DISCUSSION PAPER

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Can European Banks'
Country-by-Country Reports
Reveal Profit Shifting?
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Content of EU Banks'
Disclosures

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Can European Banks' Country-by-Country Reports Reveal Profit Shifting?

An Analysis of the Information Content of EU Banks' Disclosures

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October 2019

Abstract:

We create a novel database of hand-collected information from the country-by-country reports (CbCRs) of more than 100 multinational bank groups headquartered in the EU for 2014-2016. We compare this new dataset with information from Orbis and Bank Focus to assess in how far the new disclosure obligation increased transparency on banks' tax avoidance behavior. Our descriptive analysis shows that CbCRs uncover a large fraction of worldwide profits and real activities in terms of employees of EU bank groups, especially in tax havens. We also document a striking disconnect between reported profits and real activity, noting considerable heterogeneity between different tax havens and bank groups from different headquarter countries. Regression analysis based on CbCR data and Bank Focus data leads us to expect a tax semi-elasticity of banks' reported profits of about -4.6. In this regard, CbCRs are indicative of a more pronounced tax sensitivity than conventional databases suggest. However, the lack of important economic variables (total assets and staff cost) impedes an exact estimation of banks' profit shifting based on CbCR data alone and with standard methods. These insights are especially relevant in the context of the ongoing political discussions whether to introduce a public CbCR for all large multinational firms in the EU.

JEL Classification: H25, H26, G21, G28

Keywords: Tax Avoidance; Profit Shifting; Country-by-Country Reporting; Public Disclosure; Tax Transparency; Financial Institutions; Database

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1   Introduction

Following the strong public focus on the tax planning strategies of large multinational enterprises, several EU and OECD initiatives have developed measures aimed at curbing extensive profit shifting activities by increasing tax transparency. The so-called country-by-country reporting (CbCR) requires multinational firms to disclose certain tax-related data for every country where they operate. The reports are supposed to help tax authorities in effectively detecting presumably aggressive tax planning. More importantly, proponents argue that if the reports are made publicly available, public pressure would induce firms to pay their "fair share of taxes". Due to the novelty of these rules, empirical evidence on the effectiveness and information content of CbCR is still at an early stage. Our project intends to fill this considerable gap by exploiting data from CbCRs published by EU financial institutions. The reporting requirement was introduced by the Capital Requirements Directive IV (Directive 2013/36/EU, abbr.: CRD IV) for financial years 2014 onwards. It offers a unique research setting due to the public availability of the data.[1]

We create a novel database by collecting data from the CbCRs of multinational bank groups headquartered in the EU for financial years 2014-2016. Based on this data, we assess in how far the public's access to information on banks' tax avoidance behavior has improved by the introduction of CbCR. In particular, we investigate how much additional evidence on the tax planning activities and the tax haven usage of EU financial institutions CbCRs reveal compared to conventional databases. We also examine whether CbCR data allows for a more precise

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[1] The other existing initiatives and proposals on CbCR are not suitable to answer our research questions. Section 1504 of the Dodd-Frank Wall Street Reform and Consumer Protection Act 2010 and Chapter 10 of the EU Accounting Directive (Directive 2013/34/EU) introduced a public disclosure requirement for firms in the extractive industries. However, these regulations follow a different motive – preventing corruption in the extractive industries rather than limiting profit shifting – and lack hence important variables. The OECD determined a CbCR for all multinational firms with consolidated revenues of at least EUR 750 million in the preceding year (OECD 2015), whereby the data shall only be submitted confidentially to the tax authorities. The European Commission has developed a draft directive which resembles the OECD proposal but provides for a public disclosure of the reports (European Commission 2016; European Parliament 2017; European Parliament 2019). However, this proposal is still at a draft stage, without CbCR data being publicly available yet.

estimation of the extent of banks' profit shifting than other data sources and whether we can correct potential distortions of prior studies. Given that disclosure requirements induce additional direct and indirect costs, our insights are crucial in evaluating the added value of the new reporting requirement.

Our empirical analysis is twofold. We start with a descriptive analysis based on CbCR data. We examine the worldwide distribution of banks' country presences, profit before tax and employees, with a special focus on the usage of tax havens. For comparison, we repeat the analysis using data from Bureau van Dijk's Orbis database, which we consider as the benchmark for the maximum of information available to the public before CbCR was introduced. Our main findings are as follows. First, although public knowledge on the group structure of EU-headquartered banks seems to be quite comprehensive even without CbCR data, key financial information is unavailable for the majority of subsidiaries. We show that CbCRs reveal a large amount of worldwide profits and real activities that remain opaque when relying on other publicly available sources of information. As an example, only 55% of the worldwide workforce of the bank groups in our sample is visible at subsidiary level in Orbis. The increase in transparency induced by CbCR is especially pronounced not only for tax havens, but also for presences in the largest non-EU economies (i.e. the U.S., Japan and China).

Second, our descriptive analysis shows the important role of tax havens for EU bank groups, which is also illustrated in Figure 1. According to CbCR data, tax havens account for about 20% of banks' total country presences, whereby Luxembourg, Switzerland, Ireland, Singapore and the Channel Islands are most frequently used. CbCRs reveal a striking disconnect between reported profits before tax and real activity in terms of employees: While tax havens account for about 18% of EU banks' worldwide pre-tax profits, they only employ 5% of their worldwide workforce and make up about 10% of their worldwide tax expense. The misalignment between tax haven profits and employees is especially strong for banks

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headquartered in Germany, the United Kingdom and Italy. In line with the observed disconnect, tax havens exhibit a median profit per employee that is 2.5 times as high as in other countries and a median effective tax rate that is less than half of the rate in non-tax havens. However, there is considerable heterogeneity within the group of tax havens, suggesting that only some of them are preferably used for profit shifting. Relying solely on financial information available in Orbis leads to a severe mis-estimation of the worldwide allocation of profits, employees and taxes. All in all, our descriptive analysis indicates that EU bank groups use certain tax haven locations for tax planning and that CbCR data uncovers a substantial part of banks' global profits located in tax havens.

In a next step, we conduct a regression analysis based on CbCR data, which allows to control for additional factors that might influence the amount of reported profits and to draw more refined conclusions on the magnitude of income shifting. We follow prior profit shifting estimations (see e.g. Hines and Rice 1994; Huizinga and Laeven 2008) where reported pre-tax profits are modelled as the sum of "true" profit (explained by input factors) and shifted profit (induced by tax incentives). Due to the limited set of variables reportable in the CbCRs, our baseline regression only controls for economic activity in terms of the number of employees. In addition, we develop a refined regression where we try to account for staff cost and total assets. Finally, we repeat our analyses for the same sample of bank group-years with unconsolidated statement data from Bank Focus. We start by replicating prior estimations on banks' profit shifting (Merz and Overesch 2016) and step-by-step assimilate the design to our baseline and refined regressions.

Our main findings are as follows: Within the CbCR dataset, neither the baseline nor the refined regressions provide evidence of banks engaging in profit shifting. Using Bank Focus data, we observe that the exclusion of total assets and the replacement of staff cost by the number of employees result in an upward bias of the tax semi-elasticity of reported profits of

about 6.5 percentage points. If we assume a corresponding bias within the CbCR dataset, we expect an actual tax semi-elasticity of about -4.6 in case the CbCRs contained information on total assets and staff cost. This semi-elasticity is considerably more negative than the one documented based on Bank Focus data (about -2.0). We conclude that CbCRs, due to their strong advantage in terms of geographical coverage, are indicative of a more pronounced tax sensitivity than estimations based on financial statement data from Bank Focus suggest. However, conventional methods reach their limits when trying to adequately account for the lack of total assets and staff cost.

We contribute to several strands of literature. First, we shed light on the effectiveness of CbCR. While a few recent studies analyze the impact of CbCR on EU banks' tax avoidance behavior (Joshi et al. 2018; Overesch and Wolff 2019) and on their stock prices (Dutt et al. 2019), empirical evidence on the information content of the published data itself is at an early stage (Bouvatier et al. 2018; Fatica and Gregori 2018; Janský 2018). We provide comprehensive descriptive evidence on the CbCR data published by more than 100 EU banks and apply refined regression specifications to estimate the tax sensitivity of reported profits. We replicate the analyses using conventional datasets. To the best of our knowledge, we are the first to assess the information content of CbCRs in light of existing databases, which is crucial in determining in how far the public's insight into banks' tax avoidance behavior has improved after the implementation of CbCR.

We also contribute to the literature on profit shifting in the banking sector. While profit shifting by multinational firms in other industries has been extensively investigated (see e.g. the meta-study by Heckemeyer and Overesch (2017)), empirical evidence on the tax avoidance behavior of banks is comparably rare (see e.g. Huizinga et al. 2014; Gu et al. 2015; De Mooij and Keen 2016; Merz and Overesch 2016; Andries et al. 2017; Langenmayr and Reiter 2017). We enrich this strand of literature by using a newly published source of data with superior

coverage. We estimate the tax response of banks' reported profits based on both CbCR data and Bank Focus data in order to investigate whether the improved coverage of CbCRs translates into a more pronounced tax sensitivity compared to conventional datasets.

Finally, we add to the recently evolving literature which uses new and more comprehensive data sources to examine firms' tax avoidance activities (see e.g. Tørsløv et al. 2018). Most studies on profit shifting rely on subsidiary-level data from Bureau van Dijk's databases Bank Focus, Orbis and Amadeus, which regularly lack financial information on many subsidiaries, especially those located in tax havens. The incomplete coverage can bias the estimated tax sensitivity of profits (Dowd et al. 2017). CbCRs, though, contain information for the whole group. They reveal the location of profits, employees and taxes in all countries where the multinational firm operates. We create a novel database by collecting the CbCRs published by EU bank groups and make use of the reports to overcome the drawbacks of datasets used in prior literature.

Overall, we analyze a large amount of CbCRs that have so far not been explored and assess the incremental value of the reporting requirement in light of existing databases. In particular, we compare the inferences we can draw based on the different datasets on banks' activities in tax havens and the magnitude of their profit shifting behavior. Our descriptive analysis indicates that CbCR data uncovers a considerable part of the worldwide distribution of banks' reported profits and real activities, especially with regard to tax haven locations. Insofar, the new reporting obligation effectively increases transparency. Our regression analysis is indicative of a more pronounced tax sensitivity than estimations based on financial statement data from Bank Focus suggest. Still, the CbCR framework for banks is lacking important economic variables (total assets and staff cost), which makes it difficult to provide reliable evidence on the magnitude of shifted profits using conventional methods. These insights are important in view of the ongoing political discussions whether to introduce a public CbCR for all multinational

firms in the EU with revenues exceeding EUR 750 million (European Commission 2016; European Parliament 2017; European Parliament 2019).

The remainder of this paper is structured as follows: Section 2 provides information on the institutional background and prior literature related to our research question. Section 3 describes the data collection process. Section 4 provides descriptive evidence on the information content of EU banks' CbCRs compared to conventional databases. We conduct a regression analysis based on CbCR data and Bank Focus data in Section 5. Section 6 concludes.

2 Background and prior literature

2.1 The CbCR requirement for EU financial institutions

The CbCR requirement for EU financial institutions aims at rebuilding trust in the financial sector in the aftermath of the financial crisis by making the location of banks' activities, profits, employees and taxes more transparent. As several banks had received large public subsidies, the public should be enabled to assess whether they are paying their "fair share of taxes" in the countries where they operate. The disclosure obligation is regulated in Article 89 of the CRD IV and transposed into the national laws of the EU Member States. The CRD IV, which was published in the Official Journal of the EU on 27 June 2013 and accompanied by the Capital Requirements Regulation (Regulation EU No 575/2013, abbr.: CRR), implements the Basel III standards, in particular stricter requirements on capital, liquidity and leverage and new provisions on corporate governance and remuneration, into EU law.

Article 89 of the CRD IV obliges EU credit institutions and investment firms to publicly disclose turnover, the number of employees, profit or loss before tax, tax on profit or loss and public subsidies received separately for every country in which they maintain subsidiaries and/or branches (referred to as "section of key financials" in the following). In addition, the affected firms have to list the name, geographical location and nature of activities of their

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subsidiaries and branches (referred to as "list of subsidiaries and branches" in the following).

The disclosures are required on a "consolidated basis", which could either refer to the

consolidation scope of the applicable accounting standards or to the – narrower – prudential

scope of consolidation as defined by the CRR. While the wording of Article 89 of the CRD IV

remains open, the national transpositions in the three largest headquarter countries France,

Germany and the United Kingdom refer to the accounting scope (see Article L511-45 Code

monétaire et financier; BaFin 2015; Statutory Instruments 2013 No. 3118). Moreover, the

results of our analysis also suggest that CbCRs comprise the same group structure as

consolidated financial statements.[2]

The reporting obligation is effective from 1 January 2015 with the first wave of disclosed

CbCRs relating to the financial year 2014.[3] While bank groups headquartered in the EU have

to include all entities of the whole group in their CbCR, bank groups headquartered in a third

country only have to report on their EU entities, including their subsidiaries and branches. The

reports must be audited and shall be published together with the financial statements – either as

part of the annual report or as separate document.

The CbCR requirement for EU financial institutions offers a unique research setting. First,

the data is publicly available for financial years 2014 onwards. Second, the audit requirement

ensures a certain data reliability. Finally, the comprehensive geographical coverage of the

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[2] See the comparison of the number of employees between CbCRs and consolidated financial statements described in Section 4.3. Moreover, about 93% of the CbCRs which explicitly give information on the consolidation scope state that the accounting scope was applied.

[3] From 1 July 2014 to 1 January 2015, the information to be disclosed was transitionally limited to the name, geographical location and nature of activities of the institutions' entities as well as to the amount of turnover and the number of employees. Only global systemically important institutions (GSIIs) had to submit the complete information to the European Commission on a confidential basis. The European Commission, in cooperation with PricewaterhouseCoopers, used this data to assess the impact of the public disclosure of such tax-related information, in particular regarding potential negative economic consequences (PricewaterhouseCoopers 2014). The final decision on the inclusion of the CbCR requirement in the CRD IV as originally foreseen was made on 30 October 2014 (European Commission 2014).

banks' worldwide activities is ideally suited to estimate the magnitude of profit shifting based on new information that has so far been largely unexplored.

2.2 Prior literature

Impact and information content of CbCR

Our research is related to several strands of literature. First, we contribute to the literature on CbCR by shedding light on the information content of the recently published data. While several papers discuss potential costs and benefits of the new disclosure requirement from a normative approach (e.g. Cockfield and McArthur 2015; Evers et al. 2017; Hanlon 2018), empirical evidence on its impact and effectiveness is still at an early stage. A few papers analyze the reaction of affected firms and show that they adjusted their tax avoidance behavior to some extent. Overesch and Wolff (2019) and Joshi et al. (2018) focus on the effect of Article 89 CRD IV on the tax planning activities of multinational banks. Overesch and Wolff (2019) document increases in the effective tax burdens of multinational banks headquartered in the EU compared to different control groups unaffected by the Directive. The reaction is especially pronounced for banks particularly exposed to the increase in transparency through their activities in distinct tax havens. Joshi et al. (2018) observe a substitution of profit shifting activities between financial and industrial affiliates, the latter of which they consider not to fall under the scope of the CRD IV, leaving the overall level of corporate tax avoidance unchanged. Brown et al. (2019) analyze the interplay between CbCR and geographic segment reporting in EU banks' financial statements. They find no significant change in the segment reporting behavior after the introduction of CbCR.

Joshi (2019), Hugger (2019) and De Simone and Olbert (2019) study the firm reaction to the confidential CbCR for multinational firms with consolidated revenues in the preceding year above EUR 750 million proposed by the OECD. The concept was part of the Base Erosion and Profit Shifting project (OECD 2015) and transposed in EU secondary law (Council Directive

(EU) 2016/881) with effect for financial years starting after 1 January 2016. In contrast to the public CbCR for EU financial institutions, the confidential reporting only increases transparency vis-à-vis the tax authorities and to date does not go along with a potential increase in public scrutiny. Still, affected firms seem to change their tax planning behavior and economic activities after the introduction of the reporting requirement. Joshi (2019) and Hugger (2019) find that the effective tax rates of multinational firms with revenues exceeding the threshold of EUR 750 million increase in the years following the implementation of the disclosure requirement. De Simone and Olbert (2019) document real effects of private CbCR in the form of a reduction in the number of tax haven subsidiaries, lower investment in total employment and a reallocation of revenue, employment and total assets to subsidiaries in European low-tax jurisdictions. In summary, prior evidence suggests that affected firms changed their behavior after the introduction of both Article 89 of the CRD IV and the CbCR proposed by the OECD.

A reduction in the tax avoidance behavior in response to CbCR is, at least partly, also anticipated by the capital market. Three event studies analyze how investors perceive increases in tax transparency through the introduction of CbCR initiatives. Johannesen and Larsen (2016) document a considerable negative capital market response around two of four key dates in the legislation process of the EU Accounting Directive, which introduced a CbCR obligation for EU companies in the extractive industries. The results of Dutt et al. (2019), however, are suggestive of a zero investor response to the surprising political decision to include a CbCR requirement for EU financial institutions in the CRD IV. They conclude that investors expected a simultaneous decline in banks' tax avoidance opportunities and in information asymmetries between managers and shareholders, such that negative and positive stock price reactions offset each other on average. In an additional analysis, Joshi (2019) observes a negative capital market reaction to the publication of the first CbCR implementation package by the OECD.

