Who Faces the Global Minimum Tax? Group Size, Profit Shifting, and Policy Thresholds

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Abstract

This paper characterizes profit shifting behavior across the size distribution of multinational groups to evaluate the cutoff at which firms become liable to pay the recently introduced Global Minimum Tax (GMT). Using microeconomic administrative data with no reporting gaps for tax havens, we provide three sets of results. First, we document that German MNEs reduce their tax payments after establishing a tax haven subsidiary. Second, we show that, while not being pervasive, the probability that a group includes tax haven subsidiaries approaches unity above the GMT threshold. We then introduce a new methodology to estimate shifted profits at the group level and find an exponential gradient in profits shifted across group size. However, some profit shifting takes place across the distribution. Relating potential tax revenues to compliance costs, however, confirms that the GMT cutoff is well placed with only modest net gains possible if it were to be lowered.

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1 Introduction

On the first of January 2024, the global minimum tax (GMT) came into force. This policy tool introduces a global tax floor of 15% for the corporate income tax with a number of statutes in place in case a country chooses to undercut this legislation. To alleviate undue administrative work for internationally active firms, it is targeted only at multinational groups with more than 750 million EUR in revenue. Below this cutoff, firms are not liable to pay the GMT, above it, they may be required to do so. To the best of our knowledge, there is no economic justification for this particular size related cutoff. Instead, it is the result of an international negotiation process, at least dating back to the introduction of country-by-country reports featuring the same cutoff.

The approach of limiting reporting requirements and tax liability to very large groups resonates with recent results showing that the bulk of profit shifting in some countries, notably the U.S., is carried out by a small number of very large MNEs (Dyreng et al., 2023; Garcia-Bernardo et al., 2022). However, little evidence is available on size heterogeneity generally and the the GMT threshold in particular. How much of shifted profits does it cover? How substantial is profit shifting below the cutoff if it exists at all? What is the relationship between compliance costs and potential tax revenue? Answering these questions is important as a threshold that is too low would impose unnecessary administrative costs on firms that do not engage in aggressive profit shifting without much payoff in terms of taxes collected. A GMT threshold that is too high would miss important profit shifters. In this paper, we construct group level estimates of shifted profits in order to answer these questions.

We use administrative data on the universe of German MNEs which includes detailed data on group structure and information for each subsidiary as well as variables consolidated at the group level. We first document a decrease in taxes paid when groups establish tax haven subsidiaries. We then show that this profit shifting technology is not ubiquitous across group size. Only a quarter of the lower half of the group size distribution includes tax haven subsidiaries. At the top, the likelihood approaches unity. Third, we confirm the outsized productivity of tax haven subsidiaries which we use to construct a methodology that provides the total profits shifted for each group in our sample. In total, we find that 19 billion in profits were shifted by German owned MNEs in 2022. At the group level, this estimate allows us to evaluate the GMT threshold. We document an exponential increase of profits shifted towards the top of the group size distribution with the GMT covering 94% of all profits shifted. In our last set of results, we introduce two measures of compliance cost at the group level. Potential taxes gained clearly dominate costs above the GMT threshold. Depending on the preferred measure, there are modest net gains to be had from a lower threshold.

Establishing a sensible cutoff for the GMT and other policies is particularly relevant since at least two recent papers argue that profit shifting by U.S. multinationals is concentrated among a

small number of very large MNEs (Dyreng et al., 2023; Garcia-Bernardo et al., 2022). These MNEs are very complex firms with large affiliate networks (Francois and Vicard, 2023; Altshuler et al., 2023; Bilicka, 2019). This raises the question if the GMT should not mainly focus on such firms, at least for revenue reasons, while leaving smaller firms untouched not to increase dead weight loss through unnecessary administrative or consulting costs (Bustos et al., 2022). Since many profit shifting technologies are relatively cheap, however, it is certainly possible that many smaller firms engage in aggressive profit shifting even if we do not observe the same revenue implications from the shifting behavior of these firms in aggregate. From a fairness perspective as well as a concern for societal cohesion and trust in government, such behavior could be relevant. Indeed, this threshold could lead to responses where tax competition continues below the threshold Haufler and Kato (2024). Additionally, it is unclear if the distribution of profit shifters is as skewed in other countries as it appears to be in the U.S. Several papers have highlighted the particularity of the US when it comes to tax avoidance rules and tax planning by firms (Clifford, 2019). Germany is a particularly interesting laboratory for our study since it is a large and internationally integrated economy that is part of the first wave of GMT implementation. The U.S. has not ratified the GMT at all and it is unclear if it will in the foreseeable future.

Access to comprehensive reliable microeconomic data is vital in our setting for at least three reasons. First, we can be sure that we see the entire international group structure any point in our sample period. The Midi database does not suffer from the systematic underreporting of tax haven subsidiaries that has been established for the Orbis database (Tørsløv et al., 2022). We can, for example, use the emergence of tax haven subsidiaries for identification and provide tax haven productivity ratios based on microeconomic data. Second, we have access to comprehensive group level variables such as consolidated turnover and employment. This allows us to sort groups according to the consolidated turnover relevant for the GMT and to establish ratios relative to group level totals. Third, we have access to balance sheet data for each subsidiary in our dataset.

This paper makes four main contributions. First, we show that when MNEs grow by establishing new tax haven subsidiaries, tax payments of the rest of the group decline. This adds to a literature on the life cycle of an MNE (Alstadsæter et al., 2022; Egger et al., 2014). We also confirm that tax haven subsidiaries exhibit outsized productivity ratios. Second, we show that the existence of such subsidiaries within a group becomes very likely around the GMT threshold which appears well placed. These results add to a literature trying to isolate the key firm features determining tax planning behavior (Wier and Erasmus, 2023; Bachas et al., 2024). In our main set of results, we propose a new estimation strategy to construct group level estimates of profits shifted by focusing on productivity counterfactuals for tax haven subsidiaries. In a comprehensive placebo exercise, we confirm that this method does not suffer from simultaneity bias of large firms being both more productive and more likely to include subsidiaries in many countries, including tax havens. The exponential growth of profit shifting at the top confirms that the GMT is well targeted but profit

shifting is taking place further down the group size distribution as well. Fourth, we relate potential tax revenue gained to group level compliance costs. While the estimate of the cost function is a first pass based on the little prior information available, to the best of our knowledge, this comparison is not provided by the literature. Several recent papers have looked at the revenue and firm-level implications of this policy measure (Janeba and Schjelderup, 2023; Baraké et al., 2022; Gómez-Cram and Olbert, 2023; Gaul et al., 2022) while others have investigated the incentives for individual countries to respond with unilateral policy (Janeba and Schjelderup, 2023; Devereux, 2023). A small number of papers further consider the legal aspects as well as the optimality of policy features such as the minimum rate (Hebous and Keen, 2023; Becker and Englisch, 2021).

