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Abstract

Within the framework of the OECD BEPS initiative many countries introduced non-public country-by-country reporting for MNEs above a revenue threshold. The reports provide tax authorities with information on the global activities of multinationals at a country level. This paper investigates the responses of companies to country-by-country reporting and tests whether the goal of a reduction in tax avoidance is achieved. Difference-in-difference estimations show an increase in consolidated effective tax rates of about one percentage point in the treatment group and provide evidence for a reduction in profit shifting at the subsidiary level. Responses are more pronounced for companies experiencing a stronger increase in detection probability. At the same time, total tax payments do not rise, which may be explained by a decrease in economic activity of companies in scope. The second part of the paper investigates avoidance of the disclosure obligation and documents substantial excess mass just below the revenue threshold in the post-reform years. This effect is stronger for company types with higher costs of CbCR and lower costs of adjusting revenues.

JEL Code: F23, H26, K34, M48
Keywords: Corporate tax avoidance, multinational firms, country-by-country reporting, disclosure regulation

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1. Introduction

Tax avoidance of large corporations has been a topic of public and academic debate for decades, while the extent of corporate profit shifting continued to increase (Clausing, 2016; Tørsløv, Wier & Zucman, 2018). Public pressure on policy makers around the world to address the issue was reinforced by a series of leaks revealing the practices of some corporations.[1] One major initiative focusing on the issue of corporate tax avoidance is the OECD/G20 Base Erosion and Profit Shifting (BEPS) project. As part of this project, non-public country-by-country reporting (CbCR) was introduced for multinational companies above a revenue threshold. Starting in 2016, the reports provide information on the global activities of multinational enterprises (MNEs) to tax authorities. The goal of this reporting obligation is to increase transparency, allowing tax authorities to more effectively combat tax avoidance.

This paper looks at intended and unintended responses to CbCR focusing on two main research questions: First, this study investigates whether the primary goal of a reduction in profit shifting was achieved. Second, the paper tests if companies avoid the disclosure obligation by adjusting their revenues to a level below the reporting threshold.

The analysis of the first research question is based on a difference-in-difference approach exploiting the revenue threshold for CbCR and uses firm-level financial information on over 11,000 companies from Bureau van Dijk's Orbis database.[2] According to my estimations, companies with CbCR obligation reduce their profit shifting, leading to an increase in effective tax rates by about one percentage point relative to the control group. The response is stronger for companies that experience a more pronounced increase in the detection risk of their profit shifting behavior. I also identify a decline in profit shifting at the subsidiary level as the responsiveness of subsidiary profitability to corporate tax rates is reduced. Tax payments, however, do not rise due to CbCR. This apparent paradox may be explained by a reduction in economic activity and the use of loss carryforwards constituting unintended reactions to CbCR. As an additional unintended effect, I find a reduction in the equity ratio of companies in scope of CbCR. This may be driven by the fact that debt financing becomes relatively more attractive to companies at higher effective tax rates.

To reveal potential avoidance of the CbCR obligation, I investigate the existence of excess mass just below the CbCR threshold in the post-reform years based on the bunching approaches put forward by Chetty et al. (2011) and Kleven & Waseem (2013). I document an increase in the density just below the threshold of more than 20% by 2018. Company types for which CbCR would lead to a comparably small (large) increase in the detection risk of profit shifting show a weaker (stronger) bunching response.

The CbCR regime this paper is focused on does not stipulate the publication of the CbC information. In fact, tax authorities must ensure the confidentiality of all data received. In

[1] Examples include the Luxembourg Leaks form 2014 and the publication of the Panama and Paradise Papers in 2016 and 2017.

[2] The data was provided by the ifo Institute's Economics & Business Data Center (EBDC).

contrast, the European Union introduced a public CbCR regime for its financial sector in 2014.[3] The effect of this public CbCR regime on profit shifting is studied by Overesch & Wolff (2019) and Joshi, Outslay & Persson (2019). Overesch & Wolff (2019) describe an increase in effective tax rates of affected companies by 2.5 percentage points, mainly driven by companies with tax haven affiliates. Joshi, Outslay & Persson (2019) focus on the effects of the EU's public CbCR on subsidiary level data. They describe a reduction in profit shifting of financial affiliates and an increase in profit shifting of non-financial affiliates of European banks which are not subject to the reporting obligation. Investigating stock price, Dutt et al. (2019) find no abnormal returns for financial institutions affected by the disclosure regulation. The authors explain this by opposing effects of reductions in the information asymmetry between shareholders and managers one the one hand, and reduced profit shifting opportunities on the other.

All this work on public CbCR shares the difficulty of determining whether effects are driven by the additional information available to tax auditors or fear of reputational costs due to the public availability of the CbC reports. When evaluating the effects of non-public CbCR on profit shifting, the potential channel of increased public scrutiny is switched off. Any effects can therefore be attributed to the additional information available to tax authorities.

The work most closely related to my study are concurrent papers from De Simone & Olbert (2019) and Joshi (2020). De Simone & Olbert (2019) investigate the effects of BEPS CbCR on using a RDD approach based on Orbis data. The authors focus Companies active in the European Union and measure the effects of CbCR on real economic activity measured by the items disclosed in the reports. De Simone & Olbert find a decline in the number of tax haven subsidiaries of companies in scope. The authors also report no significant change in taxes paid, but a reduction in the investment in employees. By comparing unconsolidated accounts of low and high tax affiliates, they document a positive effect of CbCR on revenue, employment, and total assets in low tax subsidiaries in Europe. The authors interpret these results as a compensation for the shutdown of tax haven subsidiaries.

Joshi (2020) relies on data for European MNEs from Orbis to assess the impact of CbCR on profit shifting. Joshi reports an increase in effective tax rates of about 1-2 percentage points. At the affiliate level, the author reports a reduction in profit shifting starting in 2018.

My paper complements and extends these studies in a number of ways. While the analysis of the impact of CbCR on tax avoidance and tax payments provides the starting point, I continue with an investigation of the differential development of the two. While not being conclusive in this respect, I offer first insights on how to reconcile the two findings on effective tax rates and tax payments and the mechanisms at play. I also connect the effects of CbCR on tax avoidance to a conceptual framework explaining heterogeneities in the effect intensity. The analysis of changes in capital structure provides additional insights on unintended consequences of CbCR. Extending the sample beyond European MNEs to companies from almost 100 countries adds to the external validity of the results.

[3] More details on this reporting regime are provided in Section 2.

Moreover, the second research question on the avoidance of the CbCR obligation provides an additional angle. To the best of my knowledge, this is the first paper to look at such responses in conjunction with CbCR. This part of the analysis extends a small literature on the avoidance of disclosure requirements.

Gao, Wu & Zimmermann (2009) and Towery (2017) find avoidance responses for different reporting requirements in the US. Hasegawa et al. (2013) investigate responses to the – now abolished – public disclosure of corporate and personal income tax information in Japan. The authors report that both companies and individuals underreport their income to stay below an income threshold for disclosure. Australia started to publish tax return information, including income and taxes payable, for companies above an income threshold in 2015. Hoopes, Robinson & Slemrod (2018) document excess mass in terms of number of firms just under this threshold pointing towards avoidance of the reporting requirement.

Decisions on disclosure obligations are always a trade-off between the benefits of increased transparency and the direct and indirect costs.[4] Yet, empirical evidence on the effects of disclosure regulation and financial reporting is relatively scarce as noted by Leuz & Wysocki (2016). The authors attribute this to the lack of suitable control groups or counterfactuals in many cases. This study responds to the call of Leuz & Wysocki exploiting the unique setting of BEPS CbCR to construct a convincing control group. By providing new insights on the effects of the disclosure regime on company behavior, it helps to evaluate the usefulness of CbCR as a weapon in the fight against corporate tax avoidance. This paper also contributes to the ongoing debate on whether CbC data should be made publicly available.

The remainder of this paper is organized as follows: Section 2 introduces the institutional setting. In Section 3, I present the theoretical framework and derive two testable hypotheses on the effects of CbCR. Section 3 presents the results on tax avoidance and further dimensions based on a difference-in-difference approach. The results on avoidance of the CbCR obligation are summarized in Section 5. Section 6 discusses the results and relates them to findings from related literature. Section 7 concludes.

[4] Section 3 discusses the costs and benefits in more extensively.

2. Institutional Background

This section describes the relevant institutional background. It gives a short overview on the OECD/G20 BEPS project, summarizes the key aspects of the CbCR framework, and explains the main differences to the CbCR regime introduced by the European Union.

The OECD BEPS Project & Country-by-Country Reporting

In 2013, the OECD published a first action plan for its Base Erosion and Profit Shifting project (OECD, 2013). This action plan recognized the increase in profit shifting opportunities of multinational enterprises (MNEs) due to globalization and listed 15 Actions to address this issue. In 2015, the final report on BEPS was published, setting out in detail the 15 instruments aiming to reduce opportunities of tax avoidance for MNEs (OECD, 2015). These measures are supposed to introduce "coherence in domestic rules that affect cross-border activities, reinforcing substance requirements in the existing international standards, and improving transparency as well as certainty" (OECD, 2015, p. 3). A list of the different BEPS Actions is provided in the Appendix (Table A1).

To include a wider range of countries, the OECD/G20 Inclusive Framework on Base Erosion and Profit Shifting (Inclusive Framework) was created. All interested countries can join the Inclusive Framework, but have to commit to four BEPS minimum standards. These are four of the 15 BEPS Actions which have to be implemented by all members (Table A1). The implementation of the minimum standards is monitored and peer-reviewed. As of May 2020, almost 140 countries have joined the Inclusive Framework, including most of the world's major offshore financial centers.[5]

This paper focuses on one of the four minimum standards, namely Action 13 on Transfer Pricing Documentation and Country-by-Country Reporting. All Inclusive Framework members must put legislation in place requiring large MNEs to report their global activities on a country-by-country basis to the tax authorities. While the reports are shared between tax authorities, they are not made publicly available. Moreover, jurisdictions must ensure the confidentiality and appropriate use of the CbC data before becoming part of the exchange mechanism.

The OECD recommends the introduction of such a CbCR obligation for fiscal years starting on or after 1 January 2016. Still, a number of countries made use of the option to introduce the obligation at a later point in time. Table A2 lists the countries that already have CbCR legislation in place and provides details on the timing of reporting obligations.

Objective of CbCR

The goal of BEPS CbCR is to "provide tax administrations with a high level overview of the operations and tax risk profile of the largest multinational enterprise groups" (OECD, 2017, p. 11). Having this additional information may allow tax authorities to more efficiently allocate their (limited) resources and focus their auditing at companies with high tax risk. In this sense, CbCR is a complement to existing auditing processes, but not intended to be a substitute for

[5] A frequently updated list of all Inclusive Framework members is provided by the OECD under http://www.oecd.org/tax/beps/inclusive-framework-on-beps-composition.pdf.

audits. At the same time, the obligation to provide CbC data to tax authorities may deter MNEs from choosing overly aggressive tax planning strategies in the first place.

While most large MNEs had to publish balance sheet data including information on profits and taxes before CbCR in financial statements, information at the country level was not usually provided (Hanlon, 2018). The comprehensive list of subsidiaries may provide additional insights to tax authorities on the exact company structure. CbCR also covers all activity in investment hubs that is hard to single out from aggregated information. In addition, CbCR provides an overview of information that may have existed before, but was reported to many different countries which were separate information spaces to some degree. CbCR now forces companies to provide coherent information across countries, following largely – but not perfectly – harmonized definitions.

In short, CbCR aims at reducing the informational advantage of taxpayers over tax authorities (Cockfield & McArthur, 2015) and constitutes an important step towards the harmonization of the international corporate tax system.

CbCR filing obligation

The obligation to file a CbC report applies to all MNEs, i.e. companies with at least one cross-border affiliate, with the exception of groups "with annual consolidated group revenue in the immediately preceding fiscal year of less than EUR 750 million or a near equivalent amount in domestic currency" (OECD, 2015, p. 21). The objective of this exception is to exclude the majority of companies, but to include the majority of tax revenue.[6] There are two main ways in which the obligation to file a CbC report can come about:

a. Parent entity filing obligation: An MNE is required to file a CbC report by corresponding legislation in the country of residence of its ultimate parent entity (UPE).
b. Local filing obligation: Countries can require constituent entities that are resident for tax purposes to file a CbC report if there is no such obligation for the UPE in its home country, but the group otherwise meets the conditions for a CbCR obligation.[7]

The key difference between the two is that CbC reports filed under a local filing obligation are not exchanged between tax authorities. If there are local filing obligations from several jurisdictions, an MNE can pick one of its subsidiaries to act as "Surrogate Parent Entity". In sum, any MNE has to file a CbC report in a given fiscal year if (1) its revenues are above the threshold applicable and (2) it is headed in a country with CbCR legislation or has subsidiaries in countries with local filing obligations. In view of the identification strategy used in this paper, it is important to note that the revenue threshold only applies to the CbCR obligation. There are no other reforms implemented in relation to the BEPS package using this threshold that are relevant in the sample period used.[8]

[6] The OECD estimates that about 85-90% of MNE groups are excluded by this revenue threshold, while 90% of corporate tax revenues are covered (OECD, 2015).
[7] Local filing can also apply if the exchange of CbC reports provided by the parent entity is not applicable despite the existence of a Parent Entity filing obligation (OECD, 2017).
[8] In the current debate about a coordinated reform of the corporate tax system, the revenue threshold is discussed again for certain aspects of the reform (see e.g. OECD, 2019a). The French digital tax applies a threshold of EUR 750 million, but was introduced after the end of my sample period.

The CbCR mechanism

An overview on the regular CbCR process based on a parent entity filing obligation is given by Figure 1. This simple example is based on an MNE that is active in three countries (A to C) and headquartered in county B. The CbCR process comprises four main steps represented by the numbers in Figure 1: First, the ultimate parent entity of a company collects all data required for the report, including information from all subsidiaries. The financial data is then aggregated on the country level. In a second step, the full CbC report is provided to the tax authority of the UPE country. Third, the tax authority receiving the report distributes it to all countries in which the MNE in question is active. Fourth, tax authorities can use the CbC information to assess the tax risk of the reporting company.

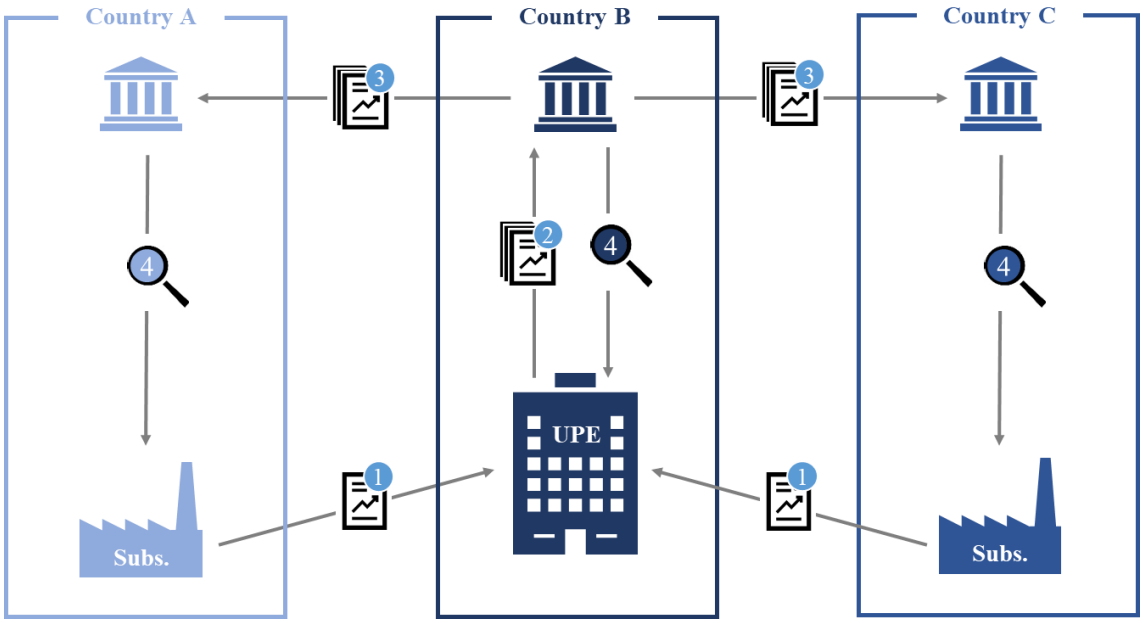

Figure 1: ***Visualization of the CbCR process***

Content of CbC reports

The content of the CbC reports is set out in the 2015 Final Report. In general, CbC reports consist of three tables. Templates of these three tables are shown in Figure A1-A3. The first table contains financial information on the global activities of an MNE group aggregated by tax jurisdiction (Figure A1). The following items are part of this first table:

- Revenues (unrelated party, related party, total)
- Profit (Loss) before Income Tax
- Income Tax Paid (on Cash Basis)
- Income Tax Accrued – Current Year
- Stated Capital
- Accumulated Earnings
- Number of Employees
- Tangible Assets other than Cash and Cash Equivalents

In a second table, all subsidiaries of the MNE group have to be listed with their tax jurisdiction and main activities (Figure A2). A third table allows for additional information and comments (Figure A3).

EU CRD IV and public CbCR in the financial sector

While there exists a number unilateral and multilateral transparency regimes such as EITI (Extractive Industries Transparency Initiative), the one closest in spirit to BEPS CbCR is a reporting framework introduced by the European Union for its financial sector.

The European Union introduced country-by-country reporting for multinational credit institutions and investment firms active in the EU via the Capital Requirements Directive IV (CRD IV, Directive 2013/36/EU). This initiative implemented the Basel III agreement. After the Directive was transposed into domestic law, it became effective in the 2014 fiscal year, requiring all banks headquartered in the EU to publish key financial information at a country level. This information includes turnover, pre-tax profits, and corporate taxes paid, as well as the name and activities of subsidiaries and branches. Non-EU banks only have to publish information of their European subsidiaries. The information is made publicly available and is not just reported to tax authorities. This constitutes a key difference to BEPS CbCR. Another difference in the absence of any threshold in terms of company size. At the same time, the scope of CbCR under CRD IV is much more limited, as it only applies to European banks or European subsidiaries of non-European institutions. For most industries and countries, the obligation of MNEs to provide extensive information on their firm structure and activities by country to tax authorities due to BEPS CbCR is unprecedented.

3. Hypothesis development

Effects of CbCR

The main goal of CbCR is to reduce profit shifting opportunities of multinational companies by increasing transparency. Traditionally, tax evasion is modelled as choice under uncertainty as first proposed by Allingham & Sandmo (1972). According to their model, firms maximize expected utility EU by choosing how much of their true income W to report to tax authorities. This reported income $\overline{W}$ is taxed at rate τ. If the underreporting goes undetected, firms gain additional disposable income in the amount of underreporting $\underline{W} = W - \overline{W}$. If the underreporting is detected, firms have to pay taxes on the true income plus a fine θ depending on the underreported income. With a probability of detection p, this results in the following maximization problem:

$$max_{\underline{W}}\, EU = (1-p)U\left[(1-\tau)\overline{W} + \underline{W}\right] + pU\left[(1-\tau)W - \theta\underline{W}\right].$$

Underreporting of income is therefore less attractive, the higher the detection probability p. However, many companies do not so much underreport their income, but rather shift profits to low tax jurisdictions. The Allingmo-Sandmo model can easily be adjusted to apply to corporate profit shifting between high and zero tax jurisdictions. The amount $\underline{W}$ could be interpreted as

the share of profits shifted from high to zero tax jurisdictions. If shifting was not to a zero, but to a low tax jurisdiction, the model changes only marginally. Profits remaining in the high tax country are taxed at a high rate $\overline{\tau}$, profits shifted to a low tax jurisdiction are taxed at a low tax rate $\underline{\tau}$. Assuming the same penalty structure as in the basic model, the adjusted optimization problem of a company would read as follows:

$$max_{\underline{W}}\, EU = (1-p)U\left[(1-\overline{\tau})\overline{W} + (1-\underline{\tau})\underline{W}\right] + pU\left[(1-\tau)W - \theta\underline{W}\right].$$

An increase in the detection probability p would reduce the amount of profit shifted to the low tax country, just as it reduces tax evasion in the basic model.

The underlying rationale of CbCR is to increase this detection probability of profit shifting as governments gain additional information on the global activities of MNEs. The additional information contained in the CbC reports may allow tax authorities to more efficiently allocate their (limited) resources at companies with high tax risk. Besides, pressure on governments that used to be inattentive to tax planning may rise, as tax payments become visible to other tax authorities, further raising the detection probability.

Garcia-Bernardo, Jansky & Tørsløv (2019) use aggregated CbC data published by the US IRS to show that lower effective tax rates are associated with higher reported profits. Garcia-Bernardo et al. also identify most important tax havens for US companies, namely Bermuda, Ireland, and the Netherlands. These early insights based on aggregated CbC data indicate the usefulness of the data collected in detecting profit shifting behavior.

