INSTITUTE
OF ECONOMIC STUDIES
Faculty of Social Sciences
Charles University

EFFECTS OF CORPORATE TRANSPARENCY ON TAX AVOIDANCE: EVIDENCE FROM COUNTRY-BY-COUNTRY REPORTING

Tijmen Tuinsma
Kristof De Witte
Petr Janský
Miroslav Palanský
Vitezslav Titl

IES Working Paper 4/2023

Institute of Economic Studies,
Faculty of Social Sciences,
Charles University in Prague

[UK FSV – IES]

Opletalova 26
CZ-110 00, Prague
E-mail : ies@fsv.cuni.cz
http://ies.fsv.cuni.cz

Institut ekonomických studií
Fakulta sociálních věd
Univerzita Karlova v Praze

Opletalova 26
110 00 Praha 1

E-mail : ies@fsv.cuni.cz
http://ies.fsv.cuni.cz

Bibliographic information:
Tuinsma T., De Witte K., Janský P., Palanský M., Titl V (2023): " Effects of Corporate Transparency on Tax Avoidance: Evidence from Country-by-Country Reporting" IES Working Papers 4/2023. IES FSV. Charles University.

This paper can be downloaded at: http://ies.fsv.cuni.cz

Effects of Corporate Transparency on Tax Avoidance: Evidence from Country-by-Country Reporting

Tijmen Tuinsma[a]
Kristof De Witte[a,b]
Petr Janský[c]
Miroslav Palanský[c]
Vitezslav Titl[a,d]

[a]Leuven Economics of Education Research, Katholieke Universiteit Leuven, Leuven, Belgium. Email: tijmen.tuinsma@kuleuven.be
[b]UNU-MERIT, Maastricht University, Maastricht, The Netherlands.
[c]Institute of Economic Studies, Faculty of Social Sciences, Charles University, Prague, Czechia.
[d]Utrecht University School of Economics, Utrecht University, Utrecht, The Netherlands.

February 2023

Abstract:
Private Country-by-Country Reporting (CbCR) is a measure against tax avoidance by large multinationals, implemented throughout the EU in 2016. Multinational companies with an annual revenue over € 750 million have been required to report their global activities on a country-by-country basis to tax authorities. Using this cutoff in a sharp regression discontinuity design, we find causal evidence for an increase in effective tax rates for affected companies, indicating an increase in tax compliance. We estimate the increase in effective tax rates at 5 to 6 percentage points locally. However, significant cross-sectional variation is present: the most aggressive multinationals with tax haven affiliates are at most moderately affected, while almost the full effect is concentrated in medium-aggressive firms. From a policy perspective, the results suggest that while CbCR was effective in combating some forms of tax avoidance, profit shifting opportunities in tax havens mostly negate this effect.

JEL: F23, H25, H26
Keywords: corporate tax avoidance, tax havens, financial transparency

Acknowledgements: The authors thank Katharina Pfeil, Matěj Bajgar, Wim Moesen, Raphael Műller, and Francisco Pitthan for their comments and acknowledge financial support from CELSA University network and, except for Petr Janský, the Horizon Europe project `DemoTrans' (grant 101059288). Petr Janský and Miroslav Palanský acknowledge support from the Czech Science Foundation (CORPTAX, 21-05547M) and the Cooperatio Program at Charles University, research area Economics. This project has received funding from the European Union's Horizon 2020 research and innovation program under the Marie Sk lodowska-Curie grant agreement No 870245.

1 Introduction

International corporate tax avoidance by multinational enterprises (MNEs) is a significant and growing problem. Estimates suggest that approximately 10%-30% of MNEs' profits are shifted to tax havens, amounting to hundreds of billions of dollars worldwide (see Blouin and Robinson, 2020; Clausing, 2016; Janský and Palanský, 2019; Tørsløv et al., 2022). The lost tax revenues have significant negative consequences for national budgets and have been shown to increase global cross-country inequality: developing countries lose a larger share of their tax revenue than more developed countries (OECD, 2015). Meanwhile, profit shifting primarily benefits the rich, thus also increasing within-country inequality (Cobham and Gibson, 2016; Cobham and Janský, 2018; Garcia-Bernardo et al., 2022; Saez and Zucman, 2016).

One major recent initiative to reduce this type of tax avoidance is Country-by-Country Reporting (CbCR). A group of 58 countries forming the OECD/G20 Inclusive Framework on Base Erosion and Profit Shifting (BEPS), including all EU member states, implemented a requirement for MNEs to submit CbCR from 2016. As of November 2021, 141 countries have joined the framework and implemented CbCR (OECD, 2021), requiring all MNEs with an annual revenue of at least €750 million to provide to the tax authorities a detailed report of their global activities on a country-by-country basis. The information is automatically privately shared with other participating countries' tax authorities, but is not made publicly available at the company level[1]. CbCR thereby increases our understanding of where MNEs locate their economic activity and where they book profits, enabling us to estimate the scale of the misalignment (Garcia-Bernardo et al., 2021a). The additional transparency of MNEs' practices brought about by CbCR is intended to increase the detection probability of profit shifting, thus discouraging firms from such tax avoidance strategies.

In this paper, we test whether the CbCR's increase in transparency affects MNEs' tax avoidance behaviour. Using financial and ownership data from Bureau van Dijk's Orbis database, we construct a dataset of EU-headquartered MNEs with revenues around the threshold of €750 million. Using a sharp regression discontinuity design (RDD) around this threshold, we find a significant increase in effective tax rates (ETRs), i.e. an increase in tax compliance, for firms subject to CbCR requirements. In our preferred specification, we estimate the effect at 6 percentage points, a significant relative effect size of over 20%. In absolute terms, the yearly additional tax revenue accrued due to private CbCR could be in the neighborhood of €26 billion.[2] However, while the internal validity of our method is high, we caution

[1] The EU has agreed to implement a partially public CbCR scheme for all companies starting in 2024, after previously having implemented public CbCR for the banking sector as well as in the extractive and logging industries (European Commission, 2021).

[2] Over these three years, the sum of before-tax profits and losses of the treated firms in our sample is €1.3 trillion. A back-of-the-envelope multiplication by 6% equals roughly €78 billion over the course of three years, or €26 billion per year.

against over-interpretation of the exact estimate since external validity is limited.

An important contribution our study offers is the investigation of CbCR efficiency in its current private form by studying the cross-sectional variation of its effect on ETRs. We hypothesize that some MNEs are deterred from avoiding taxes, but, for the most aggressive firms, the benefits still outweigh the potential costs. To test this hypothesis, we split our sample according to tax aggressiveness categories and study the effects of CbCR for these subsamples. The most aggressive firms have tax haven affiliates to shift their profits to, which is reflected in their low ETRs. We select this group by focusing only on MNEs with operations in tax havens and a below-median ETR in the pre-CbCR period. Medium-aggressive firms included in our subsample have below-median ETRs but no affiliates in tax havens. These firms are still successful in their tax optimisation, but do not use profit shifting for tax avoidance. Non-aggressive MNEs with above-median ETR (independent of their tax haven presence) form the remaining group. Our results suggest significant cross-sectional variation of the effect between these groups. Almost all of the effect is concentrated in MNEs with medium aggressiveness, as CbCR significantly increases their tax compliance. For the most aggressive firms we find a much lower increase in ETRs, with limited statistical significance. For the least aggressive firms, we find no effect of CbCR on ETRs, as expected. In agreement with the findings of Joshi (2020), private CbCR is effective in combating some tax avoidance but not from the most aggressive profit shifting using tax havens. The increase in detection risk appears insufficient to counteract the benefits of the most aggressive tax practices.

Literature on corporate tax transparency policy has thus far focused largely on public reporting in a narrower scope. One of the first (public) CbCR initiatives was introduced in the extractive sector. Johannesen and Larsen (2016) find that this led to a decrease in firm value for European gas, oil and mining companies, suggesting that increased transparency can curb the rents that tax avoidance creates for these firms. In the financial sector, the European Commission's Capital Requirements Directive IV (2014) required multinational banks to provide financial and tax information in the form of public CbCR. Overesch and Wolff (2021) argue that this resulted in an increase in ETRs for affected banks, mainly driven by banks with tax haven operations. Joshi et al. (2020) observe that this public CbCR deterred tax-motivated income shifting but it did not influence the affected banks' overall tax avoidance.