The paper is structured as follows. Section 2 briefly describes the global minimum tax and what we know about the origins of the 750 Million Euro cutoff. Section 3 introduces the MiDi database and its advantages in providing group and subsidiary data with no reporting gaps for tax havens. We then show how the appearance of tax haven subsidiaries correlates with lower taxes paid (section 4) and how likely these subsidiaries are across group size bins (section 5). Section 6 introduces our profit shifted estimate and shows its increase with group size. Section 7 relates potential taxes gained to compliance costs before 8 concludes.

2 The Global Minimum Tax

In 2021, 137 member countries of the OECD/G20 Inclusive Framework on Base Erosion and Profit Shifting (BEPS) agreed to reform international tax regulations in an attempt to halt profit shifting of large companies. The first wave of implementation began in 2024, with jurisdictions such as the EU, UK, Japan, and Canada leading the adoption. A central component of this reform is a Global Minimum Tax (GMT) on corporate profits to ensure that large multinational enterprises with global consolidated revenues exceeding 750 million EUR[1] pay at least a 15% tax rate on their profits, regardless of where they operate. This threshold on large MNEs is a carryover from the Country-by-Country Reporting (CbCR) standards implemented in 2016 and reflects a pragmatic but somewhat arbitrary cutoff.[2] For Germany, this represents 427 MNE groups in scope of the GMT, according to the 2021 OECD aggregate CbCr.

The reform aims to curb tax avoidance, reduce harmful tax competition between countries, and create a more equitable global tax system. The GMT functions through three key mechanisms: the Domestic Minimum Tax, the Income Inclusion Rule (IIR), and the Undertaxed Profits Rule (UTPR). These rules collectively prevent companies from shifting profits to low-tax jurisdictions

[1] Multinational enterprises with global consolidated revenues exceeding 750 million EUR in at least two of the past four years.

[2] The CbCR is a transparency measure introduced by the OECD's Base Erosion and Profit Shifting (BEPS) framework in 2016. It requires large MNEs to report key financial information—such as revenues, profits, taxes paid, and economic activity—separately for each jurisdiction in which they operate.

by imposing a top-up tax on earnings taxed below the minimum threshold. If a company's home country does not enforce the minimum tax, other jurisdictions where it operates can claim the additional tax revenue. These mechanisms should generate additional tax revenues for tax administrations and limit profit shifting by firms, especially for advanced economies where most ultimate parent entities are headquartered. Mechanical revenue estimates for Germany have been estimated to reach EUR 13.1 billion, according to Baraké et al. (2022).[3]

Although the GMT is expected to generate additional tax revenue, it also comes with increased administrative burdens for both governments and businesses. At the business level, firms subject to the rules must file a 28-page GloBE information return and provide data on the corporate structure, constituent entities and all information necessary for the computation of the ETR, the Top-Up Tax Rate as well as the allocation of the taxes according to the GloBE rules. Gaul et al. (2022) conducted a survey in collaboration with the Federation of German Industries (BDI) which highlights the significant cost implications for affected companies: they found that the average one-time cost of implementing compliant reporting amounted to EUR 1.6 million per company, with recurring annual costs of EUR 0.4 million.[4] At the tax administration level, additional resources are necessary to process this new information and ensure compliance with the GloBE rules. Tax authorities must develop new systems for data collection, validation, and enforcement, requiring investments in personnel, IT infrastructure, and regulatory oversight.

3 Data

The administrative Microdatabase Direct Investment (MiDi) of the German central bank collects detailed data on German foreign direct investment (FDI). Subject to a modest reporting threshold of a balance sheet total of 3 million Euro, it includes financial and ownership information on the universe of foreign affiliates owned by German parent companies. It also includes downstream investment out of Germany by firms ultimately held from abroad.[5] For each foreign affiliate owned through Germany, we can observe the identity and ownership share of the German parent company, as well as the identity and share of a potential immediate owner if the affiliate is not directly owned by the German parent. The data includes general firm characteristics such as industry, as well as detailed historical economic variables in our sample period from 2002 to 2022. Relevant for our

[3] In practice, those numbers are likely to be lower due to substance-based carve-outs and other exemptions, as well as behavioral responses of MNEs. Baraké et al. (2022) estimates that revenue gains for Germany could reach EUR 13.1 billion without carve-outs, or EUR 7.8 billion 10% carve-outs for payroll and 8% for tangible assets. Allowing for behavioral response, Ferrari et al. (2022) measure the effect of a 15% multilateral residence-based minimum tax and find an increase of corporate revenue by slightly more than 1% for Germany.

[4] The survey, which included firms with annual revenues ranging from under EUR 2 billion to over EUR 20 billion, was sent to all German companies in scopes of the GMT, and had 27 respondents.

[5] The German reporting party is obligated to report on any foreign holdings with a modest balance sheet total of more than three million Euro. Both German MNEs and foreign MNEs that organize their ownership structures through a German firm are required to report.

analysis, these include data on employment, turnover, and post-tax corporate profits.

We use information on post-tax profits to calculate pre-tax corporate profits for subsidiary i in year t and country c as: $\Pi_{it} = \Pi_{it}^{post}/(1-\tau_{ct})$. Here, τ_{ct} denotes the effective tax rate of country c taken from the OECD and the CBT Tax Database by Oxford University Centre for Business Taxation and, in rare cases where no effective tax rate is available, the statutory tax rate taken from the USAID Collecting Taxes Database.[6][7]

Data on employment at the subsidiary level allows us to construct profitability ratios as profits per employee: $\pi_{it} = \Pi_{it}/emp_{it}$. The difference between pre- and post-tax profits counts taxes paid at the subsidiary level. We scale this variable with subsidiary level turnover to construct a tax-to-turnover ratio (TTR) as a measure of taxes paid relative to economic activity of subsidiary i as: $TTR_{it} = (\Pi_{it} - \Pi_{it}^{post})/turn_{it}$. Beyond detailed data on the affiliate, Midi includes consolidated data for the entire group of which we use the consolidated turnover measure which is the relevant size variable for the GMT cutoff as well as a measure of consolidated employment.

4 The Role of Tax Haven Subsidiaries for Profit Shifting

Having access to the full network of multinational enterprises allows us to reliably document the emergence of tax haven subsidiaries as a potential profit shifting technology.[8] In this section, we test if such events correlate with lower tax payments in the non-haven subsidiaries from which we expect profits to be shifted. Our variable of interest is the tax-to-turnover ratio (TTR) in the non-haven part of groups that create tax haven subsidiaries. Since creating a new tax haven subsidiary is, by definition, an event that grows the MNE, we create a control group that is adding a subsidiary to the group but in a non-haven country.[9] Our estimation compares the evolution of the TTR of the previously existing non-haven subsidiaries of both types of groups. $T_g = 1$ denotes the treatment group which is establishing their first tax haven affiliate at event time $j = 0$ while $T_g = 0$ denotes the control group which is creating a non-haven affiliate at event time $j = 0$. We run the following event study:

