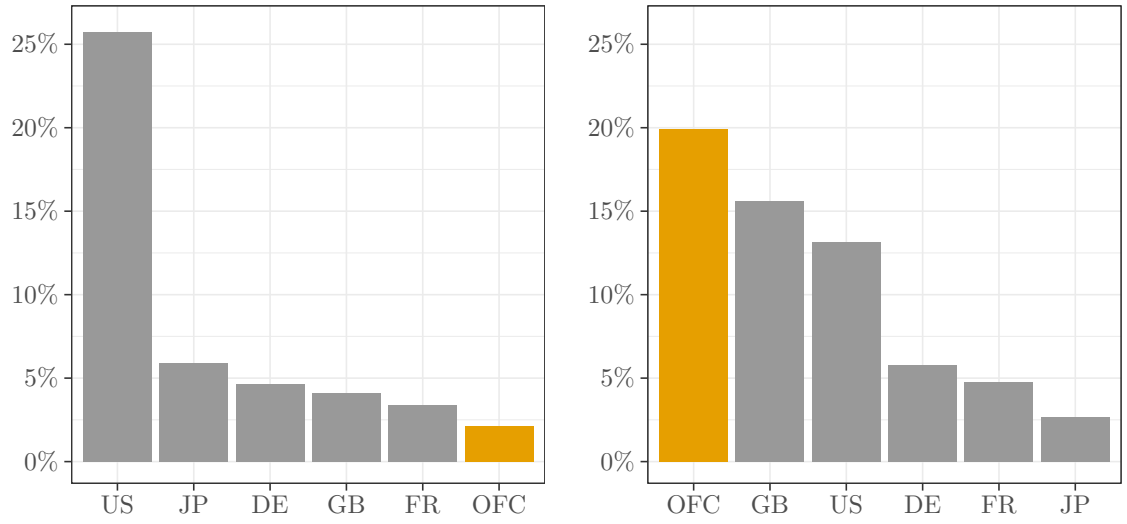
1 Introduction

The importance of tax havens or Offshore Financial Centres (OFCs) in international banking flows is widely recognized (Cassard, 1994, Lane and Milesi-Ferretti, 2011, Rose and Spiegel, 2007, Zoromé, 2007). While OFCs represent a negligible share of global GDP, they account for more than 20% of international banking assets and liabilities (Figure 1), making them the largest banking system – surpassing both the banking systems of the United States and the United Kingdom (Pogliani et al., 2022). However, the specific role of OFCs in the global banking architecture – and more generally for financial institutions – remains subject to important debate. Explanations range from the idea that banks use OFCs primarily for profit shifting, to the argument that regulatory considerations are the key drivers (Demirgüç-Kunt et al., 2023, Frame et al., 2020, Houston et al., 2012). The latter explanation is particularly relevant for banks, which may seek to avoid certain regulations, especially as regulatory constraints have become significantly more stringent in the post-financial crisis era (Tarullo, 2019). However, since tax and regulatory incentives in tax havens often go hand in hand, distinguishing the role of regulatory arbitrage from tax avoidance in banks' offshore activities remains particularly challenging.

Against this background, the primary objective of this paper is to investigate why banks borrow so much from banks located in OFCs and to assess to which extent profit shifting and tax avoidance drive their behavior.

Figure 1: **Share of selected countries and OFC in world GDP (left) and in total cross-border assets (right) in 2019**



Note: The list used to create the 'Offshore financial centres' (OFCs) group is from Kintzler et al. (2020). Weight measured using national GDP (2019) and 2019-Q4 amounts outstanding. Source: World Bank and BIS Locational Banking Statistics by residence (LBSR). Authors' calculations. Lecture: OFCs represent together 2% of global GDP but hold 20% of the total of cross-border assets.

Understanding why banks rely so heavily on OFCs matters for both economists and policymakers.

Most of the research on the determinants of offshore activities focuses on NFCs or households, leaving a significant gap in understanding *why* and *how* banks use OFCs for their own purposes.

The literature shows that OFCs are widely used by multinational firms to shift profits (Tørsløv et al., 2023), often through "phantom" corporate structures (Damgaard et al., 2024), and by households to conceal wealth and evade taxes (Zucman, 2013). By contrast, evidence on banks' own profit shifting behavior is scant: in most empirical research they are intermediaries for clients (Beer et al., 2020, Casi et al., 2020, Johannesen and Zucman, 2014, Menkhoff and Miethe, 2019, O'Reilly et al., 2021), and the few that analyze their own profit shifting strategies remain confined to single-country or regional settings (Langenmayr and Reiter, 2022, Reiter et al., 2021). This gap is all the more striking given that banks face fewer constraints when shifting profits through intra-group debt in low-tax jurisdictions. In particular, unlike non-financial firms, they are largely exempt from interest deduction limits that typically restrict such strategies (De Mooij and Hebous, 2018, Reiter et al., 2021).

Debt shifting hinges on a relatively direct intra-group mechanism: a bank establishes a subsidiary in a tax haven and has that subsidiary *lend* money to another entity of the group located in a higher tax country. The interest paid on this internal loan is deductible for the borrower, shrinking taxable profits in the high-tax country. The same interest appears as income in the OFC-based subsidiary, where it faces little or no tax. Each payment therefore moves profit from the higher tax country to the OFC without changing the group's consolidated cash position. At a macro level, this behavior manifests as unusually large intra-group debt owed to OFCs.

In this paper, we exploit the richness of the Bank for International Settlements (BIS) Locational Banking Statistics (BIS, 2003) to investigate *why* and *how* banks borrow so much from OFCs. These *restricted* data (in the terminology used by the BIS) provide country-level, bilateral, cross-border bank exposures for more than 65 countries, including the major banking systems and most OFCs which enables us to characterize banks' cross-border borrowing strategies.[2]

First, we establish that a large share of cross-border borrowing is located in OFCs and is mainly conducted through intra-group transactions. This strong intra-group preference is unique to low-tax jurisdictions: on average, banks borrow 80% intra-group from OFCs compared to 45% from the rest of the world.

Second, we relate the geographical distribution of cross-border bank borrowing (which we refer

[2]There are three levels of confidentiality for LBS databases: public, *i.e.*, accessible to all; restricted, accessible only to a few institutions; and confidential, accessible only by the BIS. The latter dataset includes the full scope of data and is therefore more comprehensive than the restricted dataset. Nevertheless, due to our focus on banking counterparties and the high quality of reporting by the largest banking systems – ensured by national institutions and the BIS – we are able, through the use of mirror data, to cover nearly all major bilateral positions, which is the primary objective of our study.

to as *borrowing country* for the sake of simplicity throughout the rest of paper) to the tax rate faced by the lending bank (hereafter *lender country*) by contrasting intra-group positions – suitable for profit shifting – with arm's-length interbank positions. If debt shifting is at play, intra-group borrowing should rise (as compared to interbank borrowing) as the lender's tax rate falls, and that is precisely what we find: in the lowest-tax jurisdictions banks borrow more than four times as much from affiliates as from unrelated banks, and the gap widens to eight-fold when the borrower is headquartered in a high-tax country. The same result holds when low-tax jurisdictions are identified by their OFC status rather than their statutory tax rate.

Using the nationality variable in our dataset – which indicates where the headquarter of the banking group is located – we show that this pattern holds not only for parent banks but also for foreign subsidiaries, indicating debt optimization strategies at the group-wide level. After that, we test the robustness of these results to the alternative hypothesis that banks borrow mainly from OFCs or countries with low corporate tax rates in order to benefit from much looser prudential regulations, the so-called regulatory arbitrage hypothesis (Demirgüç-Kunt et al., 2023, Horváth, 2020). In order to isolate the specific role of tax avoidance from broader regulatory effects, we restrict our analysis to the sample of European Union countries, where banks have been operating under a single regulatory and supervisory framework since 2014. We continue to find that banks borrow significantly more intra-group than from unrelated banks when the EU lender country has a low corporate tax rate.

Finally, we conclude by performing a simple back-of-the-envelop calculation to quantify the excess debt resulting from this debt shifting behaviour: when neutralising the offshore effect, we estimate that 57%-88% of intra-group debt in OFCs (or 45%-70% of total cross-borders banking debt in OFCs) would qualify as excess debt.

Our paper contributes to several strands of literature. First, we fill a long-standing gap in the global evidence of firms' tax avoidance by bringing international banks into the picture. Specifically, we document, for the first time, the profit shifting behavior of all major international banks, with a coverage of 90% of global banking positions (BIS, 2020). In doing so, we expand the existing research on profit shifting by banks, which has been constrained by limited country coverage due to data limitations (Aliprandi et al., 2021, Barake, 2023, Bouvatier et al., 2017, Delatte et al., 2022, Dutt et al., 2019, Fatica et al., 2020, Janskỳ, 2020, Langenmayr and Reiter, 2022).[3] Moreover the complexity of bank balance sheets and regulation makes it difficult to analyze their tax strategies

[3]The main data sources – Orbis, Foreign Affiliates Statistics (FATS) or Country-by-country reporting (CbCR) – each present significant shortcomings. Orbis offers only sparse coverage of OFCs; FATS and CbCR remained confidential for banks until recently; and while some CbCR data became publicly available, they cover only European banks, i.e. eight of the 30 global systemically important banks.

with frameworks designed for non-financial firms (De Mooij, 2012, Heckemeyer and de Mooij, 2017, Huizinga et al., 2014, Langenmayr and Reiter, 2022). As a result, the public economics literature has often left banks outside the study of corporate tax avoidance.

We also contribute to the literature on profit shifting instruments. The existing literature faces a fundamental challenge: when working at a global scale, previous papers observe excess profits without identifying the mechanisms behind their relocation, providing only *indirect* evidence of profit shifting (Cobham and Jansky, 2018, Hugger et al., 2023, Merz and Overesch, 2016, Tørsløv et al., 2023). Previous literature that focus on banks has studied *external* debt (De Mooij and Keen, 2016, Fatica et al., 2020, Gu et al., 2015, Heckemeyer and de Mooij, 2017) and papers that consider internal debt shifting have generally excluded financial companies (Buettner and Wamser, 2013, Fuest et al., 2011, Overesch and Wamser, 2014) with the notable exception of Reiter et al. (2021). Conversely, research aiming to uncover how profits are shifted focus on a single country, as the necessary granularity to distinguish between intra-group and external transactions is generally not available on an international level (Bilicka, 2019, Godar et al., 2024, Reiter et al., 2021). By leveraging unique data, we are the first to provide direct *global* evidence of profit shifting through one of its three main channels – arguably the most relevant for banks – debt shifting (Huizinga et al., 2008).

Finally, our paper makes two methodological contributions for identifying and estimating banks' profit shifting. First, comparing intra-group positions relative to the benchmark of interbank (out-of-group) positions is, to the best of our knowledge, new in the literature and constitutes a key aspect of our approach. Second we propose a new, cleaner approach to separately identify the role of tax avoidance and regulatory arbitrage in banks' intensive use of OFCs (Demirgüç-Kunt et al., 2023, Frame et al., 2020, Houston et al., 2012, Sharafutdinova and Lokshin, 2020). We leverage the institutional setting of the European Union to control for regulatory arbitrage rather than relying on composite indices of regulatory and supervisory stringency, such as the Bank Regulation and Supervision Survey (BRSS) of Barth et al. (2013). The EU provides a unique environment with harmonized banking regulations and a common supervisory framework in place since 2014.

The rest of the paper is structured as follows. Section I describes the data sources. Section II outlines the conceptual framework, methodology, and identification strategy. Section III presents the main results.

2 Data sources

2.1 Locational Banking Statistics

We are interested in understanding how international banks use Offshore Financial Centres (OFCs) to structure their cross-border borrowing activities, with a particular focus on intra-group borrowing. To investigate this issue, we rely on a restricted macro-level dataset – the Locational Banking Statistics (LBS) – compiled by the Bank for International Settlements (BIS).[4] This dataset records quarterly cross-border borrowing and lending positions of international banks at a bilateral (country) level. In other words, we can observe how much the banks located in country A hold in outstanding loans and borrowings vis-à-vis country B.

Although the LBS have documented cross-border banking activities for over 40 years, the dataset underwent significant enhancements in coverage and granularity following the 2008 financial crisis. Recognizing the need for improved monitoring of global banking activity, regulators and governments launched the G20 Data Gaps Initiative, aimed at enhancing financial data transparency. Among other improvements, this initiative introduced detailed counterparty breakdowns, enabling a clearer view of cross-border banking positions. Most notably, starting in 2014, a large majority of reporting countries began providing explicit data on intra-group borrowing positions.

Our dataset thus clearly distinguishes between intra-group borrowing (exposures within the same banking group) and unrelated borrowing (exposures between different banking groups, which we refer to as "interbank" exposures throughout the rest of the paper).[5] Comparing these two types of borrowing constitutes the core of our empirical strategy. Our measure of loans/borrowings positions aggregates bank loans/borrowings and debt securities without explicit distinction, although supplementary BIS statistics indicate that it is composed of approximately 85% deposits and 15% securities.

To avoid biases arising from substantial fluctuations during the Covid-19 pandemic, our sample period covers only from 2014-Q1 to 2019-Q4 with 28 countries reporting their banking positions vis-à-vis 67 countries.[6] Although the overall LBS dataset is publicly accessible, the detailed bilateral breakdown by counterparty remains confidential.

Last, we also take advantage of a second dimension introduced as part of these enhancements: the nationality of the banking group. This variable indicates the country in which the headquarters

[4] For more details about this dataset, see the Appendix A.

[5] The ability to observe intra-group exposures arises from the LBS's residency-based, non-consolidated reporting approach, consistent with balance of payments statistics. Unlike consolidated datasets – the Consolidated Banking Statistics (CBS) for instance – this approach explicitly records exposures between entities within the same banking group, allowing us to precisely identify intra-group borrowing – an essential element for our analysis.

[6] While a small number of countries started reporting intra-group positions as early as 2013, comprehensive and reliable reporting began predominantly in 2014.

of the reporting bank is incorporated. Thus, we can observe the borrowings from banks located in country A vis-à-vis counterparties located in country B and headquartered, for instance, in country C. This information allows us to meaningfully distinguish between the behavior of parent companies and that of their foreign subsidiaries – an important feature we exploit to assess whether banking groups adopt different strategies at the parent and subsidiary levels.[7]

Ultimately, using the liability side of the dataset, we analyze worldwide cross-border borrowing positions for 28 reporting countries vis-à-vis 67 counterparties, covering banks from 43 distinct nationalities and capturing approximately 90% of global cross-border banking positions.

2.2 Corporate income tax rates data and lists of Offshore Financial Centres (OFC)

In order to measure the level of corporate taxation in the countries in our sample, we rely on the statutory corporate income tax rate compiled by the Tax Foundation (STR, see the Appendix C for sources and details). The main advantage of relying on STRs is that they are straightforward to understand, are available for all countries and for long periods of time. For this reason, they are widely used in international tax research (Beer et al., 2020, Huizinga et al., 2014, Reiter et al., 2021) and are the most frequently cited in public debates on taxation.

However, there are a number of caveats to using the STR, the first being that the corporate tax rate is not the only tax paid by companies. The second is that tax authorities recognize the special role of credit institutions in the economy, and banks are entitled to numerous tax breaks that make the calculation of an industry-wide theoretical tax rate challenging.[8] The STR must therefore be regarded as an imperfect proxy for the actual level of tax rates supported by financial institutions. We test the robustness of our main findings using the effective tax rate (ETR) as an alternative measure of corporate taxation based on the database compiled by Aliprandi et al. (2021).[9]

To characterise the cross-sectional/geographic distribution of corporate income tax rates, we construct quintiles of the distribution of corporate income tax rates observed in the *lender* country j: $Q_{1t}, ..., Q_{5t}$.[10] To take into account the potential change in a country's statutory corporate tax rate over time and the downward trend in STR – the average STR in our sample is 24% in 2014

[7] Our dataset includes subsidiaries, branches and affiliates without distinction. We use "subsidiary" as a generic term for all three categories.

[8] De Mooij (2012) notes that, from a legal perspective, the introduction of hybrid financial instruments (convertible bonds, subordinated debt, warrants, etc.) has blurred the frontier between debt and equity instruments. Banks make extensive use of these securities, which allow some interest payments to be tax deductible. This has led tax authorities to redefine what constitutes debt on a case-by-case basis, leaving room for interpretation on theoretical tax rates. Moreover some countries make extensive use of tax rulings that are not reflected in statutory rates.