The firm reactions and capital market responses to the different CbCR obligations documented by concurrent studies may result from the reports conveying substantial new information to tax authorities and to the public. Alternatively, they could just be driven by the higher salience and increased scrutiny coming along with the introduction of the rules, but without providing new valuable insights. If the latter is true, the observed effects might only be short-term. In order to distinguish between the different explanations, it is necessary to analyze the information content of the published reports. A few studies prepared for NGOs or political groups provide first descriptive evidence. Murphy (2015) uses CbCR data of 26 EU-based banks available up to June 2015 to develop a ranking for the banks indicating the degree of profit shifting. He observes that the banks in his sample seem to have over-reported their profits in low-tax jurisdictions and tax havens, while engaging in profit under-reporting in those jurisdictions in which they have major business activities. In studies prepared for Oxfam, Aubry et al. (2016) and Aubry and Dauphin (2017) analyze CbCR data of the top five French banks (for financial year 2014) and the top 20 EU banks (for financial year 2015), respectively, focusing especially on the usage of tax havens. They document a striking mis-relation between profits and turnover, the number of employees and taxes reported in some tax havens. Tax havens are shown to exhibit profits per employee and profits per euro of turnover that are substantially higher and effective tax rates that are considerably lower than those in other countries. The authors identify Luxembourg and Ireland as the most important tax havens for European banks.

Turning to academic studies, Janský (2018) examines the CbCRs of 46 banks for 2013-2017. He follows various approaches to quantify the extent of profit misalignment, such as the discrepancy between expected profit based on the share of employees and true reported profit. Bouvatier et al. (2018) apply a gravity model to the CbCRs of the 37 systemically important banks in the EU for the year 2015. They estimate that banks' activities in tax havens are three

times higher than standard gravity factors predict on average. Monaco and Luxembourg are identified as the most attractive tax havens. Brown et al. (2019) analyze CbCR data of 70 banks for 2013-2016 and document that tax havens exhibit significantly higher profit margins, turnover per employee and profit per employee and significantly lower effective tax rates than non-tax havens.

Most closely related to our study, Fatica and Gregori (2018) conduct regression analyses based on CbCR data of the 26 largest European multinational banks for 2014-2016. They regress profit before tax on economic factors and measures of the tax rate differential between the host country and all other group locations. They observe significantly negative coefficients on the tax rate differentials ranging from -3.13 to -2.12, suggesting that banks' CbCR data exhibits tax semi-elasticities similar to those documented for financial institutions by prior literature (Merz and Overesch 2016). Our study goes beyond their analysis in several aspects. First, we use a larger and more diversified sample of CbCRs published by more than 100 different EU banks. Second, we provide comprehensive descriptive evidence on CbCR data and compare its coverage and information content with conventional databases. Third, we apply refined regression specifications to estimate the tax sensitivity of reported profits based on CbCR data. Fourth, we replicate our regression analyses using conventional datasets and compare the results, allowing for more nuanced conclusions on the increase in transparency resulting from CbCR. To the best of our knowledge, we are the first to assess the information content of CbCRs in light of existing databases. This step is crucial in determining in how far the public's insight into banks' tax avoidance behavior has improved after the implementation of CbCR and, ultimately, in evaluating the added value of the reporting obligation.

Profit shifting in the banking sector

We also contribute to the literature on profit shifting by banks. An abundant body of literature examines the magnitude of profit shifting by multinational firms – either by

comparing reported profits of high-tax and low-tax affiliates or by investigating specific profit shifting channels, namely transfer pricing, financing and the location of intangibles (see Dharmapala (2014) and Riedel (2018) for a review of the literature, and the meta study by Heckemeyer and Overesch (2017)). Still, only few authors provide evidence on profit shifting in the banking sector, which is often excluded in conventional studies. On the one hand, international financial markets have become highly integrated, such that international tax planning is increasingly relevant for banks. On the other hand, capital requirements and sector-specific regulations may curb banks' tax responsiveness. Demirgüç-Kunt and Huizinga (2001) provide early evidence on foreign banks engaging in profit shifting. Huizinga et al. (2014) and Merz and Overesch (2016) document a negative relationship between the host country tax rate and pre-tax earnings of foreign bank subsidiaries. In particular, the latter estimate that a one percentage point increase in the host country tax rate is associated with about 2.4% lower reported profits at the subsidiary level. The effect size of this tax semi-elasticity is more than twice as large as the consensus estimate of -0.8 by Heckemeyer and Overesch (2017) for other industries. The authors differentiate according to business models and find interest-bearing activities to be less responsive to taxes compared to other activities, such as trading gains and loan loss provisions.

Further studies confirm that banks engage in profit shifting via the relocation of proprietary trading activities to low-tax countries (Langenmayr and Reiter 2017), by increasing loan loss provisions in high-tax countries that allow for the tax deductibility of general provisions (Andries et al. 2017) and by adjusting leverage to the corporate income tax rate, thereby exploiting the debt shifting channel (Hemmelgarn and Teichmann 2014; Gu et al. 2015; De Mooij and Keen 2016; Heckemeyer and De Mooij 2017). We shed more light on the extent of banks' profit shifting by using a newly published source of data with superior coverage. In our regression analysis, we apply the standard approach employed in prior studies to both CbCR

data and Bank Focus data, which allows us to compare CbCRs to conventional datasets used in the existing literature.

New data sources to estimate the extent of profit shifting

In the same vein, we add to the recently evolving literature which uses new and more comprehensive data sources to examine firms' multinational activities (e.g. Tørsløv et al. (2018) exploiting foreign affiliates statistics and national account data). Most studies on profit shifting by banks and multinational firms in general rely on subsidiary-level data taken from Bureau van Dijk's databases Bank Focus (or its predecessor Bankscope), Orbis and Amadeus. These datasets do not ensure full coverage in all dimensions. First, financial information on many subsidiaries is missing for several reasons. Bankscope and Bank Focus, as industry-specific databases, only contain financial data on subsidiaries with a bank license (Merz and Overesch 2016). Tørsløv et al. (2018) note that the subsidiary-level data in Orbis is derived from public business registries, which often contain insufficient income information in many jurisdictions (especially those with low tax rates). The limited availability of data on tax havens can distort the picture on cross-border profit shifting. Dowd et al. (2017) analyze U.S. tax return data and show that neglecting tax havens leads to an underestimation of the tax response. Second, financial information on foreign branches is often missing in commercial datasets. As banks make extensive use of branches (Merz and Overesch 2016; Langenmayr and Reiter 2017), it is crucial that they are considered appropriately.

In contrast to conventional data sources, banks' CbCRs (provided they are prepared at the level of the global ultimate owner of the group) contain information for the whole group of firms, ensuring a complete geographical coverage. Moreover, since the data is presented at country level and not at entity level, the activities of branches should inherently be allocated to the appropriate country. We would thus expect the CbCR dataset to provide a more complete

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and accurate picture of banks' international profit shifting activities.[4] Nevertheless, one major drawback might impair the informativeness: Banks' reports do not contain a variable reflecting the capital invested in a country (such as total assets), which is an essential production factor. Overall, we make an important contribution by examining the actual information content of the CbCR data compared to conventional datasets.

3 Data collection process

3.1 CbCR data

As there is no central database or registry for banks' CbCRs, the reports and the data contained therein have to be hand-collected. Banks publish the CbCRs on their websites, either as part of the annual report or (albeit less often) as a separate document. The reports are usually in PDF format, whereby the structure and presentation of the data are not prescribed by the Directive and hence up to the banks' discretion. The resulting reporting heterogeneity across banks and countries makes the process of collecting the reports and extracting the relevant information challenging. We proceed as follows.

First, we create a list of banks for which we expect to find usable CbCRs. We use ownership data from Bank Focus to identify bank groups whose global ultimate owner is located in the EU. Focusing on EU-headquartered banks ensures that the report contains worldwide financial information on the whole group of firms (see Section 2.1). Moreover, we are only interested in multinational banks since purely domestic groups have no possibilities for cross-border profit shifting and their reports would only contain one country anyway. We thus keep only bank groups which have at least one foreign subsidiary or branch. We also note that the global

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[4] Further advantages of CbCR data compared to other datasets, such as Compustat, Worldscope, Bureau of Economic Analysis (BEA) data or the German central bank's databases Microdatabase Direct Investment (MiDi) and External Positions of Banks, consist in the disaggregate provision of the data at bank group-country level (not completely aggregated at parent level), the availability of data on the banks' worldwide activities (not restricted to a single country), the provision of information on profits and employees, which are key items for estimating the size of profit shifting, and the audit requirement ensuring a certain degree of data reliability.

ultimate owner information is sometimes missing in the Bank Focus ownership database. Furthermore, Bank Focus sometimes records non-banks (such as individuals, states or federal states) as global ultimate owners of bank groups. In these cases, the CbCRs are obviously not prepared by the global ultimate owner but rather by a holding company of the bank group. In order to avoid dropping banks from our list solely due to these data limitations, we also include bank entities located in EU countries with missing global ultimate owner information or with non-bank global ultimate owners. Consequently, our final search list of 597 banks sometimes contains multiple entities belonging to the same bank group. Therefore, we expect the actual number of annual CbCRs for EU-headquartered bank groups to be considerably lower.

Second, we also develop a list of typical expressions used to refer to CbCRs or within CbCRs. The terms are derived from the inspection of several exemplary hand-collected reports in several languages, namely English, German, French, Spanish, Italian and Portuguese. Table 1 contains an overview of our different search terms.

We then use the list of banks and the list of search terms as input in a Google search programmed with Python. More precisely, the automatic search combines each name from the bank list with each search term and saves the first ten PDFs found by Google for each combination. Subsequently, the downloaded PDFs are filtered according to the search terms. As most documents are no separate CbCRs but rather comprehensive annual reports, we conduct a textual analysis using regular expressions to identify the section of the document that is most likely to contain the CbCR information. This section is then inspected manually to decide whether the document actually contains a CbCR.

The automatized CbCR collection with Python is complemented by a manual search for the CbCRs of the largest EU banks, defined by total assets, and for banks where CbCRs could not be found for all years. The initial data collection was conducted in 2017. As the disclosure

obligation according to Article 89 of the CRD IV started on 1 January 2015, complete CbCRs were available for the financial years 2014-2016. To account for delayed publication of some reports, we manually updated our search in 2019 for banks for which we had found at least one report in first place.

Finally, we manually extract the data from the section of key financials (i.e. the items profit or loss before tax, number of employees, turnover, and taxes, reported for each country) and relevant additional core data (e.g. currency, unit, additional explanations) to build our database. After excluding CbCRs from financial year 2013 where the reporting requirement was not yet fully implemented, we arrive at a final sample of 114 bank groups for which we have (unbalanced) CbCR data for the period 2014-2016, amounting to a total of 316 CbCRs. This sample size of multinational bank groups headquartered in the EU is in line with Joshi et al. (2018), suggesting that our approach largely collected the available CbCRs of interest. We drop positions where several countries are combined to a single entry, such as "Others" or "Rest of the world", thereby arriving at 4,091 observations at the bank group-year-country level. Table 2 provides an overview of the distribution of CbCRs (bank group-years) and bank group-year-countries (unit of observation) over the years 2014-2016. About 20% of observations are tax havens. Table 3 shows the composition of the sample by parent country, i.e. the country where the bank is headquartered. Bank groups headquartered in France, Germany and the United Kingdom account for the majority of observations.

3.2 Orbis and Bank Focus data

One of our main contributions lies in the comparison of CbCR data to conventional datasets used in prior studies on banks' profit shifting, namely Orbis and Bank Focus. In order to construct a sample which is comparable to our sample of CbCRs, we proceed as follows:

Our starting point are the bank groups contained in our CbCR dataset. For the parent banks that published the reports, we extract all subsidiaries (with direct or indirect participation of more than 50%) from the Orbis ownership database. We then download information from unconsolidated financial statements (of the parent and of each subsidiary belonging to the group) and consolidated financial statements (only of the parent) from the financial databases of both Orbis and Bank Focus. To ensure comparability with our CbCR dataset, we only include financial information for the exact bank group-year combinations included in our CbCR sample. While Bank Focus provides more banking sector-specific variables, it only comprises entities that have a bank license, resulting in a lower coverage than Orbis. For our different analyses, we separately choose the most appropriate database. Table 4 and Table 8 provide an overview of the composition of the Orbis and Bank Focus samples.

3.3 Tax rates and additional country data

We gather countries' statutory corporate tax rates from the database of the International Bureau of Fiscal Documentation database (IBFD)[5] and, complementary, from tax handbooks prepared by EY (2014, 2015, 2016), KPMG (2015, 2017) and PricewaterhouseCoopers (2014, 2015, 2016). If available, we also consider specific tax rates for firms in the banking sector when calculating the overall statutory tax rate. To distinguish between tax havens and other countries, we apply the tax haven list developed by Hines (2010). Additional country-level information (GDP per capita, inflation rates) is taken from the World Bank's databases.[6]

4 Descriptive evidence on the information content of CbCR data

How much information on tax planning activities and tax haven usage do public CbCRs reveal which we cannot infer from conventional databases? To answer this question, we

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[5] https://research.ibfd.org/#/ (12 July 2017).
[6] https://data.worldbank.org/indicator/NY.GDP.PCAP.CD (6 December 2018);
https://data.worldbank.org/indicator/NY.GDP.DEFL.KD.ZG (22 November 2018).

examine the worldwide distribution of country presences, recorded profits and real activities of EU-headquartered banks based on our CbCR dataset and compare the results with the information available in Bureau van Dijk's Orbis database. We use the Orbis ownership and financials datasets (as opposed to Bank Focus) throughout this descriptive analysis due to their superior coverage of subsidiaries. As Orbis contains data from both public business registries and additional sources,[7] its content can be interpreted as the maximum of information available to the public before CbCR was introduced.[8] Thus, it serves as our benchmark to assess the increase in transparency induced by CbCR. Table 4 provides an overview of the distribution of subsidiaries in the Orbis financials sample over tax havens and non-tax havens for the years 2014-2016.

4.1 What do we know about banks' presence in tax havens?

We start the descriptive analysis with a comparison of the number of country presences observable in our CbCR dataset and in Orbis, applying two alternative approaches. For the first approach, we define a "country presence" according to Orbis solely based on ownership data. More precisely, we record a country presence if a bank group controls at least one subsidiary in a certain country, irrespective of whether financials are obtainable in Orbis for this subsidiary or not. Referring to the CbCR sample, we count a "country presence" if a bank group includes a certain country in the section of key financials in its CbCR.[9] We extract this information from the 2015 reports since this is the financial year with the most comprehensive CbCR coverage.

Figure 2 depicts the average number of total country presences and of tax haven presences per bank group, observable from both datasets. According to the 2015 CbCRs, the average bank group is active in about 12.6 different countries worldwide, of which about 2.5 countries (i.e.

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[7] For more details, see Tørsløv et al. (2018) and De Simone and Olbert (2019).
[8] We note that an incomplete coverage in Orbis can result from several different reasons (e.g. lack of disclosure obligations in certain countries, low transparency of certain bank groups or poor quality of the dataset).
[9] As described in Section 2.1, this inclusion signals that the bank group maintains at least one subsidiary or permanent establishment in the respective country.

20%) are tax havens. The average numbers derived from Orbis ownership information are very similar and even slightly higher, suggesting that the corporate group structures of the banks in our sample are well-represented in the commercial database.

An overview of the total number of presences for a selection of countries is shown in Figure 3.[10] It clearly stands out that Luxembourg, the second smallest EU Member State in terms of population, ranks third with 61 of the 114 banks in our sample reporting a presence there in their 2015 CbCR. Moreover, the number of presences in small offshore tax havens evidently exceeds the economic importance of these locations (e.g. the Channel Islands host almost as many bank groups as Japan). When comparing the different datasets, the numbers are nearly identical for most countries displayed. The Orbis ownership dataset even records substantially more country presences than the CbCRs in the tax havens Hong Kong and the Cayman Islands. All in all, the results suggest a good coverage of tax haven subsidiaries in the ownership database.

The comprehensive overall coverage in Orbis presumably results from the requirement of bank groups to disclose a list of all consolidated entities in their annual reports. Consequently, the CbCR introduction does not seem to have caused a substantial increase in information regarding the corporate group structures of EU-headquartered banks. It has to be noted, though, that our method tends to overestimate the coverage of Orbis. We count a country presence in the Orbis dataset if we observe at least *one* controlled subsidiary of a bank group in a certain country. However, this does not necessarily imply that Orbis records *all* subsidiaries controlled by the respective bank group in this country. The CbC disclosures, on the other hand, provide financial information aggregated at country level and should generally comprise the data of all

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[10] The selection contains the ten countries accounting for the most observations in the CbCR dataset, all remaining tax havens with more than 20 observations in the CbCR dataset and additionally China and Japan due to their economic importance.

controlled subsidiaries and permanent establishments in the reported country presences (see Section 2.1).[11]

In our second approach, we apply a different definition of the term "country presence" which focuses on the availability of key financial variables. With regard to Orbis, we now additionally require that information on both profit before tax and the number of employees is available from the single statements of at least one subsidiary of a bank group in a certain country. In the same vein as described above, this approach tends to overestimate the coverage of subsidiaries' single statement information in Orbis. Referring to the CbCR sample, we equally require that a bank group states in its CbCR both profit before tax and the number of employees in the respective country.[12] As the financial variables are reported annually and their availability can differ from year to year, we pool all the country presences observed in the three years of our sample period (2014-2016).