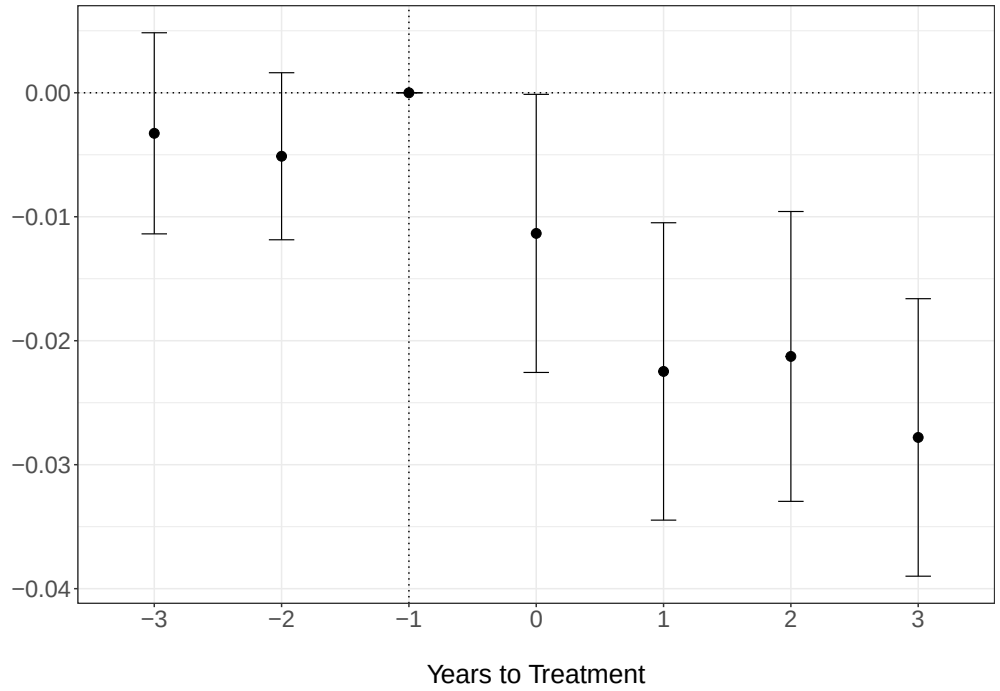
[6] We have effective tax rate information for 46 countries from 2002 to 2016, and for 78 from 2017 onward.

[7] When post-tax profits are 0 or negative, we assume that pre-tax profits are zero and that no taxes were paid.

[8] As a point of comparison, Tørsløv et al. (2023) document that the global Orbis database only covers 17% of MNE profits in 2012 motivating their macroeconomic approach. More recent work on more recent tranches of Orbis shows representativeness of aggregated values with macroeconomic variable (Kalemli-Özcan et al., 2024) but the patchy coverage of tax haven subsidiaries remains unresolved. In contrast, the Midi data is comprehensive with the exception of firms below the modest reporting threshold of a three million Euro balance sheet total. The reporting party is located in Germany and no data provided by the authorities of a tax haven is required.

[9] In robustness tests, we confirm our results using a control group of firms that are not adding new subsidiaries. The effects we show are driven by the treatment group.

Figure 1: Tax Haven subsidiaries correlate with lower TTR



Notes: This figure shows the results of the event study testing reactions of the tax-to-turnover ratio (TTR) to the emergence of tax haven subsidiaries. Our estimation compares the TTR of the ex ante existing non-haven subsidiary of groups that create a tax haven subsidiary to those of groups that create a non-haven subsidiary. Standard errors are clustered at the subsidiary level and 95% confidence bands plotted.

$$TTR_{itcg} = \sum_{j=-4,\neq -1}^{j=4} \beta^j D_{gt}^j \cdot T_g + \alpha_i + \lambda_j + \delta_{ct} + \epsilon_{it} \tag{1}$$

Here, TTR_{icgt} is tax-to-turnover ratio of a non-haven subsidiary i in country c and part of group g in year t. D_{it}^j takes value 1 j periods from the year t in which group g gets a new subsidiary. The fixed effects structure is made up of subsidiary fixed effects α_i, event time fixed effects λ_j that load on the control group, and dynamic host country - time trends δ_{ct} to capture country specific developments. Endpoints are binned at the limits of the effects window following Schmidheiny and Siegloch (2023).

Figure 1 shows the results of this event study for groups that are creating their second international subsidiary comparing groups where that second subsidiary is a tax haven subsidiary to those where it is not. We plot the β^j coefficients with 95% confidence bands. These coefficients are not statistically different from 0 until the first year after the establishment of the new subsidiary. Then, the TTR of the pre-existing non-haven subsidiaries declines by around 2.8 percentage points. [10] Intuitively, this means that a firm in France reduces its tax payments when it's group creates

[10] In untabulated results, we confirm this pattern qualitatively for groups creating their 3rd to 6th subsidiary using the same identification.

a subsidiary in the Cayman Islands compared to a similar firm in France that is part of a group creating a new subsidiary in Spain. Against a baseline of 0.08 TTR, this is a substantial effect. Standard sample robustness tests do not change the results and, relevant for the German context, they are robust to removing any combination of Switzerland, the Netherlands, and Belgium from the tax haven list.[11] In annex figure A.2 we show that this result also holds at the group level, by consolidating the pre-event non-haven subsidiaries. Quantitatively, the pre-existing part of the group reduces it's TTR by 0.6 percentage points against a pre-event TTR of 0.02.

This result confirms tax havens as a relevant profit shifting technology for multinational groups. Their appearance in a group that previously did not include tax haven subsidiaries immediately reduces tax payments of the pre-existing non-haven parts. We therefore interpret the propensity to include a tax haven subsidiary as an extensive margin measure of profit shifting. While this result is not controversial in the field of international corporate taxation (Riedel, 2018a; Davies et al., 2018; Hebous and Johannesen, 2021), we now turn to the question of how likely it is that firms employ this profit shifting technology across the group size distribution that the GMT cutoff is based on.

5 The Likelihood of Tax Haven Subsidiaries across Group Size

MNEs with consolidated turnover of 750 million Euro are potentially GMT liable. In this section, we show where in the group size distribution tax haven subsidiaries develop. Since we have access to consolidated turnover at the group level in the Midi data, we can simply sort groups by turnover size and compare the likelihood that a group includes tax haven subsidiaries across groups size deciles.[12] Figure 2 shows the resulting probability distribution. Three important observations emerge from this graph.