[9] See appendix F for more details.

[10] The use of quintiles allows us to (i) respect the confidentiality of the dataset required by the BIS and (ii) show that debt shifting in concentrated in specific quintiles.

and 21% in 2019, with a significant decrease from some large and high-tax countries such as the US and France – we calculate the time-varying quintile Q_{zt} (Table 1). This means that a lender country can move from one quintile to another over time. For example, the United States' STR was 38.9% in 2017 and 25.8% in 2018 after the Tax Cuts and Jobs Act (TCJA) reform, which means that the country moves from the the 5^{th} quintile in 2017 to the 4^{th} quintile in 2018.

Table 1: **Statutory tax rate (STR) quintiles of the lender countries in 2015**

Quintile Q_{zt}	Q_1	Q_2	Q_3	Q_4	Q_5
Statutory tax rate (in %)	[0-15]	[15-20]	[20-25]	[25-30]	[30-39]

Note: This table report the range of STR that characterized each of the quintile of corporate income tax rate we built. Since the STR are time-varying, we report the value of the bounds for the year 2015 as an example.

To complement this analysis and test the robustness of our results, we use various established lists of offshore financial centers, given the absence of an official definition. This approach has two main advantages. First, these lists serve as a useful proxy for low- or zero-tax jurisdictions, helping us mitigate potential biases associated with statutory tax rates (STRs). Second, it allows us to assess the robustness of our findings across different geographical scopes. Indeed, each list includes a different number of jurisdictions—ranging from 13 to 52—and differs slightly in terms of composition :

- First, we use the list compiled by Aliprandi et al. (2021), based on the Country-by-Country Reporting (CbCR) data on European banks. Tax havens are defined as jurisdictions that score low on a combination of two parameters: economic activity relative to profits using country-specific profit per employee data and tax rates, based on their computed country-specific effective tax rates. The list contains 16 jurisdictions, which are listed in Table 6 in the Appendix.
- Second, we use the list from Kintzler et al. (2020), which defines OFCs using LBS data as countries with the highest ratio of cross-border banking positions to resident population. The list includes 13 territories – which are listed in Table 7 in the Appendix – and corresponds to a set of offshore centres specialized in banking activities.
- Third, we test our results with the list from Johannesen and Zucman (2014). This list, which includes 52 countries (see Table 8 in the Appendix), identifies tax havens as jurisdictions that fail to meet at least one of three conditions for information provided to tax authorities: availability, access, and exchange. This list thus focuses on criteria related to financial opacity.
- Finally, Hines Jr (2010) list identifies tax havens based on their low corporate tax rates, their

self-promotion as financial centres, and whether they are also identified as such by other authoritative sources. The more general list includes 52 jurisdictions – which are listed in Table 9 in Appendix – reflecting a broader definition of tax havens.

3 Methodology and identification strategy

Our aim is to better understand the reasons for the massive cross-border loans and borrowing (or assets and liabilities) held by international banks in very small jurisdictions classified as OFCs with little or no economic activity. Drawing on evidence for non-bank multinationals (Bilicka, 2019, Tørsløv et al., 2023), we hypothesize that these cross-border positions largely reflect tax avoidance strategies by banks located (or incorporated) in high-tax countries.

In order to test this hypothesis, we examine the cross-sectional/geographical distribution of cross-border debt and ask to what extent this geographical distribution of debt can be related to the geographical distribution of corporate income tax rates. Indeed, if our main hypothesis holds, we expect a systematic pattern in the data. First, the relative use of intra-group debt should be higher when the lender country has a lower corporate tax rate, as profits shifted there face lower taxation. Second, the relative use of intra-group debt should also increase when the borrower country has a higher tax rate, as the incentive to deduct interest payments is stronger.

Thus, we need two ingredients to implement this identification strategy. First, a bilateral measure of the relative use of intra-group debt. We obtain this from the LBS dataset, which reports cross-border banking positions. Second, we need a country-level corporate tax rate faced by banks. For this, we rely on STR.

3.1 Notations and measurements

At each quarter q, we observe the outstanding amounts of debt (liabilities in the LBS definition) L_{ijkq} where:

- i denotes the *reporting/borrower* country: where the borrowing banks operate;
- j denotes the *counterparty/lender* country: where the lending banks (or counterparty bank) are located;
- k denotes the *nationality* of the borrowing banking group: where the parent company of the banking group is incorporated;

All loans and debts positions are therefore three-dimensional with: a reporting country – the borrower – a counterparty country – the lender – and a nationality – the country of incorporation.

The different possible positions are explained in detail in the Figure 9 in Appendix B. For the sake of simplicity, we omit the nationality dimension for the time being. Finally, and most importantly, as explained in the section 2, the LBS dataset makes possible to distinguish between intra-group borrowing and interbank borrowing. As a result, we mainly consider two different measures:

- L_{ijq}^{Intra}: the intra-group borrowing (or liabilities) of banks operating in borrower country i from banks operating in lender country j at quarter q
- L_{ijq}^{Inter}: the interbank borrowing of banks operating in borrower country i from banks operating in lender country j at quarter q

In essence, our empirical strategy is based on a comparison of the cross-sectional/geographical distribution of these two measures L_{ijq}^{Intra} and L_{ijq}^{Inter} in relation to the level of the corporate income tax rate (i) in the borrower country i and (ii) in the lender country j.

We start our analysis by comparing the distribution of intra-group debt L_{ijq}^{Intra} and interbank debt L_{ijq}^{Inter} across quintiles of lender country tax rates Q_z. In particular, for a given quarter q and for a given borrower country i, we examine the relative share of (the lender countries belonging to) each quintile Q_z in the total intra-group (or interbank) debt issued by banks in the borrower country i at the end of the quarter q:

$$Share_{Q_z iq}^{Intra} = \frac{\sum_{j \in Q_z} L_{ijq}^{Intra}}{\sum_{j} L_{ijq}^{Intra}} \quad \& \quad Share_{Q_z iq}^{Inter} = \frac{\sum_{j \in Q_z} L_{ijq}^{Inter}}{\sum_{j} L_{ijq}^{Inter}} \tag{1}$$

3.2 Identification strategy

Our identification strategy is conceptually analogous to a difference-in-differences strategy where the control group consists of debt to unrelated banks, the treated group consists of loans to related banks, and the (magnitude of the) treatment is the corporate tax rate of the lending country.

Building upon the established literature, in particular Fuest et al. (2011), Hebous and Ruf (2017) or Reiter et al. (2021), we assume that banking groups strategically use intra-group debt to shift profits from high-tax jurisdictions to low-tax jurisdictions such as OFCs. While acknowledging the substantial heterogeneity in global tax systems, our analysis adopts a simplified approach: we assume that, regardless of the specifics of the tax system, cross-border intra-group exposures can be used as an instrument for shifting taxable income from one jurisdiction to another while interbank exposures cannot. Interbank exposure can be used to reduce the tax base in the high-tax borrower country, but not to shift profits to a low-tax lender country (De Mooij, 2012, De Mooij and Keen, 2016).

As a result, we implicitly assume that once banks tend to optimize their global corporate income tax, we should observe a negative relationship between the corporate income tax rate in a given *lender* country and the intensity of intra-group borrowing from subsidiaries located in that country. In contrast, we should not observe such a pattern for interbank exposures.

In line with the recommendations of Dowd et al. (2017) and Cobham and Jansky (2018) that have challenged the usual hypothesis of a linear relationship between profit shifting and tax rates, our strategy allows for non-linear effects.

Comparing intra-group positions relative to the benchmark of interbank (out-of-group) positions is, to our knowledge, new in the literature and constitutes a key aspect of our approach. Many factors other than corporate tax rates can affect the relative intensity of intra-group exposures between the lender country i and the borrower country j. For example, the intensity of trade and the degree of economic integration between two countries are likely to have a significant impact on the level of intra-group transactions. Similarly, two countries that share a common currency or have strong economic, political or cultural ties are more likely to have significant intra-group transactions (Focarelli and Pozzolo, 2005, Mian, 2006, Thang, 2024). However, all these factors that are likely to influence the importance of intra-group transactions between two countries are not specific to intra-group transactions: they should also affect inter-group banking positions.

Conversely, our hypothesis is that, unlike intra-group exposures, interbank exposures are not directly affected by corporate tax rates because there is no way for banks to shift profits by increasing their borrowing from other, unrelated banks located in low-tax countries. In other words, we should not observe a systematic relationship between the cross-border distribution of interbank debt and the cross-sectional distribution of corporate tax rates. It should be noted, however, that another important factor may also affect intra-group and interbank exposures differently: banking regulation. Indeed, different regulations are likely to favor intra-group transactions over interbank transactions, and differences in the nature and extent of these regulations across countries could provide a credible alternative explanation to the profit shifting hypothesis for our findings. One possible mechanism is that prudential ratios that are calculated at the consolidated level (Tier 1 capital ratio, leverage ratios etc.) may incentivise banks to turn to intra-group financing as these assets and liabilities are netted out. We explicitly address this concern in section 4.5.

We therefore use the relative share of interbank positions as a benchmark for intra-group positions – *i.e.* we use the relative share of interbank positions as a "control group" for intra-group positions. This choice is supported by the results presented in Section 4.1. Specifically, for each pair of borrower country-lender country tax rate quintile $\{i, Q_z\}$, we construct the ratio of the relative

share of intra-group debt to the relative share of interbank debt[11]:

$$R_{Q_z iq} = \frac{Share^{Intra}_{Q_z iq}}{Share^{Inter}_{Q_z iq}} \tag{2}$$

This ratio captures deviations in the allocation of intra-group and interbank positions across quintiles Q_z for each borrower country i at the end of quarter q.[12] Alternatively, instead of using the quintiles of corporate income tax rates for the lender country i, we could use our different OFCs lists and calculate the relative shares and the ratio for both OFC lender countries and non-OFC lender countries:

$$Share^{Intra}_{OFCiq} = \frac{\sum_{j \in OFC} L^{Intra}_{ijq}}{\sum_{j} L^{Intra}_{ijq}} \;\&\; Share^{Inter}_{OFCiq} = \frac{\sum_{j \in OFC} L^{Inter}_{ijq}}{\sum_{j} L^{Inter}_{ijq}} \;\&\; R_{OFCiq} = \frac{Share^{Intra}_{OFCiq}}{Share^{Inter}_{OFCiq}} \tag{3}$$

In the subsequent graphical analysis, we now work with the ratio aggregated at the quintile level (the derivation works exactly the same if we consider OFC vs. non-OFC countries rather than different quintiles Q_z)[13] and we average all variables over time before constructing the ratio[14]:

$$\overline{R}_{Q_z} = \frac{\overline{Share}^{Intra}_{Q_z}}{\overline{Share}^{Inter}_{Q_z}} \tag{4}$$

4 Evidence of Profit-Shifting

4.1 Baseline results

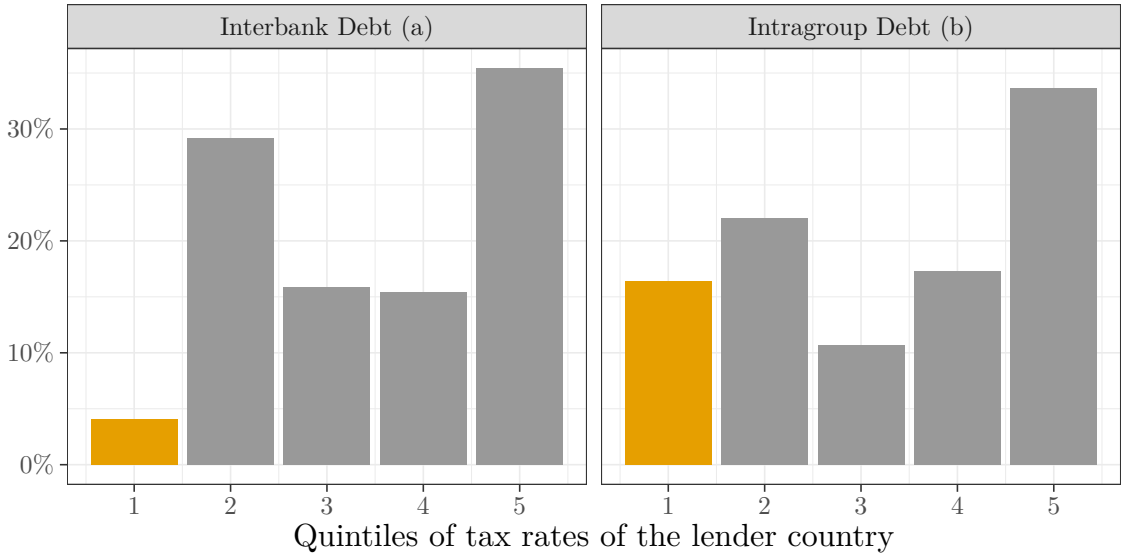
We start by examining the cross-sectional distribution of the intra-group and interbank relative shares with respect to the STR of the lender country, as explained in the section 3. We group the lender countries j into quintiles of statutory corporate tax rates Q_z and examine the *relative* share of each quintile for intra-group debt on the one hand and interbank debt on the other. In Figure 2 we show these relative shares $\overline{Share}^{Intra}_{Q_z}$ and $\overline{Share}^{Inter}_{Q_z}$ as defined in equation 4 in section 3 above.

[11] Note that this ratio computed at the quintile level Q_z can be seen as a weighted average of the individual ratios R_{ijq} with appropriate weights w_{ijq} (see the appendix E for more details):

$$R_{Q_z iq} = \sum_{j \in Q_z} w_{ijq} \cdot R_{ijq}$$

[12] In the appendix E, we present another way to understand this ratio of relative shares.
[13] As detailed in the appendix E, we can derive the same ratio at a more aggregated level using appropriate weights.
[14] $\overline{L}^{Inter}_{ij}$ is the average over all quarters q of L^{Inter}_{ijq} for instance

Figure 2: **Shares of total intra-group debt and total interbank debt by corporate tax rate quintile of lender countries**



Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents the relative share of total interbank debt (left) and the relative share of total intra-group debt (right) held by each quintile. Source: BIS Locational Banking Statistics by nationality (LBSN) and statutory corporate tax rates from the Tax Foundation. Lecture: lending banks located in countries with statutory corporate tax rates in the first quintile (Q_1) hold on average 3.9% of total interbank debt and 17.1% of total intra-group debt.

For both types of banking positions, we first observe that banks mainly borrow from (banks that are located in) countries from the 5^{th} tax quintile. More specifically, about one third of banks' international borrowing takes place vis-à-vis countries in the 5^{th} tax quintile, whether the financing is intra-group or interbank: in both cases, it represents around 32%-35% of intra-group and interbank debt. In other words, the largest share of both intra-group and interbank debt is issued to banks resident in lender countries with high corporate tax rates. This is not surprising, given that most banking transactions take place between entities operating in the largest banking systems (US, France, etc.), with STR falling in the 5^{th} quintile.

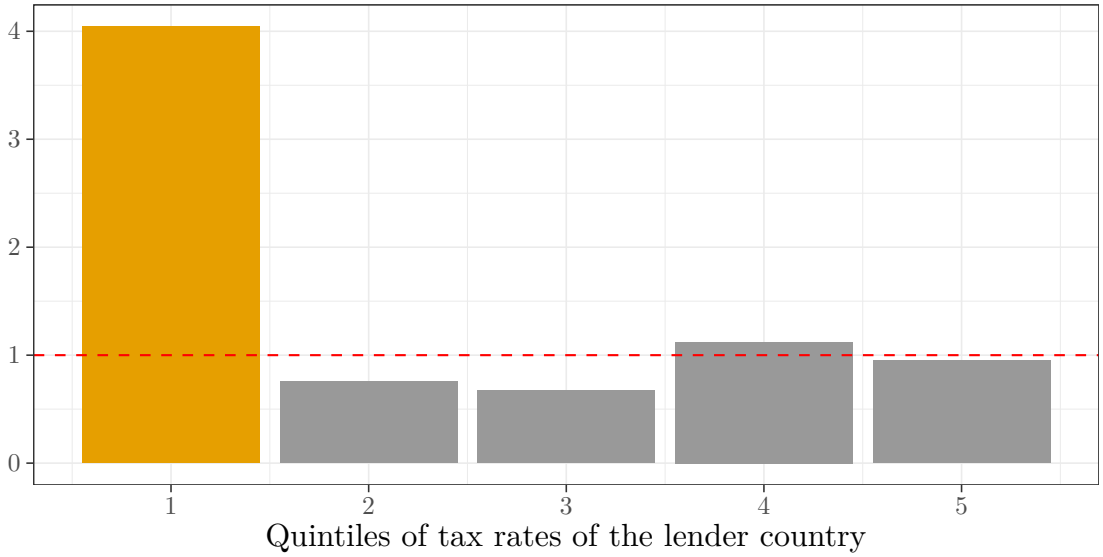
Second, we observe that the distributions from the 2^{nd} to the 5^{th} quintile are broadly similar for both types of banking positions, suggesting that banks exhibit comparable borrowing behavior across these two markets (intra-group and interbank).