Figure 4 depicts the average number of total country presences and of tax haven presences per bank group and year, based on our second approach. As expected, the numbers for the CbCR dataset are nearly unchanged compared to Figure 2. In contrast, the observable presences in Orbis drop sharply to 5.4 in total and 0.7 in tax havens. While the overall coverage of single statement information is incomplete in Orbis financials, it seems to be especially bad for tax havens which now account for only about 13% of all country presences with sufficient financial information.

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[11] A few country presences might be missing in the 2015 CbCRs due to the following reasons: (1) the use of combined country positions (e.g. "Others") in the CbCRs; (2) the application of the narrower prudential scope of consolidation by some bank groups instead of the accounting scope; and (3) differences between the accounting consolidation scope and the definition of beneficial ownership used in Orbis. As a result, the total number of country presences according to Orbis ownership information is slightly higher than according to the 2015 CbCRs.
[12] Since Article 89 of the CRD IV prescribes a disclosure of both variables for financial years 2014 onwards, the impact of this restriction compared to our initial definition of country presence is negligible. We only have to drop eight CbCRs which do not comply with the obligation and lack profit before tax.

Figure 5 investigates the differences in the total number of country presences in more detail across our selection of countries and allows for the following inferences. First, and unsurprisingly, the coverage of single statement information in Orbis is best for subsidiaries in the EU Member States. According to EU law, limited liability companies have to prepare single financial statements and file them with the relevant national business register.[13] As an example, Tørsløv et al. (2018) describe the comprehensive public business registry of France. Second, despite the requirements under EU law, the subsidiary coverage in the Member States is still far from complete if we require information on profit before tax and the number of employees, two crucial variables to assess companies' profit shifting activities. Third, transparency is especially poor for the non-European tax havens, e.g. with Singapore, Hong Kong and the Cayman Islands completely lacking any observations with sufficient financial information in Orbis. The CbCR obligation successfully sheds light on profits allocated to and the workforce employed in these locations. Fourth, CbCR also considerably increases transparency on the activities of EU-headquartered banks conducted in the world's largest economies U.S., China and Japan. All these insights should be interpreted as a lower bound of the potential transparency gains induced by CbCR for the reasons explained above.

4.2 What do we know about the location of banks' reported profits?

While the distribution of their worldwide presences already gives a first indication of potential tax planning activities of EU-headquartered banks, we are especially interested in quantifying the profits allocated to the different locations. To this end, we aggregate all profits reported in the CbCR dataset and in the Orbis dataset over the sample period 2014-2016 and compare the share of different locations.[14] As displayed in Figure 6, the Orbis data suggest that

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[13]   For   an   overview,   see   https://ec.europa.eu/info/business-economy-euro/company-reporting-and-auditing/company-reporting/financial-reporting_en (16 July 2019).

[14] Due to differences in the treatment of intra-group transactions (especially intra-group dividends) in the single financial statements and in the CbCRs, it is difficult to compare absolute profit figures between the CbCR and the Orbis database. Thus, we focus our analysis in this section on the shares of worldwide profits recorded in the respective countries.

EU-headquartered banks record only 4.4% of their total global profits in tax haven countries. In contrast, banks' CbCRs reveal that the share of tax havens is actually more than four times higher (about 18.2%).

Figure 7 provides information at a more disaggregate level and compares the profit shares for selected countries. It becomes evident that, when relying on the Orbis database, one severely overestimates the proportion of profits allocated to EU high-tax countries (e.g. France, United Kingdom, Spain) and underestimates the amounts booked in all tax haven countries displayed. Interestingly, Hong Kong, a country characterized as both a tax haven and an important financial center, ranks fourth and accounts for about 8% of the worldwide profits of EU-headquartered banks. As a caveat, we note that the occurrence of larger losses of bank groups in certain countries can make it difficult to interpret the results (e.g. the aggregate losses in Switzerland and Italy).

Finally, Figure 8 reveals considerable heterogeneity in the fraction of tax haven profits between banks from different headquarter countries.[15] According to the CbCR dataset, German bank groups record nearly two thirds and UK groups more than half of their total foreign profits in locations classified as tax havens. In contrast, French banks appear less aggressive, with tax havens accounting for only about 14% of their foreign profits. Interestingly, tax havens do not seem to play a major role for the profit allocation of Spanish and Austrian bank groups. When relying on single statement information from Orbis, the underestimation of tax haven profits is most severe for banks from the United Kingdom and the Netherlands. All in all, the conventional datasets provide a systematically incomplete and distorted picture of the allocation of banks' worldwide income.

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[15] We display all countries where at least five different bank groups disclosing a CbCR are headquartered.

4.3 What do we know about the location of banks' real activities?

To distinguish whether the profits reported in different locations result from real economic activities or rather reflect a paper shifting of profits, we next focus on the distribution of employees. Since the employee variable is not subject to consolidation adjustments (as opposed to profit before tax), we first use it for two cross-comparisons to examine the quality and completeness of our different datasets.[16]

First, we calculate the average number of employees for each bank group observable over the years 2014-2016 and add up the figures in each dataset. As depicted in Figure 9, the worldwide workforce of the 114 bank groups in our CbCR dataset amounts to 2.65 million employees. The numbers derived from the consolidated statements are nearly identical, confirming that CbCRs usually cover the full group structure. Consequently, the large majority of bank groups seem to apply the accounting consolidation scope in their CbCRs.[17] In contrast, the single statements available in Orbis contain only 55% (1.46 million) of all employees. The coverage is especially poor for tax havens, with only about 21,000 of the actually 124,000 tax haven employees visible in Orbis. Thus, not only the worldwide allocation of profits but also the distribution of real activities remains largely incomplete without the information gathered from banks' CbCRs.

Second, we investigate whether the availability of the number of employees at subsidiary level varies between headquarter countries. Taking the figures from the CbCRs as a benchmark, Figure 10 shows the percentage of employees observable from single statement data for bank groups headquartered in the respective country. Most notably, bank groups based in the United

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[16] We note that the availability of the employee variable in Orbis financials is worse than e.g. of profit before tax. However, assuming that countries with low transparency are largely characterized by high profits and a small number of employees, we conclude that a comparison based on employees should not severely understate the coverage of single statements of our bank groups in Orbis.

[17] Some minor deviations between the datasets may also result from differences in the exact definition of the employee variable (e.g. full-time equivalents vs. head count; treatment of sub-contractors).

Kingdom are by far the least transparent, with only 15.9% of their worldwide employees visible at country level without the CbCR data. Belgian, German and Italian bank groups exhibit the best coverage ratios.

We now turn to the distribution of employees across different locations and conduct the same analyses as for profits in Section 4.2. Figure 11, Figure 12 and Figure 13 provide the following insights. First, while CbCR data revealed that more than 18% of EU banks' global profits are booked in tax havens, less than 5% of their worldwide workforce is located there, indicating a misalignment between profits and economic activities (Figure 11). Second, Orbis understates the fraction of employees in tax havens, but the discrepancy to the CbCR data is not as large as for the profit figure. Third, Hong Kong, Singapore, Ireland and Luxembourg together account for the vast majority of the workforce employed in tax havens (Figure 12). The numbers in small offshore havens are virtually negligible. Most strikingly, the CbCRs record a total of only 45 employees in the Cayman Islands, which contrasts sharply with the considerable amount of profits booked there and the country's extraordinary role as a location for financial services providers (documented by Miethe 2019). Fourth, we again observe heterogeneity between different headquarter countries. E.g. bank groups based in the United Kingdom employ a substantial fraction of 16.6% of their foreign workforce in tax havens, compared to a share of only 0.4% for Spanish groups (Figure 13). While a disconnect between profits and labor is visible for banks across all headquarter countries, it is most pronounced for Italian banks, with tax havens accounting for 1.6% of their foreign employees but 30.6% of their foreign profits. The underestimation of the number of employees in Orbis is most severe for banks headquartered in the United Kingdom, Belgium and France.

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4.4 What do we know about the relation between banks' reported profits and their real activities?

Having investigated the distribution of profits and employees separately, we now combine both variables to get a more direct indication of a potential misalignment between economic activities and reported output in different locations. Figure 14 and Figure 15 show the median profit-per-employee ratio for tax havens vs. non-havens and for our selection of countries, respectively. Confirming our previous findings, labor productivity in terms of profit per employee reported in tax havens is almost 2.5 times as high as in other locations. Malta and the Cayman Islands clearly stand out with a median profit per employee of EUR 5.7 million and EUR 17.2 million, respectively, compared to the non-tax haven median of about EUR 85,000. In line with Tørsløv et al. (2018), Ireland and Luxemburg also exhibit remarkably high ratios, while the EU high-tax countries Germany, Italy and France appear at the bottom of the ranking.

However, several countries do not seem to fit into this pattern. The bank groups in our sample report a rather high profit per employee in the high-tax countries U.S. and Japan. Conversely, the labor productivities disclosed for Hong Kong, Singapore and Switzerland – three countries characterized both as tax havens and as important financial centers – are lower as one might expect. Thus, we conjecture that EU-headquartered bank groups use only some tax havens preferably for tax-induced profit shifting activities, while other tax haven locations primarily serve different purposes.

Moreover, the analyses reveal that the productivity figures are generally smaller (for both tax havens and non-havens) when calculated based on the information available in Orbis. For some countries, we do not even have a single observation with sufficient data to compute the ratio. Overall, the results suggest a relationship between opaqueness regarding a country presence and its profit per employee. CbCR data provides added value in this regard by revealing large amounts of banks' worldwide profits and employees, especially in tax havens.

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Finally, we try to assess the tax attractiveness of different locations. Figure 16 and Figure 17 illustrate the median effective tax rates (ETR) for tax havens vs. non-havens and for our selection of countries, respectively. We calculate the ETR of a country presence of a bank group as the ratio of income tax expense over profit before tax.[18] The ETR does not only reflect a location's statutory tax rate but also the scope of the tax base (e.g. tax-free income) and other incentives (e.g. tax credits). Unsurprisingly, the ETR recorded in tax havens (8.8%) is less than half of the burden that bank groups face in non-haven countries (20.0%). Correspondingly, all countries which exhibit the lowest ETRs in our selection (apart from China) are tax havens. Nevertheless, we also observe considerable variation within the group of tax havens: With a median ETR of zero, the Cayman Islands appear as the most favorable location from a taxpayer perspective. This incentive may explain why banks record such an extraordinarily high profit per employee there. In contrast, presences in Luxembourg – the tax haven most frequently used in our sample – face a median ETR of 17%, which is close to the rate observed for the United Kingdom (18.5%). This corroborates our inference that banks' choice of tax havens is not only driven by the purpose of minimizing tax payments. Due to the lack of data, the ETRs based on Orbis information deviate considerably for several countries and provide a distorted picture of banks' worldwide tax burdens.

4.5 Discussion and interim conclusion

The main findings of our descriptive analysis can be summarized as follows. First, we provide evidence on transparency gains resulting from the CbCR introduction. While public knowledge on the group structure of EU-headquartered bank groups seems to be quite comprehensive even without CbCR data, key financial information from single statements is

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[18] Some CbCRs state the amount of income tax paid (instead of current income tax expense). In these cases, we use the cash tax figure and calculate a cash ETR. While timing differences may impair the comparability between current ETRs and cash ETRs to a certain extent, the problem is mitigated since we observe three consecutive years of most bank groups.

missing for the majority of subsidiaries. The number of observable country presences with sufficient profit and employee data obtainable in Orbis is only 42% of the number represented in the CbCR dataset. Only 55% of the worldwide workforce of EU-headquartered bank groups is visible at subsidiary level in Orbis. Consequently, CbCR data uncovers a considerable part of the worldwide distribution of reported profits and real activities. Due to public business registries in EU countries, the increase in transparency observed in our sample is probably not as tremendous as it would be for MNEs headquartered in other world economies (as suggested by the results of Tørsløv et al. (2018)). Nevertheless, it is still substantial as a whole and especially pronounced for banks' locations both in tax havens and in the largest non-EU economies (i.e. the U.S., Japan and China).

Second, the analysis reveals that tax havens play an important role for EU-headquartered banks, accounting for about 20% of the total country presences contained in our CbCR dataset. The tax havens most frequently used are Luxembourg, Switzerland, Ireland, Singapore and the Channel Islands. CbCRs also point to a considerable disconnect between allocated profits and real activity: While about 18% of EU banks' worldwide pre-tax profits are booked in tax havens, only 5% of their worldwide employees work there. This misalignment is especially pronounced for banks headquartered in Germany, the United Kingdom and Italy. French, Spanish and Swedish bank groups appear less aggressive. Reported labor productivity in tax havens is about 2.5 times as high as in other countries, with the Cayman Islands and Malta exhibiting a median profit per employee of above EUR 5 million. However, the productivity figures of several other locations do not fit into this pattern, suggesting that only certain tax havens are preferably used for profit shifting, while others primarily serve different purposes. Relying solely on single statement information available in Orbis leads to a severe mis-estimation of the worldwide distribution of profits and labor productivity ratios.

Third, we provide reliable evidence on the effective tax burdens that EU-headquartered banks face in their different locations. As expected, the median ETR in tax havens is less than half of the rate in other countries. Yet, we observe considerable heterogeneity in the attractiveness of tax havens, with median ETRs ranging from 0% in the Cayman Islands to 17% in Luxembourg. Due to a lack of data, calculations based on Orbis single statement information provide a distorted picture of the effective tax burdens.

In summary, our descriptive analysis suggests that bank groups headquartered in the EU use certain tax haven locations for profit shifting. CbCRs can help to uncover a large share of these activities, which otherwise remain opaque when relying on other publicly available sources of information. This increase in transparency is an important value added of the newly compiled CbCR data. The identification of aggressive tax planning based on simple indicators, however, warrants caution as potentially confounding factors cannot be fully ruled out. To acknowledge the need for a counterfactual benchmark, we use the newly uncovered information on banks' tax haven activities in a standard profit shifting regression analysis thus controlling for important determinants of reported profits.

5   Regression analysis of CbCR data

5.1 Methodology

In our empirical specification, we follow the approach of Merz and Overesch (2016)[19] with several adjustments that are inherent to the use of the limited set of variables that the CbCRs offer. Based on the design of Hines and Rice (1994) and Huizinga and Laeven (2008), the authors model the reported pre-tax profit of a subsidiary as the sum of "true" profit (explained

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[19] Other alternatives would be to consider the effective tax rate as dependent variable or to follow Dharmapala and Riedel (2013), estimating how exogenous earnings shocks at the level of the parent firm affect the pre-tax profits of low-tax and high-tax affiliates. While we do not have sufficient control variables for the first alternative, the latter alternative is based on the estimated parent firm's profit before taxes and before shifting activities, proxied by the earnings of firms in the same industry and the same country. As we only consider the banking sector, we are not able to differentiate between industries for the construction of exogenous parent incomes, such that this approach would forfeit most of its variation.

by labor, capital and other banking sector-specific factors) and shifted profit (induced by tax incentives). More precisely, they use unconsolidated data from Bankscope and estimate the following baseline regression at the level of subsidiary i in year t:

$$lnPLBT_{it} = \beta_0 + \beta_1 STR_{it} + \beta_2 lnTOAS_{it} + \beta_3 lnSTAFF_{it} + \beta_4 X_{it} + \beta_5 lnINF_{it} + \rho_k + \mu_l +$$
$$\vartheta_t + \varepsilon_{it} \tag{1}$$

The dependent variable ($PLBT$) is profit before tax. Total assets ($TOAS$) and staff cost ($STAFF$) are used as proxies for capital and labor input, respectively. Several subsidiary-level variables (X), namely off-balance sheet items, subsidiary growth, the share of total earning assets in total assets and a measure of collateral, are included as further explanatory variables. INF controls for the host country's inflation rate.[20] The regression also contains parent fixed effects (ρ_k), bank-type fixed effects (μ_l) and year fixed effects (ϑ_t). ε_{it} denotes the error term. The main variable of interest is the statutory corporate tax rate of the subsidiary's host country (STR). Its coefficient, β_1, reflects the tax semi-elasticity of reported profits. The authors find that a one percentage point increase in the host country tax rate is associated with about 2.4% lower reported subsidiary profits. As the Bankscope database presumably lacks information on subsidiaries in low-tax countries, we would expect to find a higher tax semi-elasticity when using our CbCR database instead (similar to Dowd et al. 2017).