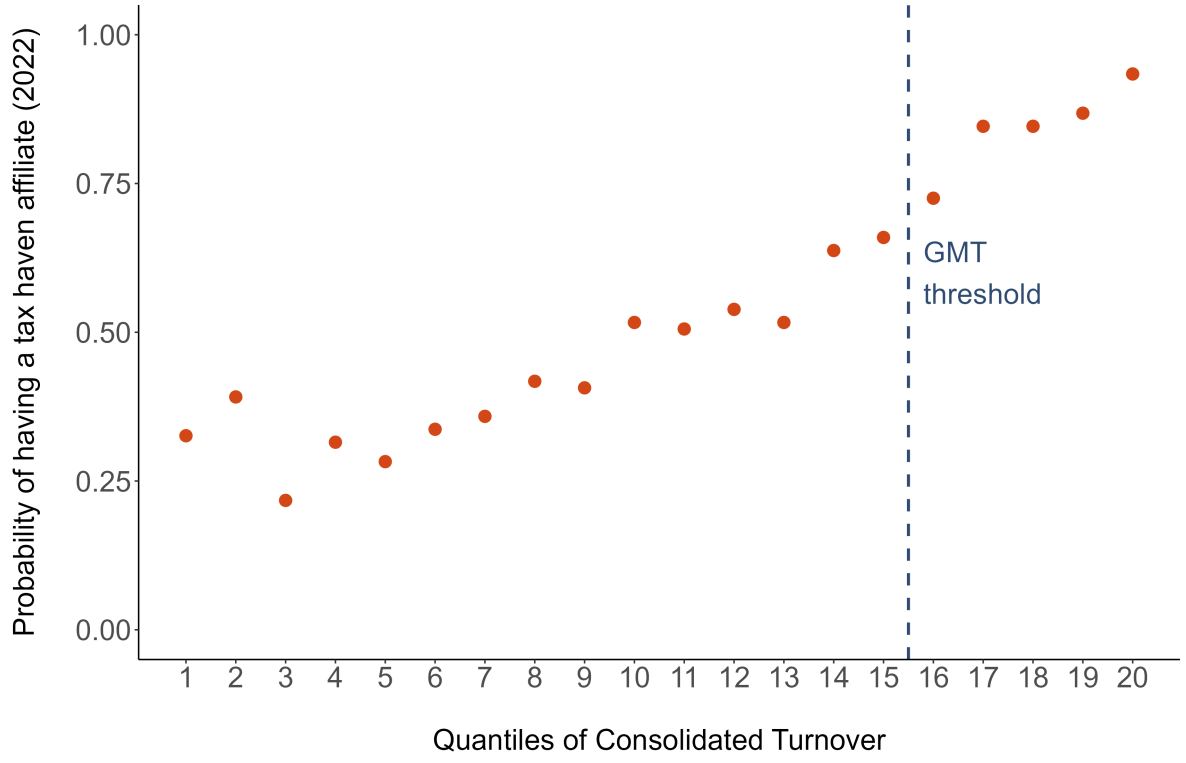
First, tax haven usage is not ubiquitous but relatively for the bottom half of the distribution. Here, three quarters of MNEs do not engage in profit shifting to tax havens at all. Second, the probability to use tax haven subsidiaries picks up after the 7th decile. Third, the probability of tax haven usage approaches unity towards the top of the group size distribution. Large groups are almost sure to use the profit shifting technology we have shown to reduce tax payments above. This finding resonates with results in Garcia-Bernardo et al. (2022) and Dyreng et al. (2023) who point out the importance of a small number of large US multinationals in international profit shifting. However, the consolidated turnover of firms at the top of our distribution is an order of magnitude larger than the GMT threshold.[13] Tax haven subsidiaries are not only a phenomenon at the very top of the group size distribution.

[11] See Table A.1 for the list of our tax havens.

[12] Privacy concerns of our data provider limits the level of disaggregation.

[13] Apple reported 394 billion in sales in 2022, the end of our sample period in its Form 10-K available here: https://s2.q4cdn.com/470004039/files/doc_financials/2022/q4/_10-K-2022-(As-Filed).pdf

Figure 2: Tax Haven usage across group size



Notes: In this figure, we collect all MNE groups in our sample into 100 bins using the consolidated turnover variable. These bins are plotted on the horizontal axis. On the vertical axis, the figure plots the average probability within each bin that a group includes a tax haven subsidiary.

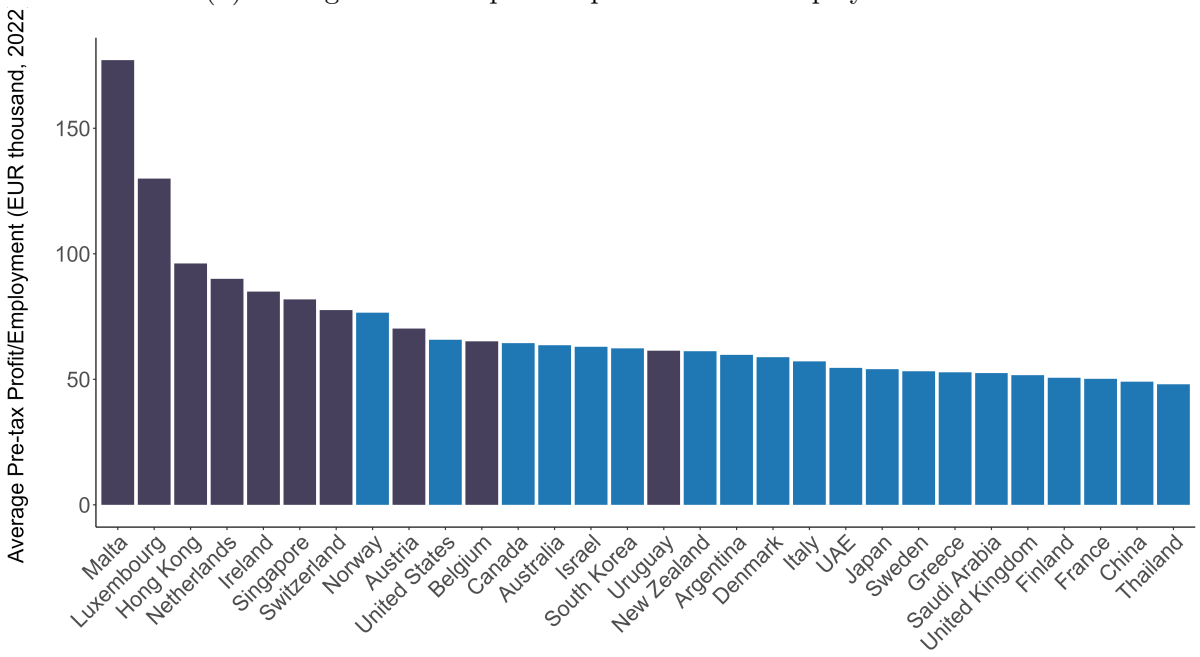
6 The Value of Shifted Profits across Group Size

If companies shift profits to tax-haven subsidiaries, these subsidiaries become more profitable on paper. In work using macroeconomic data, Tørsløv et al. (2023) document this at the country level. In our data, averaging the profitability ratio ($\pi_{it} = \Pi_{it}/emp_{it}$) at the country confirms very high profitability ratios in tax havens. Figure 3 plots two versions of this calculation for countries with at least 30 German subsidiaries in our data. In the top panel, we plot the profitability ratios for all firms, averaged within country. Dark shading indicates if a country is classified as a tax haven. Using this microeconomic approach, which reduces the weight of very aggressive profit shifters substantially, an employee of a German firm in Malta still appears to create more than triple the profits of an employee in France. Aggregating profits and employees over the entire country before taking the ratio reveals an even starker picture. Here, the Maltese employee produces 1.3 million Euros in profits against the roughly 50.000 Euros of her French counterpart. This latter approach is more (but not quite[14]) in line with the macroeconomic approach used by Tørsløv et al. (2023). In both cases, however, the outsized role of tax havens becomes apparent. Confirming this established result is a useful sanity check for our data before we turn to group level estimates.