However, there exists some skepticism about the effectiveness of non-public CbCR against profit shifting. It is well possible that the introduction of additional reporting obligations only adds a burden on businesses without raising the detection probability of profit shifting. By comparing the effects of three different tax disclosure requirements in the US, Henry, Massel, & Towery (2016) show that only one of the regimes actually lowered tax avoidance. This suggests that not all financial information provided by companies to tax authorities actually increases the detection probability and is useful to combat tax avoidance. Legislation on controlled foreign companies, for example, may already provide tax authorities with sufficient information on subsidiaries of MNEs. In addition, the CbC reports are compiled by the companies and accordingly are no third party reporting. As Kleven et al. (2011) show for personal income taxation, third party reporting is much more effective in reducing tax evasion than self-reporting.[9]

Another point of criticism is the non-public nature of the CbCR framework. This critique was brought forward frequently by public interest groups such as the Tax Justice Network or Oxfam.[10] As companies do not have to fear increased public scrutiny, the change in the detection risk of tax avoidance is lower than in the case of public CbCR. Reputation losses due to public CbCR would add to the cost of detection increasing the model parameter θ. Higher

[9] See Kleven, Kreiner & Saez (2016) for an agency model on the effectiveness of third-party reporting.
[10] See https://www.oxfam.org/en/tags/country-country-reporting and https://www.taxjustice.net/topics/corporate-tax/country-by-country/ for contributions of the two organizations on the topic.

costs in case of detection also reduce the attractiveness of tax avoidance. Hombach & Sellhorn (2018) as well as Rauter (2019) document the importance of the reputation channel studying different disclosure requirements for US and European companies in the extractive industry.

Durst (2015) warns about exaggerated expectations regarding the BEPS project in general. While he concedes that CbCR may provide some guidance to tax authorities on where to focus their resources and enforcement efforts, Durst argues that the underlying problem is the complexity of transfer pricing legislation rather than missing information. Evers, Meier & Spengel (2017) question the benefits of CbCR, even if CbC reports provide additional information to tax authorities, because tax planning mostly relies on "the legal exploitation of gaps and loopholes in national and international tax law" (Evers, Meier & Spengel, 2017, p. 11).

In the light of this debate, the effectiveness of CbCR against corporate tax avoidance seems unclear. To assess whether CbCR achieved its main goal and successfully reduced corporate profit shifting, I test the following hypothesis:

> *Hypothesis 1: MNE groups with a CbCR obligation have reduced their profit shifting activity compared to companies out of scope.*

As discussed, the effect of CbCR crucially depends on the increase in detection probability. The change in detection probability is likely to vary across firms with different characteristics (Overesch & Wolff, 2019). For companies that experience a stronger increase in the detection probability, the treatment intensity is higher. Accordingly, these companies should show a stronger reaction to CbCR compared with companies that experienced only a minor increase in the detection probability. I will extensively test for such heterogeneity in combination with *Hypothesis 1* in Section 4.

Next to the intended effect of a reduction in profit shifting, the introduction of CbCR may also have unintended effects on company behavior (Leuz & Wysocki, 2016). Feng Lu (2012) provides evidence for a "multitasking hypothesis" according to which companies will improve quality in reported dimensions, but reduce quality in unreported ones. In the context of CbCR, companies may, for example, reduce their profit shifting, but also adjust their behavior in other dimensions counteracting the desired effect. I will therefore also test the effect of CbCR on a number of additional balance sheet items, including measures of economic activity and capital structure.

Avoidance of CbCR

An increase in detection risk and consequently lower profit shifting opportunities would constitute a cost to companies, but CbCR also implies a number of additional costs for companies (see e.g. Dutt et al., 2019). The preparation of the CbC report itself can constitute a substantial burden to companies as it requires them to generate new data and put the necessary processes in place. Additionally, companies may fear that the CbC reports become public in the future, either due to political decisions or data leaks. Publicly available CbC data could lead to reputation costs for some companies – either because of of aggressive tax planning revealed or simple misinterpretation of the data by the public. The direct and indirect costs of CbCR

generate an incentive for companies to avoid the filing obligation by adjusting revenues to a level below the threshold as an additional unintended consequence of CbCR.

There is a number of ways in which firms can reduce their book revenues in order to stay under the reporting threshold. First, companies can reduce or postpone investment and thereby revenue growth. Second, firms are sometimes able to shift the booking of transactions between years. This particularly applies to one-time transactions, e.g. sale of assets. Third, firms could simply misreport their revenues. This, of course, may lead to penalties in case of detection. Lastly, firms too large to reduce their revenues to a level below the reporting threshold could split into smaller parts.

Such strategies are attractive to firms if the costs of CbCR are higher than the costs of adjusting revenues to a level below the threshold. This leads to a testable hypothesis:

> *Hypothesis 2: Some firms avoid the CbCR obligation by adjusting their revenues to a level below the revenue threshold applicable.*

As the change in detection probability and the related costs of CbCR, the costs of reducing revenues below the threshold are likely to be heterogeneous for companies with different characteristics. This would again lead to more pronounced reactions for certain company types. Whether this is the case is tested with a general assessment of *Hypothesis 2* in Section 5 of this paper.

4. Effects of CbCR on reporting companies

This section deals with the effects of non-public CbCR introduced as part of the BEPS process on companies in scope. The focus lies on the impact on corporate profit shifting, but I also investigate potential changes in tax payments and the financial structure of companies. I will first describe the empirical approach and data used to identify the effects of CbCR before presenting the main estimation results.

4.1 Empirical approach & sample selection

Regression model

Following the framework presented in Section 3, the introduction of CbCR can be interpreted as an exogenous shock to the detection probability of tax avoidance for a given company in scope of the disclosure framework. To investigate the effect of CbCR on companies, I rely on a difference-in-difference approach comparing companies with and without the obligation to file a CbC report. I estimate the average effect of CbCR on the treatment group over the post-reform period with regression models of the following form:

$$y_{i,t} = \beta_0 + \beta_1 CbCR_i * post2016_t + \beta_2 post2016_t + \gamma_i + \mu_t + X_{i,t}\delta + \varepsilon_{i,t} \qquad (1)$$

where $CbCR_i$ is a dummy equal to 1 for the treatment group, indicating whether company i is required to file a CbC report in a year t. $post2016_t$ is a dummy variable equal to 1 for all years after the introduction of CbCR in 2016. The coefficient of the interaction term, β_1 is the coefficient of main interest as it describes the change in the dependent variable $y_{i,t}$ for the treatment group relative to the change in the control group after the implementation of CbCR. μ_t and γ_i are year and company fixed effects. $X_{i,t}$ is a set of control variables including the statutory corporate income tax (CIT) rate, GDP per capita growth, and the inflation rate to control for the general economic conditions in an MNEs parent entity country; and year dummies interacted with industry dummies controlling for industry specific shocks over time. The year 2015 is excluded in the baseline estimations due to potential announcement effects.

In most estimations, the unit of observation are company groups as a whole, but some investigate the impact of CbCR at the subsidiary level. The regression model used for these estimations is analogous to the one shown in Equation (1). The assignment into treatment and control group of the subsidiaries is based on the treatment status of the company group. Controls and fixed effects in these estimations are all at the subsidiary level.

To test for heterogeneity in the treatment effect, I include an additional interaction term and estimate variants of the following model:

$$y_{i,t} = \beta_0 + \beta_1 CbCR_i * post2016_t + \beta_2 post2016_t + \beta_3 Group_i * CbCR_i * post2016_t + \gamma_i + \mu_t + X_{i,t}\delta + \varepsilon_{i,t} \quad (2)$$

The variable $Group_i$ represents different dummy based on company group characteristics that may influence treatment intensity. The triple interaction term between the group-variable, $CbCR_i$, and $post2016_t$ measures the additional treatment effect for the respective group relative to other treated companies. Instead of dummy variables, some tests for heterogeneity include interactions with continuous variables following the same structure. All continuous variables are measured relative to the mean in the sample. Coefficients reported therefore measure the treatment effect at the sample mean of these variables.

Identifying assumption

The main identifying assumption for the difference-in-difference estimator is that treatment and control group would have trended similarly without the introduction of CbCR. While there were no other size-dependent reforms implemented as part of the BEPS-process in the sample period, there might have been other shocks that affected treatment and control group differently. This is why I validate the identifying assumption of parallel pre-trends by estimating the following model and graphically showing the reform effects on the main dependent variables over time:

$$y_{i,t} = \beta_0 + \sum_{T=2010}^{2018} \beta_T (t = T)\, CbCR_i + \gamma_i + \mu_t + X_{i,t}\delta + \varepsilon_{i,t} \quad (3)$$

All variables are defined as in Equation (1). In addition, I run a series of placebo tests using financial companies which are mostly unaffected by the reform, by defining a placebo reform year, and by using a placebo revenue threshold. All these placebo tests yield coefficients for the treatment effects that are not statistically different from zero.

The robustness of results regarding the choices made in selecting the sample is extensively tested as well. These tests include reweighting the control group based on the entropy balancing method as suggested by Hainmueller (2012).

Definition of treatment and control group

The sample is split into treatment and control based on the two criteria that define the CbCR obligation: Consolidated revenues and MNE status (see Section 2). Figure 2 illustrates this assignment.

The revenue threshold can be defined either by legislation in the country of the ultimate parent entity (parent entity filing obligation) or by legislation in the country of one or several of its subsidiaries (local filing obligation). To account for this, I differentiate between the two cases:

1. If a company has a parent entity filing obligation at the start of a given business year, I use the revenue threshold applicable in the country of the UPE to determine the treatment status.
2. If a company has no parent entity filing obligation, but a local filing obligation, the threshold of EUR 750 million is used. This figure is mentioned explicitly in the OECD model legislation (OECD, 2015) and is the threshold applicable in most countries that have introduced local filing.

Table A2 in the Appendix lists the exact revenue thresholds applicable in all countries with CbCR legislation as well as potential local filing obligations. The number of companies for which parent entity and local filing obligations apply is summarized by year in Table A3. To be able to compare companies with different thresholds, I calculate the share of revenue relative to the threshold applicable and use this share as a basis for all further estimations.

According to the second criterion, the CbCR obligation only applies to MNEs, i.e. to companies with at least one foreign subsidiary. Companies in the treatment group also have to satisfy this criterion as shown in Figure 2. Companies with revenues exceeding the threshold applicable, but which do not have a known foreign subsidiary are excluded from the sample.[11]

The control group consists of company groups with revenues below the threshold, but of at least 25% of the threshold in any given year. This minimum turnover ensures that companies in the control group are not too small to be subject to comparable developments as the treatment group. In order to further improve the comparability of companies in treatment and control, I also exclude the largest companies with revenues of more than 25 times the CbCR threshold, which represents approximately the largest percentile of companies in the sample.

[11] The MNE definition in the main estimations is based on the company structure noted in Bureau van Dijk's Orbis data base in February 2020. As Orbis does not cover all subsidiaries of MNEs (Tørsløv, Wier & Zucman, 2018), a company without cross-border subsidiaries listed in Orbis may still have a CbCR obligation. Such cases would lead to errors in the assignment to the treatment and control groups. In robustness checks, I include the company groups without cross-border subsidiaries listed in Orbis into the treatment group and use the firm structure of 2016 from an older vintage of Orbis to determine the MNE status of companies.

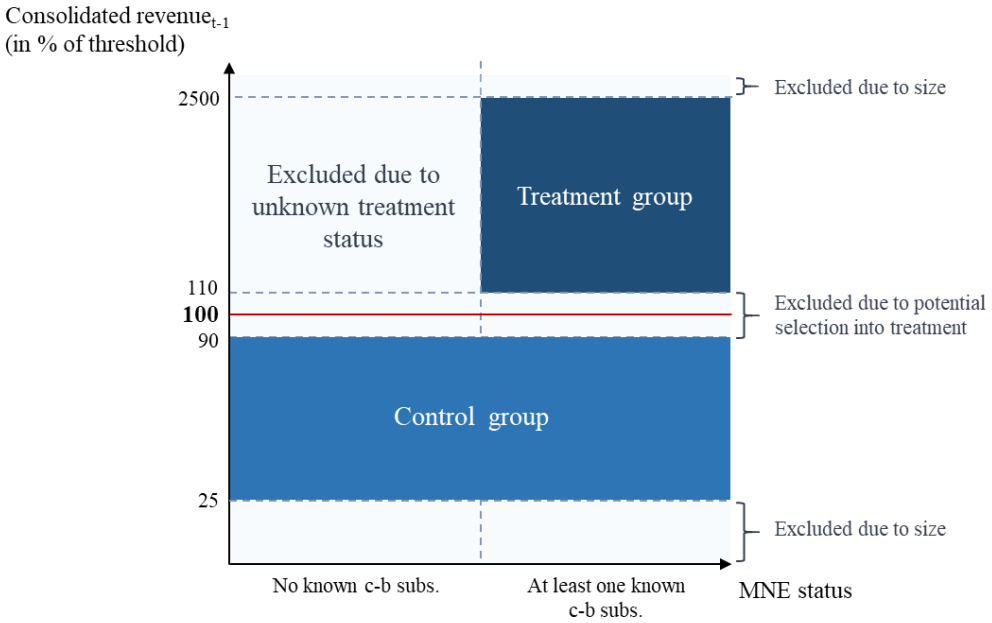

Figure 2: ***Definition of treatment and control group***

Moreover, companies with revenues within 10% of the threshold applicable in one of the treatment years are excluded for two main reasons: First, as I will show in Section 5, there exists selection into treatment of companies close the threshold. Second, the revenue calculation determining the CbCR obligation differs slightly between countries. Thus, book revenues do not perfectly reflect the revenue used to determine the CbCR obligation. Excluding companies close to the threshold reduces the risk of misclassification which would lead to a downward bias in estimations. Similarly, companies with changes in treatment status would attenuate the estimation results. Consequently, companies with changes in their CbCR obligation after 2016 are removed from the sample.

Next to the exclusions relating to the classification into treatment and control group, the sample is further restricted to non-financial companies for two reasons: First, the balance sheet of financial and non-financial companies follows different guidelines. Applying the CbCR threshold to the balance sheet information may lead to a flawed assignment of such companies into treatment or control. Second, many financial companies were already subject to stricter transparency rules due to Basel III effective since 2013 and the subsequent introduction of CbCR in the EU in 2014 (see Section 2). This is why financial companies are used in a placebo test. Lastly, I drop all observations that report negative assets or do not cover a full business year.

Consolidated financial data

The empirical analysis is largely based on firm-level data from Bureau van Dijk's Orbis database which contains detailed financial information. Most of the analysis uses a panel constructed from consolidated information of company groups. The firm-level data is complemented with information on statutory tax rates taken from KPMG's Corporate Tax Tables and EY's Worldwide Corporate Tax Guides. Additional country-level data on GDP per capita and inflation is taken from the World Bank's World Development Indicators database.

The sample period covers the years 2010-2018 and thus includes three post-reform years. The estimation results should give a good indication on short to medium term reactions of companies to CbCR. The number of observations for the treatment and control group are summarized for each year by Table A4 in the Appendix. The year 2015 is excluded to account for potential announcement effects, since the exact threshold was published already in the OECD's 2015 Final Report (OECD, 2015).[12]

The main sample is unbalanced and contains information on 11,083 companies from 98 countries, totaling 61,352 company-year observations (under exclusion of the year 2015). Of these, 3,213 companies are assigned to the treatment group (23,840 company-year observations, representing 39.9% of the sample). The control group consists of 7,870 companies (37,512 company-year observations, 61.1%). About two thirds of the companies in the sample are headed in an OECD country. To assess the robustness of results, I also construct balanced panels for the different estimations containing about 2,600 companies of which 1,550 are treated.

The dependent variables in most estimations are ratios and growth rates as their development is are more comparable between firms of different sizes than changes in levels. Detailed variable definitions and summary statistics for the full sample are provided in Table A5. Variables are generally trimmed at the first and ninety-ninth percentiles to reduce the influence of outliers and errors in the raw data. All growth rates used are further winsorized at the fifth and ninety-fifth percentile, as they have high variation.

Table A6 summarizes a number of key variables separately for treatment and control for the pre-reform period. By construction, the companies in the treatment group are larger on average in terms of revenues and also have higher pre-tax profits and tax payments in absolute terms. The key ratios and growth rates used in the estimations, such as effective tax rates, return on assets, and the growth rates of revenues, profits, and taxes are comparable across the two groups. In addition, the distribution across industries is largely similar between treatment and control (Figure A4).

Unconsolidated financial data

For some estimations, unconsolidated data at the affiliate level is used.[13] The sample of subsidiaries only covers entities located in the OECD. The shareholders of the subsidiaries are not restricted in terms of geography and come from 69 countries around the world. Subsidiaries are split into treatment and control groups, based on the treatment status of their majority shareholder. Subsidiaries are only included if a majority shareholder exists to allow for a clear assignment to treatment or control. Besides the restrictions defined on the company groups, I also exclude subsidiaries with revenues below EUR 1 million.

The remaining sample of subsidiaries contains unconsolidated financial information on 58,314 subsidiaries (293,879 entity-year observations). Of these, roughly 30% are assigned to the

[12] In previous publications, the OECD described the planned introduction of stricter reporting rules for transfer pricing (OECD, 2013) and CbCR (OECD, 2014), but made no reference to a revenue threshold.

[13] The incomplete coverage of subsidiaries in Orbis is no major issue for these estimations, as subsidiary information is not aggregated in any way.

control group (17,282 subsidiaries, 74,242 entity-year observations). 41,032 subsidiaries make up the control group (219,637 entity-year observations). In comparison to the company group sample, a larger proportion of subsidiaries is in the treatment group. This is due to the fact that company groups in the treatment group are larger than those in the control group and tend to have a larger number of subsidiaries listed in Orbis. Table A7 provides summary statistics on the full subsidiary sample, Table A8 shows separate statistics for the treatment and control group. Subsidiaries in the treatment group are on average about 2.5 times larger in terms of revenues than subsidiaries in the control group. To account for this, estimations on the subsidiary level also rely on ratios and growth rates accounting for subsidiary size as dependent variables.

4.2 Results – Effects of CbCR

This section presents estimation results on the effects of CbCR based on difference-in-difference estimations. Subsection 4.2.1 presents the results on the intended effect of a reduction in tax avoidance, including tests for heterogeneity in the treatment effect. The following subsection investigates changes in tax payments and the capital structure triggered by CbCR. The robustness of results and the identifying assumption are tested in Subsection 4.2.3.

4.2.1 Effects on tax avoidance

Company groups

The intended effect of CbCR was to reduce profit shifting opportunities of large MNEs. To assess whether CbCR achieved this goal as proposed by *Hypothesis 1*, consolidated effective tax rates are used as primary dependent variable. Effective tax rates measure taxes paid over pre-tax profits and are frequently used as an ex-post measure of tax avoidance (see e.g. Hanlon & Slemrod, 2009; Dyreng, Hanlon & Maydew, 2010; Overesch & Wolff, 2019). One advantage of using effective tax rates at the consolidated level is that they reflect all types of profit shifting, including the strategic avoidance of permanent establishments in high tax countries, which would not show in unconsolidated subsidiary level data (Beer, de Mooij & Liu, 2019). If companies reduce their tax aggressiveness due to CbCR, treated companies should experience an increase in effective tax rates relative to the control group in the post-reform period.

Figure A5 in the Appendix shows the coefficients β_T for effective tax rates according to Equation (3) over the years 2010-2018 with and without additional controls. Outcomes are normalized to zero in the year 2012 which is in the middle of the pre-reform period. I consider the parallel trend assumption between the treatment and control group to be satisfied, as none of the coefficients are statistically different from zero before 2015. The fact that the coefficient becomes larger (but remains insignificant) in 2015 points towards an announcement effect. This is why the year 2015 is excluded in the baseline regressions.

The results of the difference-in-difference estimations on effective tax rates (ETRs) are shown in Columns (1) and (2) of Table 1. The estimations test the impact of CbCR on effective tax rates following the regression model of Equation (1). The first specification does not contain

additional country-level controls, Specification (2) includes these.[14] The coefficient on the interaction term measures the relative change in effective tax rates of the treatment group relative to the control group. It is positive and statistically significant at the 1%-level in both estimations. According to my preferred specification with additional controls, the effective tax rates of companies with a CbCR obligation increased by 0.975 percentage points relative to the control group. Based on a pre-reform mean of 28.6%, CbCR therefore increases the effective tax rate by about 3.4%.

Table 1: ***Effects of CbCR on tax avoidance***

	(1) ETR Tax / Pre-tax profit	(2) ETR Tax / Pre-tax profit	(3) Tax rate differential	(4) Tax rate differential	(5) ETR Tax / Pre-tax profit	(5) Tax rate differential
post2016	4.597	3.638	-5.128*	-4.568		
	(2.966)	(2.986)	(2.938)	(2.966)		
CbCR x post2016	0.914***	0.975***	-0.997***	-1.010***		
	(0.353)	(0.369)	(0.340)	(0.357)		
CbCR x 2016					0.667	-0.563
					(0.422)	(0.411)
CbCR x 2017					0.648	-0.227
					(0.490)	(0.468)
CbCR x 2018					1.693***	-2.367***
					(0.490)	(0.470)
Basic controls	No	Yes	No	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	53,028	49,854	52,861	49,689	49,854	49,689

Notes: This table summarizes the effects of CbCR on consolidated effective tax rates and the tax rate differential as proxies for corporate profit shifting at the company group level. The estimations are based on difference-in-difference estimations following Equation (1). All variables are defined according to Table A5 in the Appendix. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the country of the ultimate parent entity. Estimations on effective tax rates all include the statutory tax rates as control variable. Standard errors (in parentheses) are clustered at the company level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

As an alternative proxy for profit shifting at the consolidated level, I use the differential between the statutory CIT rate in the country of a company's ultimate parent entity and the effective tax rate of the MNE. Here, a reduction in profit shifting would lead to reduced tax rate differentials in the treatment group. Again, the parallel trend assumption is satisfied as shown on Figure A6. The regression results are summarized in Columns (3) and (4) of *Table 1*. The treatment effect in these estimations is statistically significant and negative, indicating reduced profit shifting by companies in scope of CbCR.