When applying the regression described in equation (1) to the CbCR data, we need to make several modifications due to the different structure and variables of the underlying datasets. First, while equation (1) is based on subsidiary-level data, the CbCR data is presented at bank group-country level and hence more aggregated. Therefore, the unit of observation changes from the level of bank group-year-subsidiary (subscript it) to the level of bank group-year-country (subscript jt). Second, we can neither include the additional subsidiary-level variables

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[20] *PLBT*, *TOAS*, *STAFF*, off-balance sheet items and *INF* are in natural logs (ln).

nor the bank-type fixed effects. Third, CbCRs do not contain personnel expense, but the number of employees. Finally, we have no information on total assets from the CbCRs. These adjustments result in the following baseline CbCR regression:

$$lnPLBT_{jt} = \beta_0 + \beta_1 STR_{jt} + \beta_2 lnEMPL_{jt} + \beta_3 lnINF_{jt} + \rho_k + \vartheta_t + \varepsilon_{jt} \qquad (2)$$

EMPL denotes the number of employees. Our key variable of interest is a measure of the tax incentive to shift profits, *STR*. In our main specification, we define this variable as the difference between the statutory corporate tax rate of country *j* and either the simple average tax rate of the bank group (*STR_diff_group_simp*) or the number of employees-weighted average tax rate of the bank group (*STR_diff_group_empl*). This construction accounts for the fact that profit shifting incentives arise not only from low foreign tax rates, but also from discrepancies in national and foreign tax rates in all jurisdictions in which the multinational firm has operations (see e.g. Huizinga and Laeven 2008). Alternative definitions of the tax incentive variable are applied in robustness checks (see Section 5.4 and the notes to Table 6 for a description of the variables). The other variables of equation (2) are defined as above.[21]

We also develop a refined CbCR regression to overcome some deficiencies of the baseline model. More specifically, we try to account for staff cost and total assets in order to be more consistent with the typical profit shifting regressions.[22] The refined equation looks as follows:

$$lnPLBT_{jt} = \beta_0 + \beta_1 STR_{jt} + \beta_2 lnSTAFF^*_{jt} + \beta_3 lnINF_{jt} + \delta_{kt} + \varepsilon_{jt} \qquad (3)$$

The staff cost proxy, *STAFF**, is the product of the number of employees from the CbCR data and a country-year specific ratio of staff cost to the number of employees, calculated based

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[21] Merz and Overesch (2016) measure inflation by the annual change in the consumer price index. We deviate from this definition and use the annual growth rate of the ratio of GDP in current local currency to GDP in constant local currency, taken from the World Bank's World Development Indicators database. This allows for a slight increase in the sample size.

[22] Staff cost is preferable as it accounts for differences in the workers' productivity. However, a few profit shifting regressions also consider the number of employees instead (e.g. De Simone 2016; Joshi et al. 2018).

on unconsolidated financial statement observations from Bank Focus and Orbis (for details, see the notes to Table 7). Due to limited possibilities to construct an explicit proxy for total assets at bank group-country-year level, we instead include parent-year fixed effects, δ_{kt}, which inherently capture consolidated total assets of the whole bank group. The underlying idea is that the typical production function might not completely apply for banks, since they have to rely less on tangible assets for generating outcome than e.g. manufacturing firms. Financial assets are more mobile. Therefore, we assume that rather the sum of total assets at group level matters as an input factor than their distribution to single countries. Nevertheless, we note that failing to adequately control for capital input might bias our estimates of tax semi-elasticities. In robustness checks, we also include other proxies for staff cost and more explicit proxies for total assets (see Section 5.4).

Our regression sample is derived from the CbCR dataset described in Section 3.1. In addition, we exclude observations with missing values on the regression variables or where we cannot calculate the logarithms due to negative or zero values. We provide an overview of the composition of the regression sample in Table 5 and summary statistics of the variables discussed above in Table 6.

We start the analysis by running the baseline and the refined CbCR regressions (equations (2) and (3)) with the CbCR data (see Section 5.2). In a further step, all three regression models presented above (equations (1) – (3)) are estimated with Bank Focus data to compare the observed tax semi-elasticities across the different datasets (see Section 5.3). Finally, we check the robustness of the results in Section 5.4.

5.2 Results

Table 7 presents the results of the regressions based on CbCR data. In columns (1) and (2), we apply the baseline model, i.e. we only include the number of employees and inflation as

control variables. From prior studies, we would expect a negative relation between profit before tax and the tax rate variable. However, both tax rate coefficients – the coefficient on *STR_diff_group_simp* in specification (1) and the coefficient on *STR_diff_group_empl* in specification (2) – are positive (+1.884 and +1.992) and significant at the 5% level. This finding contradicts prior evidence according to which lower tax rates go along with higher reported profits. Hence, the engagement of banks in profit shifting does not become apparent from the CbCR data when using the baseline regression.

Columns (3) and (4) depict the results for the refined regression, which include a proxy for staff cost (instead of the number of employees) and parent-year fixed effects to implicitly control for total assets at bank group level. The tax rate coefficients now turn slightly negative, but are insignificant. We estimate that a one percentage point increase in the tax rate differential between the host country and the simple group average (number of employees-weighted group average) results in 0.341% (0.051%) lower reported profits in the host country. Although the sign of the coefficients is now in line with prior evidence, the magnitude of the effect is much smaller than the effect sizes estimated by Merz and Overesch (2016) of -2.378 for banks and by Heckemeyer and Overesch (2017) of -0.8 in their meta study on firms in other industries. Contrary to our expectations, we are not able to detect a higher tax sensitivity using the CbCR dataset.

5.3 Comparison of CbCR data and Bank Focus data

To further investigate what is driving the unexpected coefficients on the tax incentive variables, we repeat our analysis for the same sample of bank group-years with unconsolidated statement data from Bank Focus (see Section 3.2 for a description of the sample selection process). Table 8 provides an overview of the distribution of subsidiaries in the Bank Focus sample over tax havens and non-tax havens for the years 2014-2016. We choose Bank Focus over Orbis as some specifications require banking sector-specific variables not included in

Orbis and to ensure comparability with the results of prior studies on banks' profit shifting, which are mainly based on Bankscope (the predecessor of Bank Focus). We start with estimating the comprehensive regression (equation (1)) and then step-by-step assimilate the design to the baseline (equation (2)) and refined regressions (equation (3)). As tax incentive variable, we consider the statutory tax rate differential between the host country and the simple group average. The results are shown in Table 9.

Column (1) of Table 9 contains the results for the estimation of equation (1) with subsidiary-level data from Bank Focus.[23] We observe a coefficient on the tax incentive variable of -2.017, which is significant at the 1% level and in the same range as the estimate of -2.378 by Merz and Overesch (2016). The coefficients on total assets and staff cost are positive, highly significant and again close to the results documented by prior research. Our finding confirms that the tax semi-elasticities of banks documented by prior literature also apply to our sample of EU-headquartered bank groups in the years 2014-2016.

In column (2), we drop the supplemental subsidiary-level control variables, which are not available in the CbCR dataset. The size of the coefficient on the tax rate variable slightly decreases, but it still remains negative and significant at the 1% level.

In column (3), we aggregate the subsidiary-level data from Bank Focus at country level, such that the unit of observation is the same as in the CbCR dataset. This aggregation naturally implies dropping the bank-type fixed effects. The change in the level has only a slight impact on the coefficients, which are still close to those estimated in columns (1) and (2). So far, our analysis suggests that the more aggregated structure in the CbCR dataset should not severely bias the estimates of the tax sensitivity of profits. We also note that the number of observations

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[23] As described in the explanations to equation (1) in Section 5.1, we include off-balance sheet items, subsidiary growth and the share of total earning assets in total assets as subsidiary-level controls. We do not include a measure of collateral due to restrictions in data availability.

in the CbCR dataset is more than four times higher than in the comparable Bank Focus dataset, which demonstrates the improved geographical coverage of CbCRs relative to financial information from commercial databases.

Replacing staff cost by the number of employees in column (4) biases the tax rate coefficient upwards by about 0.6 to -0.944 (and insignificant), which suggests an error in the measurement of labor input if the number of employees is used as proxy. We additionally drop total assets in column (5), which corresponds to the CbCR baseline regression (equation (2), see column (1) of Table 7). Most notably, the coefficient on the tax rate difference now turns highly positive (+4.945) and significant. Its magnitude more than doubles the one observed in the CbCR sample (+1.884). The difference between both coefficients is significant at the 1% level (based on a Chi-square test). Consequently, while the lack of total assets and staff cost obviously impedes the estimation of the tax sensitivity of reported profits, we find some evidence that the CbCR dataset reveals a higher extent of profit shifting compared to the Bank Focus dataset.

In column (6), we replicate the refined CbCR regression (equation (3), see column (3) of Table 7), i.e. we include our proxy for staff cost as well as parent-year fixed effects to implicitly account for total assets at bank group level. The size of the coefficient on the tax incentive variable substantially declines to +0.530 and is no longer significant. Again, it is more positive than the coefficient observed in the CbCR sample (-0.341), but not significantly different from the latter (the Chi-square test exhibits a p-value of 0.4565). We conclude that our attempt to make up for the lack of staff cost and total assets works to some extent, but not sufficiently well enough to produce unbiased estimates.

As shown above, the exclusion of total assets accounts for the largest part of the distortion of the tax incentive variable in the Bank Focus dataset, suggesting an omitted variable bias which can be formalized as follows (Angrist and Pischke 2015; Clarke 2019):

$$\tilde{\beta}_1 = \beta_1 + \beta_2 * \tilde{\delta} \tag{4}$$

The biased estimate for the tax rate coefficient $\tilde{\beta}_1$ (reduced regression without total assets) converges in large samples to the sum of the true tax rate coefficient β_1 (complete regression with total assets) and the product of β_2 and $\tilde{\delta}$, denoting the bias. β_2 captures the relationship between the omitted variable and the dependent variable, i.e. it equals the coefficient on total assets when included in the regression on profit before tax (+0.728, see column (4) of Table 9). $\tilde{\delta}$ reflects the relationship between the variable of interest and the omitted variable, i.e. it denotes the coefficient on the tax rate variable in a regression of total assets on the tax rate difference and the other explanatory variables used in the baseline regression (+8.124 and significant at the 1% level, untabulated). Based on our Bank Focus dataset, equation (4) can hence be solved as follows:

$$4.945 \approx -0.944 + 0.728 * 8.124 \tag{5}$$

Consequently, the omission of total assets biases the tax rate coefficient upwards by about 5.9 (= 0.728 * 8.124). This effect presumably also drives the positive coefficients obtained in the CbCR baseline regression.

In summary, our analysis using Bank Focus data confirms prior evidence and suggests that even after the introduction of CbCR, multinational banks engage in profit shifting. Dropping additional subsidiary-level controls and aggregating the subsidiary-level data at country level have no impact on the sign of the tax rate coefficient and only little effect on its magnitude. In contrast, replacing staff cost by the number of employees induces a certain measurement error

and eliminating total assets causes a sizable omitted variable bias. In combination, both effects bias the tax rate coefficient upwards by about 6.5 percentage points (i.e. the difference between the tax rate coefficients depicted in columns (5) and (3) of Table 9). Assuming that the bias within the CbCR dataset has the same size, we would observe an actual tax semi-elasticity of about -4.6 if the CbCRs contained information on total assets and staff cost (i.e. coefficient of about +1.9 in column (1) of Table 7 corrected for the bias of 6.5). This estimate implies that a one percentage point increase in the tax rate difference between the host country and the simple average of a bank group is associated with about 4.6% lower reported profits in the host country. This semi-elasticity is considerably more negative than the one documented based on Bank Focus data (about -2.0).

We conclude that CbCRs, due to their strong advantage in terms of geographical coverage, are indicative of a more pronounced tax sensitivity than estimations based on financial statement data from Bank Focus suggest. However, because of the limited set of reportable variables, conventional methods are not capable of producing an accurate estimate of the extent of banks' profit shifting based on CbCR data.[24]

5.4 Robustness tests

We conduct a series of robustness tests to enhance the confidence in our results. First, we repeat the regressions with our CbCR sample, applying alternative measures of the tax incentive. We use the statutory corporate tax rate of the host country (*STR_rel*) as well as the difference between the statutory corporate tax rate of the host country and the statutory

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[24] Other potential explanations for the regression results in the CbCR dataset relate to banks' profit shifting behavior. First, as documented by Overesch and Wolff (2019), banks might have reduced their profit shifting behavior in response to the introduction of CbCR. Still, the comprehensive regression based on Bank Focus subsidiary-level data for the years 2014-2016 clearly speaks in favor of banks still engaging in profit shifting after the CbCR requirement became effective. Second, banks might only have adjusted the number of employees without changing total assets, such that their tax avoidance behavior would not become evident from the CbCRs. However, the coefficients on staff cost and total assets are similar to those estimated by prior research, which gives no indication for a substantial change in the location of employees. Overall, we consider the argument of missing total assets and staff cost to be most convincing.

corporate tax rate of the headquarter country of the bank group (*STR_diff_par*). As depicted in Table 10, the tax incentive coefficients are still strongly positive in the baseline specifications and slightly negative (but insignificant) in the refined specifications.

Second, we apply two alternative approaches to avoid dropping zero or negative values due to the logarithmic transformation of the employee variable, the staff cost proxy and the inflation variable. We now either add 1 to each value before taking the logarithm or we use the inverse hyperbolic sine transformation (see Burbidge et al. 1988; Langenmayr and Reiter 2017) of the respective variables. Table 11 shows the results. While both approaches successfully increase the sample size by about 30%, the tax incentive coefficients are still positive and significant in the baseline specifications and now even slightly positive in the refined specifications. Thus, our results are not driven by sample restrictions resulting from the definition of variables.

Third, we apply alternative methods to proxy for total assets and staff cost, which are not available in the CbCRs. Instead of including parent-year fixed effects, we now try to explicitly model the total assets of each country presence of a bank group. The first proxy *TOAS** is the product of the number of employees in a country and a country-year specific ratio of total assets to the number of employees, which is calculated based on unconsolidated financial statement observations from Bank Focus and Orbis (for details, see the notes to Table 12). Our second proxy *TOAS*_2* follows the approach of Fatica and Gregori (2018). The consolidated total assets of a bank group, taken from Bank Focus and Orbis, are allocated to the reported countries according to the distribution of turnover in the CbCRs (for details, see the notes to Table 12). With regard to staff cost, we keep using *STAFF** as defined in Section 5.1. Alternatively, we create the proxy *STAFF*_2* as the product of the number of employees and the GDP per capita of the respective country to account for potential differences in labor productivity. Table 12 illustrates the results of three different regression specifications for both the CbCR data and, if possible, the Bank Focus financials data. None of these specifications provides evidence of a

more pronounced tax sensitivity in the CbCR dataset compared to the Bank Focus dataset. Moreover, the results do not suggest that any of these alternatives perform better in controlling for capital and labor input than our refined regression described in equation (3).[25]

Fourth, we additionally repeat our regression analysis for the same sample of bank group-years with unconsolidated statement data from Orbis. While the Orbis database does not contain banking sector-specific variables, its coverage of subsidiaries is superior, allowing for a larger sample size than Bank Focus. Table 13 depicts the results. The regressions with the true total assets and staff cost variables at both subsidiary level (column (1)) and aggregated country level (column (2)) exhibit significant tax incentive coefficients of about -2, which is similar to the results in the Bank Focus sample (see Table 9). Again, dropping total assets and replacing staff cost by the number of employees severely bias the tax rate coefficient upwards (column (3)). The refined specification now generates tax rate coefficients which are close to their initial values (column (4)). Nevertheless, we do not find any evidence of the CbCR data conveying a higher tax sensitivity than the Orbis data.

Finally, we conduct additional untabulated tests where we include further country control variables or systematically exclude individual parent countries, host countries and bank group-years from the sample. We also replicate our analysis using a hand-collected dataset of CbCRs of about 50 EU bank groups collected by researchers of Charles University, Prague (see Janský

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[25] The results in Table 12 rather point to potential deficiencies of these alternative specifications. In columns (1) and (3), the *TOAS** coefficients are close to zero or even negative. This outcome may reflect multicollinearity between *TOAS** and the respective staff cost proxy, as the calculation of both proxies contains the number of employees as a factor. Moreover, column (5) exhibits a negative *STAFF*_2* coefficient, while the *TOAS*_2* coefficient is highly significant and larger in size than prior studies suggest. This finding might be driven by the fact that *TOAS*_2* is largely based on the turnover variable. Turnover is not an economic input factor in the production function but rather an output measure. Moreover, as turnover is a part of profit before tax, the variables are automatically correlated.

2018) and published online through the Open Data for Tax Justice.[26] Our main inferences remain unchanged throughout all these tests.

6   Conclusion

We create a novel database by collecting data from the CbCRs of more than 100 multinational bank groups headquartered in the EU for financial years 2014-2016. We compare this new dataset with Bureau van Dijk's Orbis and Bank Focus databases to assess in how far the public's access to information on banks' tax avoidance behavior has improved by the introduction of the new reporting requirement.

Our descriptive analysis shows that CbCRs uncover a large fraction of worldwide profits and real activities in terms of employees of EU bank groups which remain opaque when only relying on other sources of publicly available information. The transparency gains resulting from the CbCR implementation are especially strong for tax havens as well as for the largest non-EU economies. Moreover, CbCRs demonstrate the important role of tax havens, accounting for about 20% of the total country presences of EU bank groups. We document a striking disconnect between reported profits and real activity, with banks headquartered in Germany, the United Kingdom and Italy exhibiting the most pronounced misalignments. As expected, effective tax rates in tax havens are substantially lower than those in other countries. We also note considerable heterogeneity within the group of tax havens, suggesting that only some of them are preferably used for profit shifting.

Regression analyses based on CbCR data and Bank Focus data reveal the important role of total assets and staff cost, which are both not reportable in CbCRs, when estimating banks' tax responsiveness. Using Bank Focus data, we observe that the exclusion of total assets and the

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[26] The dataset is available at https://datahub.io/StephenAbbott/eu_banks_country_by_country_reporting (6 February 2019).

replacement of staff cost by the number of employees result in an upward bias of the tax semi-elasticity of reported profits. If we assume a corresponding bias within the CbCR dataset, we expect a tax semi-elasticity of about -4.6 in case CbCRs contained information on both variables, which is considerably more negative than the estimate documented for Bank Focus data. Due to their advanced geographical coverage, CbCRs are hence indicative of a more pronounced tax sensitivity than conventional databases suggest. However, standard methods for estimating the amount of profit shifting cannot fully account for the absence of important economic variables.