In public reporting, it is difficult to disentangle the effects of the additional information available to tax authorities and the effects of public scrutiny. The CbCR initiative examined in this paper is private to tax authorities and therefore does not feature a public scrutiny channel. Any effects we find can thus be attributed to new information disclosure to tax authorities. It is also the first time a form of CbCR is implemented across every industry, as opposed to within specific sectors. A total of only three papers are thus closely related to our study.

First, Hugger (2020) investigates *(i)* whether private CbCR resulted in a reduction in profit shifting, and *(ii)* whether companies avoided the disclosure obligation by manipulating their reported revenues. In a difference-in-differences setting, he finds that the introduction of CbCR policy led to an average increase in ETRs of about one percentage point for affected firms. He also finds evidence for bunching just below the threshold for reporting. In contrast to Hugger (2020), we employ an RDD with relatively small bandwidths and focus on EU MNEs only in order to more closely isolate the effect of CbCR from other potentially confounding factors. For example, it is likely that very large MNEs with very low ETRs have not been affected by the new regulation as their tax planning strategies were already well-known to tax authorities, and domestic companies (also included in the analysis by Hugger (2020)) are likely also not affected. Our approach is thus more likely to capture the real effect of CbCR. We also provide a detailed cross-sectional analysis to provide a better understanding of which firms altered their behavior as a result of CbCR. We do not find evidence of bunching behavior by European MNEs.

Second, using data only on European MNEs, Joshi (2020) does not find evidence for bunching which is in agreement with our results. She employs both an RDD as well as a difference-in-differences approach. In her RDD setting, she finds that CbCR led to an increase of 5 to 6 percentage points in the ETR for reporting MNEs relative to the unaffected firms. However, the RDD in Joshi (2020) result in relatively large standard errors. We contribute to her analysis by including a rich set of fixed effects which allow us to estimate the effects of CbCR with higher precision. This approach confirms the effect size of 5 to 6 percentage points locally around the threshold. We also extend the cross-sectional analysis as compared to Joshi (2020) by focusing on the variation of the effects across MNEs based on their tax aggressiveness. Our conclusions are in agreement with her finding that CbCR deters from general tax avoidance, but profit shifting is less affected.

Finally, Olbert and De Simone (2021) study the effects of CbCR on firms' capital and labor investments. They find that affected MNEs close down subsidiaries in tax havens, but increase real economic activity in European low-tax jurisdictions. However, the authors focus on real effects at the subsidiary level and as such do not study heterogeneity at the level of the MNE group. In this paper we are interested specifically in this aspect, so we use ETRs at the ultimate owner level to have a more direct measure of tax avoidance, which also enables us to study heterogeneity in terms of the tax aggressiveness of each MNE.

The findings in this paper should be of direct interest to policy makers fighting profit shifting. The conclusions of previous research argue that private reporting may be sufficient in deterring tax avoidance and public CbCR is not necessary (Joshi, 2020). Conversely, our results provide an argument to proceed with public CbCR to increase detection risks even more, especially for the most aggressive tax strategies, via the added channel of public scrutiny. Next to the EU, which is set to implement public CbCR starting in 2024, other countries should be encouraged to follow suit, and some do. For example, the approval of the US Disclosure of Tax Havens and Offshoring Act would result in an even broader implementation of public CbCR[3] and Australia has announced in October 2022 that it is planning to publish CbCR at the company level starting in 2023. Additionally, a minimum effective tax rate as suggested by the Biden administration in their *Made in America Tax Plan* and proposed by the OECD could complement CbCR by decreasing the benefits of profit shifting (OECD, 2021).[4]

2 Institutional Background

CbCR is a measure against 'Base Erosion and Profit Shifting' (BEPS), a set of corporate tax planning strategies whereby MNEs exploit gaps and mismatches in different countries' tax systems to lower their overall global tax burden. MNEs shift their profits away from the location of their profit-generating activities (generally higher-tax countries) to lower-tax jurisdictions, leading to the erosion of the tax base in higher-tax countries. Recognizing that globalization and digitization have led to increased opportunities for MNEs to greatly minimize their tax burden, the OECD and the G20 launched their BEPS project with an Action Plan (OECD, 2013). The final report package on BEPS details the 15 Actions to help countries tackle BEPS (OECD, 2015). Four of these instruments are minimum legal requirements for countries wishing to join. As of November 2021, 141 countries had done so, including most of the world's most important offshore financial centers.[5]

This paper focuses on Action 13 (one of the four minimum standards), which aims to improve transparency through CbCR. The objective of 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, 2020). Using this information, tax authorities can assess transfer pricing risks and determine effective audit strategies. MNEs may perceive higher detection risks, so the additional information available to authorities should provide indirect pressure on MNEs to refrain from aggressive tax planning strategies.

Under CbCR, all member countries must implement legislation requiring large MNEs to *"provide all*

[3]The Disclosure of Tax Havens and Offshoring Act passed the House of Representatives in June 2021, civil society organizations such as Oxfam and the Tax Justice Network (TJN) now urge the Senate to pass the Act. See, e.g., `https://www.oxfamamerica.org/press/oxfam-applauds-house-passage-of-disclosure-of-tax-havens-and-offshoring-act/` and `https://taxjustice.net/press/us-act-clears-fog-of-corporate-secrecy-puts-pressure-on-eu/`.

[4]See the full tax plan on `https://home.treasury.gov/system/files/136/MadeInAmericaTaxPlan_Report.pdf`.

[5]An up-to-date full list of participating countries is provided by OECD (2021).

relevant governments with needed information on their global allocation of the income, economic activity and taxes paid among countries according to a common template" (OECD, 2015). The CbC report should be filed in the country where the ultimate parent of the MNE structure is headquartered. The reports are then shared between the tax authorities of different jurisdictions through an automatic exchange of information agreement, but are not made publicly available. The CbC reports consist of three tables. The first, and most important, requires financial information disaggregated at the country level, for every country in which the MNE group is active. Reported variables include revenues, profit and loss before income tax, income tax paid, income tax accrued, capital, accumulated earnings, number of employees, and tangible assets. A second table requires a listing of all subsidiaries within the MNE structure with their tax jurisdiction and main business activities, and the third table includes additional information and comments.

Within the EU, the CbCR requirements are implemented for fiscal years starting from 1 January 2016. They apply to MNEs with an annual consolidated revenue of at least €750 million. Although this excludes 85 to 90% of MNEs from the reporting obligation, the affected MNEs represent approximately 90% of corporate revenues (OECD, 2015).

Prior to the introduction of CbCR, MNEs were required to provide aggregate information on profits and taxes to the authorities in their tax residence, but this was rarely required on a country-by-country basis. Hence, CbCR has dramatically increased the level of information available to tax authorities on MNEs' location of economic activities and reported profits (Hanlon, 2018). In a similar vein, two older tax disclosure initiatives in Europe are part of the EU Capital Requirements Directive IV (CRD IV, Directive 2013/36/EU) and the Extractive Industries Transparency Initiative (EITI). The CRD IV came into effect in 2014, requiring banks with EU headquarters to publicly report key financial data including revenue, profits and taxes paid at country level. Key differences between the CRD IV and CbCR under the BEPS project are that CbCR lacks public availability of the information, the CRD IV does not have a revenue cutoff for the disclosure requirement, and the scope, which is limited to EU banks in the CRD IV (Hugger, 2020). The EITI includes the oldest CbCR regime, requiring firms in the extractive sector to publicly disclose their financials at country level (Joshi, 2020; Overesch and Wolff, 2021). Again, the public nature of this initiative differs from BEPS CbCR, as does its objective: to prevent corruption rather than increase corporate transparency (Dutt et al., 2019). Since banks and firms in the extractive industries were subject to a form of CbCR prior to the BEPS project, we exclude these firms from our analysis.

Private CbCR is not the final step towards corporate tax accountability. In 2021, the EU has approved legislation to make these reports publicly available from 2024 (European Commission, 2021). This will provide additional scrutiny, including from the general public, shareholders, investigative journalists, and academics. Potential tax avoidance costs to companies may increase as a result in case shareholders or customers punish aggressive corporate tax strategies. This effect can only grow if public CbCR is implemented in a greater number of jurisdictions worldwide. Significantly, in 2021 the US House of Representatives passed the Disclosure of Tax Havens and Offshoring Act which effectively includes public CbCR as well. The passage of this Act in the US Senate would be a crucial step in the implementation of public CbCR for some of the largest companies in the world. Similarly, Australia seems to be leading the way towards public CbCR with its October 2022 announcement that CbC reports of all companies operating in Australia are to be made publicly available starting in 2023.