Specifications (5) and (6) of Table 1 investigate the timing of the response in more detail by including an individual interaction term for each of the treatment years (2016-2018). As

[14] The statutory tax rate in the country of the ultimate parent entity is included in both specifications as there have been changes in tax rates in several of these countries which have an effect on effective tax rates. The coefficient on the statutory tax rate is positive and statistically significant.

indicated by Figures A5 and A6, the effect of CbCR on the proxies for tax avoidance materializes only sometime after its introduction. For both effective tax rates and the tax rate differential, coefficients on the interaction do not change sign over the three treatment years, but are only statistically significant in the year 2018. In this last year of the sample period, the treatment effect on effective tax rates is almost twice as large as the average effect over the full treatment period reported in Column (2). The responses to CbCR thus get stronger over time.

Subsidiaries

As extreme effective tax rates may also result from a number of factors besides profit shifting (Blouin, 2014; Schwab, Stomberg & Xia, 2020), I conduct additional tests of *Hypothesis 1*, exploiting the fact that Orbis also contains unconsolidated financial data of subsidiaries. At the affiliate level, reduced profit shifting from high to low tax jurisdictions should lead to an increase in profits remaining in the high tax subsidiaries.

To test this, I first investigate whether the tax sensitivity of subsidiary profitability changes in response to CbCR. The estimation strategy is similar to the approach taken, for example, by Riedel, Zinn & Hofmann (2015) who investigate the impact of transfer pricing legislation on profit shifting. To account for differences in subsidiary size, I rely on the return on assets as dependent variable instead of a measure of the level of profits.[15] The result of this estimation is shown in Column (1) of Table 2. Before CbCR, a one percentage point higher statutory CIT rate in the subsidiary jurisdiction was associated with a 0.104 percentage point lower return on assets. The effect of CbCR on this tax sensitivity is measured by a triple interaction term between the statutory CIT rate in a subsidiary country and the dummies for the treatment group and the post-reform period $CbCR$, and $post2016$. The coefficient on this term is 0.0425 and statistically significant. According to this estimation, CbCR reduces the tax sensitivity of subsidiary return on assets by more than 40%. Figure A7 shows that the parallel trend assumption also holds for the subsidiary sample. The dependent variable in Column (2) is the logarithm of the return on assets allowing to calculate a semi-elasticity. According to this specification, the semi-elasticity of subsidiary profitability was reduced by about a quarter.

For the specifications reported in Columns (3) and (4) of Table 2, I split the sample of subsidiaries into high and low tax subsidiaries based on the statutory tax rate of their location country.[16] For the two sub-samples, I assess whether the share of subsidiary pre-tax profits in consolidated group profits changes due to CbCR. For the group of high tax subsidiaries, the treatment effect is positive and significant at the 1%-level, while the corresponding coefficient is insignificant for low tax subsidiaries. When interpreting the results based on this sample split, it is important to keep in mind that the low tax jurisdictions in the sample still have a mean statutory corporate tax rate of around 20%. Zero-tax jurisdictions are not part of the sample as subsidiaries in many of these jurisdictions are not covered well in Orbis. The mean tax rate in the high tax sample is 32.2%.

[15] Many empirical papers on profit shifting use the tax rate differential between the statutory CIT rate of a subsidiary location and the average CIT rate among all other entities of the same group as explanatory variable (see Beer, de Mooij & Liu, 2019 for a summary). Since Orbis does not cover all subsidiaries, it is not possible to plausibly calculate an average CIT rate with sufficient certainty based on my sample. I therefore use the statutory tax rate in the subsidiary country as main explanatory variable.

[16] I use the median statutory tax rate in 2016 for the sample split such that individual subsidiaries do not change in their classification in the sample period.

For illustration, I run the same regression for subsidiaries located in Germany, as an example of a high tax country, and for subsidiaries located Ireland, as an example of a low tax country within the OECD. While CbCR has a positive effect on the share of profits in reported by German subsidiaries, the effect in Ireland is negative, but insignificant (Columns (1) and (2) of Table A9 in the Appendix). These findings confirm the results of the previous sample split.

Table 2: ***Effects of CbCR on tax avoidance (subsidiaries)***

	(1) RoA	(2) Ln(RoA)	(3) Share pre-tax profit High tax	(4) Share pre-tax profit Low tax	(5) ETR
post2016	0.260	-0.0542	-2.979**	4.915***	-2.447
	(1.678)	(0.210)	(1.482)	(1.784)	(1.970)
CbCR x post2016	-1.162***	-0.0838***	0.738***	0.205	0.327
	(0.279)	(0.0283)	(0.236)	(0.235)	(0.223)
CIT x CbCR x post2016	0.0425***	0.00291***			
	(0.00942)	(0.000978)			
Stat. CIT rate	-0.104***	-0.0128***	-0.0249	0.00973	0.732***
	(0.0114)	(0.00126)	(0.0161)	(0.0226)	(0.0244)
Basic controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes
Observations	225,862	225,862	93,428	111,669	209,429

Notes: This table summarizes the effects of CbCR on unconsolidated subsidiary profitability, the distribution of profits across high and low tax countries, and subsidiary effective tax rates. The estimations are based on difference-in-difference estimations following Equation (1). All variables are defined according to Table A7 in the Appendix. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the subsidiary country. Standard errors (in parentheses) are clustered at the subsidiary level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

The estimation sample for Table 2 contains both domestic and cross-border subsidiaries. If only cross-border subsidiaries are considered, the treatment effect the positive effect of CbCR on the profit share in high tax subsidiaries becomes insignificant (Column (3) of Table A9). The treatment effect seems to be driven by a reduction of profit shifting out of domestic entities. However, this does not reduce profits allocated in low tax OECD subsidiaries.

Lastly, as Column (5) of Table 2 shows, effective tax rates of individual subsidiaries on average do not change in response to CbCR.[17] This result is still consistent with lower profit shifting from high to low tax jurisdictions, as profit shifting only changes the allocation of the tax base between subsidiaries, but does not reduce effective tax rates in a given country. In contrast, an increase in ETRs within subsidiaries would have pointed towards reductions in underreported profits.

In sum, the results based on both consolidated and unconsolidated financial data support *Hypothesis 1*. CbCR seems to reduce the profit shifting of companies in scope relative to the control group.

[17] The result is similar for the sub-samples of high and low tax subsidiaries.

Heterogeneity of effects on tax avoidance

Following the model of Allingham & Sandmo (1972), the effect of CbCR on corporate profit shifting is mainly driven by an increase in detection probability. The effect of CbCR should consequently be stronger for companies that experience a more pronounced increase in detection probability. Potential heterogeneity in the treatment effect is investigated by adding additional interaction terms to the baseline model according to Equation (2).

While the change in detection probability is not directly observable, it presumably depends on how much new information is provided to tax authorities. If tax authorities already had similar information before CbCR, the impact of the new reporting regime is likely to be limited. If, in contrast, CbC information is mostly new to tax authorities, the increase in the detection probability should be more pronounced. To proxy for the novelty of the CbC information, I use the listing status, US headquarters, and the type of the CbCR obligation.

Publicly listed companies generally have higher reporting obligations compared to private companies (Hasegawa et al., 2013; Hoopes, Robinson & Slemrod, 2018). Additional disclosure obligations such as CbCR may therefore provide more new information for private companies.

Companies headquartered in the United States are dealing with a tax authority that has relatively high capacity and strong enforcement levels. Also due to the worldwide tax system, the disclosure requirements in the US are particularly high. US MNEs had to report information on all subsidiaries to the IRS and the Bureau of Economic Analysis before BEPS CbCR. The availability of comparably good data on US MNEs in reflected in the focus of much of the literature on tax avoidance and disclosure requirements on these companies (Leuz & Wysocki, 2016; Tørsløv, Wier & Zucman, 2018). Therefore, change in detection probability may be lower for US companies. In contrast, tax authorities that knew little about domestic MNEs may gain a lot of new insights from the CbC data made available to them.

If a company has a local filing obligation but no parent entity filing obligation, the CbC information is only provided to a subset of countries a company is active in, as the reports are not exchanged between countries (OECD, 2019b). In addition, local filing is mainly required by high-capacity tax administrations. For these reasons, local filing is likely to provide less new information and to a lower number of tax authorities.

The estimation results on effective tax rates are and visualized by Figure 3. Table A10 in the Appendix provides the corresponding numerical results. Panel A of Figure 3 shows the coefficients on the triple interaction term between $CbCR$, $post2016$, and dummies for the proxies for information novelty discussed above. For companies that only have a local filing obligation and companies headed in the US the coefficient on the triple interaction term is negative and statistically significant, signaling a lower treatment effect for these groups. The estimated increase in effective tax rates for companies with parent entity filing obligation is 1.8 percentage points. If a company only has a local filing obligation, the total treatment effect is only 0.2 percentage points. Companies headquartered in outside the United States increase their effective tax rates by 1.3 percentage points in response to CbCR. For US companies, the treatment effect is close to zero. The coefficient on the interaction term for private companies is positive, consistent with a larger increase in the detection probability for these firms compared to publicly listed companies. However, the coefficient is not statistically different from zero.

The coefficients for other main dependent variables confirm the results of a weaker treatment effect for US companies and companies only subject to a local filing obligation. These results are consistent with the idea that CbCR has a stronger impact if the information provided is more novel.

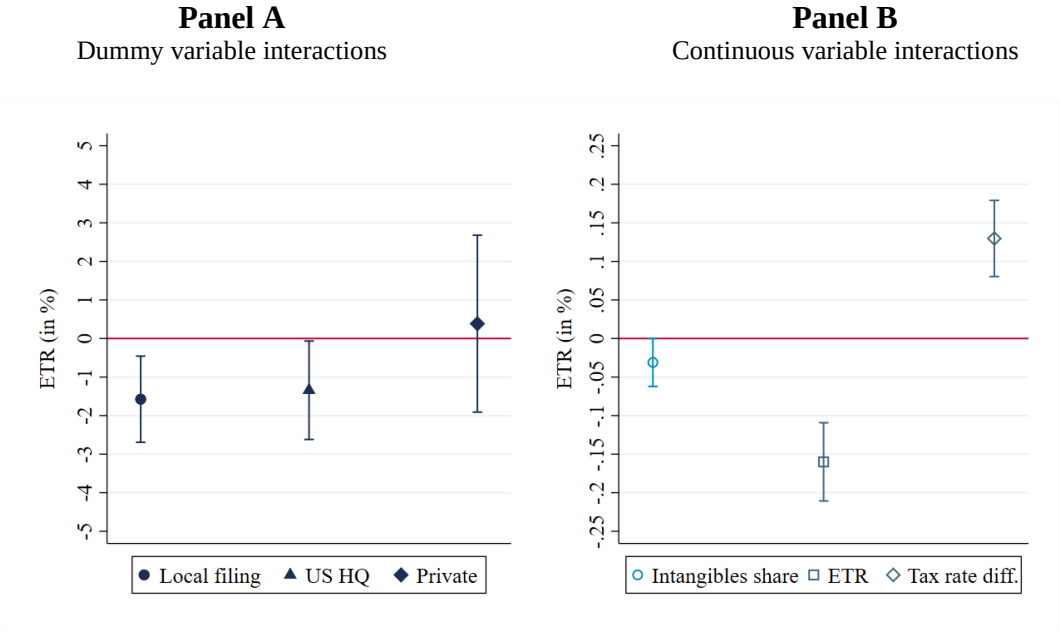

Figure 3: ***Heterogeneity of effects on effective tax rates***

Notes: This figure plots the difference-in-difference coefficients for different triple interaction terms following the estimation structure of Equation (2). Interactions for the estimations presented in Panel A are based on dummy variables, the estimations of Panel B are based on interactions with continuous variables. The dependent variable is the effective tax rate defined as taxes / pre-tax profits. All variables are defined according to Table A5 in the Appendix. The vertical lines indicate the 95% confidence intervals for the coefficient estimates with standard errors (in parentheses) clustered at the subsidiary level. The exact estimation results are shown in Table A10 in the Appendix.

Another potential factor impacting treatment intensity is the relative importance of intellectual property for companies. As intangible assets are not reported in CbC reports, the CbC information could be less useful in detecting profit shifting of companies relying heavily on intangibles. To proxy the importance of intangibles for a given company, I calculate the share of intangible assets in total assets. Panel B of Figure 3 shows the coefficient on the interaction term between the dummy for the treatment group $CbCR$, the dummy for the post-reform period $post2016$, and continuous variables including the share if intangibles. The coefficient on the corresponding interaction term is negative with a p-value of 0.051. This provides limited support for a reduced treatment effect if a company relies strongly on intangible assets.

As Overesch & Wolff (2019) report, the reduction in profit shifting of EU banks due to CRD IV is largely driven by companies with subsidiaries in European tax havens. A second factor that might influence the change in the detection probability therefore is the tax aggressiveness of companies before CbCR. The CbC information can induce tax authorities to direct their resources at firms with more aggressive tax planning strategies, as these are now easier to identify. CbCR may also provide additional evidence on tax planning strategies that authorities were aware of, but lacked the data necessary to pursue. Besides, the public debate mostly revolves around highly profitable firms with comparable low tax payments, potentially reinforcing the authorities focus on such companies when more data on their shifting practices

becomes available. These channels should lead to a stronger increase in the detection probability for companies with more aggressive tax avoidance strategies.

To proxy pre-CbCR tax aggressiveness I again resort to effective tax rates and the tax rate differential.[18] If available, I use the levels of the two variables in 2014, as CbCR should not have influenced these two years before its introduction. As shown in Panel B of Figure 3, the coefficient on the triple interaction term with the pre-CbCR effective tax rate is negative. The corresponding coefficient for the tax rate differential is positive. Both are statistically significant at the 1%-level. Hence, companies higher ETRs and a lower tax rate differential increased their effective tax rate less in response to CbCR. These results indicate that MNEs with more aggressive tax planning before CbCR more strongly reduced their profit shifting.

The results on listing status, US headquarters and tax aggressiveness provide clear support for the hypothesis that the treatment intensity depends on the change in the detection probability due to CbCR. The coefficients on the interaction terms with the share of intangible assets and listing status both have the expected signs but are not statistically significant.

4.2.2 Additional effects of CbCR

Tax payments

As reported above, CbCR increases the effective tax rate of affected companies by about one percentage point. A one percentage point increase in ETRs at given statutory rates should translate into increased tax payments if companies do not adjust their behavior in additional, unintended ways. Based on a pre-CbCR average ETR for the treatment group of 28.6%, a one percentage point increase in the ETR should increase tax payment by about 3.4%. The OECD claimed that CbCR applies to firms that account for about 90% of corporate tax revenues. Over the years 2010-2015, the 35 OECD averaged about EUR 26.1 billion in corporate tax revenues per country per year.[19] If, as estimated by the OECD, companies with CbCR obligation are responsible for about 90% of these corporate tax revenues (OECD final report 2015), an increase in the effective tax rates of these companies by 3.4% would – in the absence of any other changes – translate into extra revenues of about EUR 800 million per country per year, or a total of EUR 28 billion for all OECD countries. In relative terms, increasing tax payments would be even more beneficial to developing countries, as corporate taxes make up a larger share of their total tax revenue (Crivelli, de Mooij & Keen, 2016).

In the following, I provide evidence on the actual effect of CbCR on consolidated tax payments of companies affected. To allow for a sensible comparison between the treatment and control group, I calculate the share of tax payments in total assets and the growth rate of tax payments. Column (1) of Table 3 shows the results of the corresponding difference-in-difference estimation. The treatment effect of CbCR on the share of tax payments in total assets is insignificant and even has a negative sign. The coefficient plot for the individual years provided in Panel A of Figure A8 also suggests no treatment effect. The effect of CbCR on the growth

[18] Since data on tax haven subsidiaries in Orbis is only fragmentary, I deviate from the approach of Overesch & Wolff (2019) who have public CbC data at their disposal and focus on European tax havens.

[19] This figure is based on number from the OECD Global Revenue Statistics Database and an average exchange rate between USD and EUR for the period of 2010-2015.

rate of tax payments is negative and significant (Column (2) of Table 3). However, this effect is mainly driven by the year 2016 and fades over time (Panel B of Figure A8).[20] According to these results, there is no increase in tax payments of companies in scope of CbCR relative to the control group.

Table 3: ***Effects of CbCR on tax payments and related variables***

	(1) Tax / assets	(2) Gr. rate tax payments	(3) RoA	(4) Gr. rate revenues	(5) Gr. rate pre-tax profits	(6) Investment /Assets
CbCR x post2016	-0.00259	-5.843***	0.148	-2.343***	-4.996***	-0.323***
	(0.0277)	(1.396)	(0.104)	(0.294)	(1.343)	(0.124)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56,154	45,014	50,021	49,848	44,003	27,882

Notes: The estimations reported in this table are based on difference-in-difference estimations following Equation (1). All variables are defined according to Table A5 in the Appendix. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the country of the ultimate parent entity. Standard errors (in parentheses) are clustered at the company level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

Reconciling the effects on tax avoidance and tax payments

At first sight, the results of a reduction in profit shifting reflected in increasing effective tax rates at the one hand, and constant or even declining tax revenues seem incompatible. While a full explanation of the mechanism at play goes beyond the scope of this paper, I investigate some potential channels.

In any case, constant tax payments at higher effective tax rates clearly suggest a decline in the tax base. Such a decline could be brought about by a reduction in profitability. However, the return on assets of treated companies did not decline relative to the control group as shown in Column (3) of Table 3. The coefficient on the treatment effect is positive, but insignificant.

A second potential explanation is a reduction in economic activity. And indeed, the growth rate of revenues as one indicator of economic activity is reduced in the treatment group after the introduction of CbCR (Column (4) of Table 3). Panel C of Figure A8 shows that the identifying assumption of parallel trends is satisfied for these estimations as well. The reduction in revenue growth also translates into lower growth pre-tax profits – a direct measure of the tax base (Column (5) of Table 3 and Panel D of Figure A8). In line with a relative reduction in total activity, treated companies also reduced their investment relative to assets after the introduction of CbCR. The (relative) reduction in economic activity causing a decline in the tax base (c.p.) seems to be one channel counteracting the rise in effective tax rates.

[20] In an unreported exercise, I use the natural logarithm of the growth rate as dependent variable as dependent variable. This yields very similar results.

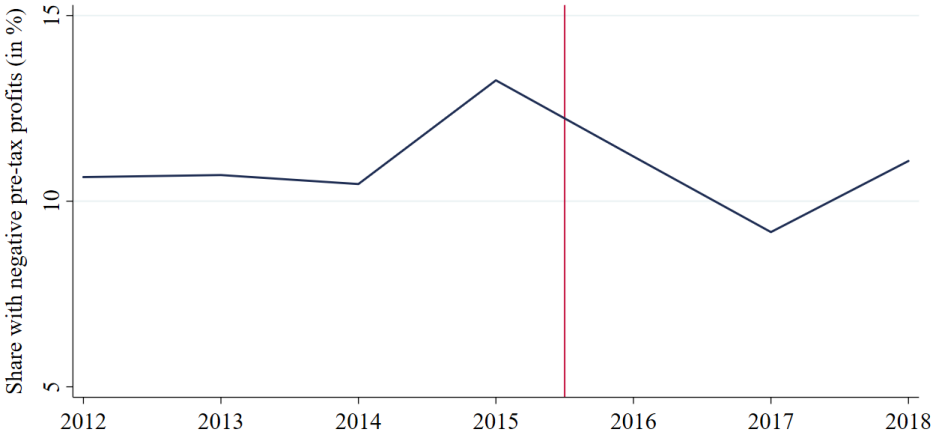

Figure 4: ***Share of treated companies with negative pre-tax profits***

Notes: This figure plots the share of companies in the treatment group with negative consolidated pre-tax profits over the years 2012-2018. The vertical line indicates the introduction of CbCR.

The extensive use of loss carryforwards by companies with CbCR obligation might reduce tax payments in the post-reform period. If companies anticipated the increase in effective tax rates due to CbCR or the BEPS project in general, they could have accumulated losses to be deducted from their tax base in later years. Figure 4 shows the share of companies in the treatment group with negative pre-tax profits from 2012 to 2018, as these years are less impacted by the financial crisis than the first sample years. The share of loss-making companies was almost unchanged between 2012 and 2014 at around 10.5%. The share jumped to 13.3% in 2015. This constitutes an increase by more than a quarter – just before the introduction of CbCR. After the introduction of CbCR in 2016, the share of loss making MNEs in the treatment group declined again. In addition, the coefficient plot for the growth rate of profits in Panel D of Figure A8 shows negative, but statistically insignificant coefficients in the years 2014 and 2015. While these results are not conclusive evidence, some companies might have prepared for higher tax payments after introduction of CbCR by accumulating losses in the periods before.

Capital structure

As documented by the estimations on economic activity, companies react in various ways to the introduction of CbCR. Changes in effective tax rates can trigger adjustments in the capital structure of companies. According to the trade-off theory on corporate capital structure, firms weigh the tax benefits versus the bankruptcy costs of debt.[21] As interest payments are tax deductible, debt financing becomes relatively more attractive at higher tax rates. While much of the existing empirical literature tests this prediction based on changes in statutory tax rates (see e.g. Rajan & Zingales, 1995; Desai, Foley & Hines, 2004; Heider & Ljungqvist, 2015; Faccio & Xu, 2015; Devereux, Maffini & Xing, 2018), CbCR impacts effective tax rates as shown in the previous section.