These insights are especially relevant in the context of the ongoing political discussions whether to introduce a public CbCR for all multinational firms in the EU with revenues exceeding EUR 750 million (European Commission 2016; European Parliament 2017; European Parliament 2019). While our findings generally support the claim of a noticeable increase in transparency due to a public CbCR, they also underline that the informative value of the reports with regard to companies' tax avoidance behavior critically hinges on the inclusion of a distinct set of variables reflecting economic input factors.

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Figures

Figure 1: Share of tax havens in banks' global country presences, profits before tax, employees and taxes
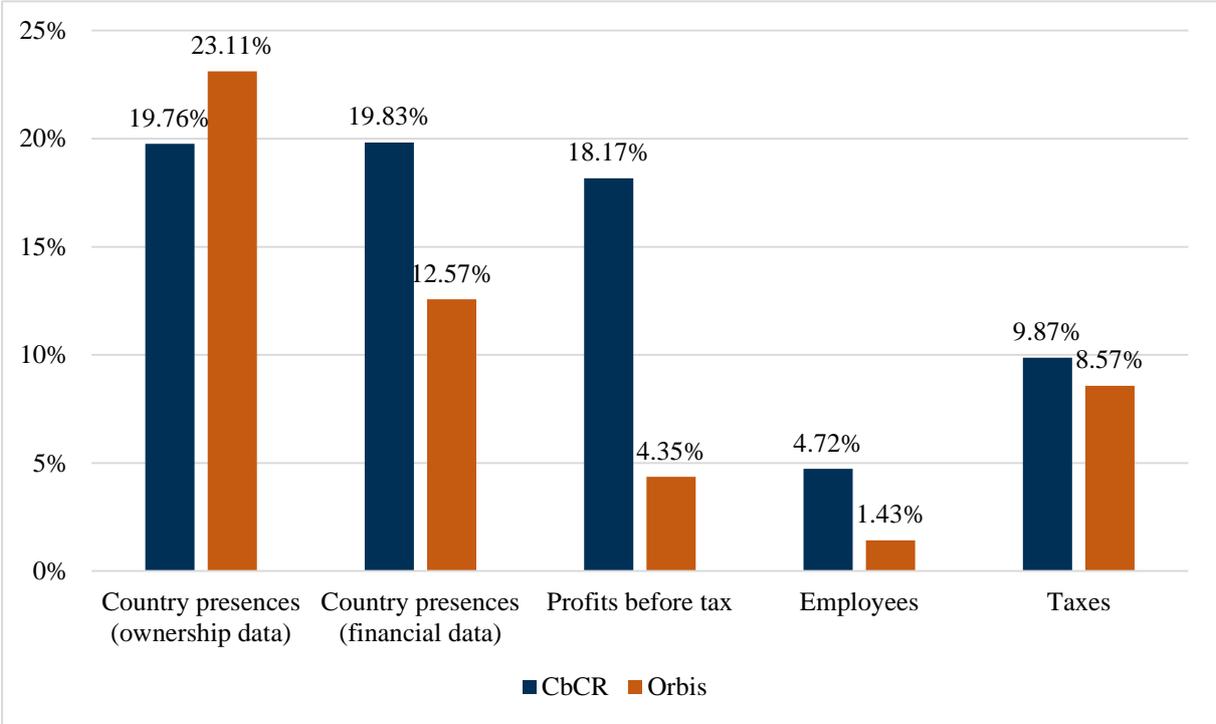

Notes: The graph shows the share of tax havens in banks' global country presences, profit before tax, number of employees and taxes. Tax havens are defined according to Hines (2010). Tax haven shares are based on aggregated values across tax havens and all countries. We record a country presence (ownership data) in the CbCR dataset if a bank group includes a certain country in the section of key financials in its CbCR. We extract this information from the 2015 reports since this is the financial year with the most comprehensive CbCR coverage. We record a country presence (ownership data) in the Orbis dataset if a bank group controls at least one subsidiary in a certain country according to Orbis ownership data. We record a country presence (financial data) in the CbCR dataset if a bank group states in its CbCR both profit before tax and the number of employees in a certain country. We record a country presence (financial data) in the Orbis dataset if information on both profit before tax and the number of employees is available from the single statements in Orbis of at least one subsidiary of a bank group in a certain country. The definition of country presences (financial data) is based on the pooled country presences across the years 2014-2016.

Figure 2: Number of total country presences and of tax haven presences – average per parent bank (ownership data) (2015)
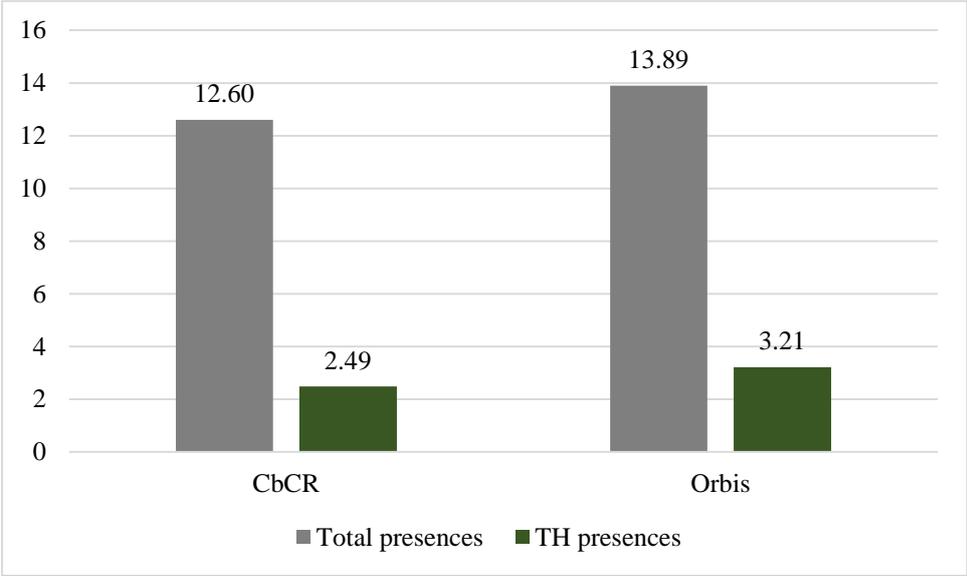

Notes: The graph shows the average number of total country presences and of tax haven presences per parent bank. Country presences are defined based on ownership information. More precisely, we record a country presence in the CbCR dataset if a bank group includes a certain country in the section of key financials in its CbCR. We extract this information from the 2015 reports since this is the financial year with the most comprehensive CbCR coverage. We record a country presence in the Orbis dataset if a bank group controls at least one subsidiary in a certain country according to Orbis ownership data. Tax havens are defined according to Hines (2010).

Figure 3: Total number of presences in selected countries (ownership data) (2015)
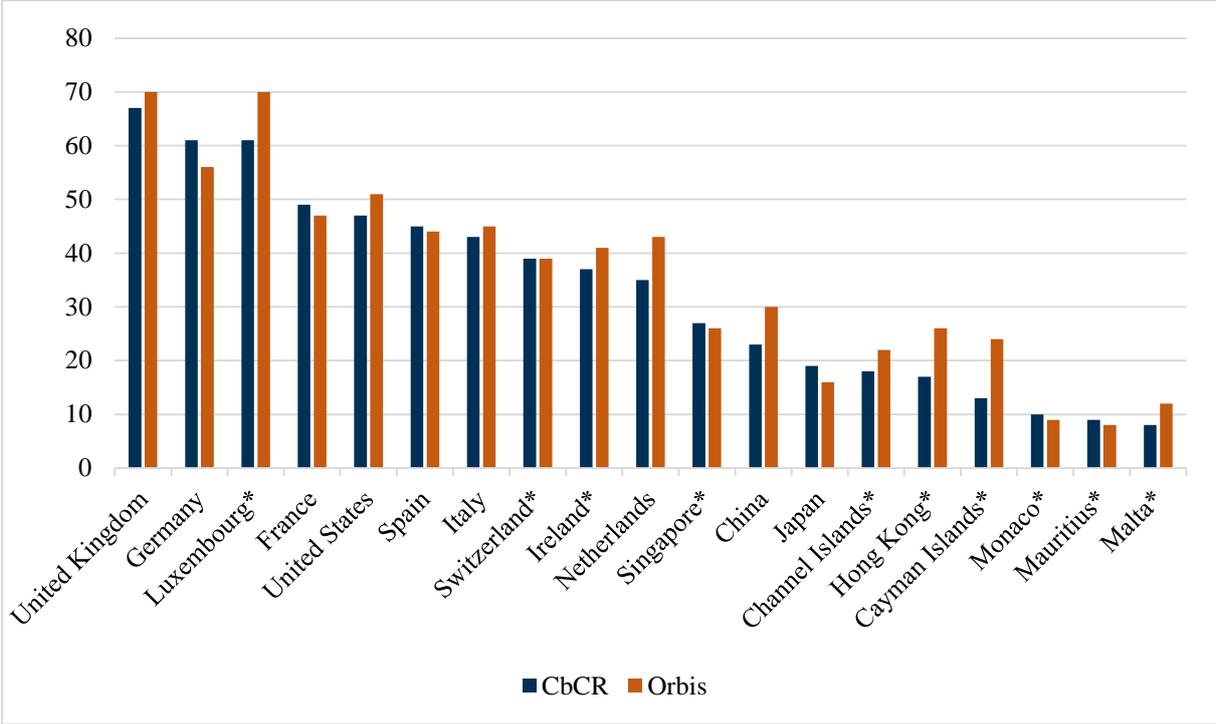

Notes: The graph shows the total number of presences reported in selected countries. Country presences are defined based on ownership information. More precisely, we record a country presence in the CbCR dataset if a bank group includes a certain country in the section of key financials in its CbCR. We extract this information from the 2015 reports since this is the financial year with the most comprehensive CbCR coverage. We record a country presence in the Orbis dataset if a bank group controls at least one subsidiary in a certain country according to Orbis ownership data. * denotes tax havens according to Hines (2010).

Figure 4: Number of total country presences and of tax haven presences – average per parent-year (financial data) (2014-2016)
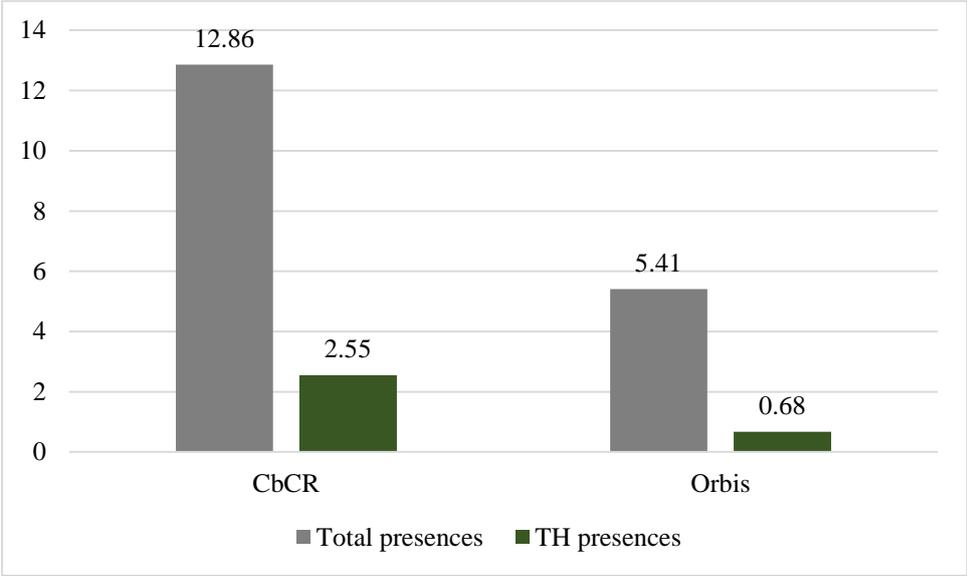

Notes: The graph shows the average number of total country presences and of tax haven presences. The averages are calculated per parent-year across the years 2014-2016. Country presences are defined based on the availability of financial information. More precisely, we record a country presence in the CbCR dataset if a bank group states in its CbCR both profit before tax and the number of employees in a certain country. We record a country presence in the Orbis dataset if information on both profit before tax and the number of employees is available from the single statements in Orbis of at least one subsidiary of a bank group in a certain country. Tax havens are defined according to Hines (2010).

Figure 5: Total number of presences in selected countries (financial data) (2014-2016)
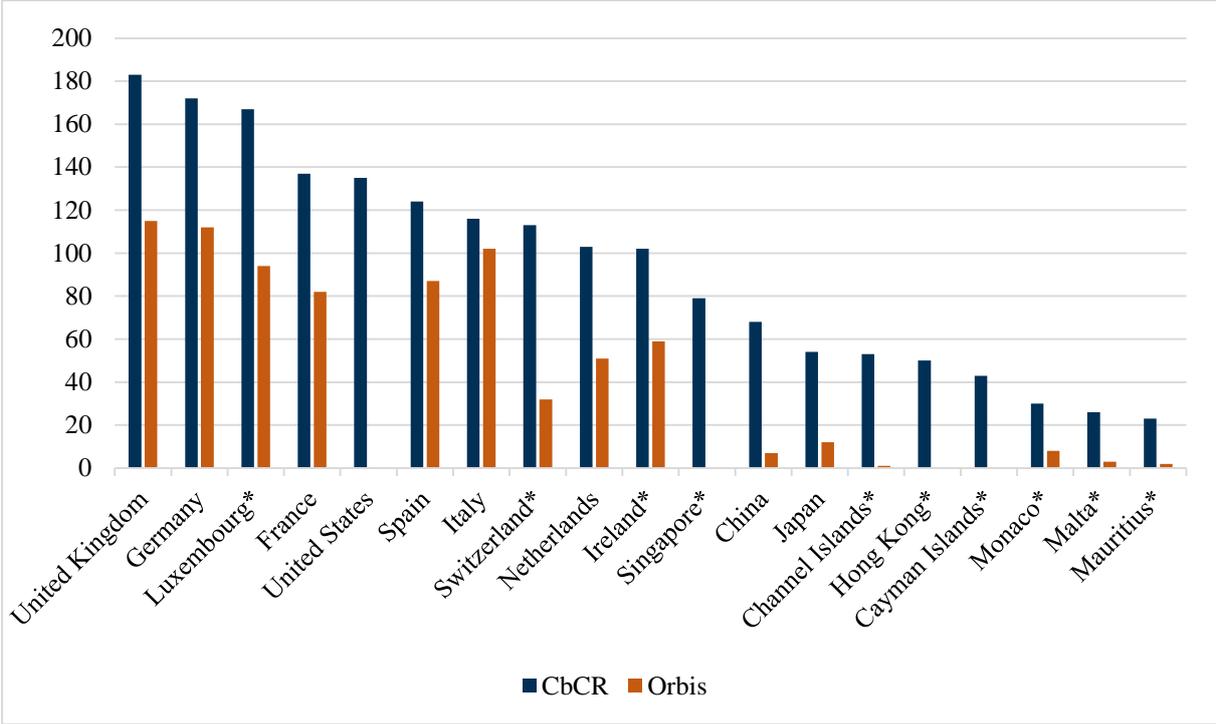

Notes: The graph shows the total number of presences reported in selected countries. Country presences are defined based on the availability of financial information. More precisely, we record a country presence in the CbCR dataset if a bank group states in its CbCR both profit before tax and the number of employees in a certain country. We record a country presence in the Orbis dataset if information on both profit before tax and the number of employees is available from the single statements in Orbis of at least one subsidiary of a bank group in a certain country. We consider the pooled country presences across the years 2014-2016. * denotes tax havens according to Hines (2010).

Figure 6: Share of total tax haven profit in total global profit
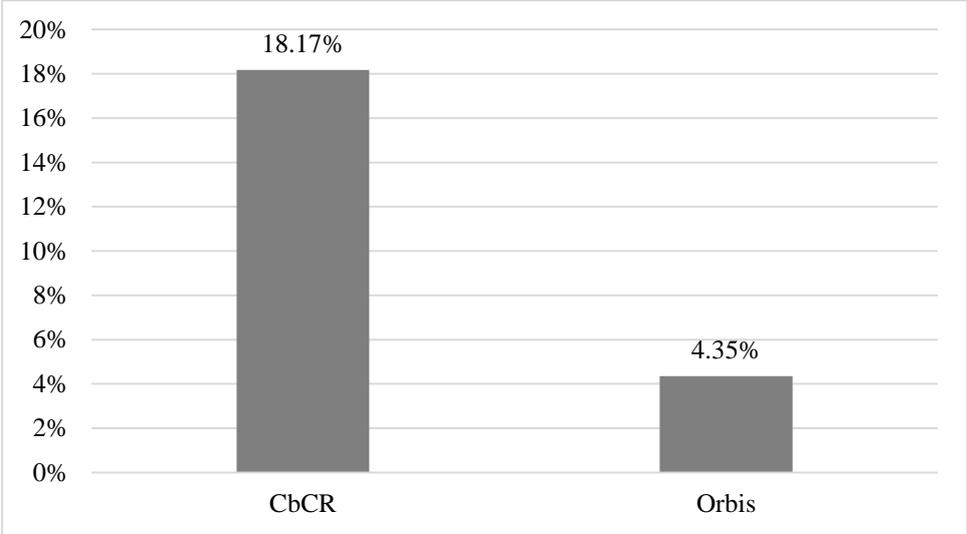

Notes: The graph shows the share of total tax haven profit in total global profit. Tax havens are defined according to Hines (2010). Tax haven shares are based on aggregated profits before tax across tax havens and all countries.