Globally, there are also initiatives to more directly increase global effective corporate income tax rates. Both the OECD and the Biden administration in the US introduced plans for a minimum effective tax rate for MNEs (OECD, 2021; US Department of the Treasury, 2021). A minimum tax rate is capable of decreasing the incentives of MNEs to use tax havens, especially the ones with tax rates below the set minimum. On the other hand, in its current form with a minimum corporate tax rate of 15%, some fear it may create a new dynamic in the corporate tax world, ultimately decreasing government tax revenues for many, especially developing countries. Johannesen (2022) describes a model in which the introduction of a global minimum tax rate creates incentives both for raising and lowering tax rates in non-havens, and in which welfare effects in non-havens are ambiguous.

3 Methodology

3.1 Hypothesis development

We begin with a proposition that MNEs make decisions about whether or not to avoid tax based on an evaluation of their costs and benefits, incorporating their preferences for maximizing pre-tax profit or after-tax profit. In particular, when an MNE expects to make a pre-tax profit, it faces the decision of whether to try to avoid paying full tax in the country where this profit is to be made, or whether to avoid paying it by, for example, shifting part of this profit to a lower-tax jurisdiction. Our methodological innovation is to discount the monetary benefit of tax avoidance with an *aggressiveness* term. As companies differ in their willingness to engage in tax avoidance activities (i.e. data show that only a subset of companies engage in profit shifting and that the ones that do shift profits vary widely in the extent to which they do so), we interact the monetary benefits that a company enjoys as a result of tax avoidance with its aggressiveness. In our model aggressiveness may be interpreted as a company-specific willingness to avoid paying corporate income tax and can range between zero (for companies that are completely opposed to tax avoidance) to one (for companies that would like to avoid paying as much corporate income tax as possible). Hence, each company i perceives its benefit from avoiding taxes as

$$\text{Payoff}_i = \underbrace{(\tau_{home} - \tau_{low}) \cdot \pi_i}_{\text{Avoided tax} = t_i} \cdot \text{Aggressiveness}_i, \tag{1}$$

where $(\tau_{home} - \tau_{low})$ is the tax rate differential between the home jurisdiction's statutory tax rate τ_{home} and the ETR when avoiding taxes τ_{low}, and π_i is pre-tax profit.

Avoiding taxes also entails costs, as it runs the risk of detection followed by sanctions. Following the classical model of tax evasion by Allingham and Sandmo (1972), we model the decision to avoid taxes as a cost-benefit consideration by each MNE, taking into account the risk of being detected and obliged to pay a sanction which is a function of the tax avoided, t_i. We model detection probability p to be constant across companies.[6] If it is not detected, the company benefits by paying a lower tax, denoted by Payoff_i. Hence, the expected utility of avoiding taxes for firm i is given by:

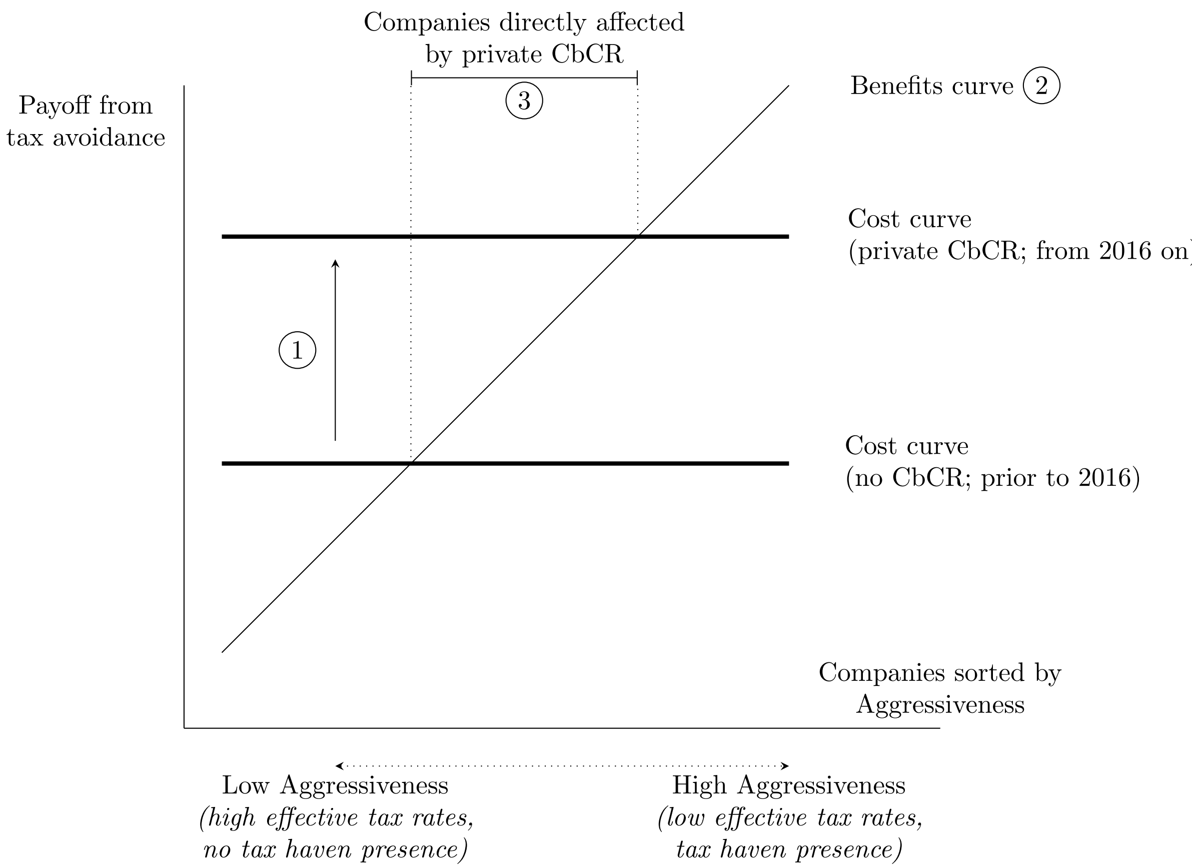
$$E[u_i|\text{Aggressiveness}_i] = (1 - p) \cdot \text{Payoff}_i - p \cdot \text{Sanction}(t_i). \tag{2}$$

A firm would only decide to engage in tax avoidance if this expected payoff is positive. The introduction of CbCR increases the detection probability p for all companies, decreasing the expected payoff. Depending on firms' aggressiveness, their expected payoff may switch from positive to negative and they will quit their tax avoidance strategy. However, for the most aggressive firms, the increase in detection probability p is not sufficient for the cost to outweigh the benefits, and their tax avoidance continues as before.

This hypothesized effect is illustrated in Figure 1, where *Aggressiveness* is presented on the horizontal axis and the payoff from tax avoidance on the vertical axis. Private CbCR raises the cost curve, but does not affect the benefits curve. This results in deterring a group of medium-aggressive firms from tax avoidance, while the cost-benefit trade-off for the most aggressive firms still leads to a decision favoring tax avoidance. This hypothesis is in agreement with empirical evidence for cross-sectional variance of the effects of transparency based on tax aggressiveness (Hanlon and Slemrod, 2009).

[6] Assuming a constant detection probability is without loss of generality. The only necessary assumption for our model is that for every firm, p does not decrease because of CbCR.

Figure 1: Diagram of the costs and benefits of MNEs when deciding whether to avoid tax, and the mechanism of a reform that increases corporate transparency and affects the companies' decision about tax avoidance



Notes:
(1) The reform in 2016 which introduced the requirement for private CbCR raised the cost of the decision to avoid tax by raising the detection probability (while keeping sanctions constant).
(2) The benefits curve has not been affected by the reform in 2016.
(3) As a result, only some companies' decision about tax avoidance was affected by the 2016 reform.

3.2 Data

We use detailed firm-level yearly consolidated financials and ownership data from the Orbis database (Bureau van Dijk, BvD). Both data sets cover the period from 2010 to 2018, thus including six pre-reform years and three post-reform years.

The main sample consists of EU-headquartered MNEs. We focus on the EU since its member states implemented CbCR simultaneously (1 January 2016) and with the same cutoff (€ 750 million) for all firms, which improves our chances of identifying any causal effects. Moreover, data availability on affiliates through Orbis is better for European MNEs. Likewise, the tax and legal systems they are subject to are more comparable across jurisdictions (a similar approach was taken by Joshi, 2020).