The estimations summarized in Table 4 investigate changes in the capital structure of MNEs due to CbCR. As shown in Column (1), the share of interest payments in EBIT of treated firms increases by 3.7 percentage points, relative to untreated companies. Before CbCR, the share of

[21] Fama & French (2002), for example, give a comprehensive summary of this theory.

interest in EBIT in the treatment group was at about 22.8% on average. The increase in tax-deductible interest payments does not influence the measures on effective tax rates used in the previous sections, as pre-tax profits used are measured after the deduction of interest payments.

The increase in interest payments is due to an increase in leverage mirrored by a decrease in the equity ratio of similar size (Columns (2) and (5) of Table 4). As shown in Columns (3) and (4), about one third of the increase in leverage is financed by short term debt (due within one year), while about two thirds are financed by longer term debt. In line with the results reported on total activity, the reduction in equity outweighs the increase in debt financing such that total assets are reduced.

Table 4: ***Effects of CbCR on the capital structure***

	(1) Interest / EBIT	(2) Leverage	(3) Leverage (short term)	(4) Leverage (long term)	(5) Equity ratio
CbCR x post2016	3.747***	2.370***	0.739***	1.577***	-2.241***
	(1.044)	(0.258)	(0.164)	(0.253)	(0.270)
Basic controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes
Observations	52,635	56,180	33,008	33,061	56,455

Notes: The estimations reported in this table are based on difference-in-difference estimations following Equation (1). All variables are defined according to Table A5 in the Appendix. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the country of the ultimate parent entity. Standard errors (in parentheses) are clustered at the company level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

4.2.3 Robustness & Placebo tests

Robustness checks

The main results reported are robust to a large number of checks. First of all, all results also hold for balanced samples. The treatment effect of CbCR on effective tax rates, for example, is 0.974 and hence almost identical to the result for the main sample (Column (1) of Table A11). Similarly, balanced-sample estimations for all other main dependent variables yield coefficients that are highly similar to the baseline results. Table A11 summarizes the corresponding results on tax avoidance and tax payments at the consolidated level.

Table A12 shows the treatment effects on the tests on tax avoidance for a balanced sample of subsidiaries. The effects on capital structure for a balanced sample of company groups are reported in Table A13.

As a further robustness check, I reweigh the observations to account for differences in terms of industry or headquarter country distribution. Weights are calculated by employing the entropy balancing method as suggested by Hainmueller (2012) and using the implementation described by Hainmueller & Xu (2013). This approach reweights the observations in the control group such that the weighted sample exactly matches the treatment group. In a second test, weights are also based on return on assets and leverage in the pre-reform year of 2013.

The coefficients for the treatment effect on effective tax rates of this and all other robustness checks is visualized in Figure 5. The dashed line indicates the coefficient size in the baseline estimations. The weighted estimations yield results that are very similar to those presented in Section 4.2.1. The baseline estimation lies well in the confidence intervals of the coefficients of these robustness checks as shown in Figure 5. The corresponding estimation results are shown in Table A14.

To assess whether results are driven by the exclusion of the pre-reform year, I run all estimations including the year 2015. Again, the results are robust. Since my main dataset only contains information on the company structure in 2020, I use an older vintage of Orbis to gain information on the company structure in 2016. All results are also robust to using this information to determine the treatment status of companies.

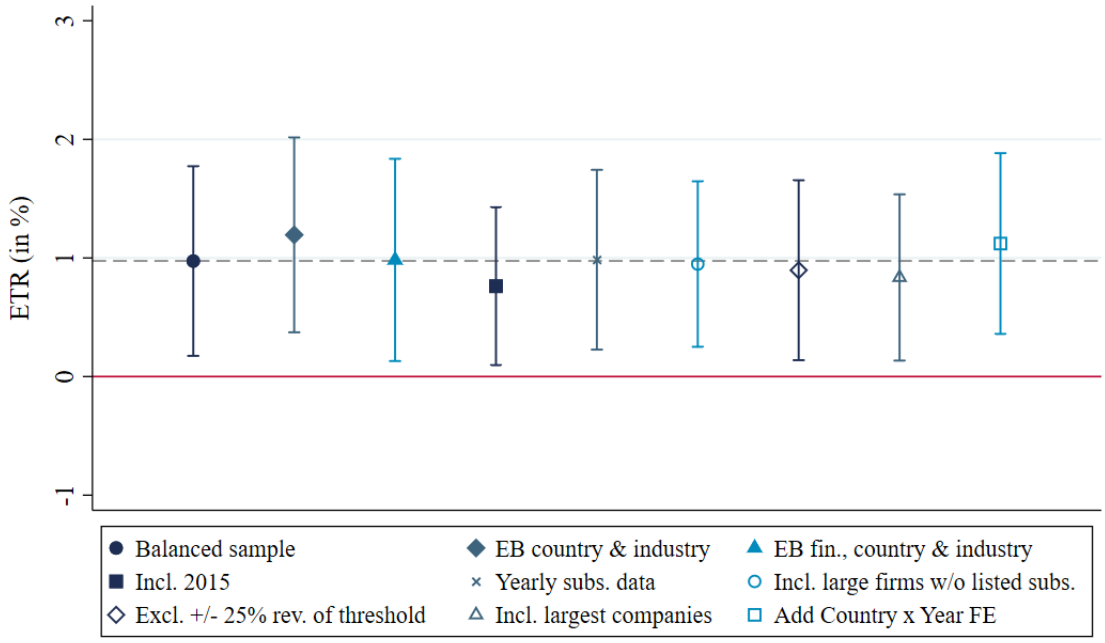

Figure 5: ***Robustness checks***

Notes: This figure plots the difference-in-difference coefficients of the treatment effect for different samples following the estimation structure of Equation (1). The dependent variable is the consolidated effective tax rate defined as taxes / pre-tax profits. The vertical lines indicate the 95% confidence intervals for the coefficient estimates with standard errors (in parentheses) clustered at the subsidiary level. The exact estimation results are shown in Table A10 in the Appendix. The dashed horizontal line represents the coefficient of the treatment effect from the baseline estimation at 0.975.

In the main estimations, I exclude companies with revenues larger than the threshold applicable, but without any cross-border subsidiaries listed in Orbis. If these companies are included in the treatment group, as they might have subsidiaries not listed in Orbis, results are largely unchanged. The same holds if the largest companies (those with revenues above 25-times the threshold) are included. To make sure that selection into treatment is not an issue, I run all estimations under exclusion of company groups with revenues around 25% of the threshold applicable. This does not substantially change any of the results. In addition, all results are robust to the inclusion of country by year fixed effects.

Lastly, all results based on unconsolidated financial information of subsidiaries are also robust to the inclusion of parent entities.

Placebo tests

The identifying assumption would be violated if other regulatory changes besides CbCR affected the treatment results. To test the validity of the research design, I conduct a number of placebo tests. The results of these placebo tests regarding the consolidated effective tax rate are summarized in Table A15 and visualized in Figure 6.

First, I test the effect of CbCR on financial companies. As these companies are subject to stricter reporting regimes in general, and even public CbCR in the EU they should not be affected much by the introduction of (non-public) OECD CbCR. For both the group of all financial companies as well as for EU financial companies, no coefficient on the main outcomes is statistically different from zero.

Second, I use a placebo threshold of 200% of the actual threshold applicable to define the treatment and control groups. Again, all coefficients on the treatment effect for the main outcomes are not statistically different from zero.

Third, I define the year 2013 as a placebo treatment year. The null hypothesis that the effects on the main outcome are statistically significant from zero cannot be rejected in this test as well.

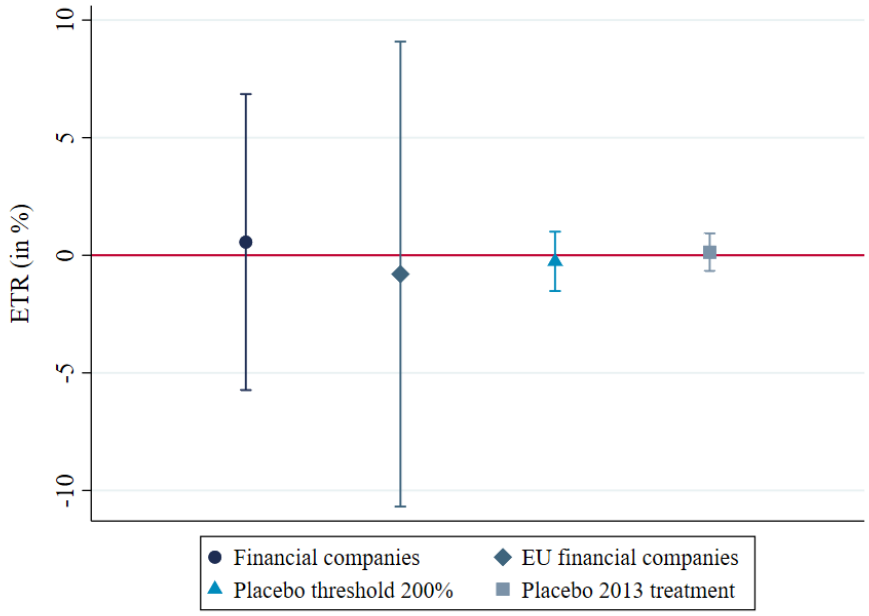

Figure 6: ***Placebo tests***

Notes: This figure plots the difference-in-difference coefficients of the treatment effect for different samples following the estimation structure of Equation (1). The dependent variable is the consolidated effective tax rate defined as taxes / pre-tax profits. The vertical lines indicate the 95% confidence intervals for the coefficient estimates with standard errors (in parentheses) clustered at the subsidiary level. The exact estimation results are shown in Table A15 in the Appendix.

5. Avoidance of the CbCR obligation

As proposed by Hoopes, Robinson & Slemrod (2018), firms are mostly free to publish information or share data with public authorities beyond legal requirements. The fact that companies generally did not disclose the information contained in CbC reports before the BEPS program indicates that the publication is perceived as costly. This cost can be due to a number of reasons, including the limitation in the ability to shift profits or the direct cost of preparing the reports (see Section 3). If CbCR is costly, firms have an incentive to avoid the disclosure obligation as proposed by *Hypothesis 2*. This section tests *Hypothesis 2* by investigating potential bunching behavior of companies below the revenue threshold. To the best of my knowledge, this is the first analysis on avoidance of the CbCR obligation.

The following section sets out the empirical approach and data used. Section 5.2 first presents the results based on the full sample, before showing results for a number of sample splits.

5.1 Empirical approach & sample selection

Basic approaches

The costs of CbCR create an incentive for firms to avoid the obligation to file a CbC report. As many of the costs of filing a report have a fixed-cost character for a given company, the filing obligation leads to discontinuous drop or "notch" in the profit function. Such a notch in profitability at the reporting threshold constitutes a potential bunching point as described in Kleven & Waseem (2013). I conduct four tests to test *Hypothesis 2* and to determine potential bunching behavior of companies due to CbCR.

First, I compare the pre-CbCR revenue distribution of company groups around the threshold with the post-CbCR distribution as proposed by Best et al. (2015) and Hoopes, Robinson & Slemrod (2018). The comparison of the two distributions allows to calculate a measure for the total excess mass b to the left of the threshold. This calculation uses an adjusted version of formula proposed by Chetty et al. (2011):

$$b = \frac{\sum_{j=-R}^{T} C_j^{CbCR} - C_j^{preCbCR}}{\sum_{j=-R}^{T} C_j^{preCbCR}} \qquad (4)$$

C_j^{CbCR} is the average number of companies in revenue bin j after the introduction of CbCR, $C_j^{preCbCR}$ is the average number of companies in the same bin over the years 2010-2014.

As a second test for bunching behavior, I compare the post-CbCR distribution with a fitted polynomial, estimated under exclusion of the observations around the notch point. This more closely follows the approach of Chetty et al. (2011) and Kleven & Waseem (2013).[22]

[22] Chetty et al. (2011) and Kleven & Waseem (2013) use their bunching estimations to calculate elasticities with respect to kinks and notches in tax schedules. The calculation of an elasticity is not possible in the setting considered in this paper as the total costs of CbCR to companies are not observable.

Third, I conduct a formal test of selection into treatment as suggested by McCrary (2008). The test assesses whether there is a discontinuity in density at the cutoff. My implementation of this test is based on the work of Cattaneo, Jansson & Ma (2018) and Cattaneo, Jansson & Ma (2019).

Excess mass below the threshold as well as the presence of a discontinuity in the density could be interpreted as evidence for avoidance of the CbCR obligation.

Lastly, I examine whether the composition of companies with revenues just below the threshold applicable based on their previous year's revenues changes after the introduction of CbCR. If the share of companies with revenues above the threshold in the preceding year increases, this would provide further evidence for avoidance of CbCR.

As shown in Section 4.2.1, there exists heterogeneity in treatment effect of CbCR on corporate tax avoidance. I test for similar heterogeneity in the extent of bunching by conducting several sample splits and comparing the changes in mass below the threshold from the pre-reform period to the years after the introduction of CbCR.

Data and sample selection

The estimations are based on consolidated financial information of company groups for the pre-reform years 2010-2014 and the treatment years of 2016-2018. The year 2015 is excluded. In order to compare the share of companies below the threshold over time, a balanced sample of non-financial companies is constructed based on the dataset described in Section 4.1, The balanced sample contains 8,542 observations per year, totaling 76,878 company-year observations. Revenue is measured as percentage share relative to the CbCR threshold applicable to a given company. The revenue threshold used follows the same definition as presented in Section 4.1 and is summarized in Table A3 for the balanced sample. For years before 2016, the revenue threshold applicable in the first treatment year is used. The median share of revenues relative to the threshold applicable in the sample is 75.6%.

The sample includes companies without cross-border subsidiaries listed in Orbis. If these companies really have no cross-border affiliates, they would not have a CbCR obligation regardless of their revenue level. Hence, they would have no incentive to adjust their revenues to stay below the threshold. The inclusion of these companies may lead to a downward bias in estimations. I still include them, as this increases the sample size in the region around the threshold by about a third and most of these companies are likely to have at least one foreign subsidiary based on their size.

There is a number of ways for companies to adjust their revenues (see Section 3). Nevertheless, most companies cannot control their revenues perfectly, and downsizing is usually connected to costs. Companies for which the costs of adjusting revenues to stay below the threshold outweigh the benefit of not having to prepare a CbC report will not bunch. Such optimization frictions attenuate bunching (Kleven, 2016).

There are additional factors that might attenuate the extend of bunching I can observe in the data. Firm splits would only be observable in the data if one part of the company continues to exist under the old name and Orbis ID. Divisions that create only new companies or companies

with revenues much lower than the threshold would lead to underestimation of the true extent of bunching.[23] Moreover, companies can use the leeway in CbCR legislation regarding the definition of revenues to avoid a filing obligation. Companies exploiting discrepancies in revenue definitions between the balance sheet data reported in Orbis and the CbCR legislation also lead to an underestimation of bunching. Besides manipulating financing variables to avoid the CbCR obligation, some companies could simply fail to comply with an existing reporting obligation.[24] Such behavior would not be visible in the data. As most tax authorities know their large companies and would be able to penalize them for such misbehavior, this is unlikely to be a large issue. For these reasons, the results on avoidance of the CbCR obligation reported in below are probably a lower bound on the true extent of avoidance behavior.

5.2 Results – Avoidance of CbCR

5.2.1 Main sample

Pre- and post-CbCR distribution of revenues

The first step to identify potential avoidance of the CbCR obligation is the comparison of revenue distributions close to the reporting thresholds applicable before and after the introduction of CbCR. Figure 7 plots the two distributions with the vertical line indicating the CbCR threshold at 100% of revenues. The solid graph shows the distribution over the pre-reform period of 2010-2014. The density decreases almost monotonously with firm size. The distribution is smooth overall, there are no larger jumps or bunch points. This changes after the introduction of CbCR as shown by the dotted graph in Figure 7. Compared to the earlier years, the density just to the left of the threshold is higher after 2016.

Regarding the bunching region, Figure 7 suggests that firms bunch at revenues between approximately 85-90% of the threshold and the threshold itself. When considering the region between 90% and 100% of the threshold, the share of sample companies in this region increased from an average of 2.76% for 2010-14 to 3.11% for the period 2016-18.[25] In absolute numbers, this implies on average an additional 30 companies that report yearly revenues between 90% and 100% of the threshold after the introduction of CbCR. In the years before CbCR, an average of 235 companies reported revenues in this region.

The comparison of the two distributions allows to calculate a measure for the total excess mass b to the left of the threshold by adjusting the approach by Chetty et al. (2011) as described by Equation (4). When the region of 90% to 100% of the threshold is considered, the excess mass b equals to 0.126, i.e. the density in the period 2016-18 is 12.6% larger than in the period before CbCR. As summarized by Figure A9 in the Appendix, the excess mass declines if wider

[23] As the sample used in the bunching estimations is balanced, companies newly created in the sample period would not be part of the sample. Company parts that continue to exist but have revenues much lower than the threshold would not contribute to the excess mass measured below the threshold.

[24] See Dyreng, Hoopes & Wilde (2016) and Bernard (2016) for examples of such non-reporting despite an existing obligation in other contexts.

[25] If a region of 15% below the threshold is considered, the share of companies in this region increases from 4.2% to 4.7%.

bunching regions are considered. For the further analysis of bunching behavior, I will therefore focus on the area between 90% and 100% of the reporting threshold.

While an increase in mass to the left of the reporting threshold is in line with the incentive to avoid the filing obligation, the share of companies just above the threshold also increased slightly from 2.24% to 2.43% for the region from threshold to 10% above it. This might due to companies trying, but failing to bunch just below the threshold as they only have imperfect control over their revenues. At the same time, some companies might be above the threshold according to Orbis data, but still avoid the filing obligation by exploiting the leeway in the definition of revenues. These effects lead to downward bias of estimations on the avoidance efforts of companies.

To test whether the difference in distributions is statistically significant, I conduct a Kolmogorov-Smirnov test. The null hypothesis of this test is that the two samples are drawn from the same distribution. This null hypothesis is rejected at the 1%-level for the region from 50% to 150% of revenues relative to the threshold applicable depicted in Figure 7. The distribution of companies by revenue before and after the introduction of CbCR is therefore different at a statistically significant level.

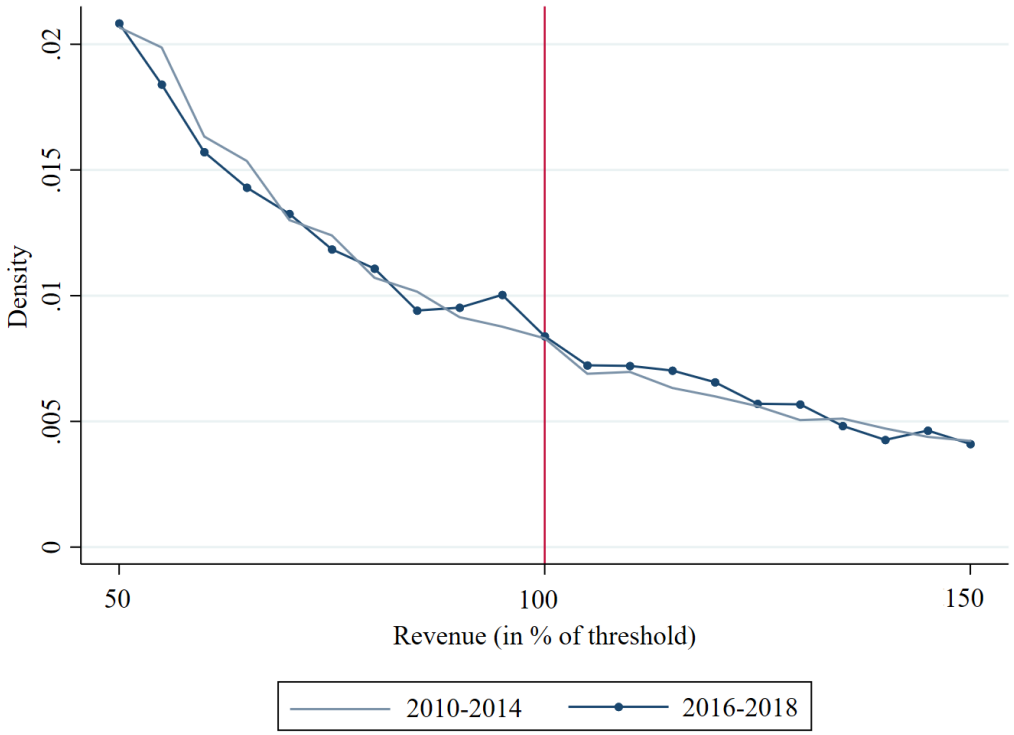

Figure 7: ***Distribution of revenues pre- and post-CbCR***

Notes: This figure plots the distribution of consolidated company revenues relative to the threshold applicable for the period 2010-2014 (solid graph) and 2016-2018 (dotted graph). The vertical line indicates the revenue threshold for the CbCR obligation at 100%. Data bins have a width of 5 percentage points and are labelled by their upper bound.

Development of bunching over the treatment period

The effects of CbCR on tax avoidance documented in Section 4.2.1 took some time to materialize. This leads to the question of how bunching behavior developed over the treatment period. On the one hand, companies above the threshold might need some time to lower their revenues. Additionally, companies coming from below the threshold and avoiding the jump might accumulate in the bunching region. This would lead to an increase in excess mass below the threshold over time. On the other hand, companies close to the threshold may want to observe the development and experiences with CbCR in the first years. After the reporting framework becomes more settled, implementing the necessary processes might become easier and cheaper. This would lead to declining excess mass over time.