Last, when it comes to intra-group borrowing, banks located in first-quintile countries provide more than 15% of the intra-group debt of international banks. By contrast, their share in cross-border interbank borrowing drops to just 4%. In other words, countries in the first quintile are almost absent from the interbank – which is consistent with their limited share of global GDP -— while they account for a disproportionately large share of intra-group financing.

To make comparisons more straightforward, Figure 3 shows the distribution of the ratio of intra-group to interbank debt $\overline{R}_{Q_z}$ (as defined in equation 4) across quintiles of statutory corporate tax

rates in the lender countries. This ratio is simply the ratio between Figures 2(b) and 2(a). It is therefore a convenient way of comparing the relative share of intra-group and interbank debt represented in Figure 2. A ratio greater than one indicates that the quintile considered represents a larger relative share of intra-group debts than interbank debts.[15]

Figure 3: **Ratio of relative share of intra-group debt to relative share of interbank debt by corporate tax rate quintile of lender countries**



Note : Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile of tax rate of the lender country, the ratio of its market share in total intra-group debt to its share in total interbank debt. Source: BIS Locational Banking Statistics by nationality (LBSN) and statutory corporate tax rates from the Tax Foundation. Lecture: using STR, lending banks located in the countries with the lowest tax rates (Q_1) have a market share of intra-group debt 4 times larger than their interbank debt market share.

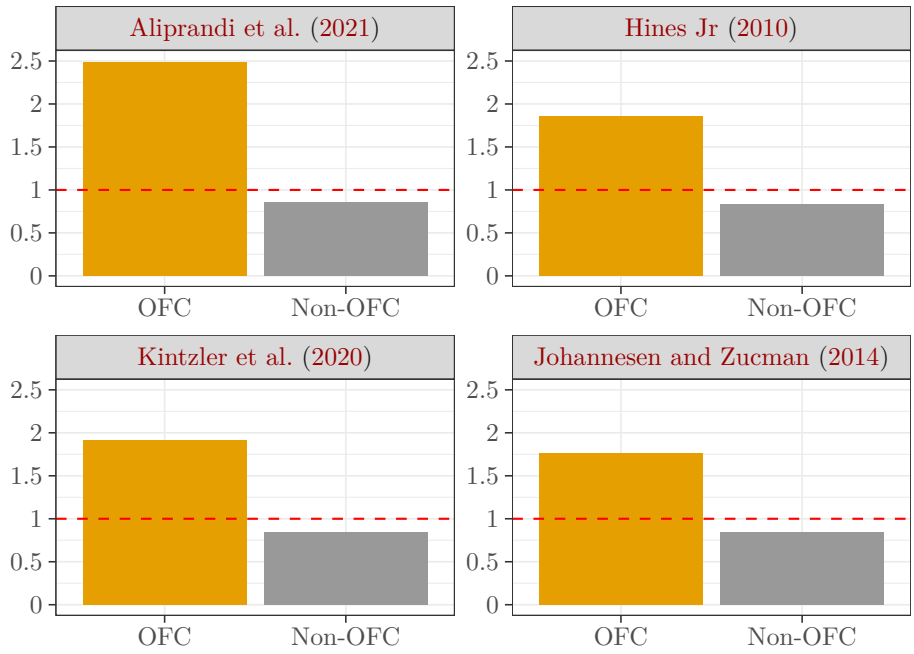
This new representation further highlights the striking pattern observed in Figure 2. The ratio for the 2^{nd} to the 5^{th} quintiles fluctuates around one, meaning that the relative shares of intra-group and interbank debt are broadly similar. In other words, when borrowing from countries in these quintiles, banks appear to respond to similar determinants in both intra-group and interbank markets. This supports our implicit assumption that interbank borrowing provides a suitable and consistent control group for intra-group borrowing.

Most importantly, the representation of this ratio reveals a sharp deviation from the otherwise similar borrowing patterns when the lending banks are located in the first tax quintile—that is, in countries with low or zero statutory tax rates. In this case, borrowing banks choose, on average, to finance themselves four times more through intra-group channels than through interbank transactions with unrelated banks. This behaviour of banks is fully consistent with the findings of Dowd et al. (2017), Fuest et al. (2025) and Bilicka (2019) that show that profit shifting is concentrated in tax havens with near-zero rates.

[15] In Appendix G, we reproduce Figure 3 and 4 using a sample of borrower countries restricted to the five reporting countries with the largest outstanding amount of debt (United States, United Kingdom, France, Spain, Italy). Germany and Japan report data to the BIS but do not authorize its dissemination.

This result is robust to classifying lender countries based on their OFC status, regardless of which OFC list is used. In Figure 4, we plot the ratio of intra-group to interbank debt for banks operating in OFCs ($\overline{R}_{\text{OFC}}$) and for banks operating in non-OFCs ($\overline{R}_{\text{non-OFC}}$) according to our four lists of OFCs.

Figure 4: **Ratio of relative share of intra-group debt to relative share of interbank debt, by OFC status of lender countries**



Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents, for each group of lender countries (OFC/non-OFC) the ratio of their relative share in intra-group debt to their relative share in interbank debt. Source: BIS Locational Banking Statistics by nationality (LBSN). OFC countries are defined according to the lists from Aliprandi et al. (2021), Hines Jr (2010), Johannesen and Zucman (2014), Kintzler et al. (2020). Source: BIS Locational Banking Statistics by nationality (LBSN). Lecture: lending banks located in OFCs (using the Aliprandi list) have a market share in intra-group debt that is 2.5 times larger than the market share in interbank debt.

Unsurprisingly, the relative share of intra-group debt from lender countries classified as OFCs is significantly higher – between 1.75 and 2.5 times higher – than the relative share of comparable interbank debt. In contrast, the relative importance of intra-group and interbank debt vis-à-vis banks resident in non-OFC lender countries remain consistently similar and close to one, further confirming the similarity in borrowing behavior across these two markets.

Overall, for the largest banking groups in the world, we find a robust and meaningful relationship between the relative importance of intra-group borrowing (relative to similar interbank borrowing) and the corporate tax rate prevailing in the lender country. For most lender countries, intra-group and interbank debt are broadly similar but for lender countries with very low-tax rates – those belonging to the 1^{st} quintile – the use of intra-group borrowing is several times greater than the use of interbank borrowing. These results are consistent with the existence of profit shifting by banks through the use of intra-group transactions as shown by Reiter et al. (2021) and Parra Ramirez and Vicard (2025) in the case of single-country analysis on Germany and France, respectively.

However, previous research has generally been constrained by limited country coverage (Aliprandi et al., 2021, Barake, 2023, Bouvatier et al., 2017, Dutt et al., 2019, Fatica et al., 2020, Janskỳ, 2020, Langenmayr and Reiter, 2022) and, to the best of our knowledge, we are the first to document this profit shifting behavior of banks on such a global scale, with our dataset covering almost 90% of global bank positions.

4.2 Econometric Evidence

Before continuing with the analysis, we present regressions that complement the graphical evidence presented in the previous section. We now work with the ratio calculated at the most disaggregated level:

$$R_{ijkq} = \frac{Share_{ijkq}^{Intra}}{Share_{ijkq}^{Inter}} \tag{5}$$

R_{ijkq} denotes the ratio of intra-group debt to interbank debt in country i vis-à-vis country j in quarter q, for a bank of nationality k. We run the following regressions:

$$\begin{cases} R_{ijkq} = \beta_0 + \beta_1 \cdot \mathbb{1}_{Q_1}^{j} + \delta_q + \delta_{iq} + \delta_{kq} + \delta_{ikq} + \varepsilon_{ijkq} \\ R_{ijkq} = \beta_0 + \beta_1 \cdot \mathbb{1}_{OFC}^{j} + \delta_q + \delta_{iq} + \delta_{kq} + \delta_{ikq} + \varepsilon_{ijkq} \end{cases} \tag{6}$$

$\mathbb{1}_{Q_1}^{j}$ is a dummy variable that takes the value 1 if the lender country j is in the first quintile of the corporate tax rate. Then, the estimated coefficient $\hat{\beta}_1$ identifies the marginal effect on R_{ijkq} of considering a banking position where the lender countries belong to the first quintile of corporate income tax rates, relative to the baseline effect – *i.e.* the average value of the ratio on Q_2 to Q_5 captured by the estimated coefficient $\hat{\beta}_0$.

Similarly, $\mathbb{1}_{OFC}^{j}$ is a dummy identifying banking positions where the lender country j is located in one of our four list of OFC countries and $\hat{\beta}_1$ estimates the associated marginal effect on the level of the ratio R_{ijkq}.

The equations are estimated using weighted least squares with the appropriate weights:

$$w_{ijkq} = \frac{L_{ijkq}^{Inter}}{\sum_{j \in Q_z} L_{ijkq}^{Inter}}$$

These weights are formally derived in Appendix E. The sample period goes from 2014-Q1 to 2019-Q4 and we use an unbalanced panel with 507 country-pairs with a minimum of 2 years and maximum of 6 years. Our setting is somewhat similar to a gravity model with pair-wise observations (lender-borrower) but with the addition of the dimension k, the nationality of the bank.

Table 2: **Ratio of relative share of intra-group debt to relative share of interbank debt: Q_1 vs. Q_2 to Q_5 and OFC lenders relative to non-OFC lenders**

	(1)	(2)	(3)	(4)	(5)
Intercept	0.83^{***}				
	(0.10)				
Quintile 1 $\mathbb{1}^j_{Q_1}$ (STR)	**2.73*****	**2.80*****	**3.63*****	**3.95*****	**4.69*****
	(1.03)	(1.05)	(1.11)	(1.24)	(1.57)
Intercept	0.82^{***}				
	(0.11)				
$\mathbb{1}^j_{OFC}$: Aliprandi et al. (2021)	**1.38*****	**1.40*****	**1.73*****	**2.18*****	**2.29*****
	(0.50)	(0.51)	(0.53)	(0.64)	(0.72)
Intercept	0.81^{***}				
	(0.11)				
$\mathbb{1}^j_{OFC}$: Kintzler et al. (2020)	**0.92****	**0.93****	**1.05****	**1.10****	**1.23*****
	(0.37)	(0.37)	(0.41)	(0.44)	(0.47)
Intercept	0.80^{***}				
	(0.11)				
$\mathbb{1}^j_{OFC}$: Hines Jr (2010)	**0.88****	**0.89****	**0.95****	**1.05*****	**1.12****
	(0.34)	(0.34)	(0.37)	(0.40)	(0.41)
Intercept	0.81^{***}				
	(0.11)				
$\mathbb{1}^j_{OFC}$: Johannesen and Zucman (2014)	**0.79****	**0.79****	**0.80****	**0.83****	**0.96*****
	(0.32)	(0.32)	(0.34)	(0.35)	(0.37)
Observations	36,931	36,931	36,931	36,931	36,931
Quarter FE	No	Yes	Yes	Yes	Yes
Borrower cty * Quarter FE	No	No	Yes	Yes	Yes
Parent cty * Quarter FE	No	No	No	Yes	Yes
Parent cty * Borrower cty * Quarter FE	No	No	No	No	Yes

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. The table reports the results of weighted OLS estimations of the regression 6 where the dependent variable is the ratio of intra-group debt over interbank debt defined in equation 5 (see Appendix E for full derivation). The sample runs from 2014-Q1 to 2019-Q4 . $\mathbb{1}^j_{Q_1}$ indicates a binary variable that takes the value 1 if the lender country j belongs to the first quintile of the statutory tax rate, measuring the additional (marginal) effect of the first quintile compared to the other quintiles (Q2 to Q5). $\mathbb{1}^j_{OFC}$ is a binary variable that takes the value 1 if the lender country j belongs to the relevant OFC list (Aliprandi et al., 2021, Hines Jr, 2010, Johannesen and Zucman, 2014, Kintzler et al., 2020). Standard errors clustered at the country pair level are reported in parentheses.

Table 2 reports the coefficients of interest $\hat{\beta}_0$ and $\hat{\beta}_1$, estimated after successively adding different sets of fixed effects (FE). First, we control for aggregate shocks by adding quarterly FEs. Then we control for reporting/borrower country-specific shocks by adding borrower country-quarter FEs. We also control for shocks that could affect the country of incorporation of the headquarter of the bank in question by adding parent country-quarter FE. However, we cannot add counterparty/lender country-quarter FE because the corporate tax rate quintiles of the lender countries vary at this level.

Several observations can be made. First, the estimated intercepts – the $\hat{\beta}_0$ coefficient – are not

statistically different from unity as expected[16]. This implies that for cross-border banking positions where the lending bank is located in a lender country in the second to the fifth quintile (or belonging to a non-OFC lender country), the relative shares of intra-group debt and interbank debt are similar.

Second, the estimated coefficients $\hat{\beta}_1$ are large, positive and statistically significant. This means that when we now consider the borrowing from banks that belongs to the first quintile of the tax rate of the lender countries or to an OFC, the relative share of intra-group debt is several times larger than the relative share of interbank debt as it has been established in the graphical analysis.

Overall, across all estimations, there is a strong evidence, consistent with the graphical analysis, that we find a significantly higher ratios R_{ijkq} when the lending bank is located in the lowest quintile of the corporate tax rates of the lender countries. Similarly, we also observe that the marginal effect of the lending bank being located in an OFC is large and significant.

4.3 Does Borrower's Tax Rate Also Matter?

The results presented so far show that international banks tend to borrow more from their subsidiaries located in low- or zero-tax jurisdictions. Repaying this intra-group debt generates interest payments, which reduce taxable profits in the borrowing bank's country while increasing profits in the jurisdiction of the lending subsidiaries. This pattern is therefore consistent with profit shifting through the debt shifting channel (Huizinga et al., 2008).

If profit shifting is indeed the main rationale behind international banks' borrowing from subsidiaries in low-tax jurisdictions, then this behavior should be even more pronounced among banks located in high-tax countries, as shown for banks (Reiter et al., 2021) and for non-financial corporations (Buettner and Wamser, 2013, Overesch and Wamser, 2014). For example, a bank located in France – where the corporate income tax rate is between 28 to 33% – should be more inclined to borrow from its subsidiaries in tax havens than a bank based in Cyprus, where the corporate tax rate is 12.5%.

We then expect to find a higher ratio if we focus only on the borrowing of banks located in high tax countries than the one from our benchmark result that combines banks from any country. Conversely, should the fiscal determinant be at stake, then the Q1 effect should vanish when we focus only on the borrowing of banks in low tax countries.

We test this by adding a second dimension to the analysis: the cross-sectional distribution of

[16] Using a standard bilateral Student test at a 5% confidence level.

corporate tax rates in borrower countries—i.e., the tax rates that banks would face on profits in the absence of profit shifting.