We exclude firms in the financial or extractive sector since they were subject to a form of (public) CbCR prior to the introduction of the BEPS project (see Section 2). The final sample includes 12,946 firms (unbalanced, 54,017 firm-year observations). Following existing literature we winsorize the ETR at 0 and 1 to limit the influence of outliers and to facilitate the interpretation of the results. Other variables are winsorized at the 1st and 99th percentile.

To find the location of all subsidiaries of an MNE, we rely on yearly ownership data from Bureau van Dijk. For every ultimate owner company we identify its (foreign and domestic) affiliates and their country of incorporation.[7] The resulting structure is used for two purposes. First, we exclude companies with no known foreign subsidiaries in their group. These firms may not be MNEs, and, as such, they may respond differently to CbCR. Second, we construct a dummy variable indicating whether the MNE controls a subsidiary in a tax haven. Following Bennedsen and Zeume (2018) and De Simone and Olbert (2021), a subsidiary is considered a tax haven affiliate if it is located in any foreign country listed in the tax haven classification in the Appendix (Table 3). In addition, we show that our approach is robust to other tax haven classifications such as the one used by Garcia-Bernardo et al. (2021b) and the Corporate Tax Haven Index.

Within our sample we identify a 'control group', i.e., firms with less than €750 million in annual revenue, and a 'treatment group', with €750 million or more in annual revenue. Table 4 presents the summary statistics for both groups. Approximately one fifth of the observations focus on the treatment group (Panel B). The average ETR is slightly lower for the treatment compared to the control group, confirming the intuition that companies with more revenue have more means to decrease their tax base. The decrease in ETRs for the control group since the introduction of CbCR is due to a race to the bottom: corporate tax rates have gone down over the years. However, the treatment group saw a smaller decrease, which indicates that CbCR may have increased tax compliance. The average treatment firm is larger than the average control firm in terms of revenue, the number of tax haven subsidiaries, and assets. The return on assets and leverage is similar for both groups.

3.3 Identification strategy

We use the consolidated effective tax rate (ETR) as a measure of tax avoidance. This measure is appropriate for our sample and research question (Hanlon and Heitzman, 2010), and has been frequently used in previous studies as a proxy for tax avoidance (e.g. Dyreng et al. (2010); Joshi (2020); Overesch and

[7] To make sure the ultimate owner firm has sufficient control over the subsidiary to use it in its tax planning strategy, we identify the Global Ultimate Owner (GUO) for every company using the GUO50 link in the Orbis database. This link identifies the ultimate owner for every company with an ownership percentage of at least 50%.

Wolff (2021)). We compute the ETR by dividing worldwide taxes paid by pre-tax profits. A lower ETR indicates a higher level of tax aggressiveness. Conversely, if firms affected by CbCR increase their tax compliance, they should experience an increase in ETRs relative to the control group.

Our empirical identification of the effect of CbCR on tax avoidance relies on a sharp regression discontinuity design (RDD). This strategy leverages the strict revenue threshold of €750 million above which MNEs are required to provide CbC reports. Hence, the running variable is consolidated revenue in the previous year. The main idea is that firms in the neighborhood of the reporting cutoff are comparable in their underlying characteristics. Given the exogenously determined €750 million threshold, their treatment status is as if randomly assigned.

For the causal inference of the effect of CbCR on ETRs to be valid, the identifying assumption that firms do not manipulate their revenue to fall just below the reporting threshold must hold. In a review of the earnings management literature, Healy and Wahlen (1999) document occurrences where regulatory incentives induced firms to manipulate their income downwards, but they find little evidence of whether this behavior is widespread or rare. To formally test the identifying assumption, we check for bunching by conducting a local polynomial density test based on McCrary (2008) and Cattaneo et al. (2018). The results in Figure 3 in the Appendix show overlapping 95% confidence intervals in the density of firm observations around the revenue threshold, suggesting a smooth distribution of firms around this cutoff.[8] Hence, the test does not invalidate the identifying assumption. As our identification strategy quasi-randomly assigns firms into control and treatment group, the resulting estimates are plausibly causal treatment effects (Cattaneo et al., 2018; Lee and Lemieux, 2010). This is in agreement with the conclusions of Joshi (2020) and De Simone and Olbert (2021), who do not find evidence of bunching. Hugger (2020) does find a discontinuity in firm distribution around the revenue threshold, but does so in a setting with a wider scope, including non-MNEs and MNEs headquartered outside Europe.

To study cross-sectional variation of the effects, we define different categories of aggressiveness based on two dummy variables. We first split the sample based on pre-reform ETRs. The most tax-aggressive firms have low pre-CbCR ETRs. We define low pre-CbCR ETRs as having a pre-CbCR ETR below the median within the country-year. Second, we categorize based on whether a company has affiliates in tax havens in the Orbis database.[9] Using these two conditions, the most aggressive firms have *both* low ETRs and tax haven affiliates. Medium-aggressive MNEs do not have subsidiaries in tax havens

[8] Figure 4 in the Appendix also provides RD plots of the three covariates (firm size, return on assets, and leverage) around the reporting threshold. The graphs provide little evidence for a discontinuity in these firm characteristics. Table 5 in the Appendix confirms this with small and insignificant RD estimates for the covariates around the cutoff.

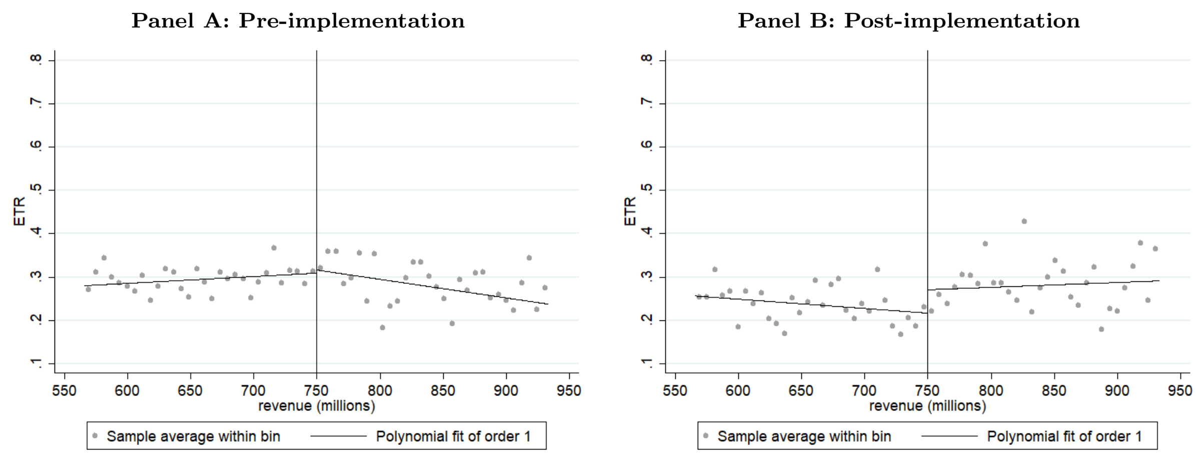
[9] A limitation of our Orbis data is that it may not observe all affiliates of an ultimate owner company. This might cause some highly aggressive firms to appear as less aggressive, making our measure of aggressiveness a conservative indicator.

but still achieve below-median ETRs. Non-aggressive companies have above-median ETRs. While we do differentiate between non-aggressive MNEs with and without tax haven affiliates, their high ETR indicates that their tax haven presence is more likely to reflect real economic activity than tax avoidance strategies. Splitting our sample into these four roughly same-sized subsamples, we perform the same RD regressions as before and compare with the original result.

In an RDD setting the bandwidth choice is fundamental for the analysis and interpretation of results, since it directly affects the properties of local polynomial estimation and inference procedures. Estimates are often sensitive to its particular value (Cattaneo et al., 2019). The bandwidth choice involves a trade-off between precision and bias: while choosing a smaller bandwidth reduces the misspecification error of the local polynomial approximation, it also leads to an increase in the variance of coefficients as fewer observations are included in the estimation. In order to prevent specification searching and subjective researcher decisions, an automatic and data-driven bandwidth selection procedure is favored. In the main specifications, we use the mean-squared error (MSE) optimal bandwidth (Cattaneo et al., 2019). As a robustness check, we also provide estimates for bandwidths of other sizes.