Figure 8 presents the excess mass by year for the period of 2016-2018 for the region of 90% to 100% of the threshold applicable compared to the average density distribution over the pre-reform years. The excess mass increased over time, indicating that bunching became more pronounced over the sample period. While the excess mass in 2016 was only 5.69%, it increased to 11.21% in 2017, and reached 20.97% in 2018. This. In terms of absolute numbers, this translates into about 50 additional companies in the bunching region in 2018 as compared to the average of 235 before the introduction of CbCR.

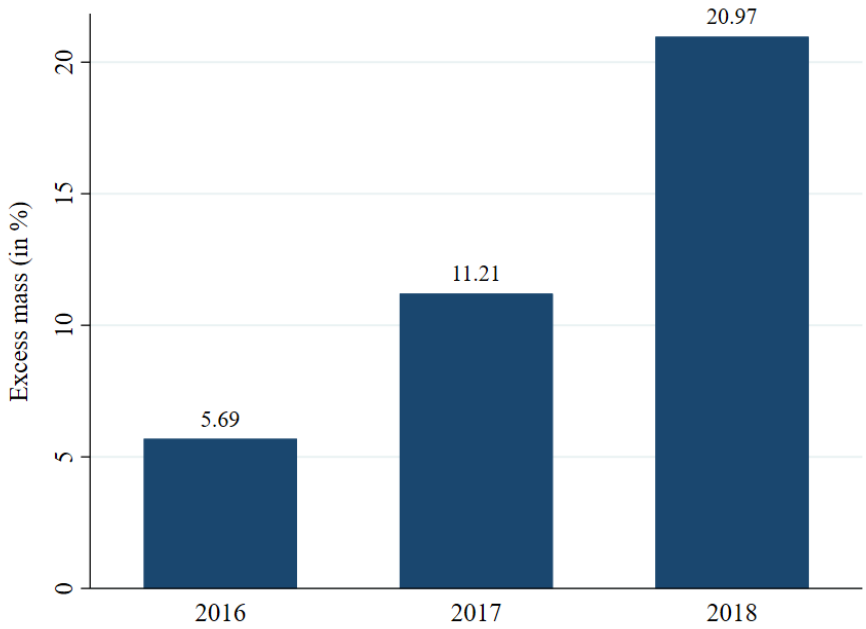

Figure 8: ***Development of excess mass between 2016 and 2018***

Notes: This figure shows the excess mass for the different years in the treatment period. The bar heights indicate the percentage difference between the average density in the pre-reform period of 2010-2014 and the density in the different post-reform years. The calculation is based on Equation (4) for the bunching region between 90% and 100% of the revenue threshold applicable.

Comparison of the post-CbCR distribution with fitted polynomial

To test the robustness of the results presented above, the bunching behavior is further analyzed using the approach described by Chetty et al. (2011) for kinks and expanded by Kleven & Waseem (2013) for the case of notches. The binned distribution of firms is compared to a counterfactual distribution estimated by fitting a seventh order polynomial to the data, excluding the observations around the notch point. Figure 9 is based on the implementation package from Chetty et al. (2011) and visualizes the results of this approach. The dotted graph indicates the density of the actual distribution, the fitted polynomial is shown by the solid graph. The vertical line indicates the revenue threshold. The bin width in this estimation is 5 percentage points, while two bins to the left and one bin to the right of the bunch point are excluded.[26] The estimated excess mass according to this approach is 27.6% and statistically significant at the 1%-level based on a standard error calculated via a bootstrap procedure.[27] For comparison, Figure A10 presents the result using the same approach on the pre-reform years. The excess mass calculated for these years is not statistically different from zero and even negative (excess mass *b* equals -0.145 with a standard error of 0.116).

Figure 9: ***Distribution of revenues and fitted polynomial 2016-2018***

Notes: This figure plots the distribution of consolidated company revenues relative to the threshold applicable (dotted graph) and the estimated counterfactual distribution (solid graph) for the years of 2016-2018. The counterfactual is estimated fitting a seventh-order polynomial to the empirical distribution, excluding two data bins below and one data bin above the notch. The notch point (revenue threshold) is marked by the vertical line. Data bins have a width of 5 percentage points and are labelled by their upper bound. The approach follows Chetty et al. (2011) and Kleven & Waseem (2013) and is based on the implementation package of Chetty et al. (2011).

[26] Results are largely robust to using other bin widths and excluding a larger region.
[27] The estimated *b* equals 0.276 with a standard error of 0.101.

RDD test

A further test for sorting into or rather out of treatment assesses whether there is a discontinuity in density at the revenue threshold (McCrary, 2008; Cattaneo, Jansson & Ma., 2018; Cattaneo, Jansson & Ma, 2019). Such a discontinuity could be interpreted as further evidence for avoidance of the CbCR obligation. Figure 10 plots the point estimates and the 95% confidence interval of the local polynomial density over consolidated revenues around the revenue threshold for the period 2016-18. Following De Simone & Olbert (2019), a third order local polynomial is used to construct the density point estimators. At the reporting threshold, a jump in density is visible. The density to the left of the threshold is higher than to the right which fits with the bunching figures shown above. The formal test for a difference in density to the right and the left of the cutoff rejects the null hypothesis of no differences at the 1%-level (p-value 0.0061). Results are largely robust to using polynomials of different order. In the Appendix, the same estimation using a fourth-degree polynomial is shown (Figure A11). The jump in density appears even clearer in this estimation, the p-value is similar (0.0069). As for the results described above, the difference in density around the cutoff even is attenuated by the increase in density just above the threshold.

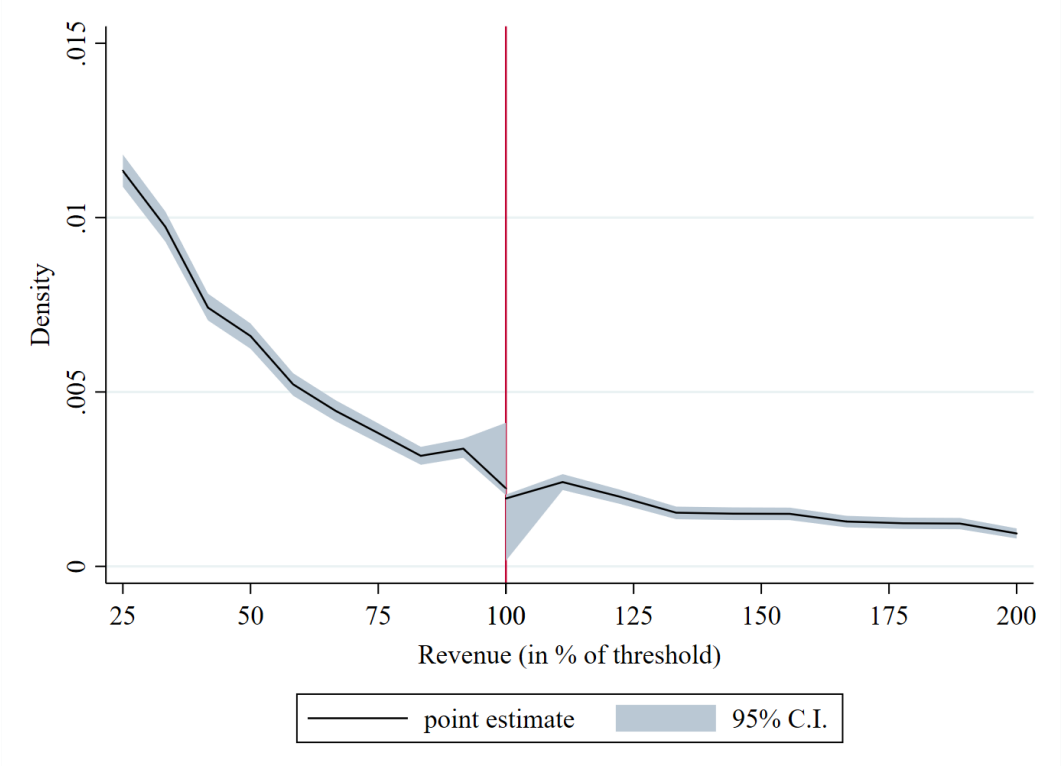

Figure 10: ***Test for discontinuity in density at the revenue threshold***

Notes: This figure plots the point estimates and the 95% confidence intervals for local polynomial densities over revenues relative to the threshold applicable. For the estimations, a third-order local polynomial is used with a bandwidth of 10 percentage points around the cutoff. The approach follows McCrary (2008), Cattaneo, Jansson & Ma (2018), and Cattaneo, Jansson & Ma (2019) and is implemented using the calculation package from Cattaneo, Jansson & Ma, (2018).

Previous revenues of companies below the threshold

The companies making up the mass just below the threshold can be divided into three types based on their revenues in the previous year: First, companies with previous year's revenues much lower than the threshold; second companies that were close to the threshold already in the year before; and third, companies with revenues above the threshold in the preceding year.

Figure 11 shows how the relative shares of these three company types in the bunching region developed since the introduction of CbCR. Compared to the years before CbCR, the share of companies with previous revenues larger than the threshold increased from just below 19% to almost 31% in 2017. This suggests that in the first years of CbCR a substantial number of companies who previously had higher revenues reduced these to move below the reporting threshold. In 2018, however, close to 90% of companies in the bunching region had revenues lower than the threshold in the previous year. This might be due to the fact that most companies previously above the threshold that have a strong incentive to avoid CbCR already reduced their revenues sufficiently in the previous years.

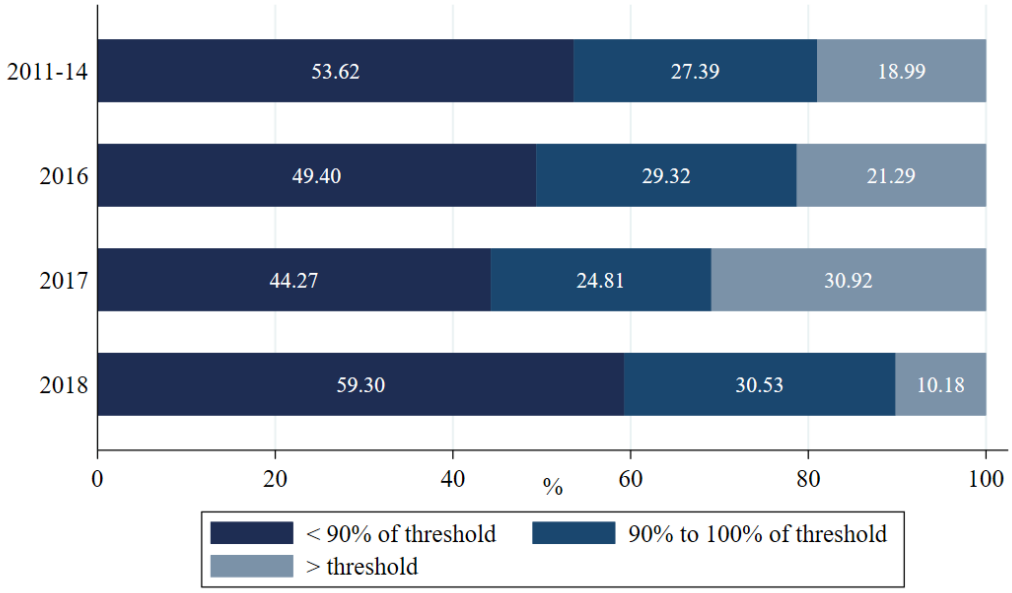

Figure 11: ***Previous revenues of firms just below the revenue threshold***

Notes: This figure shows the shares of companies in the bunching region between 90% and 100% of the revenue threshold based on their previous year's revenues for the pre-reform period and the different post-reform years.

The results presented above provide substantial evidence for *Hypothesis 2* of revenue manipulation of companies in order to stay below the CbCR threshold and avoid the filing obligation. However, the approach taken here does not allow to disentangle whether the effect is driven by reduced profit shifting opportunities due to CbCR or the direct cost of compiling a CbC report.

5.2.2 Sample splits & heterogeneity

Section 4 documented differences in the reaction to CbCR depending on the change in detection probability. This section evaluates whether such differences are also visible regarding the avoidance of CbCR.

A profit-maximizing company will weigh the costs of CbCR against the costs of avoiding the filing obligation. Consequently, the excess mass should be larger for company types with higher costs of CbCR and lower costs of adjusting revenues to stay below the threshold. To structure this analysis, I will first compare companies which differ regarding their costs of CbCR, before looking at differences in the costs of adjusting revenues. All results presented are based on the bunching region of 90% to 100% of the revenue threshold.

Heterogeneity in avoidance due to costs of CbCR

According to the results shown in Section 4.2.1, the increase in effective tax rates due to CbCR seems to depend on the rise in detection probability. Higher effective tax rates clearly constitute a major cost to companies. I therefore use the same proxies for the increase in detection probability employed in Section 4.2.1 to conduct sample splits. The excess mass in the post-CbCR period relative to the pre-reform years is then compared for the different sub-samples.

Listing status, parent entity location within the United States, and source of a potential filing obligation serve as proxies for the novelty of the CbC information to tax authorities. Panel A of Figure 12 shows the excess mass for the corresponding sub-samples. The dashed horizontal line indicates the average excess mass for the full sample at 12.62%. For all three splits, the excess mass of the sub-sample for which CbCR presumably reveals more new information to tax authorities is above that average. In contrast, for the inverse sub-samples, the excess masses are below the average of the full sample. For example, the excess mass for private companies is about five times larger than the excess mass for publicly listed companies. Companies that only have a local filing obligation do bunch under the reporting threshold at all.

A second factor potentially influencing the change in detection probability is the importance of intangible assets. The result on a sample split at the median share of intangible in total assets is shown in Panel B of *Figure 12*.[28] For companies with a relatively low share of intangibles, the excess mass in the post-CbCR years is about double the average at 24.62%. Companies with a higher share of intangibles do not seem to avoid the CbCR obligation by adjusting their revenues. The estimations of Section 4.2.1 showed that companies with more intangible assets increased their effective tax rate less due to CbCR implying lower costs of CbCR and a weaker incentive to avoid the filing obligation.

The third factor influencing the treatment intensity – and thus the cost of CbCR – is degree of tax avoidance. Based on the results from Section 4.2.1, more tax aggressive companies increase their effective tax rates more if they file a CbC report leading to higher costs of CbCR. In line

[28] In contrast to the approach of Section 4.2.1, the sample split for continuous variables is based on the median value in the respective year. This is because companies can decide whether or not to avoid the filing obligation on a yearly basis. The change in the detection risk once a CbC report is filed, however, depends on characteristics of the company before the filing of the report.

with this reasoning, the excess mass of the sub-sample with below median effective tax rates is about five times larger than for the sub-sample with higher effective tax rates (20.25% and 4.08% respectively). The difference for the sub-samples defined by tax rate differentials is much smaller, but goes in the same direction. Firms with a larger difference between the statutory tax rate in their headquarter country and their effective tax rate bunch slightly more than companies for which this difference is smaller.

Besides the factors influencing the change in detection probability, there are further company characteristics that might affect the cost of filing a CbC report and therefore impact the incentive to avoid the filing obligation.

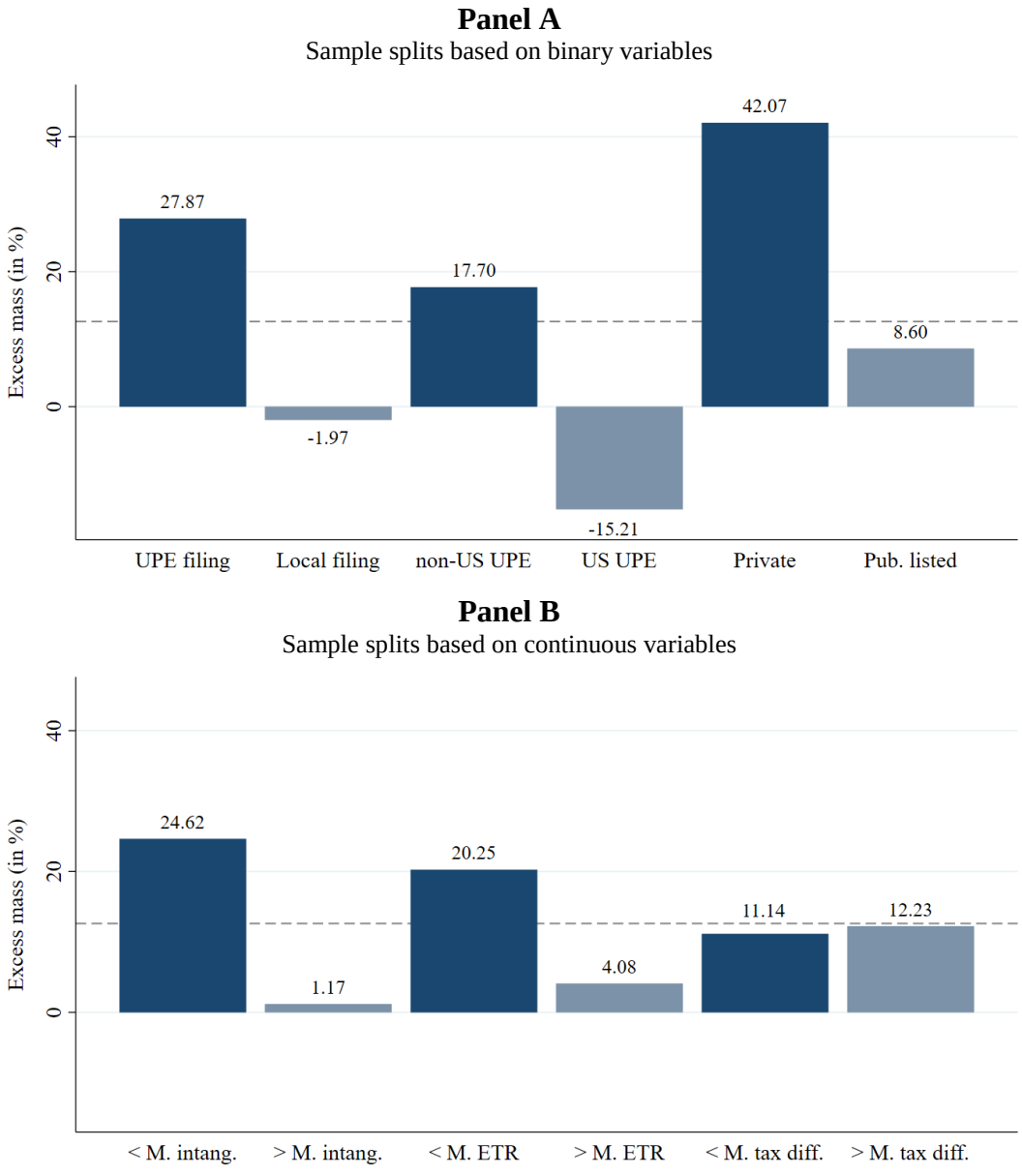

Figure 12: ***Excess mass for different sub-samples***

Notes: This figure shows the excess mass between the average density in the pre-reform period of 2010-2014 and the density in the different post-reform years for different the sub-samples. The sample splits in Panel A are based on binary variables; Panel B shows sample splits at the median of different continuous variables. The calculations are based on Equation (4) for the bunching region between 90% and 100% of the revenue threshold applicable.

The cost of an increase in effective tax rates caused by CbCR is larger in absolute terms, the higher the profitability of a company, since the higher tax rate applies to a larger base. Accordingly, the incentive to avoid the CbCR obligation is larger for firms with higher profitability. This also shows in the data, as the excess mass for companies with above median profitability in terms of return on assets is almost three times larger than for companies with below median profitability (Figure A12).

Lastly, the direct cost of preparing a CbC report may be higher, the more (cross-border) subsidiaries a company has, as the report gets increasingly complex. As shown in Figure A12, however, companies with more cross-border subsidiaries listed in Orbis bunch substantially less than companies with a lower number of such subsidiaries.[29] Possibly, companies for which many subsidiaries are recorded in Orbis are generally more transparent. Hence, the information required in a CbC report is not as costly to provide.

Heterogeneity in avoidance due to costs of bunching

Just as the costs of filing a CbC report, the costs of adjusting revenues are likely to vary for companies with different characteristics.

A key factor driving the cost of reducing revenues to a level below the threshold is the distance to the threshold in the absence of revenue manipulation (Hasegawa et al., 2013). Reducing revenues by a small amount is mostly cheaper than a large adjustment. Figure 13 plots the distribution of previous year's revenues for all companies between 90% and 100% of the threshold in the treatment period that reported revenues exceeding the threshold in the year before. For the vast majority of these companies, previous revenues were just slightly above the threshold. The median of revenues in the preceding year lies at 111.3% of the threshold. Almost 75% of the companies in question reported revenues less than 25% above the threshold in the previous year; more than 95% exceeded the threshold by less than 50%. The small number of companies coming from above 200% might be cases of company splits. One example is the HTC Corporation, a Taiwanese producer of consumer electronics. HTC sold a large part of its business including smartphone-related patents to Google in 2017. In 2017, HTC had revenues of 232.7% relative the threshold applicable. In 2018 revenues were reduced to 92.6% of the reporting threshold. These results are in line with the assumption that the costs of reducing revenue to below the threshold rise with the initial distance to the threshold.

Overall, this section provides first evidence that companies manipulate their revenues to stay under the CbCR threshold. The effect is stronger for companies with a higher cost of filing a CbC report, and for companies with lower costs of adjusting revenues as they were closer to the threshold to begin with. All results are qualitatively similar if larger bunching regions are considered. However, the excess mass is often lower as firms tend to bunch relatively close to the threshold.