We group borrower countries according to the level of their corporate tax rate (STR). We proceed in the same way as for lender countries j and we construct time-varying quintiles of corporate tax rates $\mathbb{Q}_z$, but for borrower countries i. We then repeat the previous analysis for i) borrower countries with low corporate tax rates (1^{st} quintile, $\mathbb{Q}_1$) and ii) borrower countries with high corporate tax rates (5^{th} quintiles, $\mathbb{Q}_5$). Formally, we construct:

$$\overline{R}^{H}_{Q_z} = \frac{\sum_{j \in Q_z, i \in \mathbb{Q}_5} \overline{L}^{Intra}_{ij}}{\sum_{j,i} \overline{L}^{Intra}_{ij}} \Big/ \frac{\sum_{j \in Q_z, i \in \mathbb{Q}_5} \overline{L}^{Inter}_{ij}}{\sum_{j,i} \overline{L}^{Inter}_{ij}} \quad \& \quad \overline{R}^{L}_{Q_z} = \frac{\sum_{j \in Q_z, i \in \mathbb{Q}_1} \overline{L}^{Intra}_{ij}}{\sum_{j,i} \overline{L}^{Intra}_{ij}} \Big/ \frac{\sum_{j \in Q_z, i \in \mathbb{Q}_1} \overline{L}^{Inter}_{ij}}{\sum_{j,i} \overline{L}^{Inter}_{ij}} \tag{7}$$

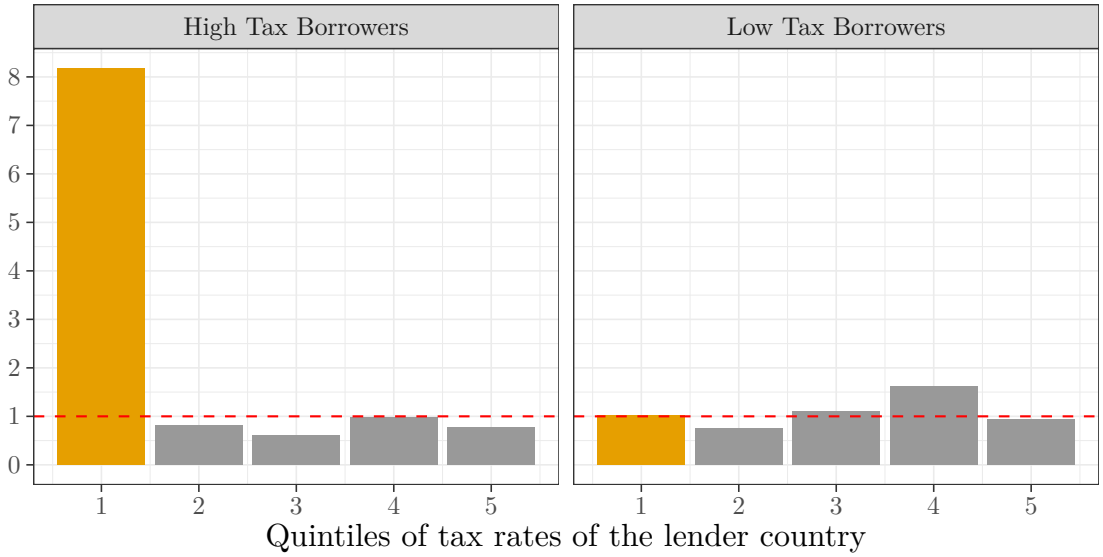
where H (L resp.) means *high* (*low* resp.) corporate tax rates in the borrower countries, $\mathbb{Q}_z$ refers to the corporate tax rates in borrower countries i and Q_z refers to the corporate tax rates in lender countries j. We expect to observe a significant positive difference in the relative use of intra-group debt between high and low-tax rate borrower countries, especially for low lender countries' tax rate Q_z or for OFC's countries.

In Figure 5, we reproduce the distribution of the ratio $\overline{R}_{Q_z}$ across the quintiles of corporate tax rates in lender countries (as in Figure 3) on the two different sub-samples: i) the sample of banks located in borrower countries with high corporate tax rates on the left ($\overline{R}^{H}_{Q_z}$) and ii) the sample of banks located in borrower countries with low corporate tax rates on the right ($\overline{R}^{L}_{Q_z}$). Low corporate tax rate borrower countries are countries in the first quintile ($\mathbb{Q}_1$) and high corporate tax rate borrower countries are countries in the fifth quintile ($\mathbb{Q}_5$).[17]

The two distinct patterns revealed in Figure 5 strongly support our main hypothesis that the relative importance of intra-group debt reflects profit shifting by banks through debt shifting. First, we observe that banks located in high-tax jurisdictions exhibit – consistent with our baseline results – a disproportionately large share of intra-group debt when borrowing from banks operating in countries in the lowest tax quintile (Q_1). More importantly, this pattern is, as expected, significantly amplified: the ratio increases from 4 in our baseline result to 8, indicating more aggressive debt shifting among banks located in high-tax countries. It is worth noting that this fifth quintile

[17] For robustness sake, we repeat this analysis in Figure 16 in Appendix G where low corporate tax rate countries are now defined as countries in the 1^{st} or the 2^{nd} quintiles and high corporate tax rate countries as countries in the 4^{th} or the 5^{th} quintiles.

Figure 5: **Ratio of the relative share of intra-group debt to the relative share of interbank debt from high-tax borrower countries (left) and low-tax borrower countries (right), by tax rate quintile of the lender country**



Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile the ratio of its relative share in intra-group debt holding to its relative share in interbank debt holding. The left-hand figure shows the distribution of this ratio for the sample of borrower countries with high corporate tax rates, *i.e.* countries in the fifth quintile ($\mathbb{Q}_5$). The right-hand figure shows the distribution of this ratio for the sample of borrower countries with low corporate tax rates, *i.e.* countries in the first quintile ($\mathbb{Q}_1$). Source: BIS Locational Banking Statistics by nationality (LBSN) and statutory corporate tax rates from the Tax Foundation. Lecture: Using STR, lender banks located in countries with the lowest tax rates (Q_5) have a relative share of intra-group debt that is 8 times larger than their relative share in interbank debt when considering borrower countries in the fifth quintile ($\mathbb{Q}_5$) but an equivalent amount of intra-group and interbank debt relative share when considering borrower countries in the first quintile ($\mathbb{Q}_1$)

of borrower countries' corporate tax rates includes banks operating in the world's largest banking systems and accounts for a substantial share of global cross-border debt.

Second, the pattern disappears entirely when we focus on banks located in the world's lowest-tax jurisdictions. This is consistent with the profit shifting via debt shifting hypothesis: a bank operating in a low-tax country has little incentive to shift profits by borrowing from subsidiaries also located in low-tax jurisdictions.

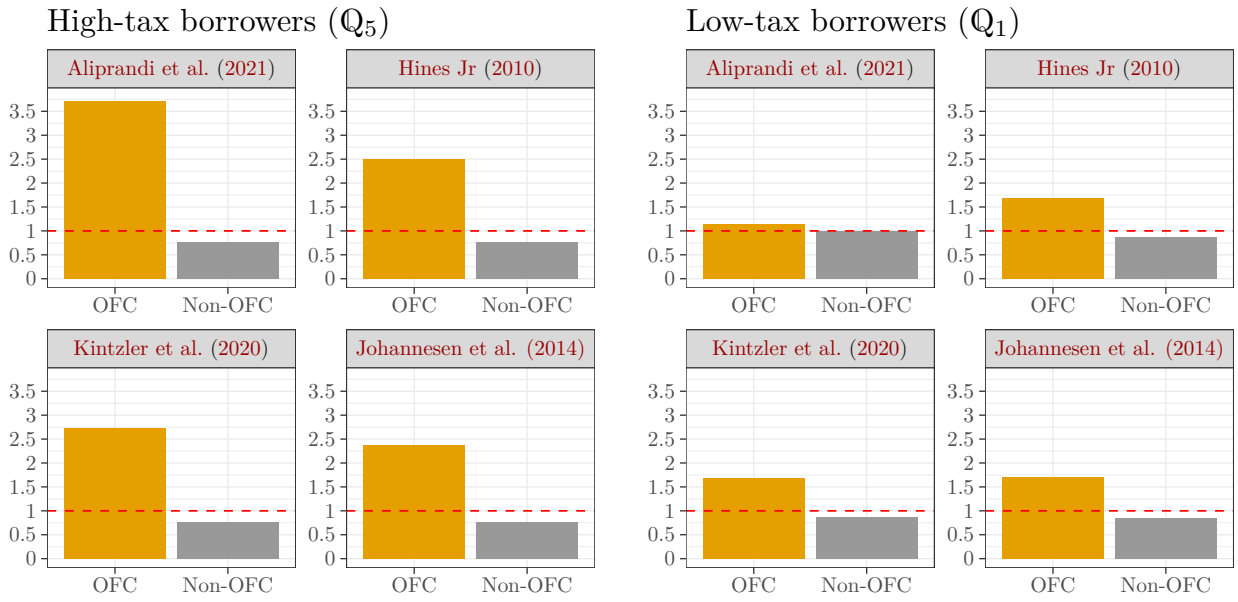
This finding is fully robust when lender countries are grouped according to their OFC status rather than their corporate tax rate as shown in Figure 6: the relative use of intra-group vs. interbank debt differs significantly between OFC and non-OFC lender countries but only when the corporate tax rate in the borrower country is sufficiently low ($\mathbb{Q}_1$ vs. $\mathbb{Q}_5$).[18]

4.4 Who is shifting profits?

Our main finding is that banking groups tend to borrow disproportionately more from their subsidiaries located in low corporate tax jurisdictions than they do from other, unrelated banks operating in the same jurisdictions. This pattern, however, is only observed when the borrowing banks

[18] In Appendix G, we show that this finding is confirmed if we compare borrower countries in the first and the second quintiles to borrower countries in the fourth and the fifth quintiles (see Figure 17).

Figure 6: **Ratio of the relative share of intra-group debt to the relative share of interbank debt from high-tax borrower countries (left, $\mathbb{Q}_5$) and low-tax borrower countries (right, $\mathbb{Q}_1$) by type of lender country (non-OFC vs. OFC)**



Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each type of lender country the ratio of its relative share in intra-group debt to its relative share in interbank debt holding. Borrowers are either high-tax countries (fifth quintile of tax rates, left) or low-tax countries (first quintile of tax rates, right). Source: BIS Locational Banking Statistics by nationality (LBSN). OFC countries are defined according to the lists from Aliprandi et al. (2021), Hines Jr (2010), Johannesen and Zucman (2014), Kintzler et al. (2020) Lecture: lending banks located in OFCs (using the Aliprandi list) have a relative share of intra-group debt that is 3.5 times larger than their relative share in interbank debt when considering borrower countries in the fifth quintile ($\mathbb{Q}_5$).

themselves are based in high-tax jurisdictions—consistent with the idea that debt is strategically allocated to shift profits.

But this evidence does not tell us who is most tax evasive in high-tax countries. In fact, our results are consistent with two intertwined but somewhat different stories. On the one hand, banks operating in the largest banking systems where they are incorporated, such as the US, UK or France, could shift profits to OFCs or low-tax rate lender countries. In this case, it is the parent companies (or domestic subsidiaries) operating in these high-tax jurisdictions that are shifting profits.

On the other hand, it could equally be foreign banks located in high-tax countries that avoid taxes by creating intra-group relationships with other subsidiaries located in lower-tax countries. Conflicting evidence exists in the literature regarding the role played by foreign subsidiaries and headquarters in profit shifting. Regarding non-financial companies, Dischinger et al. (2014) and Hebous and Johannesen (2021) for Germany and Bilicka (2019) for the United Kingdom show that the bulk of profit shifting is done by foreign subsidiaries, with the argument that multinationals are reluctant to shift profits out of their headquarters. However, for German banks, Reiter et al. (2021) find smaller tax-elasticities of internal debt when excluding the parent company. Interestingly, the

nationality dimension of the data allows us to explore this question by comparing two types of banking position:

- Intra-group debt borrowings of the *parent company* (or by domestic subsidiaries) to subsidiaries resident in another (lender) country. This corresponds to the banking positions 1 to 4 in Figure 9 in Appendix A.
- Intra-group debt borrowings of *foreign subsidiaries* resident in a (borrower) country other than the country of incorporation to subsidiaries resident in another (lender) country also other than the country of incorporation. This corresponds to the banking positions 5 & 6 in Figure 9 in Appendix A.

We therefore take advantage of the nationality dimension of our dataset, *i.e.* the information on the country k of incorporation of banks resident in a given reporting country i. This information is relevant for the analysis of profit shifting because it allows us to classify intra-group transactions into the two different groups that we have just discussed in the previous paragraph.

To construct the first group mentioned above, we impose the restriction that the reporting (borrower) country must be the same as the *nationality* country: $k = i$. In other words, we focus on debt issued by banks operating in the country in which they are incorporated. It can be the head office or a domestic subsidiary.

$$\overline{R}_{Q_z,i=k} = \frac{\sum_{j \in Q_z, i=k} \overline{L}_{ij}^{Intra}}{\sum_{j,i} \overline{L}_{ij}^{Intra}} \Bigg/ \frac{\sum_{j \in Q_z, i=k} \overline{L}_{ij}^{Inter}}{\sum_{j,i} \overline{L}_{ij}^{Inter}} \tag{8}$$

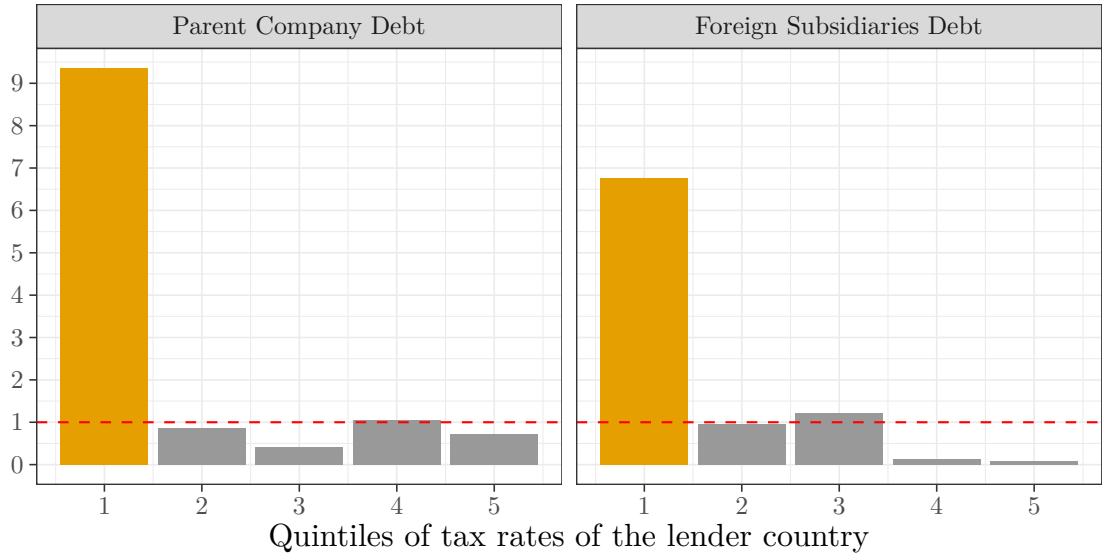
In the second group, we impose the restriction that both the reporting (borrower) country and the counterparty country must be different from the country of *nationality*: $k \neq i$ & $k \neq j$.

$$\overline{R}_{Q_z,i\neq k,j\neq k} = \frac{\sum_{j \in Q_z, i\neq k, j\neq k} \overline{L}_{ijk}^{Intra}}{\sum_{j,i} \overline{L}_{ij}^{Intra}} \Bigg/ \frac{\sum_{j \in Q_z, i\neq k, j\neq k} \overline{L}_{ij}^{Inter}}{\sum_{j,i} \overline{L}_{ij}^{Inter}} \tag{9}$$

In Figure 7, we show the distribution of the ratio $\overline{R}_{Q_z}$ for these two groups. Since all discrepancies

between the relative shares of intra-group and interbank debt are observable for the sample of high-tax borrower countries ($\mathbb{Q}_5$), we focus directly on this subsample.

Figure 7: **Ratio of the relative share of intra-group debt to the relative share of interbank debt of parent companies (left) and foreign subsidiaries (right) from countries with high corporate tax rates ($\mathbb{Q}_5$), broken down by tax rate quintile of the lender country**



Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile the ratio of its relative share in intra-group debt to its relative share in interbank debt. On the left, we show the ratio of debt issued by parents companies (or domestic subsidiaries); on the right, the ratio of debt issued by foreign subsidiaries to banks different from the country of incorporation (*i.e.*, the parent country). Source: BIS Locational Banking Statistics by nationality (LBSN) and statutory corporate tax rates from the Tax Foundation.