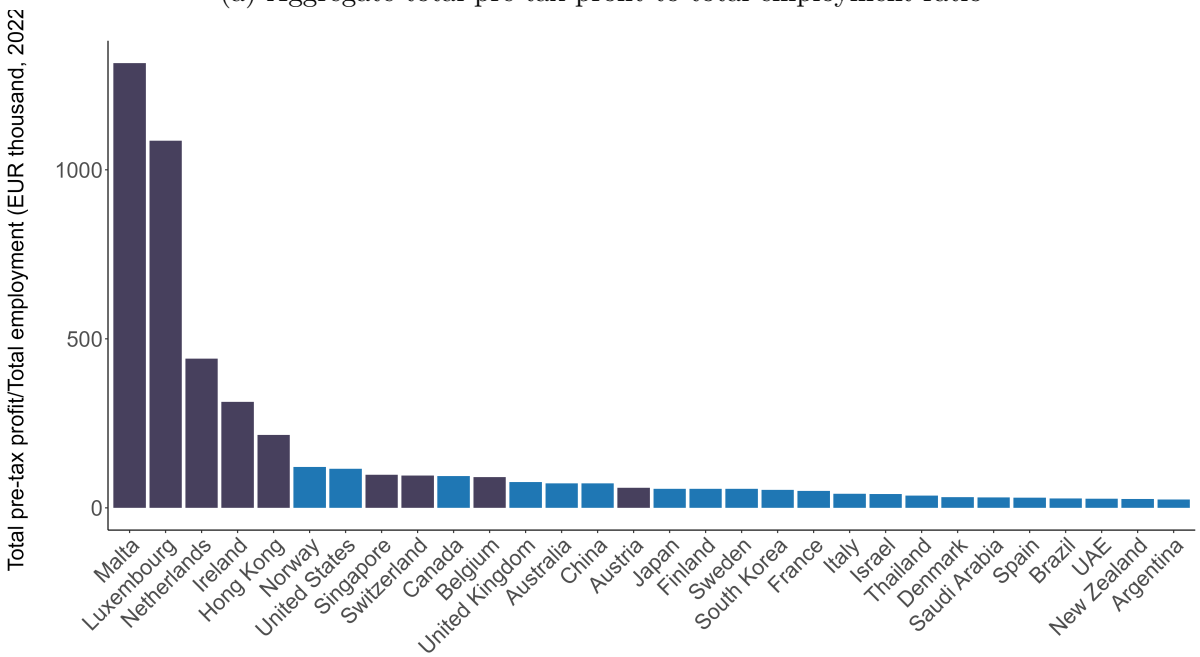
[14]Tørsløv et al. (2023) use the ratio of pre-tax profits to the wage bill, not to the number of employees, as a profitability measure.

Figure 3: Profitability differences across countries

(b) Average firm-level pre-tax profit to total employment ratio



(a) Aggregate total pre-tax profit to total employment ratio



Notes: These figures plot the top 30 profitability ratios by countries in 2022. Panel (a) plots the average firm-level pre-tax profit to total employment ratio. Panel (b) first aggregates pre-tax profit and employment for the entire country before taking the ratio. Countries that we classify as tax havens are shaded in dark blue.

Access to microeconomic data on every subsidiary of the network of German MNEs allows us to construct and interpret shifted profits at the group level. We proceed in three steps. First, we describe how we construct this measure of profits shifted by group. Second, we relate it to the group-turnover cutoff relevant for GMT liability. Third, we carry out a placebo analysis to rule out that our estimate suffers from the simultaneity bias of larger groups being both more profitable irrespective of profit shifting and more likely to have subsidiaries in any country, including in tax havens.

Group level estimate of shifted profits: We start by calculating an average profitability ratio for two types (j) of subsidiaries (i) where $j = th$ indicates that subsidiary i is in a a tax haven while $j = nh$ denotes that it is not. To ensure comparability, these averages are calculated within cells (l) of 10 group level turnover bins and 10 subsidiary level turnover bins. This ensure that our profit shifting estimate is not inflated by a mechanical relationship between productivity and group or firm size as we show in a placebo analysis below. We define the average profitability of cell l for type j as:

$$\bar{\pi}_l^j = \frac{\sum_{i=1}^{N} \pi_i^j}{N} \tag{2}$$

Within each cell, the difference between these profitability levels generates an estimate of profit shifting intensity per employee as:

$$\Delta\bar{\pi}_l = \bar{\pi}_l^{th} - \bar{\pi}_l^{nh} \tag{3}$$

$\Delta\bar{\pi}_l$ can be negative if tax haven subsidiaries are less profitable than non-haven subsidiaries of similar size in groups of similar size; it will be zero if there is no difference; and it will be positive if profit shifting from non-havens to tax havens is taking place. The one value judgment in the construction of $\Delta\bar{\pi}_l$ is a list of tax haven countries that are used to determine j. This method could therefore show that no or even negative profit shifting is taking place. We then re-scale the productivity difference for each subsidiary i in using it's total employment l_i and aggregate across all subsidiaries $i = 1, ..., N_g$ of group g such that total profits shifted for each group is:

$$PS_g = \sum_{i=1}^{N_g} \Delta\bar{\pi}_l \times l_i \tag{4}$$

This group level estimate of profits shifted loads both on within cell productivity differences and on the distribution of groups across these cells based on where they employ personnel. Intuitively, it tells us how much more (or less) productive the tax haven subsidiaries of a group are compared to a counterfactual world without tax havens. In robustness tests, we compare three counterfactual productivity levels: That of all non-haven subsidiaries (our baseline), only subsidiaries of pure non-haven groups, and all non-haven subsidiaries of groups that also include tax haven subsidiaries

(thus ignoring the non-haven parts of tax-haven groups). The resulting distributions are very close both qualitatively and quantitatively.