**Figure 7: Share of total profit in selected countries in total global profit**
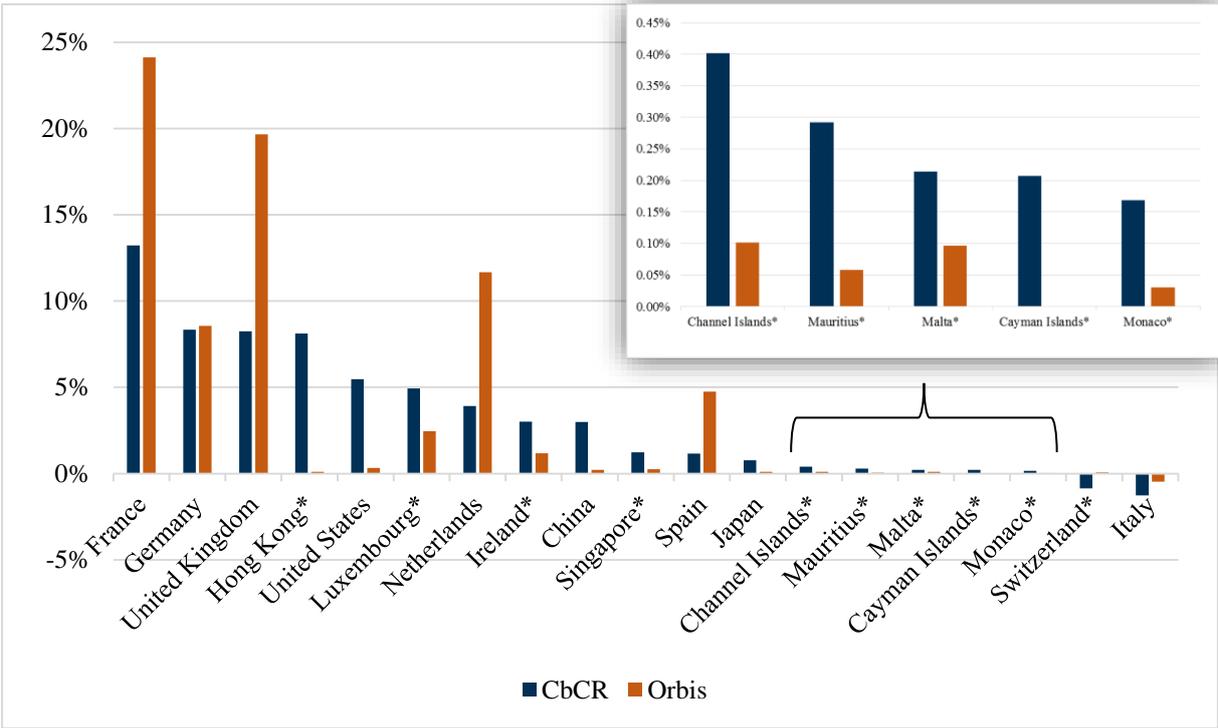
Notes: The graph shows the share of total profit recorded in selected countries in total global profit. Country shares are based on aggregated profits before tax across selected countries and all countries. * denotes tax havens according to Hines (2010).

Figure 8: Share of total tax haven profit in total foreign profit – by headquarter country
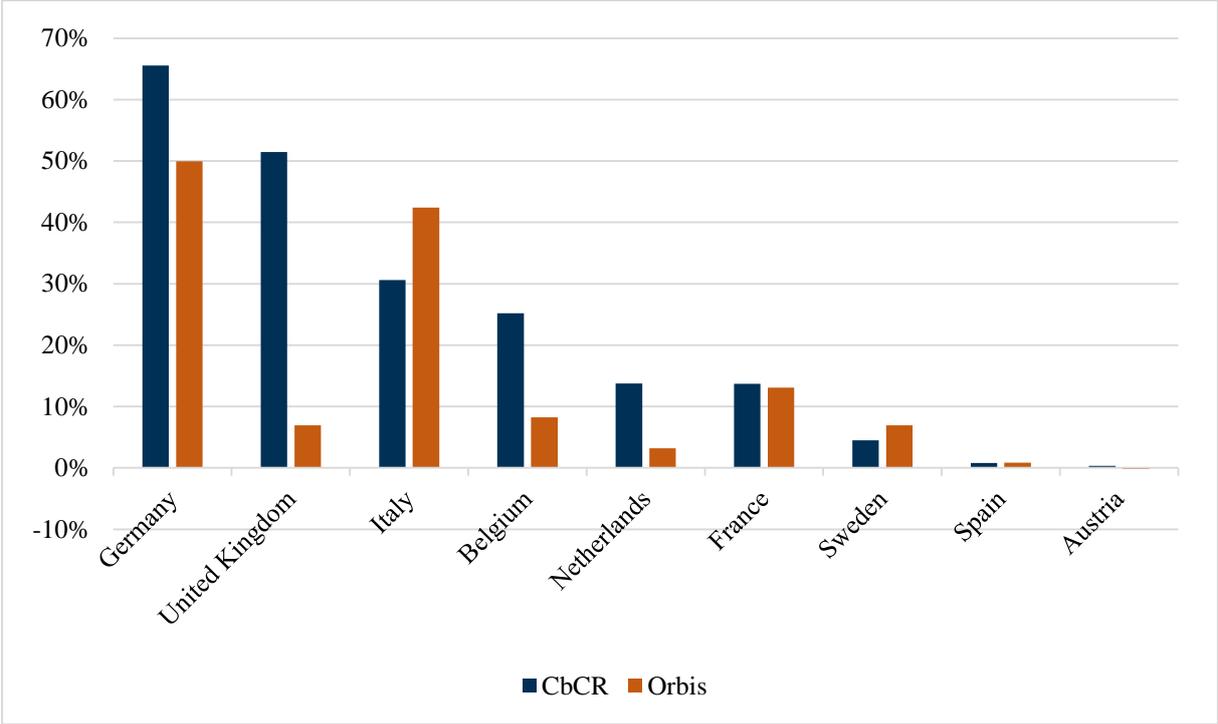
Notes: The graph shows the share of total tax haven profit in total foreign profit recorded by banks headquartered in selected countries. Tax havens are defined according to Hines (2010). The tax haven share by headquarter country is defined as the ratio of aggregated profits before tax in tax havens and aggregated profits before tax in all countries, both calculated at the level of the headquarter country. We exclude observations from the headquarter country itself, i.e. we only consider foreign country presences.

Figure 9: Aggregated annual number of global employees and of tax haven employees (average 2014-2016) (in m.)
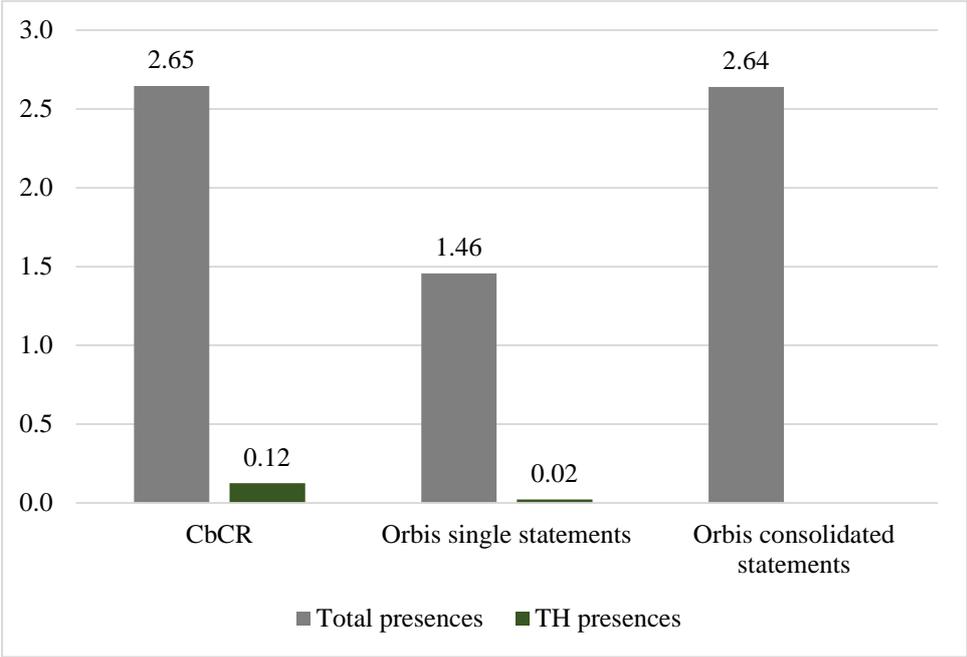
Notes: The graph shows the aggregated annual number of global employees and of tax haven employees, based on the CbCR dataset, Orbis single statement information and Orbis consolidated statement information. We calculate the average number of employees over the years 2014-2016 (all countries and tax havens) for each bank group and add up the averages across all bank groups. Tax havens are defined according to Hines (2010).

Figure 10: Number of employees in Orbis single statements relative to CbCR data – by headquarter country
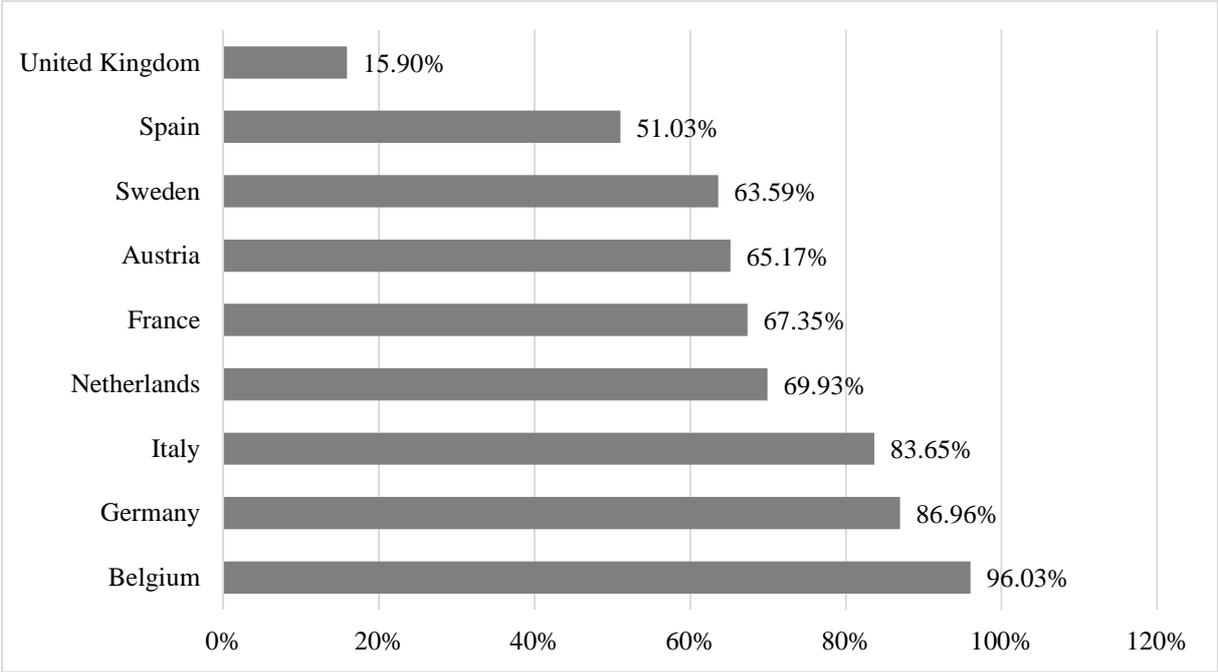
Notes: The graph shows the ratio of the aggregated number of employees in Orbis single statements and the aggregated number of employees in the CbCR dataset, both calculated at the level of the headquarter country. To this end, we calculate the average number of employees over the years 2014-2016 for each bank group and add up the averages across all bank groups headquartered in the same country.

Figure 11: Share of total number of tax haven employees in total number of global employees (average 2014-2016)
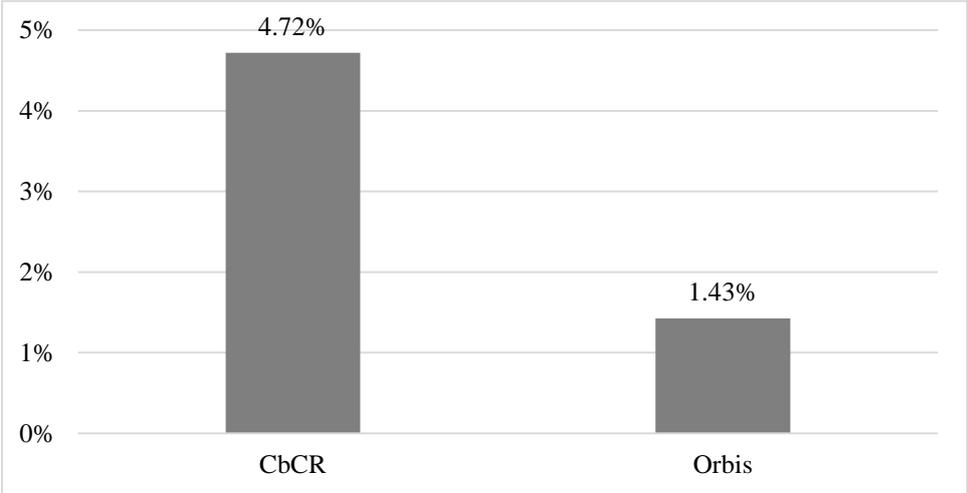
Notes: The graph shows the share of total tax haven employees in total global employees. Tax havens are defined according to Hines (2010). We calculate the average number of employees over the years 2014-2016 for each combination of bank group and reported country. Tax haven shares are based on the aggregated average number of employees across tax havens and all countries.

Figure 12: Share of total number of employees in selected countries in total number of global employees (average 2014-2016)
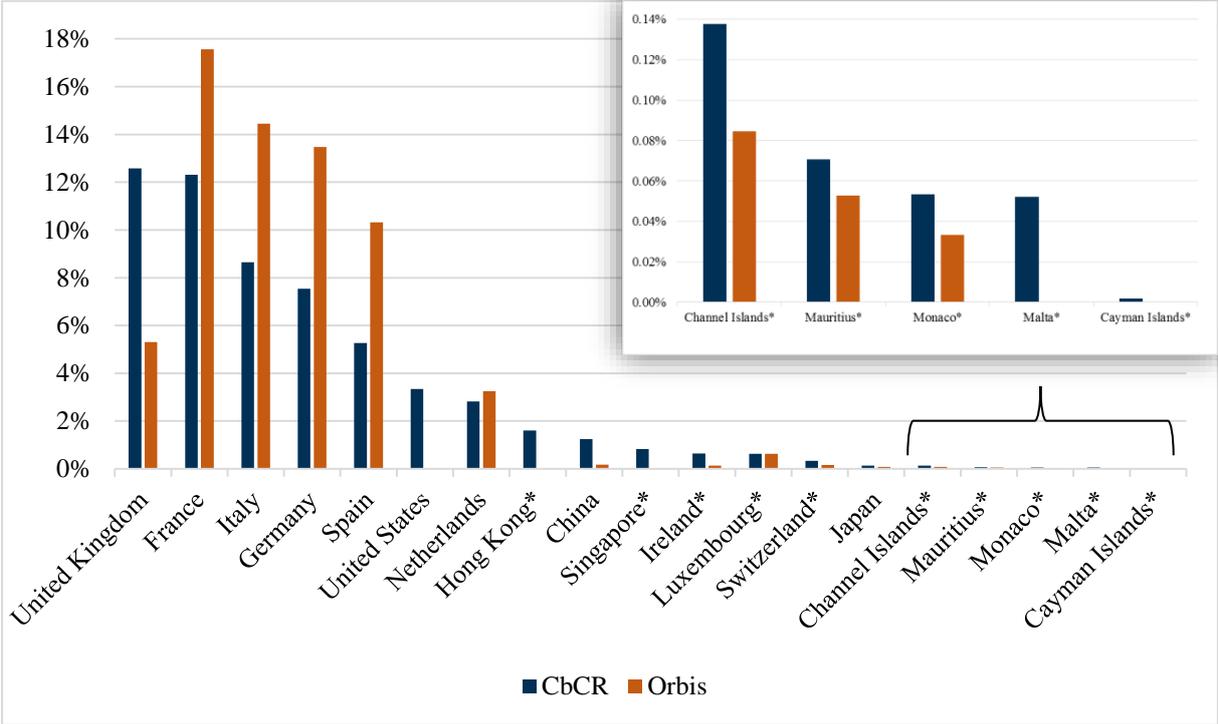
Notes: The graph shows the share of total employees recorded in selected countries in total global employees. We calculate the average number of employees over the years 2014-2016 for each combination of bank group and reported country. Country shares are based on the aggregated average number of employees across selected countries and all countries. * denotes tax havens according to Hines (2010).