Several observations can be made from Figure 7. First, we continue to observe the relative importance of the first quintile for both (i) parent companies' borrowing from their subsidiaries (left-hand side) and (ii) inter-subsidiary borrowing (right-hand side). Second, we remark that the relative importance of the first quintile is significantly more intense for parent companies borrowing from their subsidiaries. Third, subsidiaries borrow relatively little from other foreign subsidiaries located in high tax countries (Q_4 and Q_5), with an average R_{Q_z} around 0.15. Overall, we observe the largest deviations in borrowing behaviour between foreign subsidiaries that are located in low tax countries and the ones located in high-tax countries. This question is far from trivial, as the appropriate policy response to address tax avoidance depends on the underlying mechanism. If profit shifting is primarily driven by the actions of parent companies, then the concentration of these entities in a small number of countries could facilitate international coordination—requiring only a limited set of jurisdictions to reach an agreement. In contrast, if foreign subsidiaries of banking groups are also involved in tax avoidance strategies, the coordination challenge becomes significantly greater, as it would require the engagement of a much broader set of countries.

Finally, we also test the robustness of the previous findings along two important dimensions. First, we replicate four key figures of the paper using quintiles of lender or borrower corporate income

tax rates computed using effective tax rates (ETR) rather than the statutory tax rates (STR). These results are presented in Figures 12, 13, 14 and 15 presented in Appendix F. Second, we verify that our findings are robust when restricting the sample to the Top 5 reporting/borrower countries (US, UK, France, Italy and Spain). These results are shown in Figures 18 and 19.

Overall, we continue to observe the striking result that banks tend to borrow significantly more from their subsidiaries (than from other banks) when the lending banks belong to a country with a very low-tax rate or are classified as OFCs. And this effect is amplified when the borrowing bank belongs to a high-tax country.

4.5 Profit shifting or regulatory arbitrage?

The evidence presented in the previous sections supports the profit shifting hypothesis: by borrowing from their subsidiaries operating in low corporate tax jurisdictions, banks located in high corporate tax jurisdictions can shift profits, reduce their domestic taxable income and lower their global tax bill. However, the jurisdictions with low or limited corporate tax rates used to shift profits may also have less restrictive banking regulations and banks may also seek to exploit this uneven playing field through intra-group transactions. In other words, our evidence so far is not at first sight inconsistent with regulatory arbitrage (Demirgüç-Kunt et al., 2023, Frame et al., 2020, Horváth, 2020, Houston et al., 2012, Karolyi and Taboada, 2015, Ongena et al., 2013).

Before explicitly testing this competing hypothesis, it is important to note that it is not straightforward to explain the unusual distribution of intra-group debt across countries that we have highlighted in the previous sections with regulatory arbitrage. In a sense, it requires a very strong correlation between corporate tax rate and regulatory stringency: not only is it necessary for the very small lender countries with low tax rates to be also characterized by very permissive or soft banking regulations – to explain the pattern in Figure 3 – but it is also necessary for the larger borrower countries with high tax rates to have stringent banking regulations – to explain the pattern in Figure 5. While it is likely that small jurisdictions with low tax rates, such as the Cayman Islands or the Bahamas, are also often characterized by ultralight banking regulation, it is much less obvious that the large countries with relatively high corporate tax rates are all characterized by similarly strong banking regulation.[19]

[19] For instance, this briefing note from the European Parliament indicates : "*Much has been written about the Basel III agreement on capital and liquidity requirements for internationally active banks. Far less attention has been paid to the status of international efforts to implement Basel II. In particular, there have been many questions about the slow pace of Basel II implementation in the United States compared to countries in Europe and Asia. Accordingly, this paper summarises the status of US implementation of Basel II*". See also this blog post written by Nicolas Véron from the Bruegel Institute about a change introduced by the USA to a regulatory requirement on banks, known as the supplementary leverage ratio and perceived as a breach in the implementation of Basel III rules.

That being said, we propose a new way to test this competing hypothesis of regulatory arbitrage more explicitly. Typically, researchers have used data on banking regulation, for example from Barth et al. (2013). Rather, we take advantage of the composition of our sample which includes 13 borrower countries and 27 lender countries belonging to the European Union (out of 28 countries). Thus, our dataset covers a large fraction of cross-border unconsolidated banking positions between banks resident in EU member states.[20]

Since 2014, there is a single banking regulation in the European Union (the *Capital Requirements Regulation* and the *Capital Requirements Directive IV* have both implemented the Basel II regulatory framework) and a Single Supervisory Mechanism (SSM) as well as a Single Resolution Mechanism (SRM) within the eurozone. Consequently, the possibility of regulatory arbitrage by EU banks using intra-group transactions with their subsidiaries resident in other EU member states is significantly reduced, if not entirely eliminated. This aspect of unified and homogeneous regulation is explicitly emphasized in the Single Rulebook: "*This will ensure uniform application of Basel III in all Member States. It will close regulatory loopholes and will thus contribute to a more effective functioning of the Single Market*".

The second reason that justifies focusing on the EU is the important tax competition between Member States. While there has been a concerted effort to make banking regulation more homogeneous, there is no comparable trend regarding European fiscal rules. On the contrary, the 2006 European Court of Justice judgment on the Cadbury-Schweppes case, which weakened the ability of Member States to tax profits declared in other Member States, has created an incentive for firms to shift profits to low-tax European countries rather than non-European OFCs (Ruf and Weichenrieder, 2013). We can take advantage of this particular institutional design and replicate our analysis on this subset of EU area members to see if our main finding still holds for a sample of countries where regulatory arbitrage is unlikely.

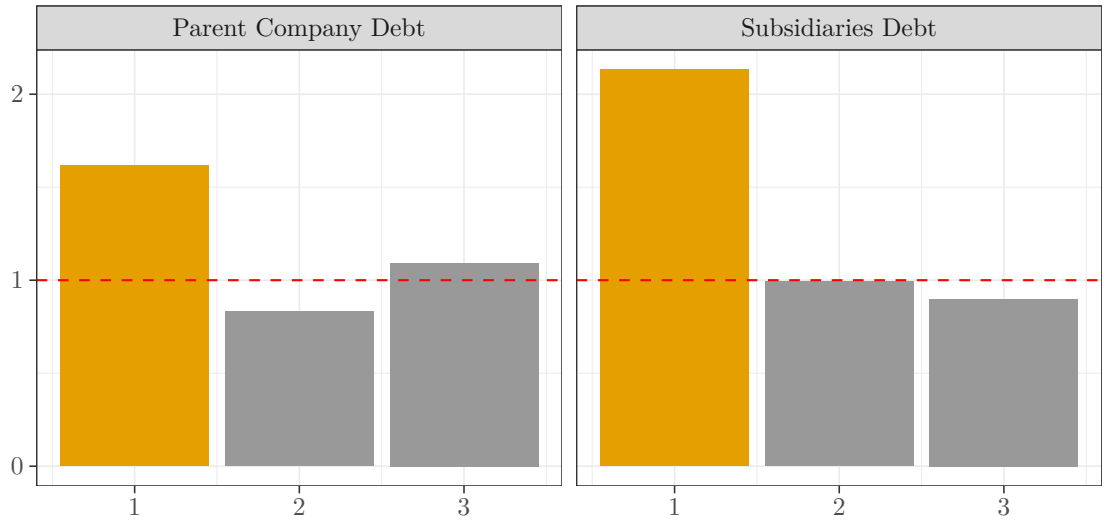
However, since the total number of countries has decreased significantly (from 28 to 13 for the reporting countries), we no longer break the population into quintiles of corporate income tax rates but rather into terciles for confidentiality reasons. It should also be noted that this sampling restriction results in the exclusion of the most aggressive OFCs, *i.e.* those characterized by zero or near-zero corporate income tax rates. Consequently, all else being equal, the underlying level of profit shifting is likely to be lower and our test must be considered as conservative.

In Figure 8, we show how the ratio $\overline{R}_{T_z}$ varies across terciles of the lender country's tax rate T_z. Following our previous analysis, the distribution of the ratio is shown separately for parent companies and for foreign subsidiaries. If regulatory arbitrage is the main driver of our previous

[20] Remember however that Germany reports data to the BIS but do not authorize their dissemination.

findings, we should no longer observe a particular pattern: rather, we should find a ratio fluctuating around 1 for all three terciles.

Figure 8: **Ratio of the relative share of intra-group debt to the relative share of interbank debt of the parent company (left) and foreign subsidiaries (right), broken down by tax rate terciles of the lender country; European Union sample**



Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile the ratio of its relative share in intra-group debt to its relative share in interbank debt. On the left we show the ratio of debt issued by parents companies (or domestic subsidiaries); on the right, the ratio of debt issued by foreign subsidiaries to banks different from the country of incorporation. Source: BIS Locational Banking Statistics by nationality (LBSN) and statutory corporate tax rates from the Tax Foundation.

However, despite the de facto exclusion of the most aggressive OFCs from this analysis, we still observe a similar pattern to that of the full sample: banks tend to borrow significantly more from their subsidiaries (compared to interbank borrowing) when the countries where the lender banks are located have a low corporate tax rate. This observation holds for both (i) parent banks borrowing from subsidiaries (left-hand side) and (ii) inter-subsidiaries borrowing (right-hand side). In other words, in an identical regulatory and supervisory environment with no (or very limited) possibility of regulatory arbitrage, subsidiaries in the least taxed European countries tend to issue more than twice as much intra-group debt as interbank debt. This confirms that the profit shifting hypothesis in itself has significant explanatory power for the pattern we have uncovered in this paper.

Importantly, with this test, we propose a novel, more refined approach to separately identifying the role of tax avoidance and regulatory arbitrage in banks' intensive use of OFCs (Demirgüç-Kunt et al., 2023, Frame et al., 2020, Houston et al., 2012, Sharafutdinova and Lokshin, 2020).

4.6 Estimating the excess of intra-group debts in tax havens

If the observed imbalance in the propensity of international banks to borrow intra-group rather than externally vis-à-vis OFC is driven by debt shifting motives, then these liabilities are the byproduct of tax optimization strategies and lack genuine economic substance.

Estimating the amount of artificial intra-group debt is valuable for several reasons. First, it is a novel contribution to the literature by providing the first quantitative assessment of the share of banking debt in OFCs that can be attributed to banks' tax optimization strategies. Second, this excess debt artificially inflates the role of OFCs in the global financial architecture, as these jurisdictions consistently rank among the top three largest exposures for international banking groups (Kintzler et al., 2020). Understanding the proportion of debt that is driven by tax-motivated determinants – rather than by genuine economic or financial activity – is essential for an accurate assessment of banks' exposures and could justify excluding such stocks from broader analyses of banking debt. Finally, these artificial liabilities distort key international statistical tables, including the balance of payments financial accounts and countries' net external positions. Failure to neutralize these artificial debt creates the misleading impression that most countries are net debtors to offshore jurisdictions (Zucman, 2013), when these positions do not reflect actual indebtedness but rather the outcome of tax-driven accounting practices. Ultimately, these artificial flows and stock positions introduce noise into global statistics, further complicating the accurate assessment of macroeconomic balances in a geopolitical environment where countries are increasingly focused on identifying and mitigating their financial vulnerabilities.

To estimate the amount of excess intra-group debt, we follow a standard approach in the previous literature (Vicard, 2015, Wier, 2020), performing a back-of-the-envelope calculation that neutralizes the tax effect based on our main econometric specifications. In our case, this involves correcting for the distortion effect of Q_1 by adjusting the level of intra-group debt to bring the intra-group/interbank ratio into line with that observed in other (arm's-length) quintiles.

To do so, we start from the econometric specification that includes all fixed effects: time, borrower country-time, parent country-time, parent country-borrower country-time. We construct an estimation range by adjusting the ratio of Q_1 countries to the maximum observed ratio in another quintile (Q_4 in our estimates), which serves as our upper bound, and then to the minimum observed ratio in another quintile (Q_3 in our estimates), which serves as our lower bound ratio.

Using this approach, we find that, over the period analyzed, between 57% and 88% (with an average of 74%) of the cross-border intra-group debts vis-à-vis OFCs could be attributed to profit shifting. Alternatively, this correspond to 45%-70% of total cross-borders banking debt vis-à-vis

OFCs. This estimate is consistent with the findings of Parra Ramirez and Vicard (2025), who examine debt shifting among French banks and estimate that approximately 90% of intra-group debts in OFCs may lack genuine economic substance. Notably, even after a 74% reduction in intra-group bank debt held in OFCs, these jurisdictions would still account for more than 5% of total cross-border banking debt, a figure that remains twice their share of global GDP.

5 Conclusion

This paper investigates the significant amount of debt held by international banks in offshore financial centers, which represent a substantial portion of global banking debt despite the negligible GDP of these locations. While previous research has extensively explored the use of OFCs by non-financial corporations and households primarily for tax avoidance, the motivations for banks, particularly considering stricter post-financial crisis regulations, have remained less clear and have been less extensively studied. This paper addresses this gap by examining cross-border borrowing strategies of major international banks and employing a novel approach to isolate tax incentives from regulatory effects.

Leveraging the unique Locational Banking Statistics dataset from the BIS, the paper provides the first direct global evidence that the location of intra-group debt within multinational banks is significantly influenced by tax considerations, even when accounting for regulatory differences. The findings indicate a strong preference for intra-group borrowing from OFCs, which are often low-tax jurisdictions, particularly for banks located in high-tax countries where the incentive for profit shifting is greater. By comparing the geographical distribution of intra-group and interbank borrowing across different corporate tax rate quintiles of lender countries, the paper reveals a systematic relationship consistent with the debt shifting hypothesis. This pattern is robust across various definitions of OFCs and holds for both parent companies and foreign subsidiaries, suggesting group-wide debt optimization strategies. Furthermore, by focusing the analysis on the European Union, which operates under a single regulatory and supervisory framework, we can effectively isolate the role of tax avoidance from regulatory arbitrage, confirming that taxation is a primary determinant of these borrowing patterns within a unified regulatory environment like the EU.

An important contribution of this paper is to provide the first estimate in the literature of the magnitude of "excess" offshore banking debt globally, suggesting that between 57% and 88% of intra-group banking debt in tax havens could be attributed to profit shifting. This highlights the significant distortion introduced by tax-driven accounting practices in global financial statistics and underscores the need for effective public policies to combat these practices.

The findings open several avenues for future research. Further investigation could explore the role of non-bank financial institutions within banking groups and their potential involvement in intra-group debt shifting, as acknowledged data limitations currently constrain this analysis. Additionally, examining the interest rates on these intra-group loans could provide insights into transfer pricing on interest rates as another channel for profit shifting. The increasing availability of micro-level data on derivatives may also allow for a better understanding of how these instruments are used for tax deductibility purposes by banks. Finally, understanding the dynamics of profit shifting by foreign subsidiaries versus parent companies in different regulatory and tax environments warrants further exploration to inform targeted policy responses.

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Appendix

A The Locational Banking Statistics dataset (LBS)

First, we reproduce a brief official description of the BIS Locational Banking Stastitics[21] (BIS, 2003): "*The locational banking statistics (LBS) measure international banking activity from a residence perspective, focusing on the location of the banking office. They are compiled following principles that are consistent with balance of payments statistics. The LBS capture outstanding claims (financial assets) and liabilities of internationally active banks located in reporting countries on counterparties residing in more than 200 countries. Banks record their positions on an unconsolidated basis, including intra-group positions between offices of the same banking group. The LBS capture around 95% of all cross-border banking activity.*"

The counterparties of positions reported by banks can be broken down into: (i) non-financial corporations, (ii) households, (iii) general governments, but also (iv) non-bank financial institutions and (v) banks. With regard to the latter, the data set provides us with an additional and crucial breakdown between *intra*-group and *inter*-bank positions. Intra-group refers to all positions between banks having the same controlling institution from a prudential point of view, this includes branches, subsidiaries and also affiliates without distinction.[22]

The breakdown of cross-border banking positions by financial instrument – loans/deposits vs. debt securities vs. derivatives – is not available in our dataset and we therefore consider cross-border positions including all financial instruments. Similar data from the BIS suggest that our statistical aggregate "debt" is comprised of loans/deposits for about 78%, debt securities for 13% and other instruments for 9%.