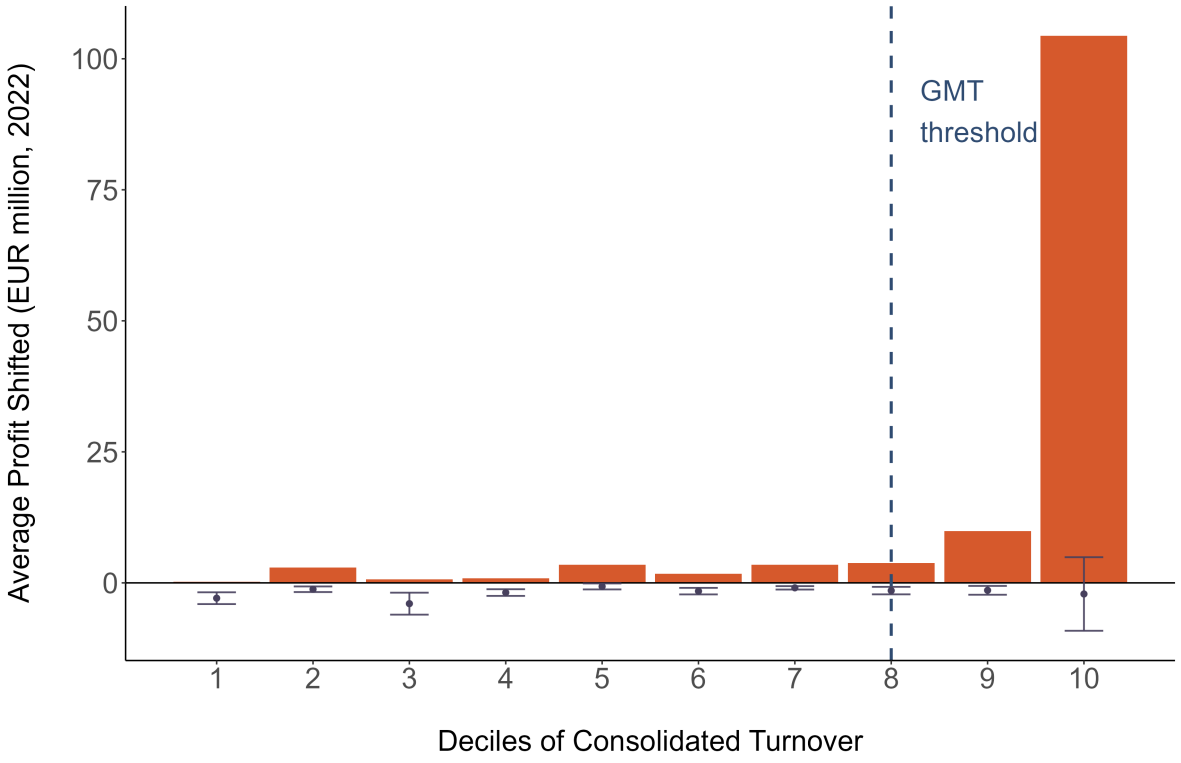
Using this method, we find that German owned MNEs shifted a total of 19 billion Euros (or 19.6 USD) from their foreign subsidiaries into tax havens in 2022. Comparing this number to existing profit shifting estimates needs nuance because methods and datasets differ (Riedel, 2018b; Beer et al., 2020).[15] Our estimate is based on counterfactual profitabilities using country average ETRs. Bachas et al. (2024) show that, across firm size, ETRs follow a hump shape within countries. We could therefore overestimate the counterfactual productivity of non-haven subsidiaries and underestimate shifted profits. However, our estimate is larger than that of Neumeier et al. (2025) who, using CBCR reports, estimate that 10.9 billion Euros per year are shifted out of Germany and 7.6 billion are shifted by German MNEs from countries other than Germany in the period 2016 to 2019. Neumeier et al. (2022) report 10.7 billion shifted from Germany in 2016 and 2017. Since these papers also assume country level ETRs, one reason for our higher number could be that CBCR reports only include firms above the 750 million reporting threshold while our estimate includes the entire group size distribution.

Shifted profits and group size: Turning to the distribution of profits shifted across group size, figure 4 shows the average profits shifted across groups for deciles of consolidated turnover. This average is relatively stable for the first eight deciles of the total turnover distribution. A group in the 7th decile shifts 1.7 million EUR, one in the 4th decile 0.9 million EUR. In the last three deciles, we see an exponential gradient reaching 10 million EUR in the 9th decile and more than 100 million Euros per group in the top decile. Using our microeconomic data to classify groups into GMT liable, we find that 94% of all profit shifting takes place above the GMT threshold, plotted in the dashed line. When we look at profits shifted in relation to turnover at the group level, however, we find a monotonous negative gradient. This suggests that while total profits shifted increase with group size, profit shifting aggressiveness actually decreases.[16] Before we turn to further results on profit shifting aggressiveness and total costs and benefits of the GMT, we provide more evidence testing the credibility of our approach in a placebo exercise.

Placebo analysis to tackle simultaneity bias: Multinational groups that use tax havens can systematically differ from those that do not in ways unrelated to profit shifting. Most importantly, larger groups being both more productive and more likely to have a subsidiary in any given country can introduce simultaneity bias. This bias grows with the number of countries defined as tax havens, a degree of freedom of the authors. A larger tax haven list, potentially including some big OECD countries, would mean that any remaining non-haven control group would include less and less firms, potentially from less developed economies. We would erroneously attribute productivity difference between these sets of firms. Calculating productivity differences in cells of subsidiary and group

[15] Tørsløv et al. (2023) find that 55 billion USD are shifted out of Germany in 2018, a substantially larger number.
[16] These results are not plotted as they currently await output control at the Bundesbank.

Figure 4: Profit shifted across group size



Notes: This figure plots the profit shifted gradient across group size. Consolidated turnover bins are plotted on the horizontal axis. On the vertical axis, we plot the average profits shifted per group in each decile. The dashed line shows the GMT threshold which lies close to the beginning of the 8th decile. The black dots and confidence bands show the mean and standard error of the means of the 100 placebo samples we draw in a dataset without tax haven subsidiaries.

turnover eliminates this bias as the following placebo analysis shows. We start by eliminating all tax haven subsidiaries from the sample. Mirroring the sample share of tax havens in our original sample, we then draw a random list of countries as 'placebo' countries and test if we detect profit shifting where there should be none. We repeat our group-level profits shifted analysis using 100 such placebo samples and placebo country lists. The black dots and error bars in figure 4 show the mean of the group-means for each decile as well as their 95% confidence bands.[17]

The results show that despite our rich microeconomic data, noise is substantial at the top with confidence bands ranging from a negative 7 to a positive 3 million EUR in decile 10. Compared to the more than 100 million profits shifted in our tax haven sample, however, these numbers are small. Most importantly, we do not see a gradient across group size in these placebo samples. This confirms that our main results are not driven by simultaneity bias across the group size distribution. This placebo methodology is robust to increasing or decreasing the size of our placebo country list, meaning that there is no mechanical relationship between the number of countries chosen as tax havens and the size of profit shifted estimated. Any potential error of falsely including a country in the tax haven list therefore moves our estimate closer to the placebo, a downward bias. Untabulated robustness tests confirm that dropping each country from the tax haven list in turn does not qualitatively alter the results.

7 Potential Tax Revenue and Compliance Costs

Having established a profit shifting estimate as well as its gradient across the group size distribution, we now turn to a comparison of tax revenue gained versus compliance costs incurred across the group size distribution. We start by computing, for each turnover decile, the total profits shifted from the averages plotted in figure 4. We then assume a 15% GMT tax rate on this profit and plot the resulting tax potential in figure 5. This comparison assumes (a) that the shifted profits were not taxed prior to GMT introduction and (b) that they are taxed at the 15% GMT threshold after its introduction.[18] The resulting distribution repeats the exponential figure seen in average profits shifted. Note that the vertical axis is cut to make visual inspection at the bottom of the distribution possible: Total revenue in the top decile is more than 10 times that of the 9th decile.