Figure 13: Share of total number of tax haven employees in total number of foreign employees (average 2014-2016) – by headquarter country
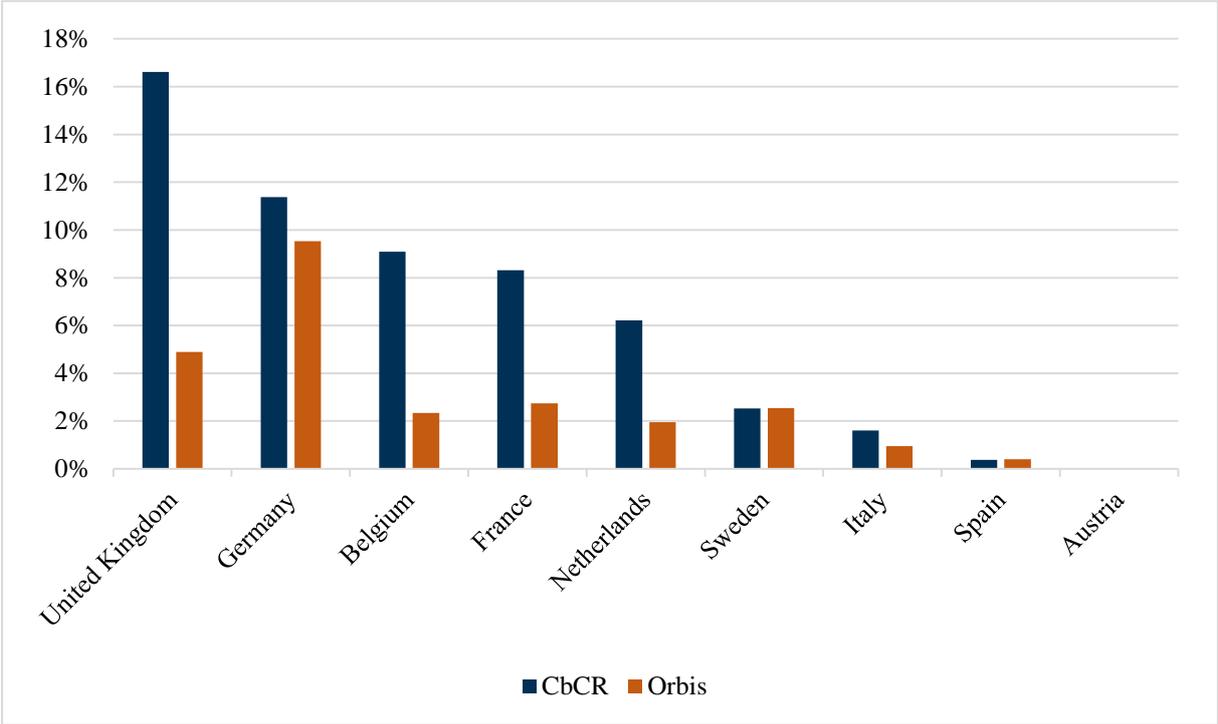
Notes: The graph shows the share of total tax haven employees in total foreign employees recorded by banks headquartered in selected countries. Tax havens are defined according to Hines (2010). We calculate the average number of employees over the years 2014-2016 for each combination of bank group and reported country. The tax haven share by headquarter country is defined as the ratio of the aggregated average number of employees in tax havens and the aggregated average number of employees in all countries, both calculated at the level of the headquarter country. We exclude observations from the headquarter country itself, i.e. we only consider foreign country presences.

Figure 14: Profit per employee in tax havens vs. other countries (in th. EUR)
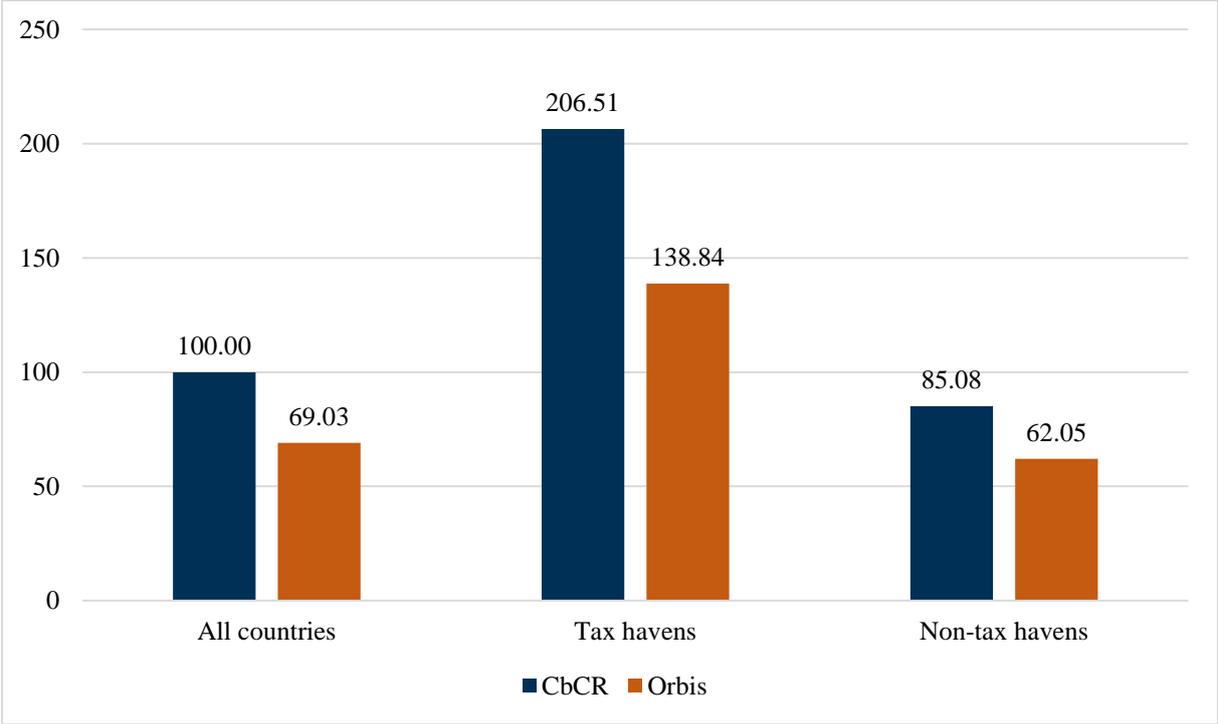
Notes: The graph shows the profit per employee of bank presences in tax havens vs. other countries. We calculate the ratio of profit before tax and the number of employees at bank group-year-country level and take the median across all countries, tax havens and non-tax havens, respectively. Tax havens are defined according to Hines (2010). We replace values of zero employees in a reported country by a value of 0.5 employees in order not to lose these observations which principally have an infinitely large profit-per-employee ratio. The value of 0.5 is based on the assumption that banks report all employee figures (in full-time equivalents) below 0.5 as zero due to rounding. We do not consider observations with zero or negative profit before tax.

Figure 15: Profit per employee in selected countries (in th. EUR)
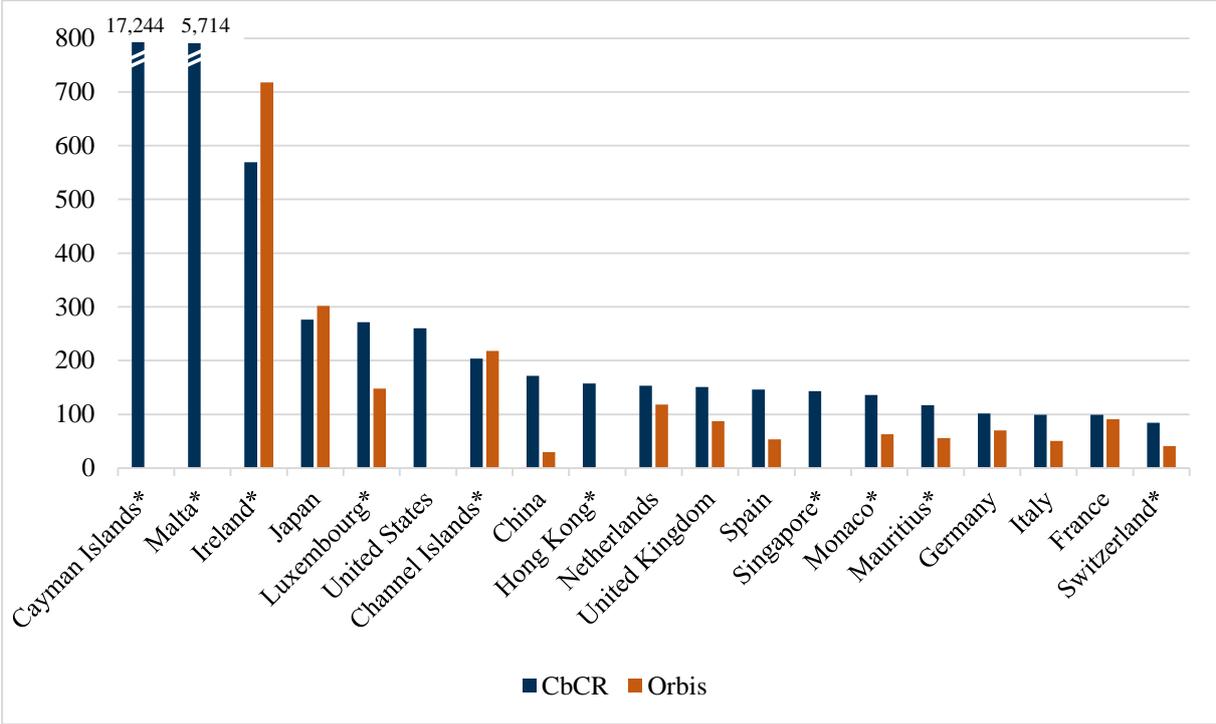
Notes: The graph shows the profit per employee of bank presences in selected countries. We calculate the ratio of profit before tax and the number of employees at bank group-year-country level and take the median across selected countries. We replace values of zero employees in a reported country by a value of 0.5 employees in order not to lose these observations which principally have an infinitely large profit-per-employee ratio. The value of 0.5 is based on the assumption that banks report all employee figures (in full-time equivalents) below 0.5 as zero due to rounding. We do not consider observations with zero or negative profit before tax. * denotes tax havens according to Hines (2010).

Figure 16: Effective tax rate in tax havens vs. other countries
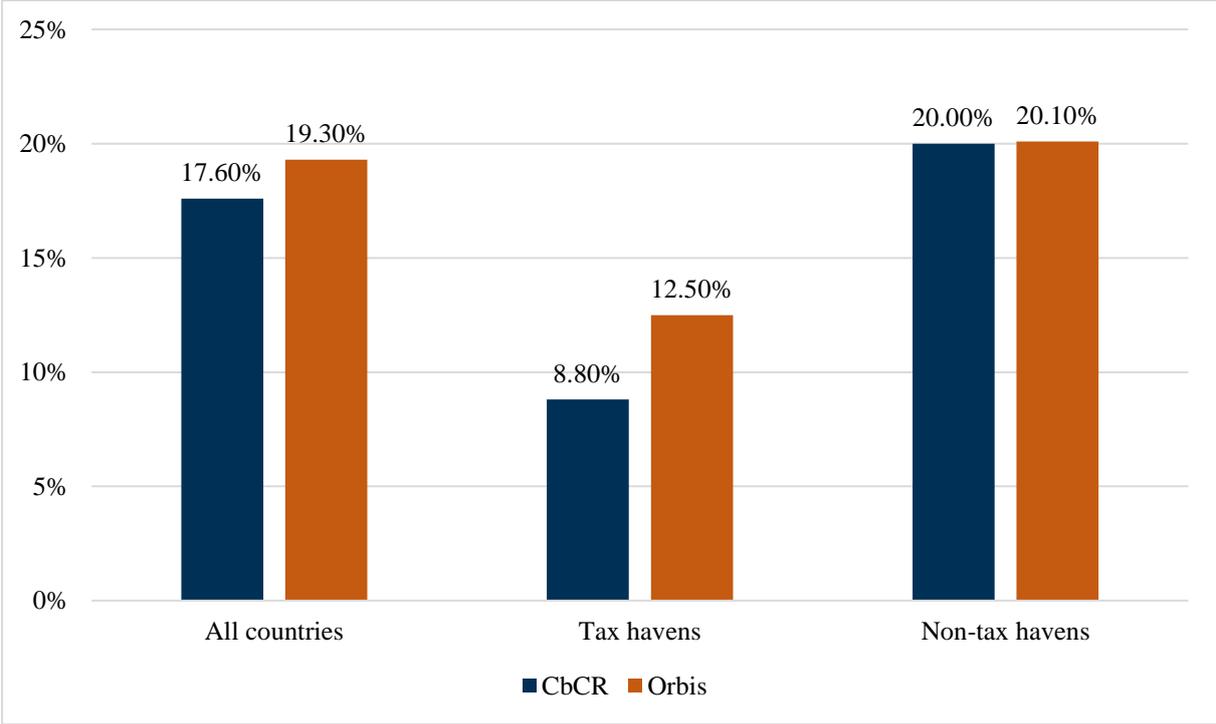
Notes: The graph shows the effective tax rates of bank presences in tax havens vs. other countries. We calculate the ETR as the ratio of income tax expense over profits before tax at bank group-year-country level and take the median across all countries, tax havens and non-tax havens, respectively. Some CbCRs state the amount of income tax paid (instead of current income tax expense). In these cases, we use the cash tax figure and calculate a cash ETR. While timing differences may impair the comparability between current ETRs and cash ETRs to a certain extent, the problem is mitigated since we observe three consecutive years of most bank groups. We do not consider observations with effective tax rates outside the range of [0;1]. Tax havens are defined according to Hines (2010).

Figure 17: Effective tax rate in selected countries
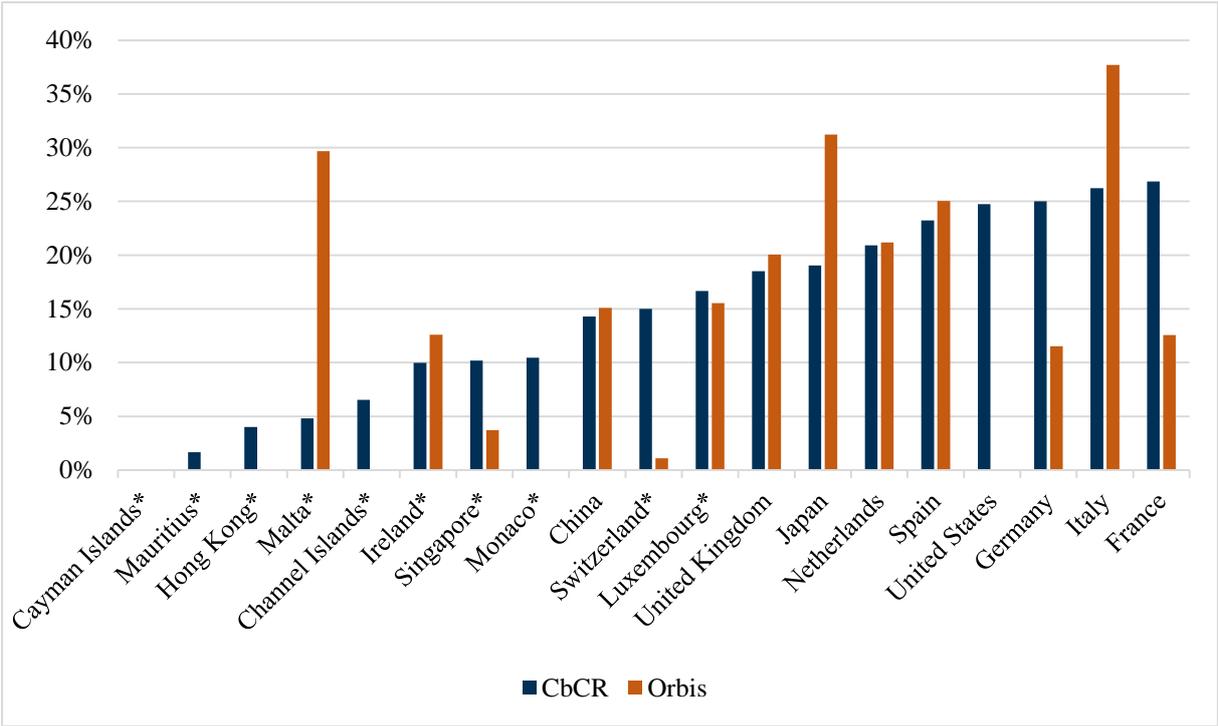
Notes: The graph shows the effective tax rates of bank presences in selected countries. We calculate the ETR as the ratio of income tax expense over profits before tax at bank group-year-country level and take the median across selected countries. Some CbCRs state the amount of income tax paid (instead of current income tax expense). In these cases, we use the cash tax figure and calculate a cash ETR. While timing differences may impair the comparability between current ETRs and cash ETRs to a certain extent, the problem is mitigated since we observe three consecutive years of most bank groups. We do not consider observations with effective tax rates outside the range of [0;1]. Tax havens are defined according to Hines (2010).

Tables

Table 1: CbCR search terms

English	annual report; annual financial statement; country-by-country report; country by country reporting; capital requirements directive iv; art "89" crd iv; tax report country; name, nature of activities and geographical location; information location businesses country; information location activities; locations information by country
German	"jahresbericht" OR "konzernabschluss" OR "geschaeftsbericht"; laenderbezogen bericht; laenderspezifisch bericht; 26 a kwg; art 89 eu-richtlinie 2013/36/eu
French	document de reference; informations sur les implantations et les activites relatives a l'exercice; informations relatives aux implantations et activites; implantation par pays; art L.511-45; nom des implantations, nature d'activite et localisation geographique; rapport financier annuel
Italian	relazioni e bilanci; informativa al pubblico stato per stato; dell'art 89 della direttiva 2013/36/UE; informativa al pubblico ex art 89; comunicazione per paese
Spanish	cuentas anuales; informe bancario annual; informacion para el cumplimiento del art 89; denominacion, naturaleza y ubicacion; art 87 de la ley 10/2014; cuentas anuales consolidadas, informe de gestion e informe de audioria
Portuguese	relatorio de gestao e contas; denominacao, natureza das atividades e localizacao geografica; informacio por pais

Notes: The table displays typical expressions used to refer to CbCRs or within CbCRs. The terms are derived from the inspection of several exemplary hand-collected reports and used as input in a Google search programmed with Python. See Section 3.1 for a description of the CbCR data collection process.