We do not consider the currency breakdown and we pool all positions regardless of their currency. Note also that we do not use the cross-border banking *flows* or *transactions* but rather focus on the *outstanding amounts* or *exposures*. The reason for this is that corporate income tax rates are broadly stable over time, which means that quarterly changes in bilateral loans are likely to be driven by effects other than tax rates (business cycle, exchange rate fluctuations, risk management, regulatory motives, etc.). By focusing on outstanding amounts, we filter out most of the short-term fluctuations and identify the medium – and long-term factors behind the level of intra-group activity.

The LBS are disseminated under two datasets, the LBS *Reporting* since the 1980s, with instruments

[21] The complete document is available at: https://www.bis.org/statistics/about_banking_stats.htm?m=6%7C31

[22] According to the LBS reporting guidelines *"Branches are normally not incorporated as separate legal entities, and for statistical purposes are considered quasi corporations. In the LBS, as in the BPM, branches that are located in a different country from their parent are considered separate entities (BPM6, paragraph 4.26)."*

breakdown and a larger geographical coverage and the LBS *Nationality* which add information about the parent country, available since mid-2012 with an increased coverage over time. Our sample covers the period going from 2014-Q1 to 2019-Q4, but some countries started to report data later: as of Q1 2014, intra-group positions were reported by 17 out of 28 countries in the sample. The number of reporting countries increased to 22 by Q1 2015, 24 by Q1 2016, 26 by Q1 2017, and 28 by Q1 2019.

In the Tables 3, 4 and 5 below, we list (i) the 28 reporting/borrower countries, (ii) the 43 parent/nationality countries and (iii) the 67 counterparty/lender countries of our sample.

Table 3: **List of the 28 reporting/borrower countries**

Austria (AT)	Australia (AU)	Bahamas (BS)	Belgium (BE)
Canada (CA)	Cayman Islands (KY)	Cyprus (CY)	Denmark (DK)
Spain (ES)	Finland (FI)	France (FR)	United Kingdom (GB)
Hong Kong SAR China (HK)	Indonesia (ID)	Ireland (IE)	Italy (IT)
South Korea (KR)	Luxembourg (LU)	Macao SAR China (MO)	Malaysia (MY)
Netherlands (NL)	Philippines (PH)	Portugal (PT)	Sweden (SE)
Chinese Taipei (TW)	Turkey (TR)	United States (US)	South Africa (ZA)

Table 4: **List of the 43 parent/nationality countries**

Austria (AT)	Australia (AU)	Belgium (BE)	Bahrain (BH)
Bermuda (BM)	Brazil (BR)	Bahamas (BS)	Canada (CA)
Switzerland (CH)	Chile (CL)	China (CN)	Cyprus (CY)
Germany (DE)	Denmark (DK)	Spain (ES)	Finland (FI)
France (FR)	United Kingdom (GB)	Greece (GR)	Hong Kong SAR China (HK)
Indonesia (ID)	Ireland (IE)	India (IN)	Italy (IT)
Japan (JP)	South Korea (KR)	Cayman Islands (KY)	Luxembourg (LU)
Macao SAR China (MO)	Mexico (MX)	Malaysia (MY)	Netherlands (NL)
Norway (NO)	Panama (PA)	Philippines (PH)	Portugal (PT)
Russia (RU)	Sweden (SE)	Singapore (SG)	Turkey (TR)
Chinese Taipei (TW)	United States (US)	South Africa (ZA)	

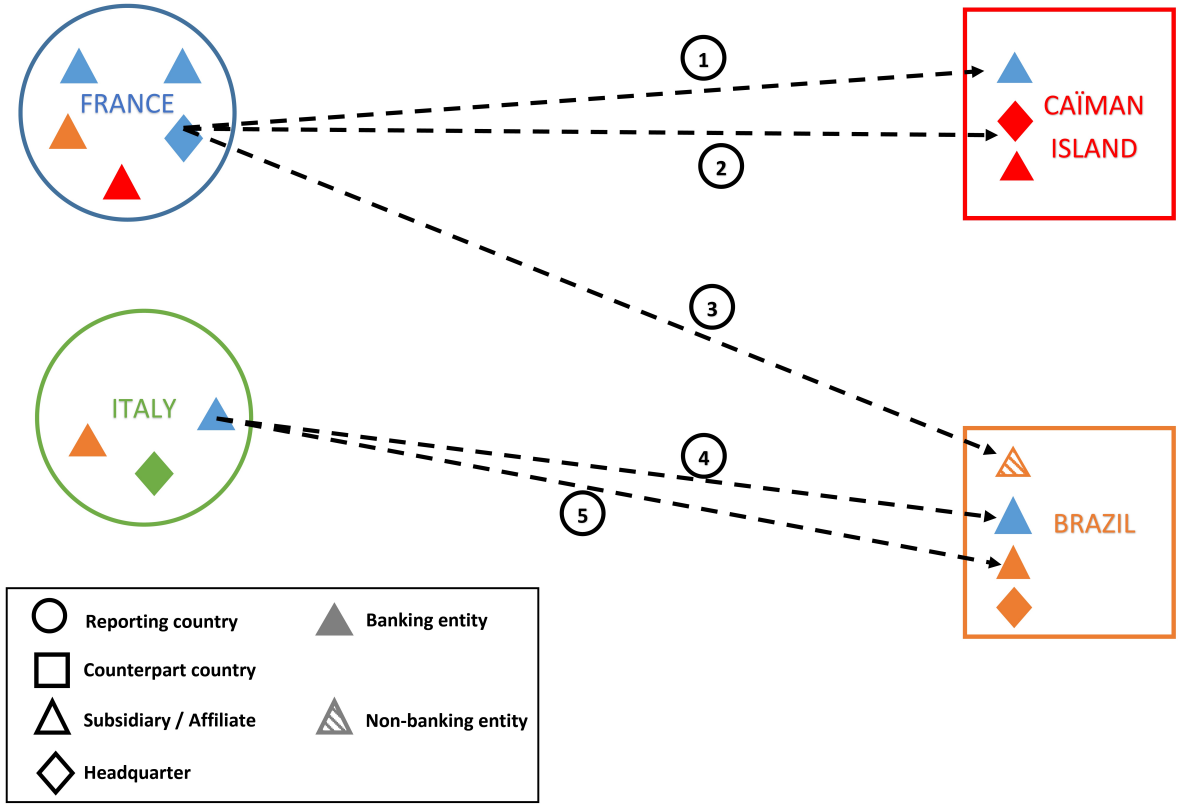
Table 5: **List of the 67 counterparty/lender countries**

United Arab Emirates (AE)	Australia (AU)	Austria (AT)	Bahrain (BH)
Belgium (BE)	Bermuda (BM)	Bulgaria (BG)	Brazil (BR)
Bahamas (BS)	Canada (CA)	Switzerland (CH)	Chile (CL)
China (CN)	Cyprus (CY)	Czechia (CZ)	Germany (DE)
Denmark (DK)	Estonia (EE)	Spain (ES)	Finland (FI)
France (FR)	United Kingdom (GB)	Guernsey (GG)	Greece (GR)
Hong Kong SAR China (HK)	Hungary (HU)	Indonesia (ID)	Ireland (IE)
Israel (IL)	India (IN)	Iran (IR)	Isle of Man (IM)
Italy (IT)	Jersey (JE)	Japan (JP)	South Korea (KR)
Kuwait (KW)	Cayman Islands (KY)	Latvia (LV)	Luxembourg (LU)
Lithuania (LT)	Macao SAR China (MO)	Malta (MT)	Mexico (MX)
Malaysia (MY)	Nigeria (NG)	Netherlands (NL)	Norway (NO)
Panama (PA)	Peru (PE)	Philippines (PH)	Poland (PL)
Portugal (PT)	Qatar (QA)	Romania (RO)	Russia (RU)
Saudi Arabia (SA)	Sweden (SE)	Singapore (SG)	Slovenia (SI)
Slovakia (SK)	Thailand (TH)	Turkey (TR)	Chinese Taipei (TW)
United States (US)	South Africa (ZA)		

B The structure of the dataset and the nationality dimension

In the in Figure 9 below, we present the global structure of the dataset using stylized examples of cross-border banking positions. To illustrate the richness of this dataset, we identify six typical banking positions using different breakdowns: the counterparty country, the nationality country and the institutional sector (to identify the nature of the underlying exposures).

Figure 9: **Structure of the LBSN dataset**



(1) Outstanding amounts (assets or liabilities depending on how look at it) of banks resident in France, of French nationality (*i.e.* whose parent company is incorporated in France) vis-à-vis one of its subsidiary resident in the Cayman Islands.

(2) Outstanding amounts of banks resident in France, of French nationality (*i.e.* whose parent company is incorporated in France) to another bank resident in the Cayman Islands.

(3) Outstanding amounts of banks resident in France, of French nationality (*i.e.* whose parent company is incorporated in France) to a non-bank entity resident in Brazil (non-bank financial entity or non-financial entity).

(4) Outstanding amounts of banks (subsidiaries) resident in Italy, of French nationality (*i.e.* whose parent company is incorporated in France) to a subsidiary of the same group resident in the Cayman Islands.

(5) Outstanding amounts of banks (subsidiaries) resident in Italy, of French nationality (*i.e.* whose parent company is incorporated in France) to another bank resident in Brazil.

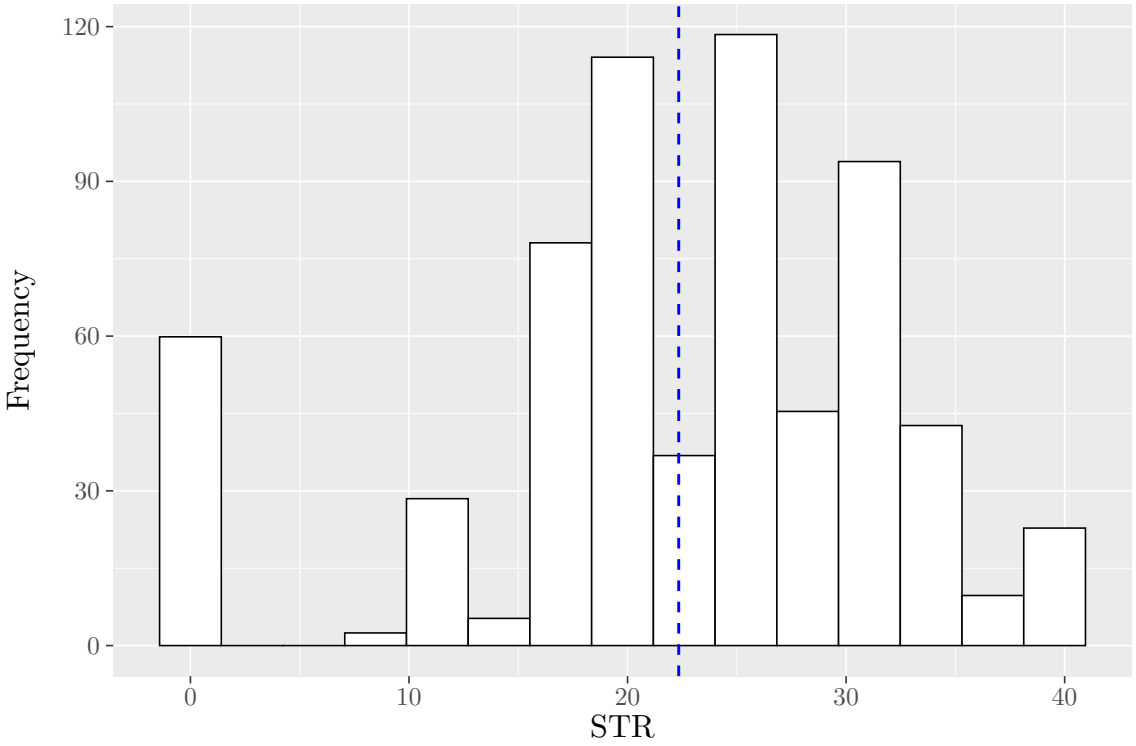
In the paper, we focus on banking positions – hence we disregard the banking position **(3)** – and we compare:

- intra-group positions to interbank positions: positions **(1)** and **(4)** vs. positions **(2)** and **(5)**
- OFCs or low-tax jurisdictions to other, normal countries: positions **(1)** and **(2)** vs. positions **(4)** and **(5)**

C About the statutory corporate income tax rate (STR)

We use data from the Tax Foundation think tank which to our knowledge has the largest database of Statutory corporate income Tax Rates. It is freely available at: https://taxfoundation.org/publications/corporate-tax-rates-around-the-world/. It is a synthesis of the lists published by accounting firms like Deloitte combined with original data collection. In Figure 10, we plot the distribution of these STR.

Figure 10: **Distribution of the Statutory Tax Rates**



Source: statutory corporate tax rates from the Tax Foundation.

D Lists of Offshore Financial Centres

Below are the details of the countries identified as "tax havens" or Offshore Financial Centres (OFC). Note that since 2010, Curaçao and Sint Maarten came into existence due to the secession of the Netherlands Antilles. We have removed the Netherlands Antilles from the Johannesen & Zucman list which goes from 52 to 51 countries and from the Hines list. He have also added Curaçao and Sint Maarten to the Hines Jr list which thus goes from 52 to 53.

Table 6: **List of Offshore Financial Centers from Aliprandi et al. (2021)**

Bahamas	Hong Kong	Macao
Bermuda	Ireland	Malta
British Virgin Islands	Isle of Man	Mauritius
Cayman Islands	Jersey	Panama
Gibraltar	Kuwait	Qatar
Guernsey	Luxembourg	

Table 7: **List of Offshore Financial Centers from Kintzler et al. (2020)**

Cayman Islands (KY)	Isle of Man (IM)	Curaçao (CW)
Guernsey (GG)	Bahamas (the) (BS)	Singapore (SG)
Jersey (JE)	Bermuda (BM)	Switzerland (CH)
Macao (MO)	Hong Kong (HK)	Bahrain (BH)
Luxembourg (LU)		

Table 8: **List of Tax Havens from Johannesen and Zucman (2014)**

Andorra	Dominica	Niue
Anguilla	Gibraltar	Panama
Antigua and Barbuda	Grenada	Saint Kitts and Nevis
Aruba	Guernsey	Saint Lucia
Austria	Hong Kong	Saint Vincent and the Grenadines
Bahamas (the)	Isle of Man	Samoa
Bahrain	Jersey	San Marino
Belgium	Liberia	Seychelles
Belize	Liechtenstein	Singapore
Bermuda	Luxembourg	Sint Maarten (Dutch part)
Barbados	Macao	Switzerland
Cayman Islands (the)	Malaysia	Trinidad and Tobago
Chile	Malta	Turks and Caicos Islands (the)
Cook Islands (the)	Marshall Islands (the)	Uruguay
Costa Rica	Monaco	Vanuatu
Curaçao	Montserrat	Virgin Islands (British)
Cyprus	Nauru	Virgin Islands (U.S.)

Table 9: **Lists of Tax Havens from Hines Jr (2010)**

Andorra	Guernsey	Nauru
Anguilla	Hong Kong	Netherlands Antilles
Antigua and Barbuda	Ireland	Niue
Aruba	Isle of Man	Panama
Bahamas	Jersey	Samoa
Bahrain	Jordan	San Marino
Barbados	Lebanon	Seychelles
Belize	Liberia	Singapore
Bermuda	Liechtenstein	St. Kitts and Nevis
British Virgin Islands	Luxembourg	St. Lucia
Cayman Islands	Macao	St. Martin
Cook Islands	Maldives	St. Vincent and the Grenadines
Costa Rica	Malta	Switzerland
Cyprus	Marshall Islands	Tonga
Djibouti	Mauritius	Turks and Caicos Islands
Dominica	Micronesia	Vanuatu
Gibraltar	Monaco	
Grenada	Montserrat	

E Methodology and identification strategy : additional derivations

Aggregate ratio as a weighted sum of individual ratios In the methodology section 3, we pointed out that the ratios computed at the quintile level Q_z can be seen as a weighted average of the individual ratios R_{ijkq} with appropriate weights w_{ijkq}.

$$R_{Q_zikq} = \sum_{j \in Q_z} w_{ijkq} \cdot R_{ijkq} = \sum_{j \in Q_z} w_{ijkq} \cdot \frac{\frac{L_{ijkq}^{Intra}}{L_q^{Intra}}}{\frac{L_{ijkq}^{Inter}}{L_q^{Inter}}} = \sum_{j \in Q_z} w_{ijkq} \cdot \frac{\frac{L_{ijkq}^{Intra}}{\sum_{ijk} L_{ijkq}^{Intra}}}{\frac{L_{ijkq}^{Inter}}{\sum_{ijk} L_{ijkq}^{Inter}}}$$

where Q_z denote the quintile z of corporate tax rate in the lender countries j, i denotes the borrower country, k denote the nationality and q denotes the quarter considered.