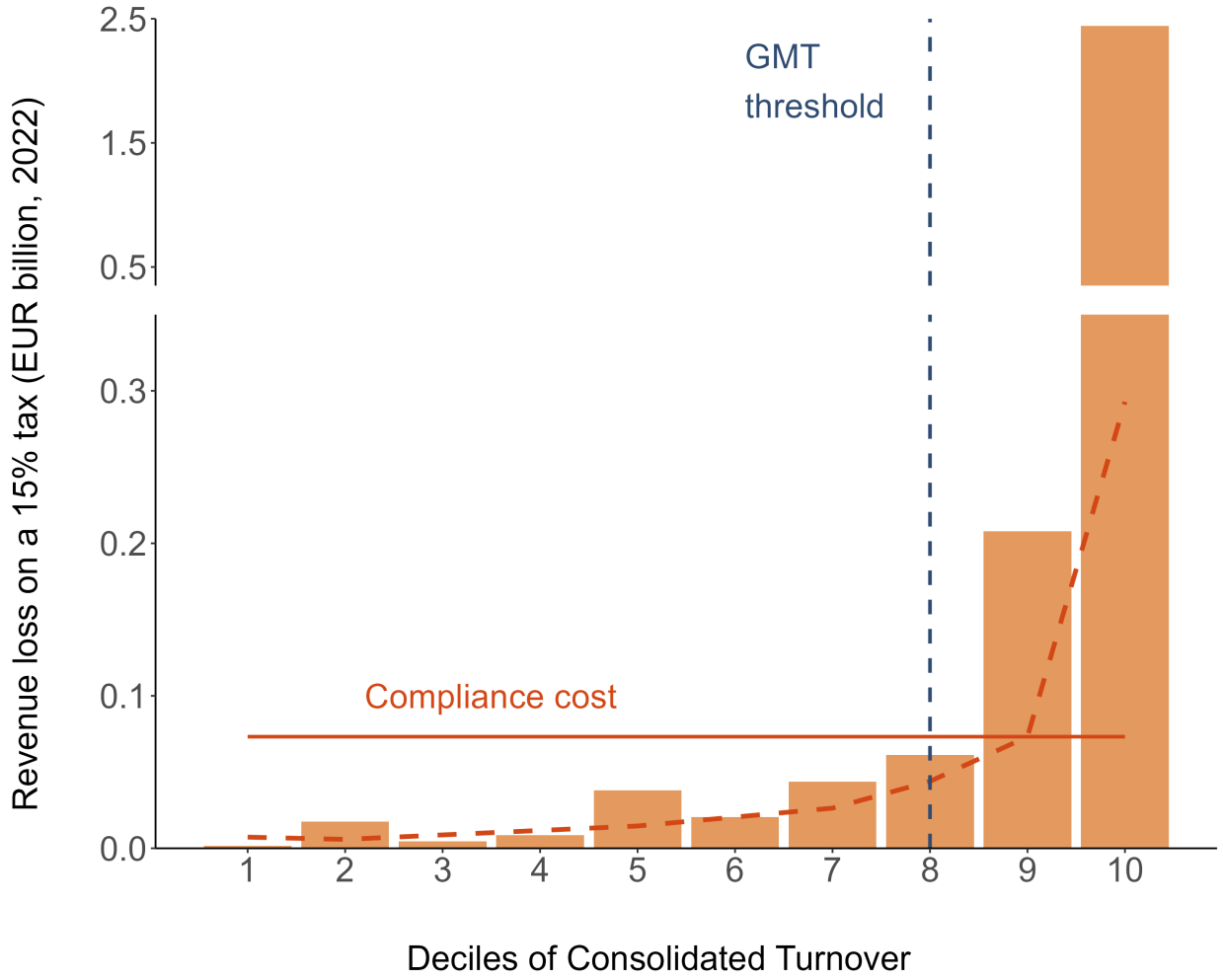
To compare this potential tax revenue gain to the potential compliance cost from a global minimum tax at the firm level, abstracting from administrative costs of the tax administration[19],

[17] In annex figure A.3, we ignore the fact that each of the 100 draws creates a mean and show the larger confidence bands of the standard errors around the means not adjusted for sample size. Deciles 7, 9, and 10 remain significant.

[18] Effective tax rates of MNEs can be lower than this due to substance based carve outs and other deductions. They can also be higher for example due to still existing CfC rules. We believe 15% is an interesting theoretical point of comparison because it is the targeted minimum tax rate.

[19] In discussions about GMT implementation in the German parliament, administrative experts differed on the question if the GMT would lead to higher administrative costs or lower costs due to a potential of streamlining with now redundant regulations targeting profit shifting. We do not take a stance either way here.

Figure 5: Aggregate Tax Revenue and Compliance Costs Across Group Size



Notes: This figure plots the potential revenue loss from a 15% tax on aggregated profit shifted estimated in Figure 4 across group size and the estimated aggregated compliance cost. Consolidated turnover bins are plotted on the horizontal axis. The vertical bars shows revenue from a 15% tax on aggregate profit shifted at the bin level. The solid red line simulates a constant compliance cost of EUR 400,000 per group (multiplied by the number of groups per bin). The dotted line plots an alternative compliance cost that is group size dependent: each affiliate is worth around EUR 30,000 of compliance cost to the group. The dashed line shows the GMT threshold which lies close to the beginning of the 8th decile.

we take two approaches. Data on firm level compliance costs is scarce. Gaul et al. (2022) surveyed a small number of German MNEs to gauge expected compliance costs and report 0.4 million Euros in yearly costs per group. To compare this estimate with our revenue calculations, we need to take a stance on whether we believe this cost will vary with the size of the group and if so how. In our first approach we assume that the cost is the same across groups irrespective of size. This means that all groups incur a cost of 0.4 million per year, to comply with GMT reporting requirements, no matter if the group shifts profits or not. In figure 5 the solid horizontal line represents this cost estimate aggregated across all groups within each decile.

In our second approach we assume that the cost is proportional to the number of subsidiaries within each group. We construct a cost function by dividing the compliance cost estimate with the average number of subsidiaries within the sample of groups represented in the survey. This gives us a compliance cost estimate per subsidiary, which we multiply with the total number of subsidiaries per group in our sample for a group-level cost estimate. The dashed line in figure 5 shows this cost estimate averaged for all groups within each decile.