To avoid specification bias, we rely on a non-parametric regression discontinuity design. Therefore, within these bandwidths, we perform local linear polynomial regressions. We use a triangular kernel function to place more weight on observations close to the threshold. This kernel in conjunction with the MSE-optimizing bandwidth also leads to point estimators with optimal properties (Cattaneo et al., 2019). Using this bandwidth acknowledges the misspecification error, hence continuing with statistical inference as if this bias were absent would be methodologically incoherent. We thus adjust for this error by using the bias-correction for estimates provided by Cattaneo et al. (2018). Since standard errors may be correlated within firms, we cluster at the firm level. Following the quasi-random experimental setting, distribution into treatment and control groups is assumed to be independent of covariates or fixed effects. Hence, adding controls or fixed effects is not necessary for obtaining consistent or unbiased estimates. However, we include specifications with covariates and fixed effects added to the local linear polynomial regressions to decrease the sampling variability of the estimator (Lee and Lemieux, 2010). In particular, we add consolidated financial indicators as control variables: size, return on assets, and leverage. We also use year, headquarter country, country-year, industry, and firm fixed effects to capture unobserved heterogeneity at these levels.

Figure 2: Regression discontinuity plots



Note: these figures plot tax avoidance (measured by ETR) against consolidated revenue around the reporting threshold of €750 million, represented by the vertical lines. Observations are placed into 30 bins on the left of the threshold and 30 bins on the right. Local linear fits are plotted separately on the left and on the right of the cutoff. Panels A and B provide plots for the pre- and post-implementation period, respectively (2010-2015 and 2016-2018). The bandwidth used is the MSE-optimal bandwidth of €183.9 million around the threshold, following Cattaneo et al. (2019).

4 Results

Main findings

First, we show graphical evidence of the discontinuity in ETRs around the revenue threshold. Figure 2 plots ETR around the reporting threshold for the pre- and post-implementation period. Panel B shows a clear and positive discontinuity of ETRs in the post-implementation period (2016-2018), indicating an increase in tax compliance by affected MNEs because of CbCR. For comparison, we plot the same discontinuity graph for the pre-implementation period (2010-2015) in Panel A. Here, no evidence of a discontinuity in tax avoidance around the €750 million threshold in annual revenue is visible. Altogether, the panels in Figure 2 provide initial visual evidence of an increase in tax compliance caused by CbC reporting obligations.

Next, to provide insight into proper causal inference, we present the main results of our nonparametric regression discontinuity design in Table 1. These results are from the post-implementation period (2016 onwards) and the bandwidth around the reporting threshold is MSE-optimal (following Cattaneo et al., 2019). All estimates are positive, around 5-6 percentage points, and statistically significant at the 10% level at least. This indicates an increase in tax compliance as a result of CbCR. Adding covariates and fixed effects increases the precision and significance level. Column (5) in Table 1, the full specification

Table 1: Effects of CbCR on ETR (in percentage points)

	(1)	(2)	(3)	(4)	(5)
Bandwidth	Optimal	Optimal	Optimal	Optimal	Optimal
CbCR	0.0544*	0.0564*	0.0576*	0.0549**	0.0611***
	(0.0314)	(0.0305)	(0.0306)	(0.0257)	(0.0109)
Bandwidth	183.9	183.9	183.9	183.9	183.9
Year FE	No	No	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes
Industry FE	No	No	No	Yes	Yes
Country-year FE	No	No	No	Yes	Yes
Firm FE	No	No	No	No	Yes
Controls	No	Yes	Yes	Yes	Yes
Observations	760	760	760	760	760

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: this table shows the main results of our nonparametric regression discontinuity design for the postimplementation period. The design uses the MSE-optimal bandwidth around the reporting threshold, and a triangular kernel. Estimates are bias-corrected, standard errors are clustered at the firm level. Control variables are firm size, return on assets, and leverage.

with control variables and year, industry, country and firm fixed effects estimates a 6 percentage point increase in ETR, statistically significant at the 1% level. Compared to the post-implementation average ETR in the control group of 26%, the relative effect size is also economically highly relevant at over 20%. However, despite their internal validity, RD results are highly local and external validity is limited. Hence, we merely claim that CbCR has a positive effect on ETRs and tax compliance overall, but it is not necessarily the same size for the full treatment group.

As a falsification test, we present the same analysis for the pre-implementation period in Table 6 in the Appendix. Before 2016, there existed no policy that made MNEs with a revenue just below €750 million different from those with a revenue just above this threshold, so there should not be a discontinuity in ETRs around this cutoff. The findings in Table 6 confirm this, since estimates are small and none of the results statistically differ from zero.

As a robustness test, we present estimates for sub-optimal bandwidths. Table 7 in the Appendix shows estimation results for 125% and 75% of the optimal bandwidth. The estimates in the full specification are 6.6 and 7.9 percentage points respectively, significant at the 1% level, thus confirming the robustness of our main result to using other bandwidths. Using sub-optimal bandwidths increases the bias, which explains the slightly larger point estimates relative to our main result.

Cross-sectional variation

To study the variation of the effects of CbCR across firms, we perform sample splits based on firms' tax aggressiveness. We define four groups based on two variables: pre-CbCR ETR and presence in tax havens (see Section 3.3).

The results of our full specification RDD are summarized in Table 2. The largest and most significant effect is found for the medium-aggressive firms with low pre-CbCR ETRs but no affiliates in tax havens.[10] The introduction of CbCR increased detection risks sufficiently for them to increase their tax contributions, indicated by the highly statistically significant increase in ETRs of 6 percentage points in column (3). Conversely, the effect of CbCR on the most aggressive firms with profit shifting opportunities is limited, see column (4). Despite finding *some* effect, the increase in ETRs for this subsample is only 1.5 percentage points and statistically significant at the 10% level. As hypothesized, the additional transparency and detection risk from CbCR is not sufficient to offset the benefits of profit shifting for some of the most aggressive MNEs. As expected, in columns (1) and (2) we do not find a statistically significant effect for the least aggressive firms with high ETRs, independent of their activity in tax havens. Since their ETRs do not indicate successful tax avoidance strategies, these firms are likely to have real economic reasons for their activity in tax haven jurisdictions which is unaffected by CbCR. These heterogeneity results are robust to using other tax haven definitions such as Garcia-Bernardo et al. (2021b) and the Corporate Tax Haven Index (see Table 11 in the Appendix). Using the latter tax haven list, we do not even find any significant increase in ETRs for the most aggressive firms.

In summary, our results show that while CbCR did have a positive overall effect on tax compliance, there is significant cross-sectional variation. The most aggressive MNEs mostly continued to shift their profits to tax havens. The bulk of CbCR's effectiveness is concentrated in firms that are likely to have previously avoided taxes but without shifting profits to affiliates in tax havens.

5 Conclusion and Discussion

This paper studies whether the introduction of private Country-by-Country Reporting (CbCR) in the EU in 2016 led to an increase in tax compliance. We further study whether the reform affected multinational enterprises (MNEs) across the board or whether any cross-sectional variance is present. CbCR aims to provide insight into profit shifting strategies of MNEs. It increases transparency by obligating MNEs

[10] Tables 8, 9, and 10 in the Appendix show that this conclusion also holds when using specifications without covariates and fixed effects, or when only using either covariates or fixed effects.

Table 2: The effects of CbCR on ETR (in percentage points) for sample splits based on tax aggressiveness

	(1)	(2)	(3)	(4)
Pre-CbCR ETR	High	High	Low	Low
Tax haven subsidiaries in Orbis	No	Yes	No	Yes
CbCR	-0.00811	-0.00537	0.0618***	0.0155*
	(0.0150)	(0.0142)	(0.00656)	(0.00879)
Bandwidth	183.9	183.9	183.9	183.9
All FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	173	157	182	168

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note: this table shows results of the RDD for subsamples split by their observed indicators of tax aggressiveness. Tax havens are classified following Olbert and De Simone (2021), see Table 3 in the Appendix. The design uses the MSE-optimal bandwidth around the cutoff and a triangular kernel. Estimates are bias-corrected, standard errors are clustered at the firm level. Fixed effects include year, country, country-year, industry, and firm fixed effects. Control variables are firm size, return on assets, and leverage.

with an annual revenue of at least €750 million to report their financial information to tax authorities on a country-by-country basis. Using sharp threshold, we employ a nonparametric regression discontinuity design to study the effects of CbCR on effective tax rates (ETRs), a proxy for tax avoidance.