The quantity $\frac{L_{ijkq}^{Intra}}{\sum_{ijk} L_{ijkq}^{Intra}} = \frac{L_{ijkq}^{Intra}}{L_q^{Intra}}$ denotes the market share / relative share of intra-group debt issued by borrower country i vis-à-vis lender country j with nationality k at quarter q among the aggregate intra-group debt issued at quarter q in the aggregate intra-group exposures at quarter q.

This equivalence explains the correspondence between the graphical analyses and the regression analyses. In this Appendix, we provide the derivation of this equivalence. Let us first, rewrite the ratio R_{Q_zikq}

$$R_{Q_zikq} = \frac{\dfrac{\sum\limits_{j\in Q_z} L^{Intra}_{ijkq}}{\sum\limits_{ijk} L^{Intra}_{ijkq}}}{\dfrac{\sum\limits_{j\in Q_z} L^{Inter}_{ijkq}}{\sum\limits_{ijk} L^{Inter}_{ijkq}}} = \frac{\sum\limits_{ijk} L^{Inter}_{ijkq}}{\sum\limits_{ijk} L^{Intra}_{ijkq}} \cdot \frac{\sum\limits_{j\in Q_z} L^{Intra}_{ijkq}}{\sum\limits_{j\in Q_z} L^{Intra}_{ijkq}} = \frac{\sum\limits_{ijk} L^{Inter}_{ijkq}}{\sum\limits_{ijk} L^{Intra}_{ijkq}} \cdot \sum_{j\in Q_z} \frac{L^{Intra}_{ijkq}}{\sum\limits_{j\in Q_z} L^{Inter}_{ijkq}}$$

We can then rewrite slightly and get

$$R_{Q_zikq} = \frac{\sum\limits_{ijk} L^{Inter}_{ijkq}}{\sum\limits_{ijk} L^{Intra}_{ijkq}} \cdot \sum_{j\in Q_z} \frac{L^{Intra}_{ijkq}}{L^{Inter}_{ijkq}} \cdot \frac{L^{Inter}_{ijkq}}{\sum\limits_{j\in Q_z} L^{Inter}_{ijkq}} = \sum_{j\in Q_z} \frac{\dfrac{L^{Intra}_{ijkq}}{\sum\limits_{ijk} L^{Intra}_{ijkq}}}{\dfrac{L^{Inter}_{ijkq}}{\sum\limits_{ijk} L^{Inter}_{ijkq}}} \cdot \frac{L^{Inter}_{ijkq}}{\sum\limits_{j\in Q_z} L^{Inter}_{ijkq}}$$

Finally, if we define the weights as $w_{ijkq} = \dfrac{L^{Inter}_{ijkq}}{\sum\limits_{j\in Q_z} L^{Inter}_{ijkq}}$ – *i.e* the share of interbank debt issued by borrower country i vis-à-vis lender country j with nationality k at quarter q among the total interbank debt issued by borrower country i vis-à-vis all the lender countries belonging to Q_z with nationality k at quarter q – we can rewrite :

$$R_{Q_ziq} = \sum_{j\in Q_z} \frac{\dfrac{L^{Intra}_{ijkq}}{\sum\limits_{ijk} L^{Intra}_{ijkq}}}{\dfrac{L^{Inter}_{ijkq}}{\sum\limits_{ijk} L^{Inter}_{ijkq}}} \cdot w_{ijkq} = \sum_{j\in Q_z} R_{ijkq} \cdot w_{ijkq}$$

Alternatively, we could write :

$$R_{Q_ziq} = \frac{Share^{Intra}_{Q_zikq}}{Share^{Inter}_{Q_zikq}} = \frac{\sum\limits_{j\in Q_z} Share^{Intra}_{ijkq}}{\sum\limits_{j\in Q_z} Share^{Inter}_{ijkq}} = \sum_{j\in Q_z} \left[Share^{Intra}_{ijkq} \cdot \frac{1}{\sum\limits_{j\in Q_z} Share^{Inter}_{ijkq}} \right]$$

Then,

$$R_{Q_zikq} = \sum_{j\in Q_z} \left[\frac{Share^{Intra}_{ijkq}}{Share^{Inter}_{ijkq}} \cdot \frac{Share^{Inter}_{ijkq}}{\sum\limits_{j\in Q_z} Share^{Inter}_{ijkq}} \right] = \sum_{ijk} R_{ijkq} \cdot w_{ijkq}$$

In fine, the weight can be seen as :

$$w_{ijkq} = \frac{Share^{Inter}_{ijkq}}{\sum_{j \in Q_z} Share^{Inter}_{ijkq}} = \frac{Inter_{ijkq}}{\sum_{j \in Q_z} Inter_{ijkq}}$$

We could also aggregate these ratios at different intermediate levels as well: for instance, we could compute the same weighted average ratio for a subset of borrower countries i or for a subset of nationalities k.

Alternative interpretation of the ratio of relative shares We have constructed the following ratio of relative shares:

$$R_{Q_z ikq} = \frac{Share^{Intra}_{Q_z ikq}}{Share^{Inter}_{Q_z ikq}} \tag{10}$$

This ratio of relative shares $R_{Q_z ikq}$ captures discrepancies in the allocation of intra-group and interbank positions across quintiles Q_z for each borrower country i at the end of quarter q. Another way to understand this ratio is to consider that it indicates to which extent the ratio of intra-group to interbank liabilities for a given quintile Q_z differs from the same ratio for the entire population of lender countries.

$$R_{Q_z ikq} = \frac{\frac{\sum_{j \in Q_z} L^{Intra}_{ijkq}}{\sum_{ijk} L^{Intra}_{ijkq}}}{\frac{\sum_{j \in Q_z} L^{Inter}_{ijkq}}{\sum_{ijk} L^{Inter}_{ijkq}}} = \frac{\frac{\sum_{j \in Q_z} L^{Intra}_{ijkq}}{\sum_{j \in Q_z} L^{Inter}_{ijkq}}}{\frac{\sum_{ijk} L^{Intra}_{ijkq}}{\sum_{ijk} L^{Inter}_{ijkq}}} \tag{11}$$

F Supplementary results with the effective tax rates

Effective corporate tax rates. Due to the limitations of using statutory tax rates, we also perform a robustness analysis using these *effective corporate tax rates* (ETR). Using the database compiled by Aliprandi et al. (2021), which collects information on 'profit before tax' and 'tax' reported by European banks in the Country-by-Country Reporting (CbCR) data they have been required to publish since 2014, we compute an ETR for each borrower and lender country in our sample (see Table 10).

Table 10: **List of reporting banks (CbCR data)**

ABN AMRO Group NV	Allied Irish Banks Plc
Banca Monte dei Paschi di Siena SpA	Banco Bilbao Vizcaya Argentaria SA
Banco de Sabadell SA	Banco Popular Espanol SA
Banco Santander SA	Bankia SA
Barclays Plc	Bayerische Landesbank
Belfius Banque SA	BNP Paribas SA
Commerzbank AG	Credit Agricole Group
Credit Mutuel Group	Credit Suisse Group AG
Danske Bank A/S	DekaBank
Deutsche Bank AG	Dexia SA
DNB ASA	DZ Bank AG
Erste Group Bank AG	Groupe BPCE
HSBC Holdings Plc	ING Groep NV
Intesa Sanpaolo SpA	KBC Group NV
Kreditanstalt für Wiederaufbau	Landesbank Baden-Wuerttemberg
Landesbank Hessen-Thueringen Girozentrale	Lloyds Banking Group Plc
Nationwide Building Society	NIBC Bank NV
Norddeutsche Landesbank Girozentrale	Nordea Bank AB
Rabobank	Raiffeisen Bank International AG
Royal Bank of Scotland Group Plc	Skandinaviska Enskilda Banken AB
Societe Generale SA	Standard Chartered Plc
Svenska Handelsbanken AB	Swedbank AB
UBS Group AG	UniCredit SpA

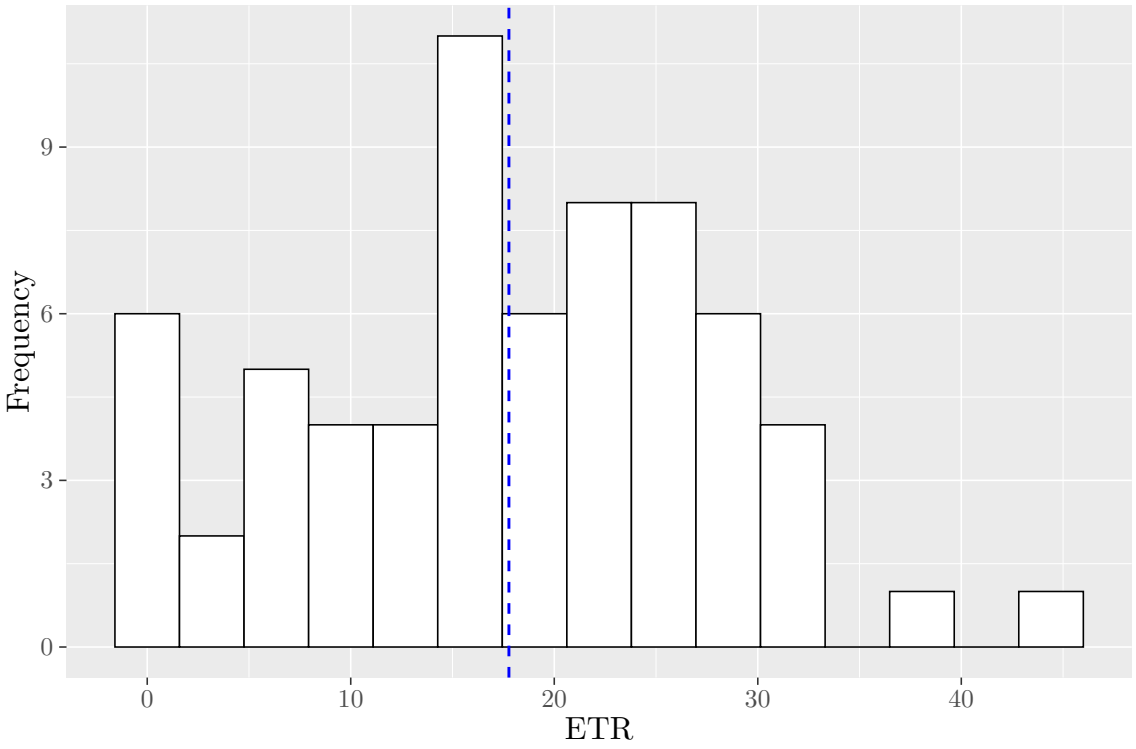
As some jurisdictions have only a small number of European banks, small changes in tax collected or profits realised each year can lead to large variations, so we average the ETR over time. Importantly, while STRs used for the main results are time-varying, ETRs are constructed to be time-invariant. Our computation is conducted on the 46 largest banks in the European Union from 2013 to 2019, operating in 152 countries which represent 4418 observations.

$$ETR_i = \frac{\sum_b \sum_t Tax_{ibt}}{\sum_b \sum_t Profits_{ibt}} \tag{12}$$

Where i is the country, t the year and b the individual bank. Similarly to Aliprandi et al. (2021), we extract only positive profits and positive taxes. In Figure 11 below, we plot the resulting distribution of the ETR and in Table 11 we show the quintiles computed from this distribution of

ETR.

Figure 11: **Distribution of the Effective Tax Rates (ETR)**



Source: effective corporate tax rates from the EU Tax Observatory (Aliprandi et al., 2021).

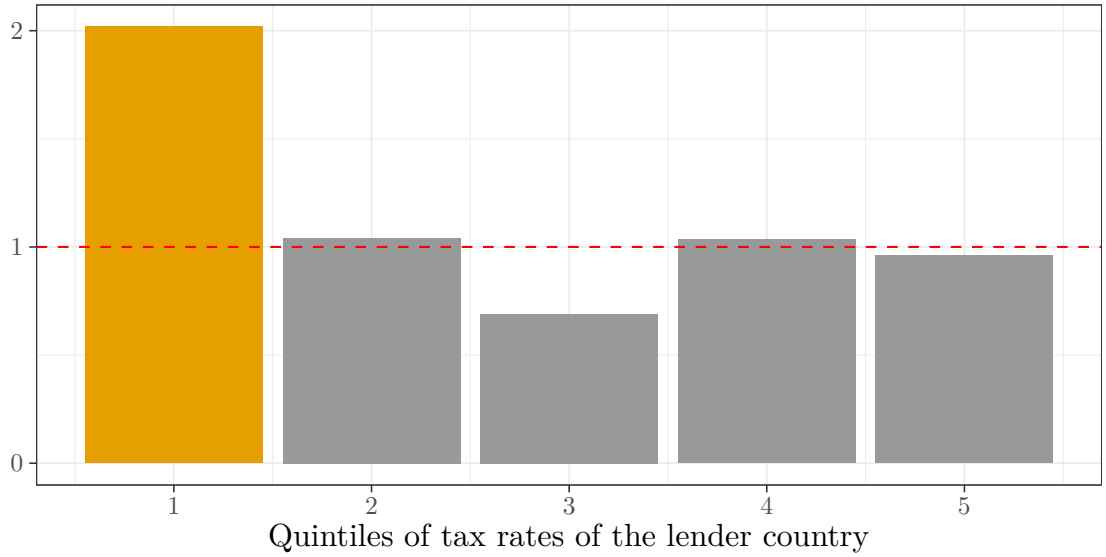
Table 11: **Effective tax rate (ETR) quintiles of the lender countries**

Quintile Q_z	Q_1	Q_2	Q_3	Q_4	Q_5
Effective tax rates (in %)	[0-8]	[8.8-15.6]	[15.7-20.8]	[21-25.4]	[26.3-44.4]

Note: This table report the range of ETR that characterized each of the quintile of corporate income tax rate we built.

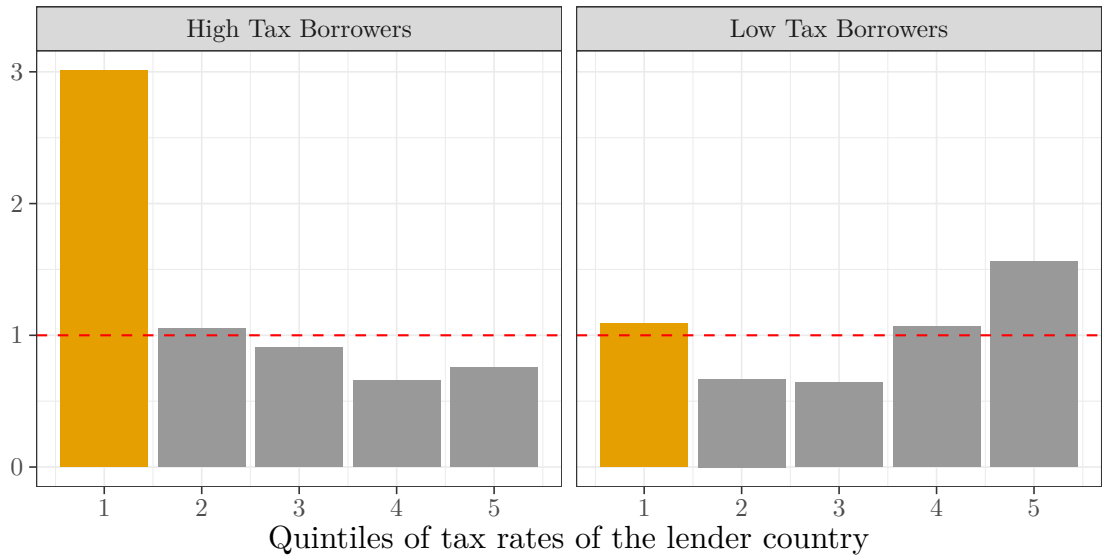
Replication of the main results with *effective* corporate tax rates. We now replicate the four main Figures of the paper using quintiles of lender or borrower corporate income tax rates computed using the *effective tax rates* (ETR) and not the *statutory tax rates* (STR). These are Figures 12, 13, 14 and 15 below.