Table 2: CbCR sample composition (descriptive analysis) – Tax havens vs. other countries

		2014	2015	2016	Total
CbCRs (bank group-years)		100	112	104	316
Observations	All host countries	1,269	1,411	1,411	4,091
	Tax havens	258	279	278	815
	Non-tax havens	1,011	1,132	1,133	3,276

Notes: The table shows the number of CbCRs (bank group-years) and of observations (bank group-year-countries) in the CbCR dataset underlying the descriptive analysis. Tax havens are defined according to Hines (2010).

Table 3: CbCR sample composition (descriptive analysis) – Headquarter countries

Headquarter Country	2014	2015	2016	Total
Austria	42	43	43	128
Belgium	41	32	29	102
Cyprus	8	9	9	26
Denmark	24	24	23	71
France	361	357	347	1,065
Germany	240	233	221	694
Greece	21	23	24	68
Ireland	2	2	2	6
Italy	117	134	119	370
Luxembourg	13	22	22	57
Netherlands	100	138	140	378
Poland	0	0	4	4
Portugal	23	23	23	69
Slovenia	4	4	4	12
Spain	88	92	106	286
Sweden	58	64	63	185
United Kingdom	127	211	232	570
Total	1,269	1,411	1,411	4,091

Notes: The table shows the composition of the CbCR sample underlying the descriptive analysis by headquarter country.

Table 4: Orbis financials sample composition at subsidiary level (descriptive analysis) – Tax havens vs. other countries

	2014	2015	2016	Total
All subsidiaries	8,048	8,692	8,607	25,347
Subsidiaries in tax havens	295	416	432	1,143
Subsidiaries in non-tax havens	7,753	8,276	8,175	24,204

Notes: The table shows the number of subsidiaries in the Orbis financials sample underlying the descriptive analysis. Tax havens are defined according to Hines (2010).

Table 5: CbCR sample composition (regression analysis) – Tax havens vs. other countries

		2014	2015	2016	Total
CbCRs (bank group-years)		86	106	95	287
Observations	All host countries	691	814	746	2,251
	Tax havens	60	126	56	242
	Non-tax havens	631	688	690	2,009

Notes: The table shows the number of CbCRs (bank group-years) and of observations (bank group-year-countries) in the CbCR dataset underlying the regression analysis. The regression sample is derived from the CbCR sample used for the descriptive analysis (see Table 2), after excluding observations with missing, zero or negative profit before tax, missing or zero employees, a missing tax incentive variable (*STR_diff_group_simp*) and missing, negative or zero inflation. Tax havens are defined according to Hines (2010).

Table 6: Summary statistics on CbCR data (regression analysis)

	Obs.	Mean	Std. Dev.	p25	p50	p75
PLBT (ln)	2,251	16.932	2.472	15.672	17.111	18.530
EMPL (ln)	2,251	5.731	2.155	4.248	5.694	7.137
STR_rel	2,251	0.260	0.080	0.200	0.250	0.320
STR_diff_par	2,251	-0.045	0.096	-0.114	-0.039	0.006
STR_diff_group_simp	2,251	0.011	0.080	-0.049	0.011	0.072
STR_diff_group_empl	2,242	-0.023	0.086	-0.084	-0.023	0.039
INF (ln)	2,251	-4.222	1.195	-4.770	-4.107	-3.693

Notes: The table shows summary statistics for the CbCR dataset underlying the regression analysis. *PLBT* and *EMPL* denote profit or loss before tax and the number of employees, respectively. *STR_rel* is defined as the statutory corporate tax rate of the host country. *STR_diff_par* (1) / *STR_diff_group_simp* (2) / *STR_diff_group_empl* (3) are defined as the difference between the statutory corporate tax rate of the host country and (1) the statutory corporate tax rate of the headquarter country of the bank group / (2) the simple average tax rate of the bank group / (3) the number of employees-weighted average tax rate of the bank group. *INF* is the host country's inflation rate, measured as the annual growth rate of the ratio of GDP in current local currency to GDP in constant local currency.

Table 7: Regression results – CbCR data

	Baseline		Refined	
	(1)	(2)	(3)	(4)
STR_diff_group_simp	1.884**		-0.341	
	(0.805)		(0.761)	
STR_diff_group_empl		1.992**		-0.051
		(0.770)		(0.756)
EMPL (ln)	0.718***	0.714***		
	(0.021)	(0.021)		
STAFF* (ln)			0.601***	0.598***
			(0.031)	(0.031)
INF (ln)	-0.061	-0.061	-0.023	-0.025
	(0.060)	(0.060)	(0.050)	(0.051)
Intercept	11.278***	11.368***	5.965***	5.993***
	(0.381)	(0.382)	(0.645)	(0.655)
Parent & Year FE	Yes	Yes	No	No
Parent-Year FE	No	No	Yes	Yes
Obs.	2,251	2,242	2,227	2,219
Adj. R^2	0.761	0.760	0.706	0.705

Dependent variable: PLBT (ln)

Notes: The table shows the results of OLS regressions with profit or loss before tax (ln) as the dependent variable. See Section 5.1 for a description of the explanatory variables. The staff cost proxy *STAFF** is the product of the number of employees from the CbCR data and a country-year specific ratio of staff cost to the number of employees. For the construction of the staff cost/number of employees-ratio, we proceed as follows: First, we combine data on staff cost and the number of employees from Bank Focus and Orbis in a single staff cost and number of employees variable, respectively, by using the data contained in Bank Focus in the first place and filling the missing values with data from Orbis, if available. Second, we aggregate the Bank Focus/Orbis subsidiary-year level data at country-year level. Third, we calculate the staff cost/number of employees-ratio for each country-year. This ratio proxies payroll expense per employee in a given country-year. Since financial data on tax havens is regularly missing in Bank Focus and Orbis, we proxy the staff cost/number of employees-ratio for tax havens by the maximum ratio of the other countries. After multiplying the ratio with the number of employees from the CbCRs, we normalize the resulting staff cost to consolidated staff cost, again taken from Bank Focus and Orbis. I.e. the sum of the staff cost proxy over all countries reported in a CbCR equals the staff cost as reported in the consolidated financial statement of the parent bank.

We use heteroscedasticity-robust standard errors clustered at country-year level, shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Table 8: Bank Focus financials sample composition at subsidiary level (regression analysis) – Tax havens vs. other countries

	2014	2015	2016	Total
All subsidiaries	360	423	385	1,168
Subsidiaries in tax havens	28	36	6	70
Subsidiaries in non-tax havens	332	387	379	1,098

Notes: The table shows the number of subsidiaries in the Bank Focus sample underlying the regression analysis conducted in Section 5.3. Observations with missing, zero or negative profit before tax, missing or zero total assets, missing or zero staff cost, missing or zero employees, a missing tax incentive variable (*STR_diff_group_simp*) and missing, negative or zero inflation are dropped. Tax havens are defined according to Hines (2010).

Table 9: Stepwise replication of CbCR regressions with Bank Focus data

	Dependent variable: PLBT (ln)					
	(1)	(2)	(3)	(4)	(5)	(6)
STR_diff_group_simp	-2.017***	-1.569***	-1.583**	-0.944	4.945***	0.530
	(0.561)	(0.459)	(0.727)	(0.761)	(0.929)	(1.096)
TOAS (ln)	0.649***	0.567***	0.694***	0.728***		
	(0.043)	(0.035)	(0.055)	(0.047)		
STAFF (ln)	0.238***	0.312***	0.193***			
	(0.048)	(0.038)	(0.050)			
EMPL (ln)				0.164***	0.783***	
				(0.042)	(0.046)	
STAFF* (ln)						0.821***
						(0.040)
INF (ln)	-0.012	0.013	0.012	0.007	-0.125	-0.040
	(0.034)	(0.031)	(0.038)	(0.037)	(0.079)	(0.069)
Intercept	-0.829	0.960	-1.483**	0.067	12.162***	3.068**
	(0.868)	(0.773)	(0.639)	(0.872)	(0.513)	(1.293)
Other subsidiary-level controls	Yes	No	No	No	No	No
Bank-type FE	Yes	Yes	No	No	No	No
Parent & Year FE	Yes	Yes	Yes	Yes	Yes	No
Parent-Year FE	No	No	No	No	No	Yes
Level	Subsid.	Subsid.	Country	Country	Country	Country
Obs.	1,000	1,168	486	486	486	486
Adj. R^2	0.754	0.734	0.794	0.796	0.662	0.678

Notes: The table shows the results of OLS regressions with profit or loss before tax (ln) as the dependent variable. The staff cost proxy *STAFF** is calculated as explained in the notes to Table 7, now using the number of employees according to the Bank Focus single statement information (instead of the CbCRs). See Section 5.1 for a description of the other explanatory variables.

We use heteroscedasticity-robust standard errors clustered at country-year level, shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Table 10: CbCR regressions with alternative tax incentive variables

	Dependent variable: PLBT (ln)			
	Baseline		Refined	
	(1)	(2)	(3)	(4)
STR_rel	2.176**		-0.208	
	(0.853)		(0.805)	
STR_diff_par		2.020**		-0.208
		(0.815)		(0.805)
EMPL (ln)	0.717***	0.718***		
	(0.021)	(0.021)		
STAFF* (ln)			0.600***	0.600***
			(0.031)	(0.031)
INF (ln)	-0.061	-0.061	-0.024	-0.024
	(0.060)	(0.060)	(0.051)	(0.051)
Intercept	10.819***	11.358***	6.024***	5.972***
	(0.428)	(0.379)	(0.625)	(0.655)
Parent & Year FE	Yes	Yes	No	No
Parent-Year FE	No	No	Yes	Yes
Obs.	2,254	2,254	2,230	2,230
Adj. R^2	0.761	0.761	0.706	0.706

Notes: The table shows the results of OLS regressions with profit or loss before tax (ln) as the dependent variable, using alternative tax incentive variables. *STR_rel* is the statutory corporate tax rate of the host country. *STR_diff_par* is the difference between the statutory corporate tax rate of the host country and the statutory corporate tax rate of the headquarter country of the bank group. The staff cost proxy *STAFF** is defined as in the notes to Table 7. See Section 5.1 for a description of the other explanatory variables.

We use heteroscedasticity-robust standard errors clustered at country-year level, shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Table 11: CbCR regressions including observations with zero or negative values on EMPL and INF

	Dependent variable: PLBT (ln)			
	Baseline		Refined	
	"Plus 1" (1)	IHS (2)	"Plus 1" (3)	IHS (4)
STR_diff_group_simp	1.051[*] (0.614)	1.100[*] (0.616)	0.007 (0.582)	0.606 (0.589)
EMPL (*modified*)	0.605[***] (0.021)	0.568[***] (0.021)		
STAFF* (*modified*)			0.550[***] (0.025)	0.380[***] (0.022)
INF (*modified*)	-0.385 (0.923)	-0.265 (0.807)	2.504[**] (1.161)	1.501 (0.923)
Intercept	11.700[***] (0.284)	11.529[***] (0.284)	6.472[***] (0.485)	11.469[***] (0.342)
Parent & Year FE	Yes	Yes	No	No
Parent-Year FE	No	No	Yes	Yes
Obs.	2,929	2,929	2,900	2,900
Adj. R^2	0.711	0.702	0.679	0.625

Notes: The table shows the results of OLS regressions with profit or loss before tax (ln) as the dependent variable. In principle, the variables are defined as in Section 5.1 and in the notes to Table 7. However, we modify the calculation of the employee variable (*EMPL*), the staff cost proxy (*STAFF**) and the inflation variable (*INF*) to increase the sample size. To this end, we replace missing values of inflation (*INF*) with the average inflation of all countries in the sample in the respective year. Moreover, we apply two alternative approaches to avoid dropping zero or negative values of *EMPL*, *STAFF** and *INF* due to the ln transformation. First, in column (1) and (3), we add 1 to each value before taking the ln. Second, in column (2) and (4), we use the inverse hyperbolic sine transformation (IHS) instead of taking the ln (for details, see Burbidge et al. 1988; Langenmayr and Reiter 2017).

We use heteroscedasticity-robust standard errors clustered at country-year level, shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Table 12: Regressions with alternative proxies for staff cost and total assets (CbCR sample and Bank Focus (BF) sample)

| | Specification A | | Specification B | | Specification C |
| | CbCR | BF | CbCR | BF | CbCR |
	(1)	(2)	(3)	(4)	(5)
			Dependent variable: PLBT (ln)		
STR_diff_group_simp	0.065	-0.345	1.335**	-0.355	-0.062
	(0.792)	(0.992)	(0.528)	(1.032)	(0.271)
TOAS* (ln)	-0.176**	0.290**	0.016	0.456***	
	(0.079)	(0.139)	(0.021)	(0.123)	
TOAS*_2 (ln)					0.990***
					(0.042)
STAFF* (ln)	0.789***	0.514***			
	(0.091)	(0.145)			
STAFF*_2 (ln)			0.685***	0.308***	-0.077**
			(0.025)	(0.113)	(0.034)
INF (ln)	-0.040	-0.010	0.100**	-0.002	0.030
	(0.050)	(0.055)	(0.043)	(0.052)	(0.020)
Intercept	6.576***	1.566*	4.900***	1.999*	-4.189***
	(0.654)	(0.931)	(0.399)	(1.130)	(0.478)
Parent & Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	No
Level	Country	Country	Country	Country	Country
Obs.	2,227	486	2,236	486	2,210
Adj. R^2	0.722	0.708	0.794	0.704	0.894

Notes: The table shows the results of OLS regressions with profit or loss before tax (ln) as the dependent variable, using alternative proxies for total assets and staff costs.
*TOAS** is the product of the number of employees from the underlying dataset indicated in the header (CbCR or Bank Focus) and a country-year specific ratio of total assets to the number of employees. For the construction of the total assets/number of employees-ratio, we proceed as follows: First, we combine data on total assets and the number of employees from Bank Focus and Orbis in a single total assets and number of employees variable, respectively, by using the data contained in Bank Focus in the first place and filling the missing values with data from Orbis, if available. Second, we aggregate the Bank Focus/Orbis subsidiary-year level data at country-year level. Third, we calculate the total assets/number of employees-ratio for each country-year. This ratio proxies total assets per employee in a given country-year. Since financial data on tax havens is regularly missing in Bank Focus and Orbis, we proxy the total assets/number of employees-ratio for tax havens by the maximum ratio of the other countries. After multiplying the ratio with the number of employees from the underlying dataset, we normalize the resulting total assets to consolidated total assets, again taken from Bank Focus and Orbis. I.e. the sum of the total assets proxy over all country presences of a bank group equals the total assets as reported in the consolidated financial statement of the parent bank.

The second total assets proxy *TOAS*_2* is only used in the CbCR sample. It allocates the total assets of a bank group to the country presences according to the distribution of turnover. To this end, we calculate the turnover share of a country presence as the ratio between turnover reported in this country and the sum of turnover over all country presences of a bank group (both taken from the CbCR). We then multiply the turnover share of each country presence with the consolidated total assets of the respective bank group, taken from Bank Focus and Orbis.

STAFF* is defined as in the notes to Table 7 and Table 9. The second staff cost proxy *STAFF*_2* is the product of the number of employees from the underlying dataset indicated in the header (CbCR or Bank Focus) and the GDP per capita of the reported country. See Section 5.1 for a description of the other explanatory variables.

We use heteroscedasticity-robust standard errors clustered at country-year level, shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Table 13: Stepwise replication of CbCR regressions with Orbis data

	Dependent variable: PLBT (ln)			
	(1)	(2)	(3)	(4)
STR_diff_group_simp	-1.802***	-2.110***	0.560	-2.637**
	(0.480)	(0.652)	(1.275)	(1.133)
TOAS (ln)	0.661***	0.554***		
	(0.020)	(0.033)		
STAFF (ln)	0.206***	0.324***		
	(0.014)	(0.037)		
EMPL (ln)			0.749***	
			(0.033)	
STAFF* (ln)				0.727***
				(0.036)
INF (ln)	-0.014	0.081	-0.053	0.055
	(0.031)	(0.055)	(0.138)	(0.113)
Intercept	-0.428	0.168	10.554***	3.444***
	(0.314)	(0.530)	(0.616)	(0.855)
Other subsidiary-level controls	No	No	No	No
Bank-type FE	No	No	No	No
Parent & Year FE	Yes	Yes	Yes	No
Parent-Year FE	No	No	No	Yes
Level	Subsidiary	Country	Country	Country
Obs.	3,327	624	622	620
Adj. R^2	0.751	0.795	0.605	0.605

Notes: The table shows the results of OLS regressions with profit or loss before tax (ln) as the dependent variable, using the Orbis financials dataset. The staff cost proxy *STAFF** is calculated as explained in the notes to Table 7, now using the number of employees according to the Orbis single statement information (instead of the CbCRs). The other variables are defined as in Section 5.1.

We use heteroscedasticity-robust standard errors clustered at country-year level, shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

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