We find strong evidence for an increase in ETRs (i.e. an increase in tax compliance) for MNEs with a reporting obligation. This increase amounts to approximately 6 percentage points in the full specification. We continue by studying the cross-sectional variance in the effects of CbCR between more and less tax-aggressive firms. In line with our developed hypothesis, we observe that the effect is concentrated among MNEs with medium levels of aggressiveness. Only those likely to engage in general tax avoidance but without affiliates in tax havens to shift profits to, were affected by CbCR. For these MNEs, CbCR increased the detection risk sufficiently to offset the benefits of tax avoidance, thus increasing their tax compliance. The most aggressively tax-avoiding MNEs, with tax haven presence and low pre-CbCR tax rates, are affected only to a limited extent as the benefits of profit shifting still outweigh the risks. Our results confirm the intuitive hypothesis that CbCR has no effect on high-tax firms.

Our results are in agreement with findings from Joshi (2020), who concludes that CbCR does deter general tax avoidance, but not the most aggressive profit shifting strategies. Contrary to her conclusion, however, we argue that private CbCR may not be sufficient to fight tax avoidance, since the most tax aggressive MNEs with profit shifting opportunities were not affected. Our explanation is that private CbCR did not sufficiently increase the expected cost of engaging in profit shifting to offset its benefits, and hence does not deter these firms from avoiding taxes. Public CbCR, which will come into force in the EU in 2024, extends the existing reporting obligation to continue to increase detection risks and costs of tax avoidance. Further research should indicate whether this is sufficient to deter MNEs from engaging in aggressive tax strategies. In the US, the House of Representatives already passed a legislative act including the publication of CbC reports. The additional channel of scrutiny increases MNEs' accountability to the general public. The introduction of a minimum corporate tax rate, as proposed by both the Biden administration and the OECD, may decrease the benefits of profit shifting as well.

References

Allingham, M. G. and Sandmo, A. (1972). Income tax evasion: A theoretical analysis. *Journal of Public Economics*, 1(3-4):323–338.

Bennedsen, M. and Zeume, S. (2018). Corporate Tax Havens and Transparency. *The Review of Financial Studies*, 31(4):1221–1264.

Blouin, J. and Robinson, L. A. (2020). Double counting accounting: How much profit of multinational enterprises is really in tax havens? SSRN Scholarly Paper ID 3491451, Social Science Research Network, Rochester, NY.

Cattaneo, M. D., Idrobo, N., and Titiunik, R. (2019). A Practical Introduction to Regression Discontinuity Designs: Foundations. Cambridge: Cambridge University Press. doi:10.1017/9781108684606.

Cattaneo, M. D., Jansson, M., and Ma, X. (2018). Manipulation Testing Based on Density Discontinuity. *Stata Journal*, 18(1):234–261.

Clausing, K. A. (2016). The Effect of Profit Shifting on the Corporate Tax Base in the United States and Beyond. *National Tax Journal*, 69(4):905–934.

Cobham, A. and Gibson, L. (2016). Ending the era of tax havens. Why the UK government must lead the way. http://oxfamilibrary.openrepository.com/oxfam/bitstream/10546/601121/4/bp-ending-era-tax-havens-uk-140316-en.pdf.

Cobham, A. and Janský, P. (2018). Global distribution of revenue loss from corporate tax avoidance: re-estimation and country results. *Journal of International Development*, 30(2):206–232.

De Simone, L. and Olbert, M. (2021). Real Effects of Private Country-by-Country Disclosure. *Working paper*. https://dx.doi.org/10.2139/ssrn.3398116.

Dutt, V. K., Ludwig, C. A., Nicolay, K., Vay, H., and Voget, J. (2019). Increasing tax transparency: investor reactions to the country-by-country reporting requirement for EU financial institutions. *International Tax and Public Finance*, 26(6):1259–1290.

Dyreng, S. D., Hanlon, M., and Maydew, E. L. (2010). The Effects of Executives on Corporate Tax Avoidance. *The Accounting Review*, 85(4):1163–1189.

European Commission (2021). Directive (EU) 2021/2101 of the European Parliament and of the Council of 24 November 2021 amending Directive 2013/34/EU as regards disclosure of income tax information by certain undertakings and branches. *Official Journal of the European Union*, L 429/1.

Garcia-Bernardo, J., Haberly, D., Janský, P., Palanský, M., and Secchini, V. (2022). The indirect costs of corporate tax avoidance exacerbate cross-country inequality. Technical report, WIDER Working Paper.

Garcia-Bernardo, J., Janský, P., and Tørsløv, T. (2021a). Multinational corporations and tax havens: evidence from country-by-country reporting. *International Tax and Public Finance*, 28(6):1519–1561.

Garcia-Bernardo, J., Janský, P., and Zucman, G. (2021b). Did the Tax Cuts and Jobs Act Reduce Profit Shifting by US Multinational Companies?

Hanlon, M. (2018). Country-by-Country Reporting and the International Allocation of Taxing Rights. *International Bureau of Fiscal Documentation*, forthcoming.

Hanlon, M. and Heitzman, S. (2010). A Review of Tax Research. *Journal of Accounting and Economics*, 50(2):127–178.

Hanlon, M. and Slemrod, J. (2009). What does tax aggressiveness signal? evidence from stock price reactions to news about tax shelter involvement. *Journal of Public economics*, 93(1-2):126–141.

Healy, P. M. and Wahlen, J. M. (1999). A Review of the Earnings Management Literature and Its Implications for Standard Setting. *Accounting horizons*, 13(4):365–383.

Hines, J. R. and Rice, E. M. (1994). Fiscal Paradise: Foreign Tax Havens and American Business. *The Quarterly Journal of Economics*, 109(1):149–182.

Hugger, F. (2020). The Impact of Country-by-Country Reporting on Corporate Tax Avoidance. *Ifo Working Paper Series*. https://www.ifo.de/en/publikationen/2019/working-paper/impact-country-country-reporting-corporate-tax-avoidance.

Janský, P. and Palanský, M. (2019). Estimating the scale of profit shifting and tax revenue losses related to foreign direct investment. *International Tax and Public Finance*, 26:1048–1103.

Johannesen, N. (2022). The global minimum tax.

Johannesen, N. and Larsen, D. T. (2016). The power of financial transparency: An event study of country-by-country reporting standards. *Economic Letters*, 145:120–122.

Joshi, P. (2020). Does private country-by-country reporting deter tax avoidance and income shifting? Evidence from BEPS Action 13. *Journal of Accounting Research*, 58(2):333–381.

Joshi, P., Outslay, E., and Persson, A. (2020). Does Public Country-by-Country Reporting Deter Tax Avoidance and Income Shifting? Evidence from the European Banking Industry. *Contemporary Accounting Research*, 37(4):2357–2397.

Lee, D. S. and Lemieux, T. (2010). Regression Discontinuity Designs in Economics. *Journal of Economic Literature*, 48(2):281–355.

McCrary, J. (2008). Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of Econometrics*, 142(2):698–714.

OECD (2013). Action Plan on Base Erosion and Profit Shifting. OECD Publishing. https://doi.org/10.1787/9789264202719-en.

OECD (2015). Transfer Pricing Documentation and Country-by-Country Reporting, Action 13 - 2015 Final Report. OECD/G20 Base Erosion and Profit Shifting Project, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264241480-en.

OECD (2020). BEPS Action 13 on Country-by-Country Reporting – Peer Review Documents: October 2020. OECD/G20 Base Erosion and Profit Shifting Project, OECD Publishing, Paris. www.oecd.org/tax/beps/beps-action-13-on-country-by-country-reporting-peer-review-documents.pdf.

OECD (2021). Members of the OECD/G20 Inclusive Framework on BEPS.

OECD (2021). Tax Challenges Arising from the Digitalisation of the Economy – Global Anti-Base Erosion Model Rules (Pillar Two): Inclusive Framework on BEPS. OECD, Paris, https://www.oecd.org/tax/beps/tax-challenges-arising-from-the-digitalisation-of-the-economy-global-anti-base-erosion-model-rules-pillar-two.htm.

Olbert, M. and De Simone, L. (2021). Real Effects of Private Country-by-Country Disclosure. *The Accounting Review*. _eprint: https://meridian.allenpress.com/accounting-review/article-pdf/doi/10.2308/TAR-2020-0714/2988004/tar-2020-0714.pdf.

Overesch, M. and Wolff, H. (2021). Financial Transparency to the Rescue: Effects of Public Country-by-Country Reporting in the EU Banking Sector on Tax Avoidance. *Contemporary Accounting Research*, 38(3):1616–1642.

Saez, E. and Zucman, G. (2016). Wealth Inequality in the United States since 1913: Evidence from Capitalized Income Tax Data. *The Quarterly Journal of Economics*, 131(2):519–578.