Figure 12: **Ratio of relative share of intra-group debt to relative share of interbank debt, by effective tax rate quintile of lender countries**



Note : Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile the ratio of its share in total intra-group debt to its share in total interbank debt. Source: BIS Locational Banking Statistics by nationality (LBSN) and effective corporate tax rates from the EU Tax Observatory (Aliprandi et al., 2021). Lecture: Using STR, lender banks located in the countries with the lowest tax rates (Q1) hold relatively 2 times more intra-group debt than interbank debt.

Figure 13: **Ratio of the relative share of intra-group debt to the relative share of interbank debt from high-tax borrower countries (left) and low-tax borrower countries (right), by quintile of the effective tax rate of the lender country.**

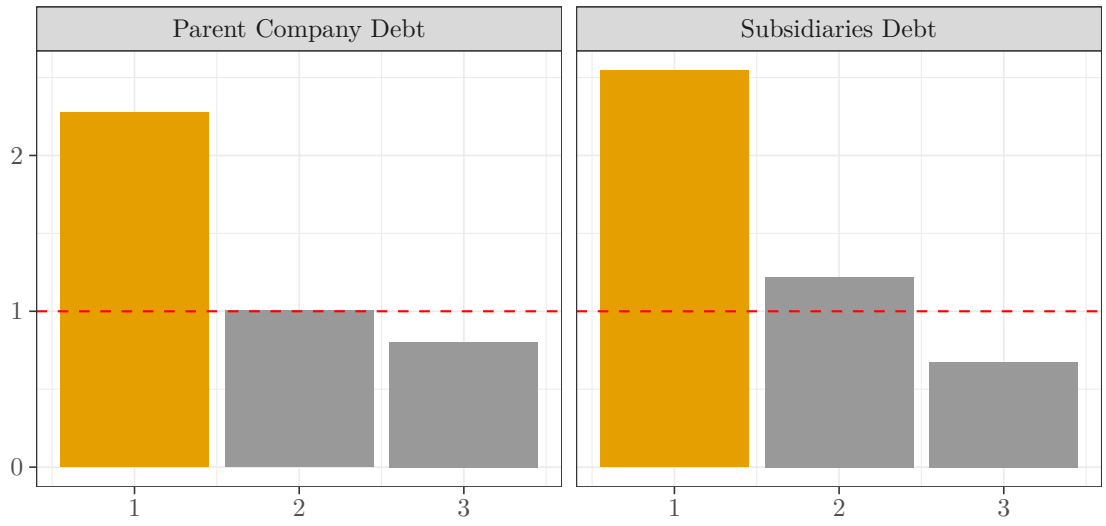


Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile the ratio of its relative share in intra-group debt to its relative share in interbank debt. Source: BIS Locational Banking Statistics by nationality (LBSN) and effective corporate tax rates from the EU Tax Observatory (Aliprandi et al., 2021). Lecture: Using STR, lender banks that resides in country which tax rates in Q1 hold relatively 3 times more intra-group debt as they hold interbank debt.

Figure 14: **Ratio of the relative share of intra-group debt to the relative share of interbank debt of parent companies (left) and foreign subsidiaries (right) from countries with high corporate tax rates ($\mathbb{Q}_5$), broken down by quintiles of the effective tax rate of the lender country.**

Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile the ratio of its relative share in intra-group debt to its relative share in interbank debt. On the left we present the ratio of debt issued by parents companies (or domestic subsidiaries); on the right, the ratio of debt issued by foreign subsidiaries to banks different from the country of incorporation (*i.e.*, the parent country). Source: BIS Locational Banking Statistics by nationality (LBSN) and effective corporate tax rates from the EU Tax Observatory (Aliprandi et al., 2021).

Figure 15: **Ratio of the relative share of intra-group debt to the relative share of interbank debt of the parent company (left) and foreign subsidiaries (right), by tertile of the effective tax rate of the lender country; European Union sample**

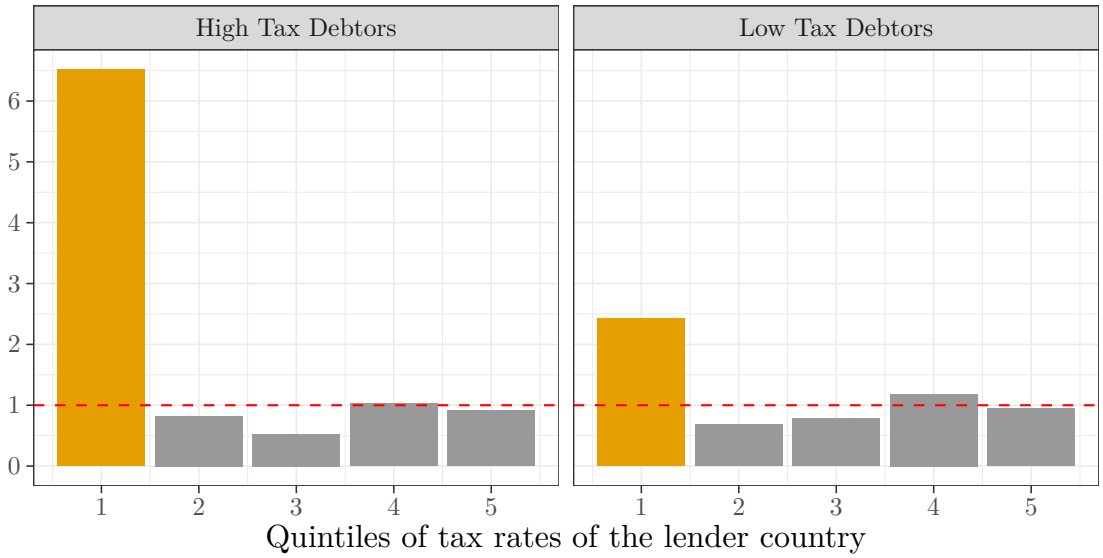


Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile the ratio of its relative share in intra-group debt to its relative share in interbank debt. On the left we present the ratio of debt issued by parents companies (or domestic subsidiaries); on the right, the ratio of debt issued by foreign subsidiaries to banks different from the country of incorporation. Source: BIS Locational Banking Statistics by nationality (LBSN) and effective corporate tax rates from the EU Tax Observatory (Aliprandi et al., 2021).

G Additional robustness checks

Low-tax jurisdictions ($Q_1 \cup Q_2$) vs. High-tax jurisdictions ($Q_4 \cup Q_5$). In this Appendix, we first replicate Figures 5 and 6 presented in section 4.3 but we now compare borrower countries in the first and second quintiles ($Q_1 \cup Q_2$) to borrower countries in the fourth and fifth quintiles ($Q_4 \cup Q_5$).

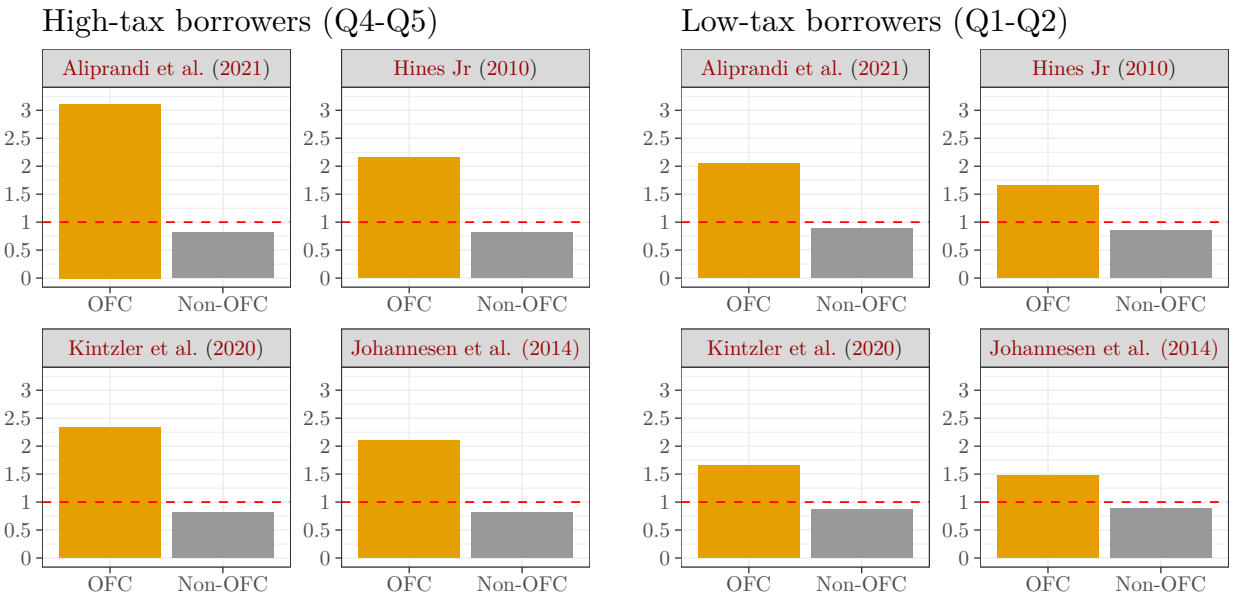
Figure 16: **Ratio of the relative share of intra-group debt to the relative share of interbank debt from high-tax borrower countries (left, $Q_4 \cup Q_5$) and low-tax borrower countries (right, $Q_1 \cup Q_2$), broken down by tax rate quintile of the lender country.**



Note : Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile the ratio of its relative share in intra-group debt to its relative share in interbank debt. Source: BIS Locational Banking Statistics by nationality (LBSN) and statutory corporate tax rates from the Tax Foundation. Lecture : Lending banks that resides in country which tax rates in Q1 hold relatively more than 6 times more intra-group debt as they hold interbank debt.

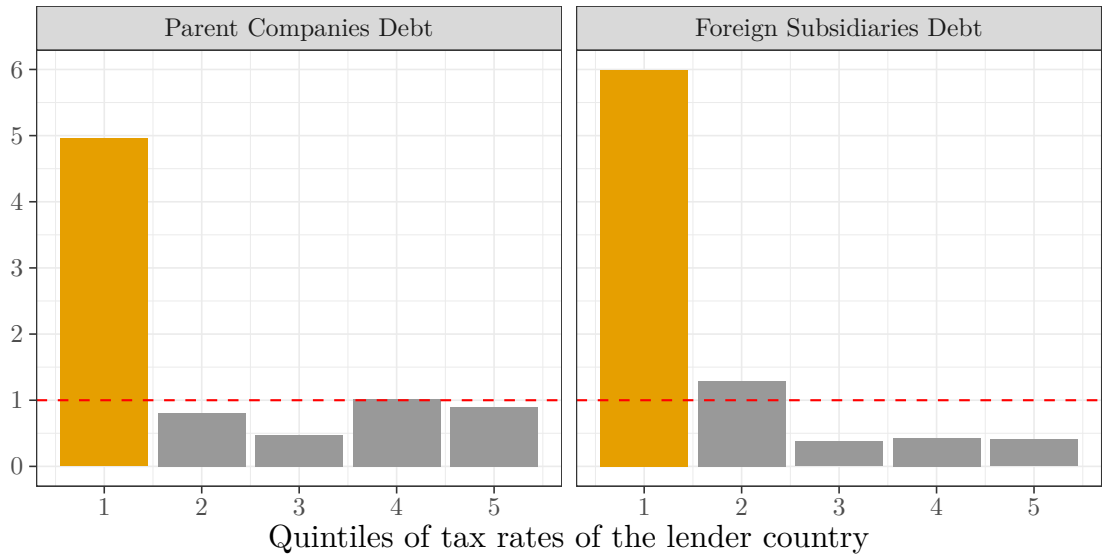
Sample limited to the Top 5 borrower countries. Finally, we conclude the Appendix by reproducing Figures 4 and 7 but now limiting our sample to the 5 largest reporting/borrower countries: the United States (US), the United Kingdom (GB), France (FR), Spain (ES) and Italy (IT).

Figure 17: **Ratio of the relative share of intra-group debt to the relative share of interbank debt from high-tax borrower countries (left, $Q_4 \cup Q_5$) and low-tax borrower countries (right, $Q_1 \cup Q_2$), broken down by type of lender country (non-OFC vs. OFC)**



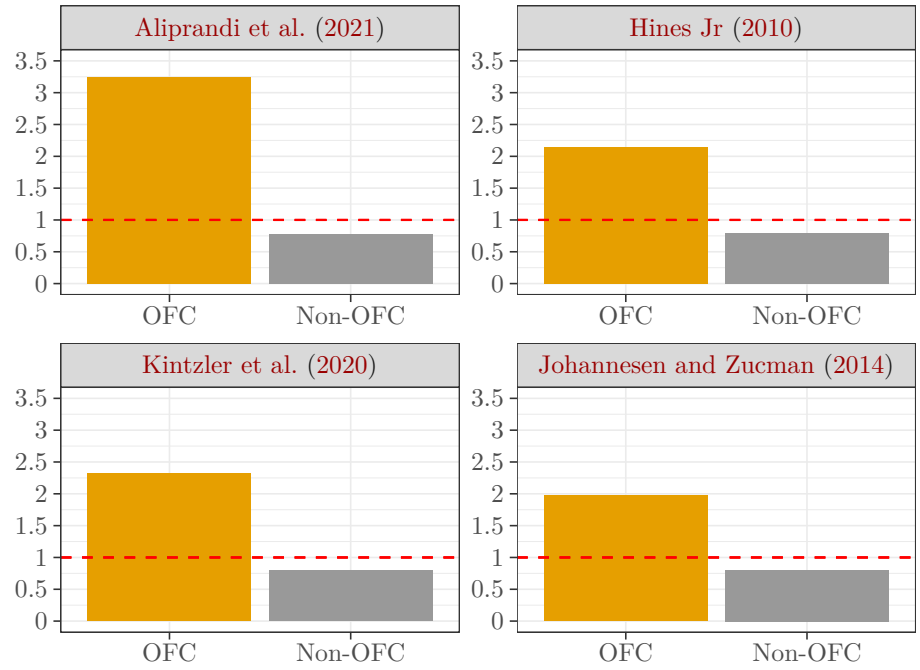
Note: Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each type of lender country the ratio of its relative share in intra-group debt to its relative share in interbank debt. The borrowers are either high-tax countries (fifth quintile of tax rates, left) or low-tax countries (first quintile of tax rates, right). Source: BIS Locational Banking Statistics by nationality (LBSN). OFC countries are defined according to the lists from Aliprandi et al. (2021), Hines Jr (2010), Johannesen and Zucman (2014), Kintzler et al. (2020) Lecture: lending banks located in OFCs (using the Aliprandi list) have a market share of intra-group debt 3 times larger than their interbank debt market share when considering borrower countries in the fifth quintile ($\mathbb{Q}_5$).

Figure 18: **Ratio of the relative share of intra-group debt to the relative share of interbank debt of the parent company (left) and foreign subsidiaries (right) by tax rate quintile of the borrowing country; top 5 borrowing countries**



Note : Weighted average between 2014-Q1 and 2019-Q4. Each bar represents for each quintile the ratio of its share in total intra-group debt to its share in total interbank debt. Borrowers located in the United-States, United Kingdom, France, Spain, Italy. Source: BIS Locational Banking Statistics by nationality (LBSN) and statutory corporate tax rates from the Tax Foundation. Lecture: Using STR, lending banks that resides in country with the lowest tax rates (Q1) hold relatively 5 to 6 times more intra-group assets as they hold interbank assets.

Figure 19: **Ratio of the relative share of intra-group debt to the relative share of interbank debt, by OFC status of lender countries, top 5 borrowers.**



Note: Weighted average between 2014-Q1 and 2019-Q4. The 5 largest borrowers are the US, the UK, France, Spain, Italy. Each bar represents, for each group of lender countries (OFC/non-OFC) the ratio of its relative share in intra-group debt to its relative share in interbank debt. Source: BIS Locational Banking Statistics by nationality (LBSN). OFC countries are defined according to the lists from Aliprandi et al. (2021), Hines Jr (2010), Johannesen and Zucman (2014), Kintzler et al. (2020). Source: BIS Locational Banking Statistics by nationality (LBSN). Lecture: lender banks located in the countries with the OFCs (using the Aliprandi list) have a market share of intra-group debt 3.25 times larger than their interbank debt market share..