[29] The result is very similar, if the number of all subsidiaries is considered.

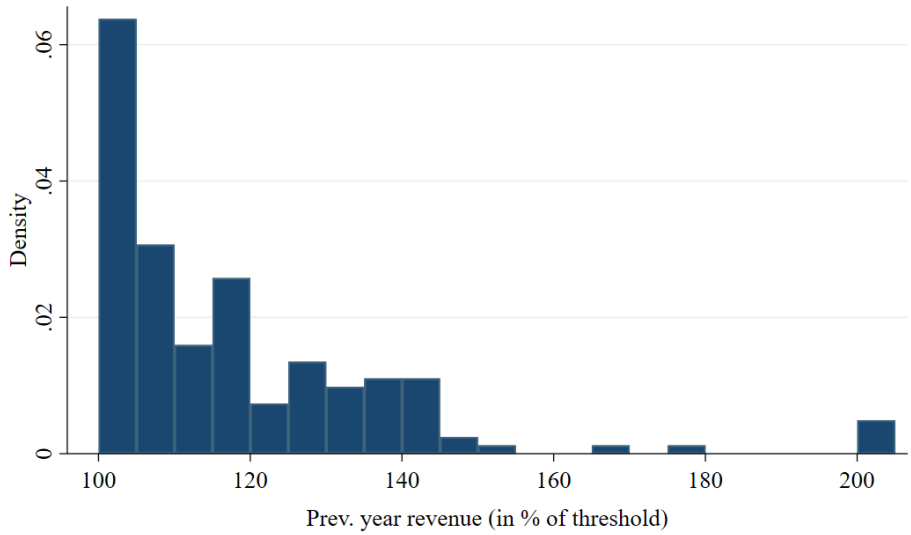

Figure 13: ***Distribution of previous year revenues of companies in the bunching region***

Notes: This figure shows the distribution of previous year's revenues for companies that have revenues between 90% and 100% of the threshold applicable in a post-reform year and reported revenues above the threshold in the previous year. The distribution is cut a level of 200% of the threshold. The last bar shows the total density of all previous year's revenues above 200%.

6. Discussion

This section discusses my findings on non-public BEPS CbCR, compares them to the related literature, including the work on public CbCR, and reflects on the limitations of the paper.

Discussion of results on effects of CbCR

Most of my results fit well with previous studies on related questions. The results presented in Section 4.2.1 suggest that BEPS CbCR achieved its main goal and reduced profit shifting of MNEs. CbCR leads to an increase in effective tax rates and a reduction in the difference between statutory and effective tax rates of companies in scope. According to my baseline estimations, the increase in effective tax rates is about one percentage point. Joshi (2020) reports a larger increase in effective tax rates due to CbCR of about 1.5 percentage points. This difference is due to the restriction of Joshi (2020) to MNEs from the European Union. If I exclude all non-EU companies from my baseline specification, I find a treatment effect of 2.1 percentage points. The now larger effect compared to Joshi (2020) may be driven by my exclusion of companies close to the threshold. The inclusion of these companies attenuates results due to selection into treatment. The generally larger treatment effect for EU-companies can be explained by the discussion about the publication of the CbC reports in the European Union. The European Commission proposed a corresponding directive in 2016, however there

was not much progress since then. Nevertheless, the prospect of a publication of the CbC data might trigger a more pronounced response by companies.[30]

For my sample of subsidiaries located in OECD countries, I find an increase in the share of profits reported in high tax jurisdictions, but no significant change in the share reported by low tax OECD affiliates. This effect seems to be driven by higher profit shares remaining in domestic affiliates (and the parent entity) in high tax countries. As profit shares have to sum to one, profits reported in non-OECD subsidiaries not covered by the dataset have to decline. These include affiliates in offshore financial centers. This matches with the result of De Simone & Olbert (2019) that MNEs in scope of CbCR reduce their tax haven usage.

The extent of the reduction in tax avoidance seems to depend on the change in detection probability, reflected e.g. in a weaker response of firms that only have a local filing obligation. Besides gradual adjustment processes of companies, this may be a reason why the effect of CbCR on effective tax rates is only statistically significant in the last year of the sample period (Table 1 and Joshi, 2020). In 2016, more than 40% of the sample only had a local filing obligation – in 2018 this applied to only 7.5% of the sample. The very limited effect of local filing obligations, where the information is only provided to a single tax authority and not exchanged between countries also shows the ineffectiveness of unilateral increases in disclosure requirements against global profit shifting.

My finding that CbCR leads to an rise in effective tax rates but no increase in tax payments, is in line with the results of Joshi, Outslay & Persson (2019) on the EU's CRD IV and De Simone & Olbert (2019) for BEPS CbCR. Compatible results from a different setting are reported by Carrillo, Pomeranz & Singhal (2017). The authors exploit a natural experiment in Ecuador in which tax authorities notified firms about differences between declared revenue and revenues reported from third parties. While firms raised their reported revenues as a response, 96% of the effect was offset by an increase in reported costs such that tax collection remained almost unchanged. Looking at public disclosure of payments to governments by the European extractive industry, Rauter (2019) finds that companies in scope raise payments to host governments, but at the same time decrease total investments relative to competitors without disclosure requirement. A reduction in economic activity also seems to be a consequence of CbCR, potentially driven by and counteracting the rise in effective tax rates. Negative effects of higher taxes on investment are well documented in the literature. For instance, Suàrez-Serrato (2018) shows that the elimination of tax havens reduces investment of companies affected. Giroud & Rauh report a negative effect of effective tax rates on investment and entrepreneurial activity. De Simone & Olbert (2019) document a reduction in the growth of employment due to CbCR.

[30] The much larger excess mass below the threshold for the subsample of EU companies (38.3% compared to 6.6 % for non-EU companies) fits with higher expected costs of CbCR for these companies.

Discussion of results on avoidance of CbCR

Section 5 provides extensive evidence that some companies avoid the CbCR obligation by adjusting their revenues to levels below the threshold. This effect is stronger for companies with higher costs of CbCR and lower costs of adjusting revenues. The specific result of a stronger response of private companies compared to publicly listed companies confirms the findings of Hasegawa et al. (2013) and Hoopes, Robinson & Slemrod (2018) for other reporting regimes. Similar to my reasoning, Hasegawa et al. (2013) argues this is due to higher costs of disclosure for private companies as general reporting requirements for public companies are much stronger. As for the change in effective tax rates, the response is more pronounced for companies with a parent entity filing obligation compared to those with only local filing obligations. This difference may again contribute to the increase in the excess mass below the threshold over the post-reform period.

My finding of bunching below the revenue threshold and a corresponding discontinuity in density contradicts the findings of De Simone et al. (2019) who report no statistically significant discontinuity. This difference in results is probably driven by the fact that bunching behavior increased over the treatment period. De Simone et al. (2019) only use the year 2016 to test for manipulation in revenues. If the manipulation test is run on my data for the year 2016 only, the jump in density is not statistically significant as well. For 2018, however, the jump is significant even at the 0.1%-level. In addition, the sample of De Simone et al. (2019) contains companies headquartered in non-European countries (but with at least one subsidiary in the EU), but do not account for the potentially different thresholds applicable for these companies. This could further contribute to an underestimation of revenue manipulation.

Regarding the effects of CbCR, the results of De Simone & Olbert (2019) are less pronounced or of lower statistical significance in some dimensions than the results reported in this paper. One example is the growth of revenues, where De Simone & Olbert find no clear results, while I report a statistically highly significant negative coefficient. Moreover, the significance levels reported by De Simone & Olbert (2019) for some dependent variables strongly depends on the bandwidth chosen for their RDD design. The same holds for the RDD results of Joshi (2020). The reason for this may be avoidance of the CbCR obligation reported in Section 5.2.2. Selection into treatment by companies close to the threshold causes issues for identification based on an RDD design which strongly relies on observations close to the threshold.

To test whether the exclusion of companies around the threshold is sensible, I run the main estimations on the previously excluded companies with revenues close to the threshold. For this sample, the effect of CbCR on effective tax rates is insignificant and even yields a negative coefficient (Column (5) of Table A15). While this does not entirely falsify RDD designs in this context, it still suggests that such an identification strategy should be treated with caution.

Lastly, the effect on effective tax rates and the avoidance of the CbCR obligation get stronger over time. This finding is confirmed by Joshi (2020) and is similarly reported by Overesch & Wolff (2019) for private CbCR. As De Simone & Olbert only use data for the years 2016 and 2017, this could also explain weaker statistical significance in their results.

Non-public vs. public CbCR

While the public reporting regime established under CRD IV for the EU financial sector is related to BEPS CbCR, the effects may be quite different. Public CbCR as under CRD IV could limit corporate profit shifting due to the information provided to tax authorities or due to the public availability of the data and resulting fear of reputational costs and public pressure. As the CbC information in the BEPS reporting framework is only reported to tax authorities, the analysis of this reporting regime attributes most of the effect to the channel of better informed tax auditors.

For most specifications, I find an increase in effective tax rates due to non-public CbCR by about one percentage point, whereas Overesch & Wolff (2019) document an increase of 2 to 2.5 percentage points for the public CbCR regime in the European financial sector. Thus, the effect size of non-public CbCR is about half as large as for public CbCR, suggesting at first glance that public pressure and additional disclosure to tax authorities are equally important to reduce profit shifting. Since the financial sector is unique in a number of ways, however, I would refrain from this conclusion. The heterogeneity in responses to BEPS CbCR found in this paper is in line with companies weighing the costs of a reduction on tax avoidance and consequently higher tax payments against the perceived increase in the detection probability. The regulatory environment of the financial sector already included comparably strict reporting requirements before CRD IV. The change in the detection risk due to public CbCR may therefore be smaller than it would be for other industries. This makes it unlikely that the results for public CbCR from the European financial-sector can be extrapolated to a much wider population of companies.

If the effects of public CbCR in the financial sector are smaller than one could expect for other sectors, the actual difference in the effectiveness of public versus non-public CbCR would be even larger. As discussed above, the treatment effect of BEPS CbCR on effective tax rates is around 2 percentage points for European companies – potentially amplified by the mere discussion about publication of the CbC reports. This strengthens the case for the publication of the CbC data in order to introduce the additional channel of public pressure to further reduce profit shifting of the companies in scope. A sufficient reduction in tax avoidance could also help to increase tax payments in contrast to the findings for non-public CbCR reported in this paper and by De Simone & Olbert (2019). Dyreng, Hoopes & Wilde (2016), for instance, describe that public information on subsidiary locations led to increased tax payments of the businesses affected in the United Kingdom.

At the same time, the publication of CbC reports would increase the costs of reporting to companies. While the direct cost of preparing the report would not change if the reports were to be published, additional indirect costs such as reputation losses will occur. As long as such reputational losses are due to actual tax avoidance, this could be interpreted as an expression of the desired public pressure, but there may also be cases were misinterpretations of the data lead to reputational losses which do not punish actual tax avoidance. In addition, potentially sensitive business information becomes available to competitors. If the costs of CbCR to companies rise due to the publication of the reports, the incentive to avoid the reporting

obligation increases. The avoidance behavior of the CbCR obligation documented in Section 5 of this paper and the connected distortions of economic activity are then likely to rise.

In sum, this paper offers some additional aspects in the evaluation of non-public versus public CbCR. A conclusive judgment on the relative benefits of the two forms of CbCR, however, is beyond the scope of this paper.

Limitations

While the findings of this paper contribute to the evaluation of non-public CbCR in the short- and medium run, the data only covers three post-reform years. Consequently, I cannot assess the impact of the reform in the longer run. Over the following years, effects may continue to become larger, as companies continue to adjust their behavior. Tax authorities also gain experience in the usage of CbC data for their risk assessment further increasing their effectiveness. Then again, companies might increasingly find ways to engage in profit shifting not detectable via CbCR. This would lead to a reduction of the effectiveness of CbCR in the longer run. In terms of evaluating these long term effects by applying the approach taken in this paper for an extended sample may be problematic. Since 2019, the reporting threshold of EUR 750 million has frequently been discussed or even been implemented as a threshold for other regulatory packages.

A margin of adjustment not discussed so far is an increase in the underreporting of income by companies. Such a change in the underreporting of income would not be visible in the data used for this paper. As the definition of the reporting obligation does not depend on the level of profits, avoidance of CbCR should at least not aggravate the underreporting of profits as other disclosure regimes do (Hasegawa et al., 2013).

Moreover, all data used only capture responses by companies. How tax authorities use the CbC data to improve the efficiency of their efforts to combat profit shifting is beyond the scope of this paper. This question for future research would complement the existing findings on non-public and public CbCR.

7. Conclusion

As part of the OECD BEPS process, many countries introduced mandatory country-by-country reporting for multinational company groups above a revenue threshold. The CbC reports contain information on MNE activities, including their profits and taxes paid, on a country-level as well as a list of all subsidiaries. These reports are not published but are made available to tax authorities. This paper investigates whether such non-public CbCR is an effective tool in the global fight against corporate tax avoidance.

The first part of the analysis relies on a difference-in-difference approach, based on firm-level data for more than 11,000 companies. I document an increase in effective tax rates of companies with CbCR obligation of about one percentage point compared to the control group.

The effect is stronger for companies that experience a more pronounced increase in the detection probability of tax avoidance measured by different proxy variables. The analysis of unconsolidated subsidiary data provides further evidence on a reduction on profit shifting due to CbCR. At the same time, there is no increase in tax payments due to CbCR. Apparently, this is due to a reduction in economic activity of companies in scope. Indicative evidence also suggests the use of loss carryforwards. Moreover, the difference-in-difference analysis reveals an increase in leverage and a simultaneous reduction in the equity ratio of companies with CbCR obligation, potentially driven by a rising tax benefit of debt financing.

The second part of the paper investigates potential avoidance of the reporting obligation. Looking at the density distribution around the revenue threshold, this paper reports excess mass below the threshold after the introduction of CbCR. The increase in density below the threshold varies substantially for different sub-samples. The excess mass documented for private companies, for instance, is five times larger than the excess mass in the sub-sample of publicly listed companies. These results again suggest a stronger response of companies for which CbCR would entail a larger increase in the detection probability.

Overall, CbCR seems to achieve its main goal of a reduction in corporate profit shifting. Yet, tax payments are not rising and unintended consequences such as the reduction in economic activity or the avoidance of the CbCR obligation by adjustments in revenues introduce new distortions.

Besides the immediate impact of CbCR on corporate behavior, the reporting regime constitutes an important step towards the harmonization of international corporate tax system. The data collected provides information on the extent of global corporate profit shifting and potentially facilitates political decision making on corporate tax reform in the future. The coordination mechanism established over the course of the BEPS program in general and for CbCR in particular can help to find coordinated solutions to the current challenges of the international corporate tax system.

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Appendix A: Definitions and summary statistics

Table A1: ***List of BEPS Actions***

Action 1	Address the Tax Challenges of the Digital Economy
Action 2	Neutralise the Effects of Hybrid Mismatch Arrangements
Action 3	Strengthen CFC Rules
Action 4	Limit Base Erosion via Interest Deductions and Other Financial Payments
Action 5	**Counter Harmful Tax Practices More Effectively, Taking into Account Transparency and Substance**
Action 6	**Prevent Treaty Abuse**
Action 7	Prevent the Artificial Avoidance of PE Status
Action 8-10	Assure that Transfer Pricing Outcomes are in Line with Value Creation
Action 11	Measuring and Monitoring BEPS
Action 12	Require Taxpayers to Disclose their Aggressive Tax Planning Arrangements
Action 13	**Re-examine Transfer Pricing Documentation**
Action 14	**Make Dispute Resolution Mechanisms More Effective**
Action 15	Develop a Multilateral Instrument

Notes: This table summarizes the BEPS actions and descriptions as listed in Annex A of the Explanatory Statement of the 2015 Final Reports available at https://www.oecd.org/ctp/beps-explanatory-statement-2015.pdf. Actions in bold are the four minimum standards of the Inclusive Framework.

Table A2: ***CbCR implementation by country***

Jurisdiction	UPE filing from	Threshold	Local filing from	Jurisdiction	UPE filing from	Threshold	Local filing from
Andorra	01/01/2018	EUR 750 million	01/01/2018	Korea	01/01/2016	KRW 1 trillion	01/01/2016
Anguilla	01/01/2019	USD 850 million	No local filing	Latvia	01/01/2016	EUR 750 million	01/01/2016
Argentina	01/01/2017	EUR 750 million	01/01/2017	Liechtenstein	01/01/2017[1)]	CHF 900 million	01/01/2017
Australia	01/01/2016	AUD 1 billion	01/01/2016	Lithuania	01/01/2016	EUR 750 million	01/01/2016
Austria	01/01/2016	EUR 750 million	01/01/2017	Luxembourg	01/01/2016	EUR 750 million	01/01/2016
Bahamas	01/01/2018	USD 850 million	01/01/2018[2)]	Malaysia	01/01/2017[1)]	MYR 3 billion	No local filing
Belgium	01/01/2016	EUR 750 million	01/01/2016	Malta	01/01/2016	EUR 750 million	01/01/2017
Bermuda	01/01/2016	EUR 750 million	No local filing	Mauritius	01/07/2018	EUR 750 million	No local filing
Brazil	01/01/2016	BRL 2260 billion	01/01/2016[2)]	Mexico	01/01/2016	MXN 12 billion	01/01/2016
BVI	01/01/2018	EUR 750 million	01/01/2018	Monaco	01/01/2018	EUR 750 million	No local filing
Bulgaria	01/01/2016	EUR 750 million	01/01/2017	Netherlands	01/01/2016	EUR 750 million	01/01/2016
Canada	01/01/2016	EUR 750 million	01/01/2016	New Zealand	01/01/2016	EUR 750 million	No local filing
Cayman Isl.	01/01/2016	USD 850 million	No local filing	Nigeria	01/01/2018	NGN 160 billion	01/01/2018
Chile	01/01/2016	EUR 750 million	No local filing	Norway	01/01/2016	NOK 6.5 billion	01/01/2017
China	01/01/2016	RMB 5.5 billion	01/01/2016[2)]	Pakistan	01/01/2016	EUR 750 million	01/01/2017
Colombia	01/01/2016	81 million UVT	01/01/2016	Panama	01/01/2018	EUR 750 million	No local filing
Costa Rica	01/01/2017	EUR 750 million	No local filing	PNG	01/01/2017[1)]	PGK 2.3 billion	01/01/2017[2)]
Côte d'Ivoire	01/01/2018	XOF 491 967 750 000	No local filing	Peru	01/01/2017	PEN 2.7 billion	01/01/2017[2)]
Croatia	01/01/2016	EUR 750 million	01/01/2017	Poland	01/01/2016	EUR 750 million	01/01/2017

Table A2 continued

Jurisdiction	UPE filing from	Threshold	Local filing from	Jurisdiction	UPE filing from	Threshold	Local filing from
Curaçao	01/01/2018[1)]	NAFI 1.5 billion	01/01/2018	Portugal	01/01/2016	EUR 750 million	01/01/2017
Czech Republic	01/01/2016	EUR 750 million	01/01/2017	Qatar	01/01/2018	QAR 3 billion	01/01/2018[2)]
Denmark	01/01/2016	DKK 5.6 billion	01/01/2017	Romania	01/01/2016	EUR 750 million	01/01/2017
Egypt	FYs ending on/after 31/12/2018	EGP 3 billion	No local filing	Russia	01/01/2017[1)]	RUB 50 billion	01/01/2017
Estonia	01/01/2016	EUR 750 million	01/01/2017	San Marino	01/01/2019	EUR 750 million	01/01/2019
Finland	01/01/2016	EUR 750 million	01/01/2016	Saudi Arabia	01/01/2018	SAR 3.2 billion	01/01/2018
France	01/01/2016	EUR 750 million	01/01/2016	Senegal	01/01/2018	XOF 491 967 750 000	01/01/2018
Gabon	01/01/2017	XOF 491 967 750 000	01/01/2017	Seychelles	FYs ending on/after 31/12/2019	EUR 750 million	No local filing
Germany	01/01/2016	EUR 750 million	01/01/2017	Singapore	01/01/2017[1)]	SGD 1.125 billion	No local filing
Gibraltar	01/01/2016	EUR 750 million	01/01/2017	Slovak Republic	01/01/2016	EUR 750 million	01/01/2017
Greece	01/01/2016	EUR 750 million	01/01/2016	Slovenia	01/01/2016	EUR 750 million	01/01/2017
Guernsey	01/01/2016	EUR 750 million	01/01/2016	South Africa	01/01/2016	ZAR 10 billion	01/01/2016
Hong Kong	01/01/2018[1)]	HKD 6.8 billion	01/01/2018	Spain	01/01/2016	EUR 750 million	01/01/2016
Hungary	01/01/2016	EUR 750 million	01/01/2017	Sri Lanka	01/04/2018	SKR 115 billion	01/04/2018
Iceland	01/01/2017	ISK 100 billion	01/01/2017	Sweden	01/01/2016	SEK 7 billion	01/01/2016
India	01/04/2016	INR 5 500 crore	01/01/2016	Switzerland	01/01/2018[1)]	CHF 900 million	01/01/2018
Indonesia	01/01/2016	IDR 11 trillion	01/01/2016	Tunisia	01/01/2020	TND 1638,8 million	01/01/2020
Ireland	01/01/2016	EUR 750 million	01/01/2016	Turks & Caicos Islands	01/01/2020	USD 850 million	No local filing
Isle of Man	01/01/2017[1)]	EUR 750 million	01/01/2017	UAE	01/01/2019	AED 3150 million	01/01/2019
Italy	01/01/2016	EUR 750 million	01/01/2016	United Kingdom	01/01/2016	EUR 750 million	01/01/2016
Japan	01/04/2016[1)]	JPY 100 billion	01/04/2017	United States	30/06/2016[1)]	USD 850 million	No local filing
Jersey	01/01/2016	EUR 750 million	01/01/2016	Uruguay	01/01/2017	EUR 750 million	01/01/2017
Kazakhstan	01/01/2016	EUR 750 million	01/01/2016	Viet Nam	01/05/2017	VND 18 000 billion	No local filing

Notes: This table summarizes the CbCR implementation status as of May 2020 for all countries with CbCR legislation in place. The information is taken from https://www.oecd.org/tax/automatic-exchange/country-specific-information-on-country-by-country-reporting-implementation.htm. Countries marked with [1)]: Voluntary parent surrogate filing is or was available for earlier fiscal years. Countries marked with [2)]: Local filing has been suspended.