Tørsløv, T., Wier, L., and Zucman, G. (2022). The Missing Profits of Nations. *The Review of Economic Studies*. _eprint: https://academic.oup.com/restud/advance-article-pdf/doi/10.1093/restud/rdac049/45444681/rdac049.pdf.

US Department of the Treasury (2021). The Made in America Tax Plan. https://home.treasury.gov/system/files/136/MadeInAmericaTaxPlan_Report.pdf.

Appendix

Table 3: Tax haven classification

AD	Andorra	LI	Liechtenstein
AG	Antigua and Barbuda	LR	Liberia
AI	Anguilla	LU	Luxembourg
AW	Aruba	MC	Monaco
BB	Barbados	MH	Marshall Islands
BH	Bahrain	MO	Macau
BM	Bermuda	MT	Malta
BS	Bahamas	MU	Mauritius
BZ	Belize	MV	Maldives
CH	Switzerland	NL	Netherlands
CR	Costa Rica	NR	Nauru
CY	Cyprus	PA	Panama
DM	Dominica	PR	Puerto Rico
GD	Grenada	SC	Seychelles
GI	Gibraltar	SG	Singapore
HK	Hong Kong	SM	San Marino
IE	Ireland	TO	Tonga
JO	Jordan	VC	St Vincent and the Grenadines
KN	Saint Kitts and Nevis	VG	British Virgin Islands
KY	Cayman Islands	VU	Vanuatu
LB	Lebanon	WS	Samoa
LC	Saint Lucia		

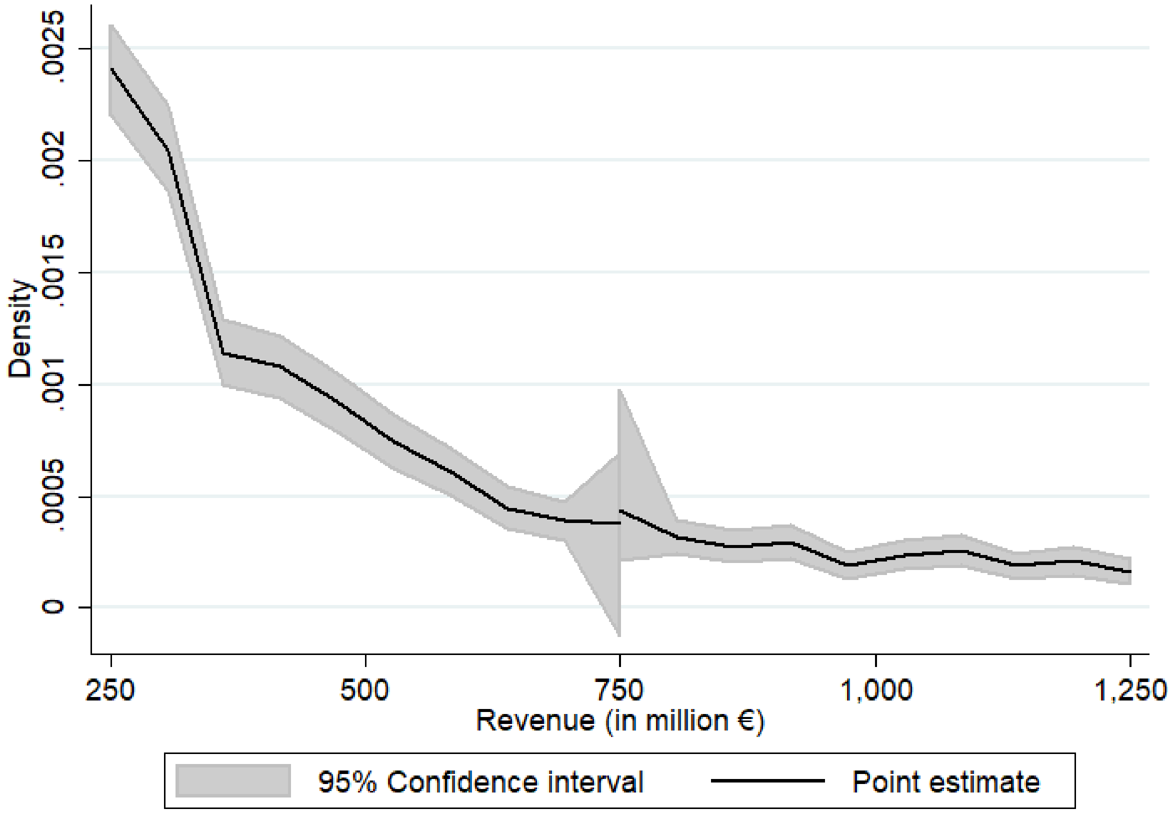
Note: this table lists all countries that are considered tax havens in this paper. The classification follows De Simone and Olbert (2021): countries are included if they either appear in the list of tax havens of Bennedsen and Zeume (2018), if they are on Tax Justice Network's blacklist of European preferential tax regimes, or if they are in the "big seven" tax havens in Hines and Rice (1994) plus Puerto Rico.

Table 4: Descriptive statistics

	N	Mean	SD	Min	Max
Panel A. Control group (< €750 million revenue)					
Revenue (million €)	43,098	214.4	156.9	4.853	749.9
Tax haven subsidiaries	43,098	0.924	5.198	0	335
pre-CbCR	*33,730*	*0.854*	*4.618*	*0*	*321*
post-CbCR	*9,368*	*1.178*	*6.887*	*0*	*335*
ETR	39,483	0.288	0.217	0	1
pre-CbCR	*30,695*	*0.295*	*0.220*	*0*	*1*
post-CbCR	*8,788*	*0.260*	*0.203*	*0*	*1*
Size	40,711	18.83	1.143	16.46	24.53
Return on assets	40,206	7.650	7.863	1.15e-05	44.37
Leverage	40,504	0.600	0.217	0.0910	1.425
Panel B. Treatment group (≥ €750 million revenue)					
Revenue (million €)	9,775	4,449	5,971	750.0	22,813
Tax haven subsidiaries	10,919	13.87	39.64	0	803
pre-CbCR	*7,933*	*13.52*	*38.74*	*0*	*632*
post-CbCR	*2,986*	*14.80*	*41.93*	*0*	*803*
ETR	9,376	0.280	0.196	0	1
pre-CbCR	*6,990*	*0.285*	*0.198*	*0*	*1*
post-CbCR	*2,386*	*0.265*	*0.189*	*0*	*1*
Size	9,770	21.48	1.602	16.46	24.53
Return on assets	9,491	7.078	6.925	0.000833	44.37
Leverage	9,692	0.639	0.195	0.0910	1.425

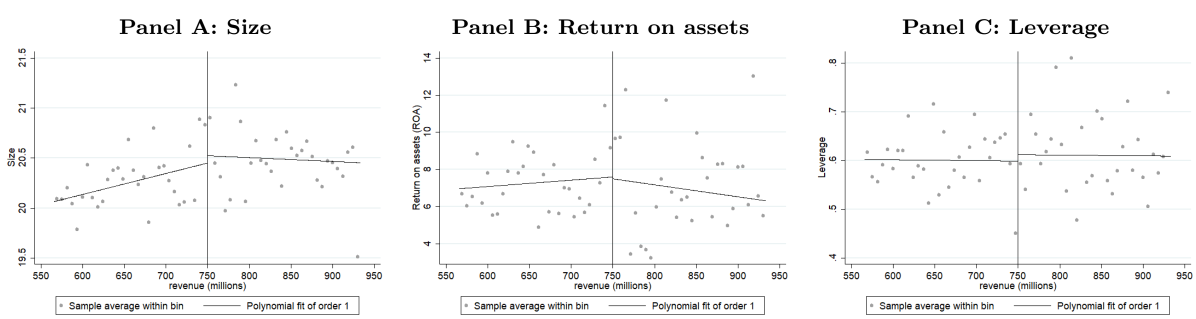
Note: this table shows descriptive statistics for all yearly consolidated financial variables as well as the number of tax haven subsidiaries, split between the control group and the treatment group. *ETR* is defined as taxation divided by pre-tax profits, *Size* is defined as the natural logarithm of total assets, *Return on assets* is defined as pre-tax income divided by total assets, and *Leverage* is defined as total liabilities divided by total assets.

Figure 3: McCrary (2008) treatment manipulation test



Note: this figure graphically shows the result of the McCrary (2008) test for bunching around the treatment threshold (€750 million in consolidated revenue). Third-degree local polynomial densities of consolidated revenue in the post-implementation period, together with their 95% confidence interval, are plotted to the left and to the right of the threshold.