Name of the MNE group: Fiscal year concerned: Currency used:										
Tax Jurisdiction	Revenues			Profit (Loss) before Income Tax	Income Tax Paid (on Cash Basis)	Income Tax Accrued – Current Year	Stated Capital	Accumulated Earnings	Number of Employees	Tangible Assets other than Cash and Cash Equivalents
	Unrelated Party	Related Party	Total							

Figure A1: ***Template for Table 1 of the CbC report***

Notes: This template is taken from OECD (2015), p. 29.

Name of the MNE group: Fiscal year concerned:																
Tax Jurisdiction	Constituent Entities Resident in the Tax Jurisdiction	Tax Jurisdiction of Organisation or Incorporation if Different from Tax Jurisdiction of Residence	Main Business Activity(ies)													
			Research and Development	Holding or Managing Intellectual Property	Purchasing or Procurement	Manufacturing or Production	Sales, Marketing or Distribution	Administrative, Management or Support Services	Provision of Services to Unrelated Parties	Internal Group Finance	Regulated Financial Services	Insurance	Holding Shares or Other Equity Instruments	Dormant	Other[1]
	1.														
	2.														
	3.														
	1.														
	2.														
	3.														

Figure A2: ***Template for Table 2 of the CbC report***

Notes: This template is taken from OECD (2015), p. 30.

Name of the MNE group: Fiscal year concerned:
Please include any further brief information or explanation you consider necessary or that would facilitate the understanding of the compulsory information provided in the Country-by-Country Report.

Figure A3: ***Template for Table 3 of the CbC report***

Notes: This template is taken from OECD (2015), p. 30.

Table A3: ***Number of MNEs by threshold applicable***

Year	2016	2017	2018
Effects estimations: Company groups (consolidated data, unbalanced)			
Parent entity filing obligation	5,357	8,446	8,218
Local filing obligation only	3,763	852	666
Effects estimations: Subsidiaries (unconsolidated data, unbalanced)			
Parent entity filing obligation	31,789	46,624	40,377
Local filing obligation only	14,593	1,406	423
Avoidance estimations: Company groups (consolidated data, balanced)			
Parent entity filing obligation	4,423	7,582	7,803
Local filing obligation only	4,119	960	739

Notes: This table summarizes the number of companies with parent entity filing obligation and local filing obligation in the different samples used in Sections 4 (effects estimations) and 5 (avoidance estimations). The sample of subsidiaries does not include ultimate parent entities.

Table A4: ***Observations in treatment and control (company groups)***

Year	Treatment (CbCR obligation)	Control (No CbCR obligation)
2010	2,802	3,106
2012	2,831	3,634
2012	2,913	3,851
2013	2,977	4,048
2014	3,017	4,871
2016	3,113	6,007
2017	3,104	6,194
2018	3,083	5,801

Notes: This table summarizes the number of companies in the treatment and control group by year for the sample used for the baseline estimations of Section 4. Years are defined according to the start date of a company's business year.

Table A5: ***Variable definition and summary statistics (company groups)***

Variable	Definition / Comment	Obs	Mean	SD	Min	Max
ETR (in %)	Tax / pre-tax profits (negative taxes replaced with zero)	53,131	27.16	18.26	0.000	177.1
Tax rate differential (in ppts.)	Difference between statutory CIT rate in country of UPE and ETR	52,942	0.772	17.72	-131.2	40.00
Tax / Total assets (in %)	Negative taxes replaced with zero	59,900	1.651	1.546	0.000	8.970
Tax / revenue (in %)	Negative taxes replaced with zero	60,021	1.931	2.104	0.000	14.06
RoA (in %)	Pre-tax profits / Total assets (positive profits only)	53,305	7.340	5.678	0.158	34.75
Interest / EBIT (in %)		56,295	21.88	52.15	-333.5	454.7
Equity ratio (in %)	Shareholder funds / total assets	60,198	44.32	19.40	-16.13	88.24
Leverage (in %)	(Short term financial debt + long term financial debt) / total assets	59,925	23.86	17.65	0.000	81.33
Leverage (long term) (in %)	Long term financial debt / total assets	60,372	14.60	15.02	0.000	73.71
Leverage (short term) (in %)	Short term financial debt / total assets	60,195	8.816	10.33	0.000	51.54
Investment / total assets (in %)		30,865	3.810	5.509	0.000	34.99
Growth rate revenues (in %)		53,136	8.445	15.22	-15.74	43.52
Growth rate total assets (in %)		52,924	8.093	14.10	-13.47	41.59
Growth rate taxation (in %)		48,102	11.29	69.37	-100.0	194.1
Growth rate pre-tax profits (in %)		46,896	9.501	60.68	-109.5	158.4
Stat. CIT rate (in %)	Statutory CIT rate in country of UPE	61,352	27.96	8.776	0.000	55.00
GDPPC growth (in %)	Growth rate of GDP per capita in country of UPE	58,278	2.327	2.505	-8.998	18.07
Inflation (in %)	Inflation (CPI) per capita in country of UPE	57,695	1.996	1.944	-2.425	36.91
Listed	Dummy = 1 if a company is listed on a stock exchange	61,352	0.771	0.420	0	1
OECD	Dummy = 1 if the UPE of a company is located in an OECD country	61,352	0.685	0.465	0	1
Local filing	Dummy = 1 if a company only has a local filing obligation	61,352	0.335	0.472	0	1
Intangibles share	Intangible assets / total assets	56,562	10.08	15.21	0	70.99

Notes: This table shows summary statistics of consolidated data for the sample used for the baseline estimations of Section 4. All firm level variables are trimmed at the 1st and 99th percentile. Growth rates are additionally winsorized at the 5th and 95th percentile.

Table A6: ***Summary statistics for treatment and control group (company groups)***

Variable	Obs	Mean	SD	Min	Max
Treatment (CbCR)					
Revenue (in million EUR)	14,540	3502.4	3644.3	163.8	24454.7
Pre-tax profits (in million EUR)	14,200	266.1	438.3	-346.4	3631.7
Taxation (in million EUR)	14,083	69.22	104.8	-46.12	757.9
ETR (in %)	12,398	29.69	16.84	0.754	184.5
RoA (in %)	12,984	7.717	5.794	0.160	34.73
Interest / EBIT (in %)	13,648	22.78	46.89	-330.3	450.4
Tax / total assets (in %)	14,239	1.849	1.652	0.000	8.959
Growth rate revenues (in %)	11,277	9.545	15.34	-15.74	43.52
Growth rate taxation (in %)	10,409	12.35	66.27	-100.0	194.1
Growth rate pre-tax profits (in %)	10,265	9.932	57.99	-109.5	158.4
Control (No CbCR)					
Revenue (in million EUR)	19,510	337.6	199.2	151.3	9269.0
Pre-tax profits (in million EUR)	19,417	22.55	63.53	-348.0	3381.9
Taxation (in million EUR)	19,369	6.096	12.49	-45.88	528.8
ETR (in %)	15,734	30.20	19.61	0.750	185.3
RoA (in %)	16,707	7.142	5.799	0.160	34.75
Interest / EBIT (in %)	17,716	24.15	57.54	-333.5	454.7
Tax / total assets (in %)	18,925	1.630	1.568	0	8.970
Growth rate revenues (in %)	15,321	8.584	16.01	-15.74	43.52
Growth rate taxation (in %)	13,801	11.96	72.24	-100.0	194.1
Growth rate pre-tax profits (in %)	13,419	8.493	63.99	-109.5	158.4

Notes: This table shows summary statistics of consolidated data for the treatment and control group in the pre-reform period (2010-2014) as used for the baseline estimations of Section 4.

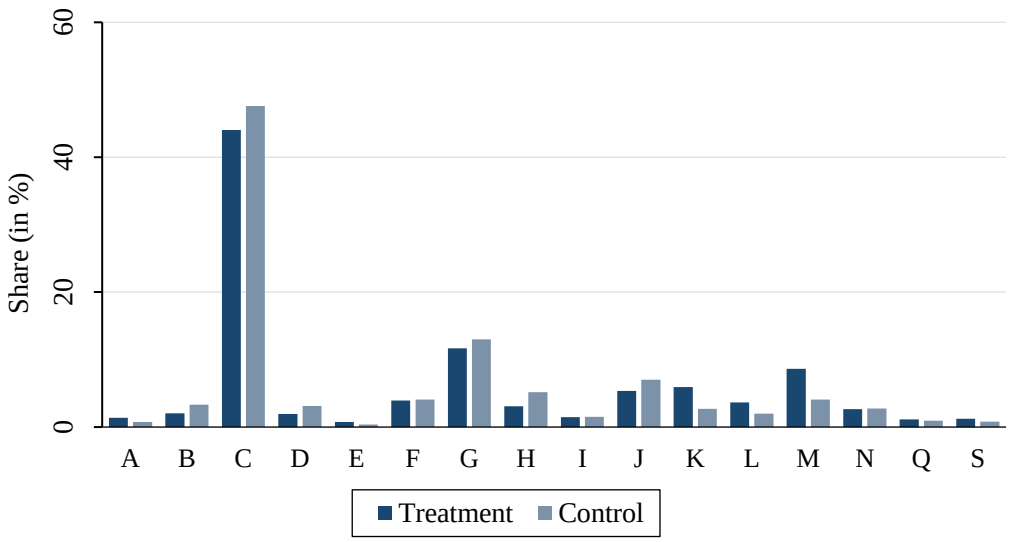

Figure A4: ***Industry composition of treatment and control group***

Notes: This figure shows the distribution of companies in the treatment and control group as used for the baseline estimations of Section 4 across NACE-letter groups. Industry groups that make up less than 1% of treatment and control are not shown.

Table A7: ***Variable definition and summary statistics (subsidiaries)***

Variable	Definition / Comment	Obs	Mean	SD	Min	Max
ETR (in %)	Tax / pre-tax profits (negative taxes replaced with zero)	210,004	25.87	19.61	0	182.4
Share of pre-tax profits (in %)	Measured relative to consolidated company group profits (positive values only).	211,294	5.957	15.25	0.0007	140.4
RoA	Pre-tax profits / Total assets (positive profits only)	226,576	11.41	11.06	0.0896	68.47
Stat. CIT rate (in %)	Stat. CIT rate in subsidiary country	293,879	26.96	5.920	9.000	40.69
GDPPC growth (in %)	Growth rate of GDP per capita in subsidiary country	293,879	1.265	1.639	-8.998	9.424
Inflation (in %)	Inflation (CPI) per capita in subsidiary country	293,879	1.539	1.199	-1.311	16.33

Notes: This table shows summary statistics of unconsolidated data for the sample used in the estimations of Section 4.2.1. The sample does not include ultimate parent entities.

Table A8: ***Summary statistics for treatment and control group (subsidiaries)***

Variable	Obs	Mean	SD	Min	Max
Treatment (CbCR)					
Revenue (in million EUR)	122,839	87.84	215.3	1.061	2,936.5
Pre-tax profits (in million EUR)	121,312	5.234	19.95	-34.78	300.8
Taxation (in million EUR)	118,316	0.982	3.101	-5.312	38.23
ETR (in %)	81,275	29.95	20.17	0.188	197.8
RoA (in %)	95,186	11.52	10.99	0.090	68.47
Share of pre-tax profits (in %)	88,870	3.864	11.36	0.001	140.4
Control (No CbCR)					
Revenue (in million EUR)	34,978	34.58	65.19	1.061	1,279.2
Pre-tax profits (in million EUR)	34,691	1.862	8.961	-34.25	273.9
Taxation (in million EUR)	33,927	0.422	1.548	-5.293	38.19
ETR (in %)	22,821	30.59	20.77	0.189	197.5
RoA (in %)	26,601	10.55	10.74	0.090	68.23
Share of pre-tax profits (in %)	13,648	22.78	46.89	-330.3	450.4

Notes: This table shows summary statistics of unconsolidated data for the treatment and control group in the pre-reform period (2010-2014) as used for the estimations of Section 4. The sample does not include ultimate parent entities.

Appendix B: Additional tables & figures – effects of CbCR

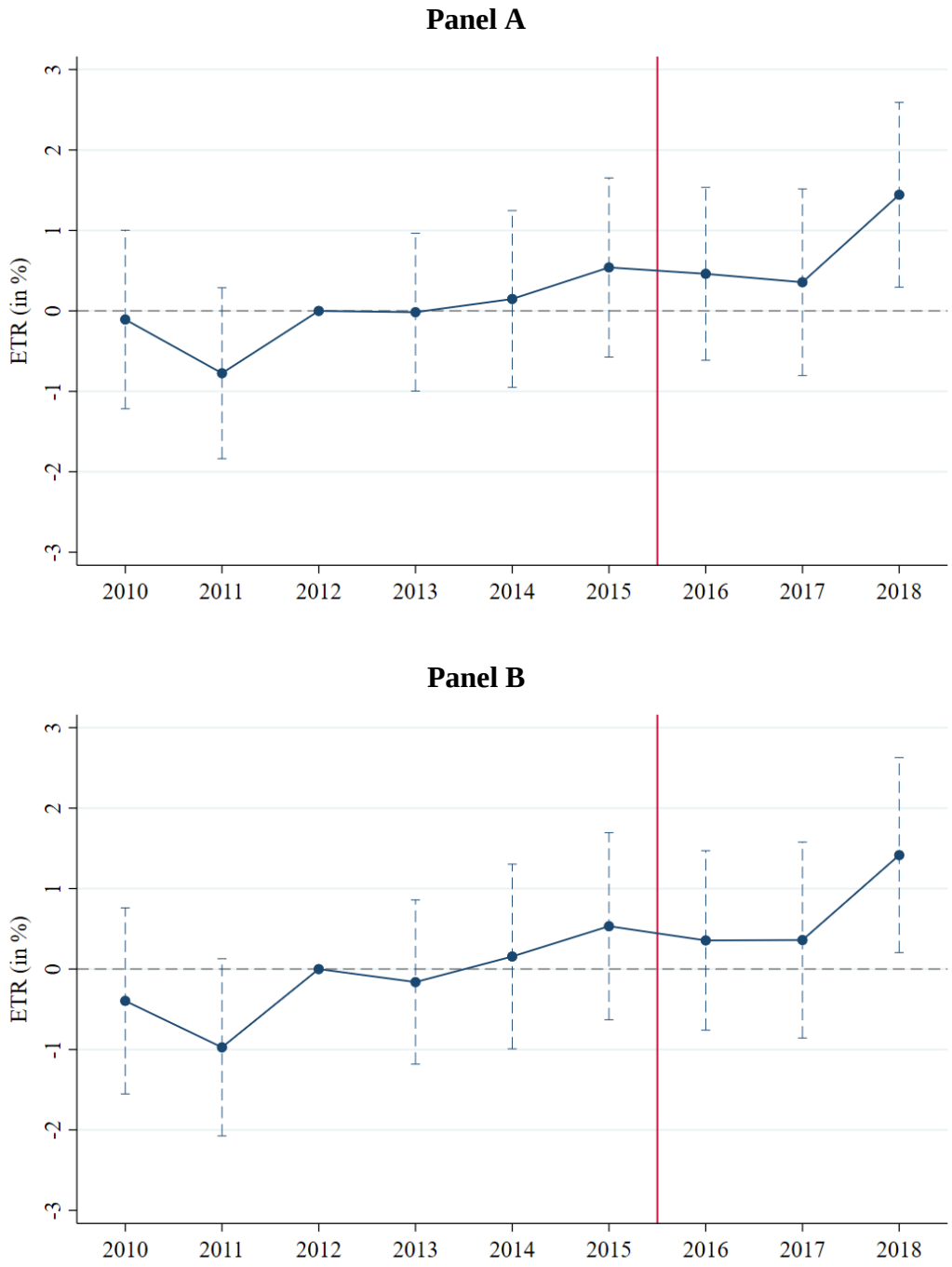

Figure A5: ***CbCR effects on effective tax rates***

Notes: This figure shows the coefficients on the term $\sum_{T=2010}^{2018} \beta_T (t = T)\, CbCR_i$ from Equation (3). The dependent variable is the consolidated effective tax rate. The estimation of Panel A does not include additional country controls, the estimation of for Panel B does include these controls. The dashed vertical lines indicate the 95%-confidence interval.

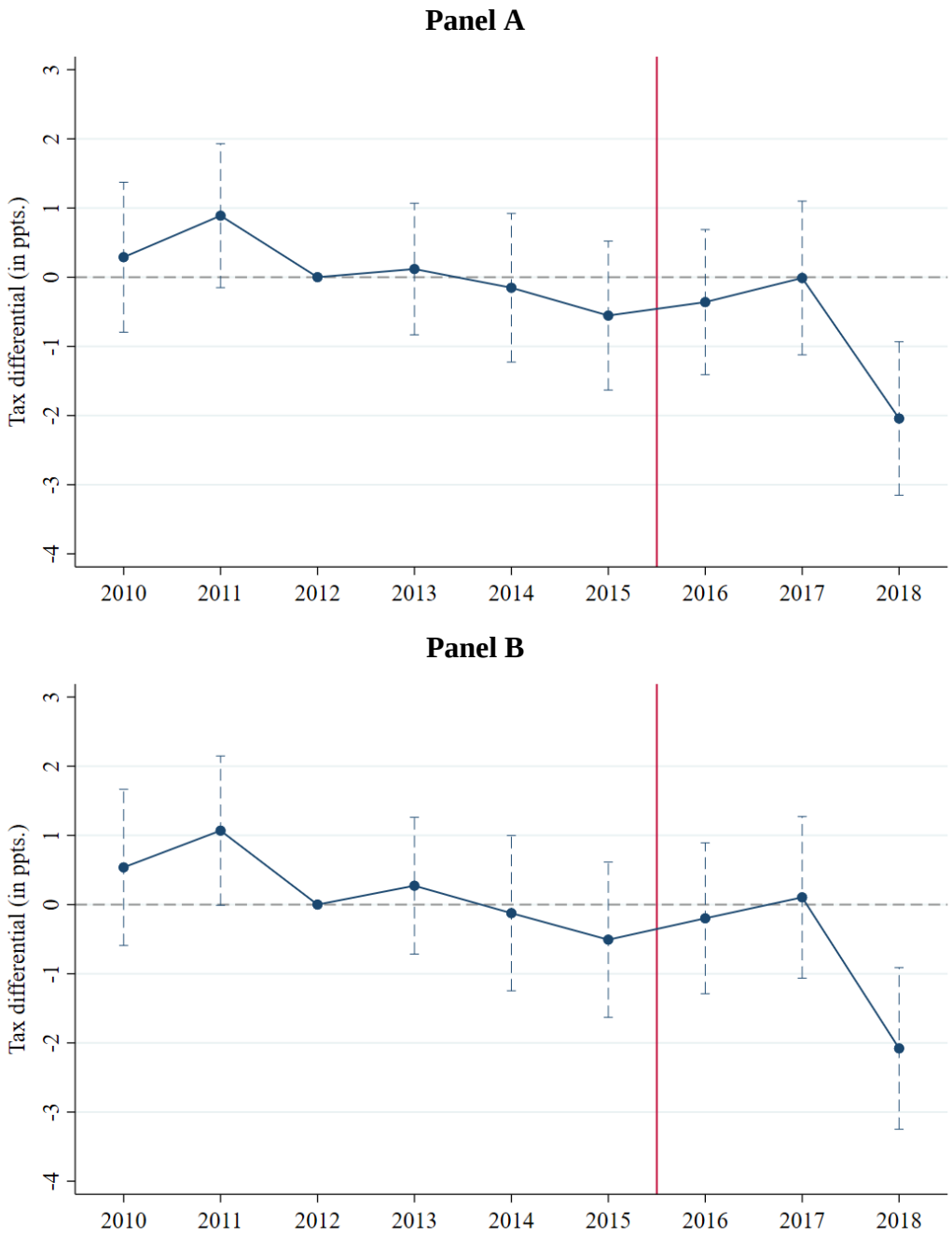

Figure A6: ***CbCR effects on tax rate differentials***

Notes: This figure shows the coefficients on the term $\sum_{T=2010}^{2018} \beta_T (t = T)\, CbCR_i$ from Equation (3). The dependent variable is the tax rate differential between the statutory tax rate in the country of a company's ultimate parent entity and the effective tax rate of the company. The estimation of Panel A does not include additional country controls, the estimation of for Panel B does include these controls. The dashed vertical lines indicate the 95%-confidence interval.

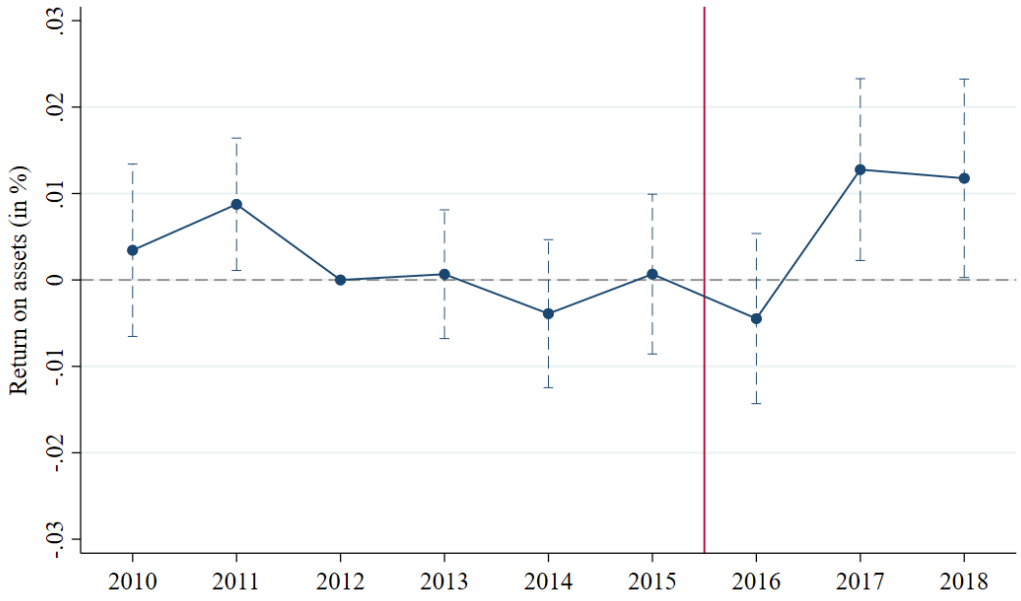

Figure A7: ***CbCR effects on tax sensitivity of subsidiary return on assets***

Notes: This figure shows the coefficients on the term $\sum_{T=2010}^{2018} \beta_T (t = T)\, CbCR_i$ from Equation (3). The dependent variable is the unconsolidated return on assets at the subsidiary level. Ultimate parent entities are not included. The dashed vertical lines indicate the 95%-confidence interval.

Table A9: ***Effects of CbCR on tax avoidance (subsidiaries) – additional results***

	Share of pre-tax profit			
	(1) Germany	(2) Ireland	(3) High tax - cross-border	(4) Low tax - cross-border
CbCR x post2016	4.309***	-1.170	0.146	-0.127
	(1.055)	(1.497)	(0.393)	(0.283)
Basic controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes
Observations	10,123	2,308	46,147	72,434

Notes: This table summarizes the effects of CbCR on the distribution of profits across different groups of subsidiaries. The estimations are based on difference-in-difference estimations following Equation (1). All variables are defined according to Table A7. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the subsidiary country. The statutory tax rate is not included in Specifications (1) and (2) as there were no changes in the sample period and the effect is captured by the company fixed effects. Standard errors (in parentheses) are clustered at the subsidiary level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

Table A10: ***Tests for heterogeneity***

	ETR					
Interaction with	(1) Dummy = 1 for only local filing obligation	(2) Dummy = 1 for UPE in US	(3) Dummy = 1 for private company	(4) Intangible assets / total assets	(5) ETR	(6) Tax rate diff.
CbCR x post2016	1.771***	1.290***	0.938**	1.103***	1.023***	0.674*
	(0.469)	(0.399)	(0.375)	(0.379)	(0.359)	(0.373)
Group x CbCR x post2016	-1.575***	-1.342***	0.384	-0.0311*	-0.160***	0.130***
	(0.570)	(0.651)	(1.170)	(0.0159)	(0.0259)	(0.0252)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49,854	49,854	49,854	46,150	45,556	45,525

Notes: This table summarizes the effects of CbCR on consolidated effective tax rates. The estimations are based on difference-in-difference estimations following Equation (2) testing for heterogeneities in the treatment effect. The coefficient on $Group\ x\ CbCR\ x\ post2016$ measures the difference in the treatment effect between the different groups. All variables are defined according to Table A5. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the country of the ultimate parent entity. Standard errors (in parentheses) are clustered at the company level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

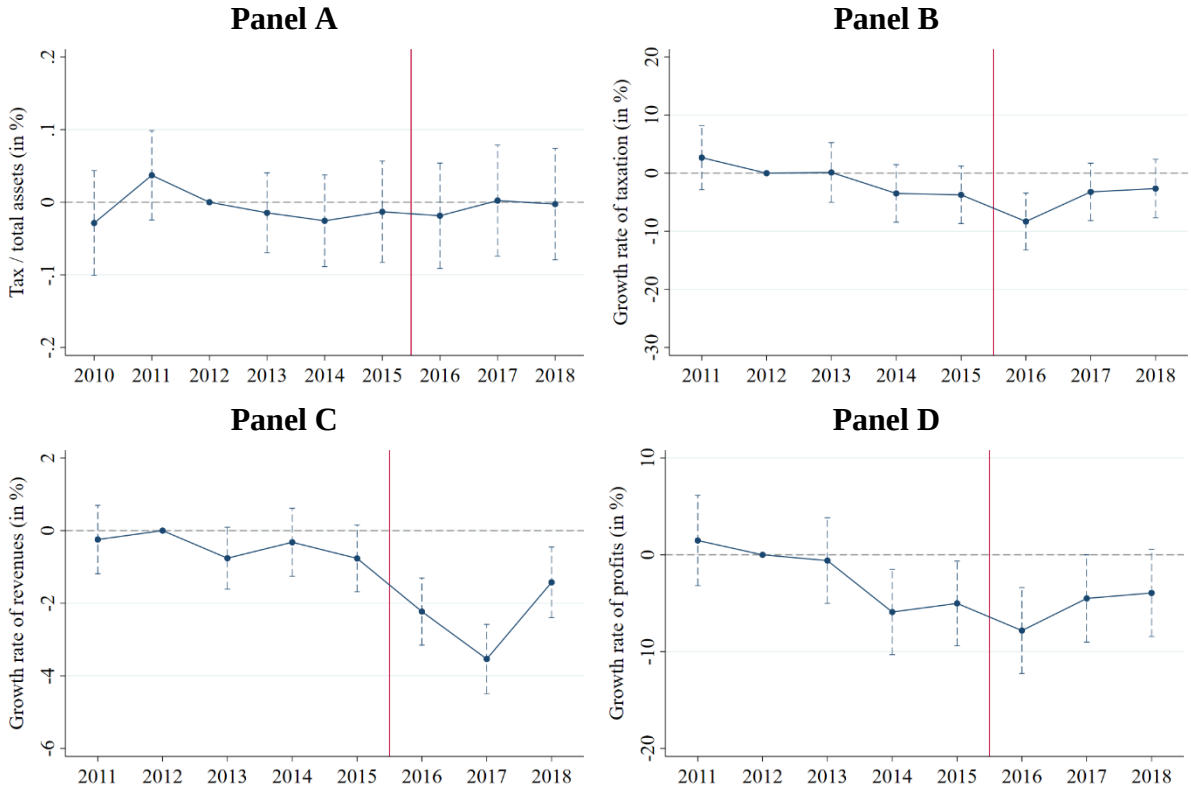

Figure A8: ***CbCR effects on tax payments & growth rates of taxation, revenues, and profits***

Notes: This figure shows the coefficients on the term $\sum_{T=2010}^{2018} \beta_T (t = T)\ CbCR_i$ from Equation (3). In Panel A, the dependent variable is the share of taxes in total assets based on consolidated financial information. In Panels B to D, the dependent variable is the growth rate of consolidated tax payments, revenues, and pre-tax profits, respectively. The dashed vertical lines indicate the 95%-confidence interval.

Table A11: ***Effects of CbCR on tax avoidance & tax payments – Balanced sample***

	(1) ETR	(2) Tax rate diff.	(3) Tax / total assets	(4) Gr. rate tax payments	(5) RoA	(6) Gr. rate revenues	(7) Gr. rate pre-tax profits	(8) Investment/Assets
CbCR x post2016	0.974**	-0.972**	-0.0545	-8.209***	-0.115	-3.534***	-6.365***	-0.374**
	(0.408)	(0.401)	(0.0335)	(1.475)	(0.143)	(0.321)	(1.398)	(0.160)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21,117	20,741	32,239	20,161	21,148	29,590	20,252	14,142

Notes: This table summarizes the effects of CbCR based on difference-in-difference estimations following Equation (1) for a balanced sample of company groups. All variables are defined according to Table A5. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the country of the ultimate parent entity. Standard errors (in parentheses) are clustered at the company level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

Table A12: ***Effects of CbCR on tax avoidance –Balanced sample (subsidiaries)***

	(1) RoA	(2) Ln(RoA)	(3) Share pre-tax profit High tax	(4) Share pre-tax profit Low tax	(5) ETR
Subs. CIT rate	-0.107***	-0.0120***	-0.0572*	0.0169	0.703***
	(0.0240)	(0.00220)	(0.0330)	(0.0342)	(0.0367)
CbCR x post2016	-0.818	-0.0647	1.575***	0.623	0.427
	(0.507)	(0.0464)	(0.558)	(0.449)	(0.342)
CIT x CbCR x post2016	0.0484***	0.00379**			
	(0.0172)	(0.00158)			
Basic controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes
Observations	54,944	54,944	16,864	26,104	49,240

Notes: This table summarizes the effects of CbCR based on difference-in-difference estimations following Equation (1) for a balanced sample of subsidiaries. All variables are defined according to Table A7. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the subsidiary country. Standard errors (in parentheses) are clustered at the company level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

Table A13: ***Effects of CbCR on the capital structure – Balanced sample***

	(1) Interest / EBIT	(2) Leverage	(3) Leverage (short term)	(4) Leverage (long term)	(5) Equity ratio
CbCR x post2016	4.722***	2.606***	0.739***	1.577***	-2.273***
	(1.117)	(0.310)	(0.164)	(0.253)	(0.321)
Basic controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes
Observations	27,985	32,903	33,008	33,061	32,631

Notes: This table summarizes the effects of CbCR based on difference-in-difference estimations following Equation (1) for a balanced sample of company groups. All variables are defined according to Table A5. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the country of the ultimate parent entity. Standard errors (in parentheses) are clustered at the company level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

Table A14: ***Effects of CbCR – Robustness tests***

	ETR							
Robustness test	(1) EB country & industry	(2) EB Fin., country & industry	(3) Incl. 2015	(4) Yearly subs. data	(5) Incl. largest firms w/o known subs.	(6) Excl. +/- 25% rev. of threshold	(7) Incl. largest companies	(8) Add country x year FE
CbCR x post2016	1.195***	0.983**	0.762**	0.985**	0.836**	0.896**	0.948***	1.121***
	(0.419)	(0.435)	(0.339)	(0.387)	(0.358)	(0.387)	(0.356)	(0.389)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49,854	44,513	56,576	47,538	51,718	44,569	52,623	49,854

Notes: This table summarizes the effects of CbCR on consolidated effective tax rates for different samples. The estimations are based on difference-in-difference estimations following Equation (1). All variables are defined according to Table A5. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the country of the ultimate parent entity. Standard errors (in parentheses) are clustered at the company level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

Table A15: ***Effects of CbCR – Placebo tests***

	ETR				
Placebo test	(1) All fin.	(2) EU fin.	(3) Treatment2013	(4) Threshold 200%	(5) +/- 10 % rev. of threshold
CbCR x post2016	0.560	-0.800	0.131	-0.258	-0.300
	(3.199)	(5.003)	(0.407)	(0.643)	(1.120)
Basic controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Year x Industry FE	Yes	Yes	Yes	Yes	Yes
Observations	1,386	684	27,911	19,684	4,728

Notes: This table summarizes the effects of CbCR on consolidated effective tax rates for different samples. The estimations are based on difference-in-difference estimations following Equation (1). All variables are defined according to Table A5. Basic controls are the statutory CIT rate, GDP per capita growth, and the inflation rate in the country of the ultimate parent entity. Standard errors (in parentheses) are clustered at the company level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level.

Appendix C: Additional tables & figures – avoidance of CbCR

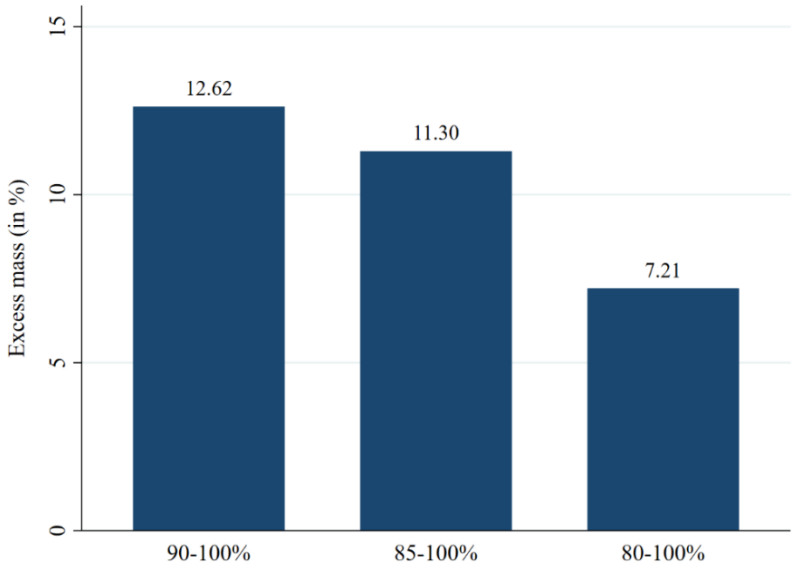

Figure A9: ***Excess mass calculated for different bunching regions***

Notes: This figure shows the excess mass when different bunching regions are assumed. Calculations are based on Equation (4). The bars indicate the percentage difference between the average density in the pre-reform period of 2010-2014 and the average density in the post-reform period of 2016-2018.

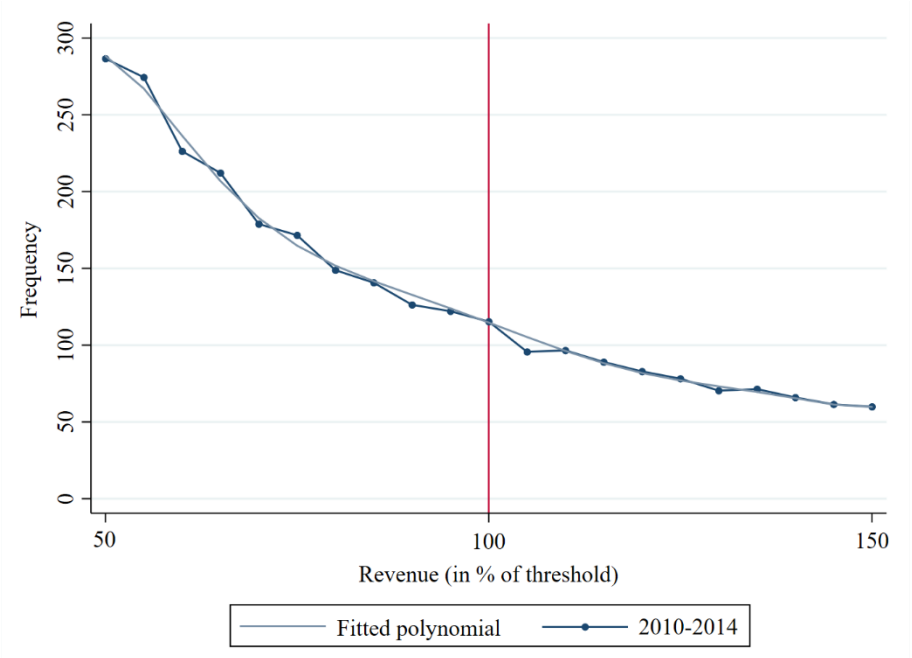

Figure A10: ***Distribution of revenues and fitted polynomial 2010-2014***

Notes: This figure plots the distribution of consolidated company revenues relative to the threshold applicable (dotted graph) and the estimated counterfactual distribution (solid graph) for the years of 2010-2014. The counterfactual is estimated fitting a seventh-order polynomial to the empirical distribution, excluding two data bins below and one data bin above the notch. The notch point (revenue threshold) is marked by the vertical line. Data bins have a width of 5 percentage points and are labelled by their upper bound. The approach follows Chetty et al. (2011) and Kleven & Waseem (2013) and is based on the implementation package of Chetty et al. (2011).

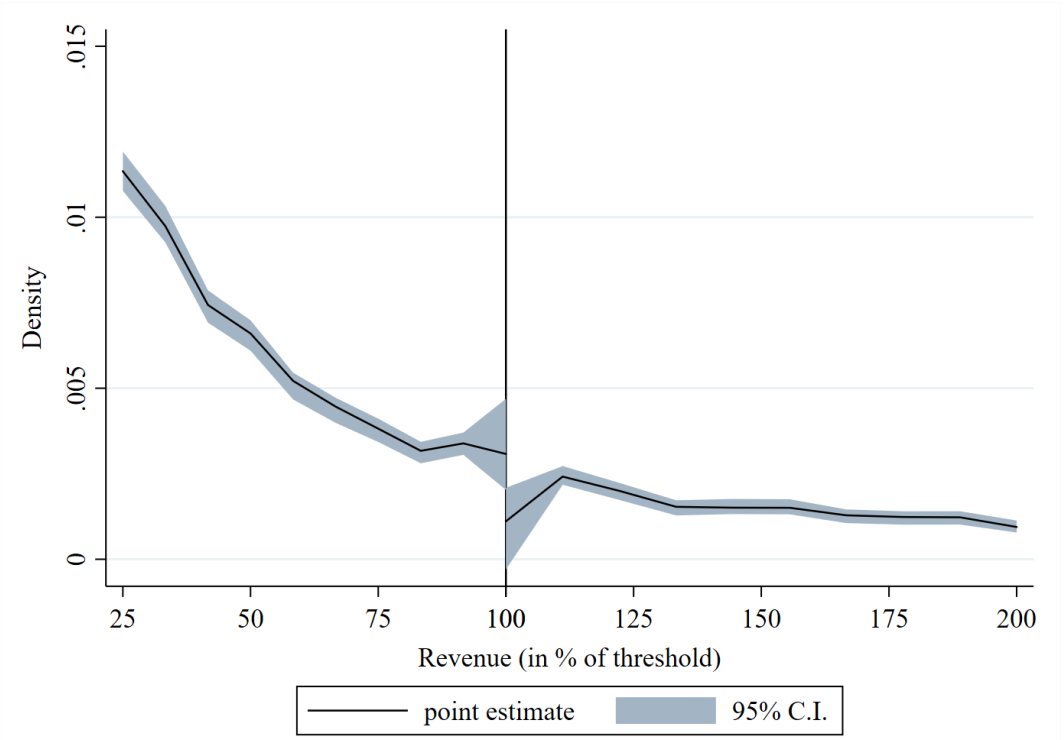

Figure A11: ***Distribution of revenues pre- and post-CbCR (forth order polynomial)***

Notes: This figure plots the point estimates and the 95% confidence intervals for local polynomial densities over revenues relative to the threshold applicable. For the estimations, a forth-order local polynomial is used with a bandwidth of 10 percentage points around the cutoff. The approach follows McCrary (2008), Cattaneo, Jansson & Ma (2018), and Cattaneo, Jansson & Ma (2019) and is implemented using the calculation package from Cattaneo, Jansson & Ma (2018).

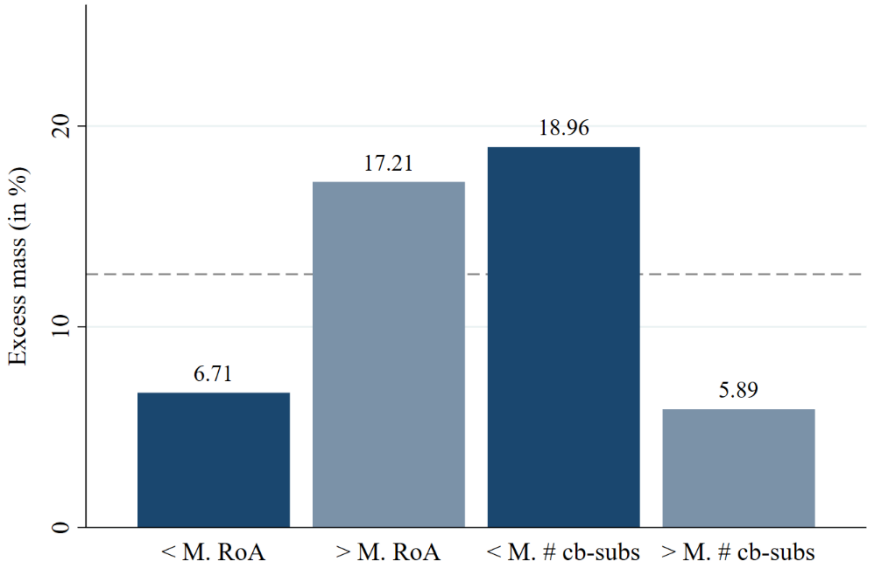

Figure A12: ***Excess mass for additional sub-samples***

Notes: This figure shows the excess mass between the average density in the pre-reform period of 2010-2014 and the density in the different post-reform years for different the sub-samples. The main sample is split at the median of different continuous variables. The calculations are based on Equation (4) for the bunching region between 90% and 100% of the revenue threshold applicable.