Figure 4: Regression discontinuity plots – covariates



Note: these figures plot three covariates against consolidated revenue around the reporting threshold of €750 million, represented by the vertical lines, for the post-implementation period (2016-2018). Observations are placed into 30 bins on the left of the threshold and 30 bins on the right. Local linear fits are plotted separately on the left and on the right of the cutoff. The bandwidth used is the MSE-optimal bandwidth of €183.9 million around the threshold, following Cattaneo et al. (2019).

Table 5: The effects of CbCR on covariates

	(1)	(2)	(3)
Variables	Size	ROA	Leverage
CbCR	-0.0276	0.750	0.0271
	(0.238)	(1.866)	(0.0534)
Bandwidth	183.9	183.9	183.9
Observations	760	760	760

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: this table shows results of an RD with triangular kernel on our three covariates: size, return on assets (ROA), and leverage. The design uses the MSE-optimal bandwidth around the cutoff. Estimates are bias-corrected, standard errors are clustered at the firm level.

Table 6: The effects of CbCR on ETR (in percentage points) in the pre-implementation period

	(1)	(2)	(3)	(4)	(5)
Bandwidth	Optimal	Optimal	Optimal	Optimal	Optimal
CbCR	0.0295	0.0126	0.0126	0.00981	0.0174
	(0.0497)	(0.0488)	(0.0488)	(0.0427)	(0.0187)
Bandwidth	195.6	195.6	195.6	195.6	195.6
Year FE	No	No	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes
Industry FE	No	No	No	Yes	Yes
Country-year FE	No	No	No	Yes	Yes
Firm FE	No	No	No	No	Yes
Controls	No	Yes	Yes	Yes	Yes
Observations	886	886	886	886	886

Standard errors in parentheses

Note: this table shows the results of our nonparametric regression discontinuity design for the two years before the implementation of CbCR (2014-2015). The design uses a mean-squared error optimal bandwidth around the reporting threshold, and a triangular kernel. Estimates are bias-corrected, standard errors are robust and clustered at the firm level. Control variables are firm size, return on assets, and leverage.

Table 7: The effects of CbCR on ETR (in percentage points) using suboptimal bandwidths

	(1)	(2)	(3)	(4)	(5)	(6)
Bandwidth (% of optimal)	125%	125%	125%	75%	75%	75%
CbCR	0.0479	0.0511	0.0663	0.0567	0.0568	0.0790
	(0.0291)	(0.0247)	(0.0104)	(0.0338)	(0.0267)	(0.0117)
Bandwidth	229.9	229.9	229.9	137.9	137.9	137.9
Firm FE	No	No	Yes	No	No	Yes
Other FE	No	Yes	Yes	No	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Observations	992	992	992	547	547	547

Standard errors in parentheses

Note: this table shows the main results of our nonparametric regression discontinuity design for the postimplementation period, for two different bandwidths. Columns (1)-(3) use 50% of the mean-squared error optimal bandwidth around the reporting threshold, while columns (4)-(6) use 75% of this optimal bandwidth. All specifications use a triangular kernel. Estimates are bias-corrected, standard errors are robust and clustered at the firm level. *Other FE* includes year, country, country-year, and industry fixed effects. Control variables are firm size, return on assets, and leverage.

Table 8: The effects of CbCR on ETR (in percentage points) for sample splits based on tax aggressiveness

	(1)	(2)	(3)	(4)
Pre-CbCR ETR	High	High	Low	Low
Tax haven subsidiaries in Orbis	No	Yes	No	Yes
CbCR	0.111	0.0264	0.0995*	0.0642
	(0.0817)	(0.0688)	(0.0548)	(0.0417)
Bandwidth	183.9	183.9	183.9	183.9
All FE	No	No	No	No
Controls	No	No	No	No
Observations	173	157	182	168

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: this table shows results of the RDD for subsamples split by their observed indicators of tax aggressiveness. Tax havens are classified following Olbert and De Simone (2021), see Table 3 in the Appendix. The design uses the MSE-optimal bandwidth around the cutoff and a triangular kernel. Estimates are bias-corrected, standard errors are clustered at the firm level. Fixed effects include year, country, country-year, industry, and firm fixed effects. Control variables are firm size, return on assets, and leverage.

Table 9: The effects of CbCR on ETR (in percentage points) for sample splits based on tax aggressiveness

	(1)	(2)	(3)	(4)
Pre-CbCR ETR	High	High	Low	Low
Tax haven subsidiaries in Orbis	No	Yes	No	Yes
CbCR	0.111	0.0267	0.116**	0.0733*
	(0.0715)	(0.0666)	(0.0495)	(0.0390)
Bandwidth	183.9	183.9	183.9	183.9
All FE	No	No	No	No
Controls	Yes	Yes	Yes	Yes
Observations	173	157	182	168

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: this table shows results of the RDD for subsamples split by their observed indicators of tax aggressiveness. Tax havens are classified following Olbert and De Simone (2021), see Table 3 in the Appendix. The design uses the MSE-optimal bandwidth around the cutoff and a triangular kernel. Estimates are bias-corrected, standard errors are clustered at the firm level. Fixed effects include year, country, country-year, industry, and firm fixed effects. Control variables are firm size, return on assets, and leverage.

Table 10: The effects of CbCR on ETR (in percentage points) for sample splits based on tax aggressiveness

	(1)	(2)	(3)	(4)
Pre-CbCR ETR	High	High	Low	Low
Tax haven subsidiaries in Orbis	No	Yes	No	Yes
CbCR	-0.0200	0.0169	0.0677***	-0.00104
	(0.0155)	(0.0139)	(0.00692)	(0.00908)
Bandwidth	183.9	183.9	183.9	183.9
All FE	Yes	Yes	Yes	Yes
Controls	No	No	No	No
Observations	173	157	182	168

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: this table shows results of the RDD for subsamples split by their observed indicators of tax aggressiveness. Tax havens are classified following Olbert and De Simone (2021), see Table 3 in the Appendix. The design uses the MSE-optimal bandwidth around the cutoff and a triangular kernel. Estimates are bias-corrected, standard errors are clustered at the firm level. Fixed effects include year, country, country-year, industry, and firm fixed effects. Control variables are firm size, return on assets, and leverage.

Table 11: The effects of CbCR on ETR (in percentage points) for sample splits based on tax aggressiveness

	(1)	(2)	(3)	(4)
Subsample	Medium aggressive	Highly aggressive	Medium aggressive	Highly aggressive
Pre-CbCR ETR	Low	Low	Low	Low
Tax haven subsidiaries	No	Yes	No	Yes
Tax haven list	Garcia-B. et al. (2021)	Garcia-B. et al. (2021)	CTHI (2019)	CTHI (2019)
CbCR	0.0600***	0.0244**	0.0618***	0.00958
	(0.00598)	(0.0105)	(0.00625)	(0.00902)
Bandwidth	183.9	183.9	183.9	183.9
All FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	196	154	186	164

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: this table shows the results of an RDD for the subsample of low pre-CbCR ETR, split by their tax haven presence. Tax havens are classified following Garcia-Bernardo et al. (2021b) or the Corporate Tax Haven Index (CTHI) from 2019, using a cutoff score of 70. The design uses an MSE-optimal bandwidth around the cutoff and a triangular kernel. Estimates are bias-corrected, standard errors are robust and clustered at the firm level. Control variables are firm size, return on assets, and leverage.

IES Working Paper Series

2023

1. Josef Bajzik, Tomáš Havránek, Zuzana Iršová, Jiří Novák: *Are Estimates of the Impact of Shareholder Activism Published Selectively?*
2. Klára Kantová: *Ex-Prisoners and the Labour Market in the Czech Republic*
3. Theodor Petřík, Martin Plajner: *Concurrent Business and Distribution Strategy Planning Using Bayesian Networks*
4. Tijmen Tuinsma, Kristof De Witte, Petr Janský, Miroslav Palanský, Vitezslav Titld: *Effects of Corporate Transparency on Tax Avoidance: Evidence from Country-by-Country Reporting*

All papers can be downloaded at: http://ies.fsv.cuni.cz

Univerzita Karlova v Praze, Fakulta sociálních věd
Institut ekonomických studií [UK FSV – IES] Praha 1, Opletalova 26
E-mail : ies@fsv.cuni.cz http://ies.fsv.cuni.cz