Both of these assumptions on the size profile of the compliance cost might appear rather extreme. Under the size-constant cost assumption a group operating across 2 jurisdictions has the same compliance cost as a group operating across 100. The assumption that the cost is proportional to the number of subsidiaries, on the other hand, implies that each additional subsidiary within a group adds the same marginal compliance costs irrespective of the original size of the group. This assumes away any economies of scale in compliance effort. While we acknowledge that both assumptions are extreme, we argue that any realistic size gradient in the compliance cost will lie somewhere between the gradients represented by these two assumptions. Comparing these two cost profiles therefore gives us an idea of the range of possible cost profiles we should consider when choosing the GMT threshold. Both approaches abstract from the costs of setting up or updating a tax avoidance strategy which we interpret as sunk costs at the time of the GMT introduction.

Whenever the total costs exceeds the total revenue loss, compliance costs dominate potential gains resulting in a net loss from red tape if that decile would be GMT liable. Two observations emerge from comparing our estimated potential tax revenue with either of the two cost functions. First, potential net losses or gains are small in the bottom of the distribution. They become systematically positive with the 7th decile where the average group would owe 17 million worth of taxes more than it would incur in administrative costs. Second, at the top while the dynamic cost estimate increases substantially (to almost 300 million EUR) due to the large number of subsidiaries per group in the top deciles, this development is outperformed by potential taxes gained.

All deciles above the GMT threshold have a positive ratio and while some net tax revenue could be gained by moving the threshold to the 7th decile, these would be modest in comparison of the current coverage. The GMT therefore seems well placed both from a total revenue perspective, with 94% of all profits shifted covered and from a net revenue perspective as we show here. The

level playing field concern remains of course as profit shifting aggressiveness as a function of total turnover or employees has a negative gradient. We also abstract from any revenue or fiscal multiplier in these results.

8 Conclusion

In this paper, we analyze heterogeneity in profit shifting across the group size distribution and use this to evaluate the 750 million Euro turnover threshold of the global minimum tax (GMT). Access to administrative data on German foreign investment at the firm level allows us to study MNE networks and the distribution of their real and booked activity.

We start by documenting a decrease in taxes paid relative to turnover when groups create subsidiaries in tax havens, consistent with profit shifting. While only every fourth group in the lower half of the group size distribution includes a tax haven subsidiary, this likelihood approaches unity at the top of the distribution. Looking at productivity ratios across countries, we confirm a sizable differential with tax havens appearing fare more productive than other countries.

We introduce a methodology to construct profits shifted at the group level. This method is based on comparing productivity differentials within turnover deciles at the group and firm level between tax haven and non-haven subsidiaries. We confirm that it does not pick up simultaneity bias of large groups being more likely to include subsidiaries in tax havens and being more productive due to reasons other than profit shifting. Our results show an exponential increase of shifted profits in the deciles that are covered by the minimum tax but some profit shifting below the threshold as well.

In our final result, we relate the potential tax revenue gained to the compliance cost incurred by groups of different size. Our results suggest that, depending on the cost structure within groups, some modest net gains can be had from lowering the GMT threshold. By and large, however, the coverage of the GMT appears well targeted: It captures the bulk of profits shifted and does so for groups that avoid more taxes than their potential compliance cost.

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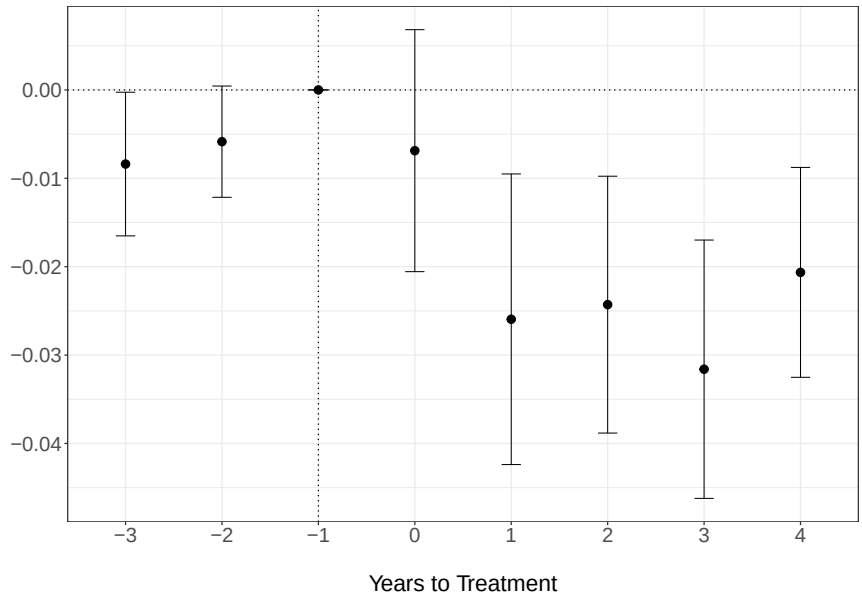
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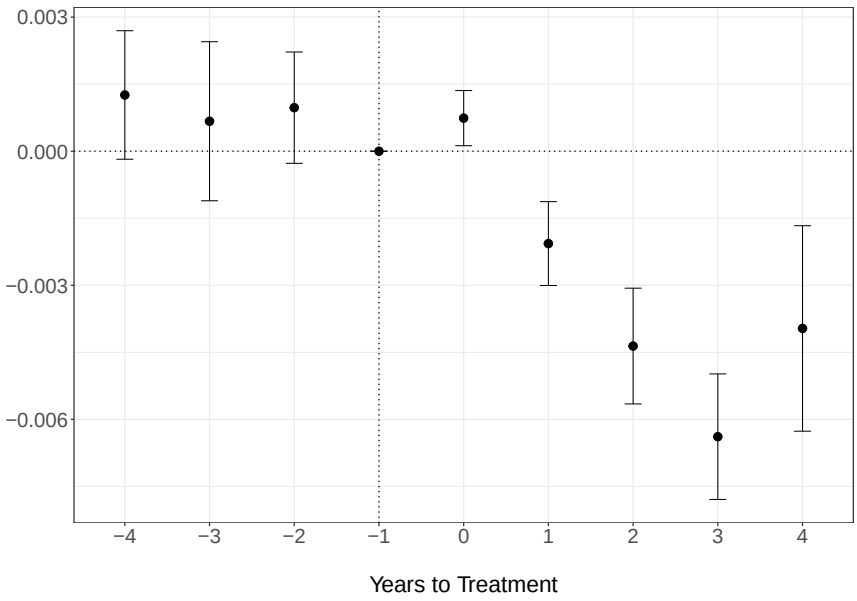
Annex

Figure A.1: Tax Haven subsidiaries correlate with lower TTR - Excluding Austria, Belgium, Switzerland



Notes: This figure shows the results of the event study testing reactions of the tax-to-turnover ratio (TTR) to the emergence of tax haven subsidiaries in a sample without Austria, Belgium, and Switzerland. Our estimation compares the TTR of the ex ante existing non-haven subsidiary of groups that create a tax haven subsidiary to those of groups that create a non-haven subsidiary. Standard errors are clustered at the subsidiary level and 95% confidence bands plotted.

Figure A.2: Tax Haven subsidiaries correlate with lower TTR - Group Level

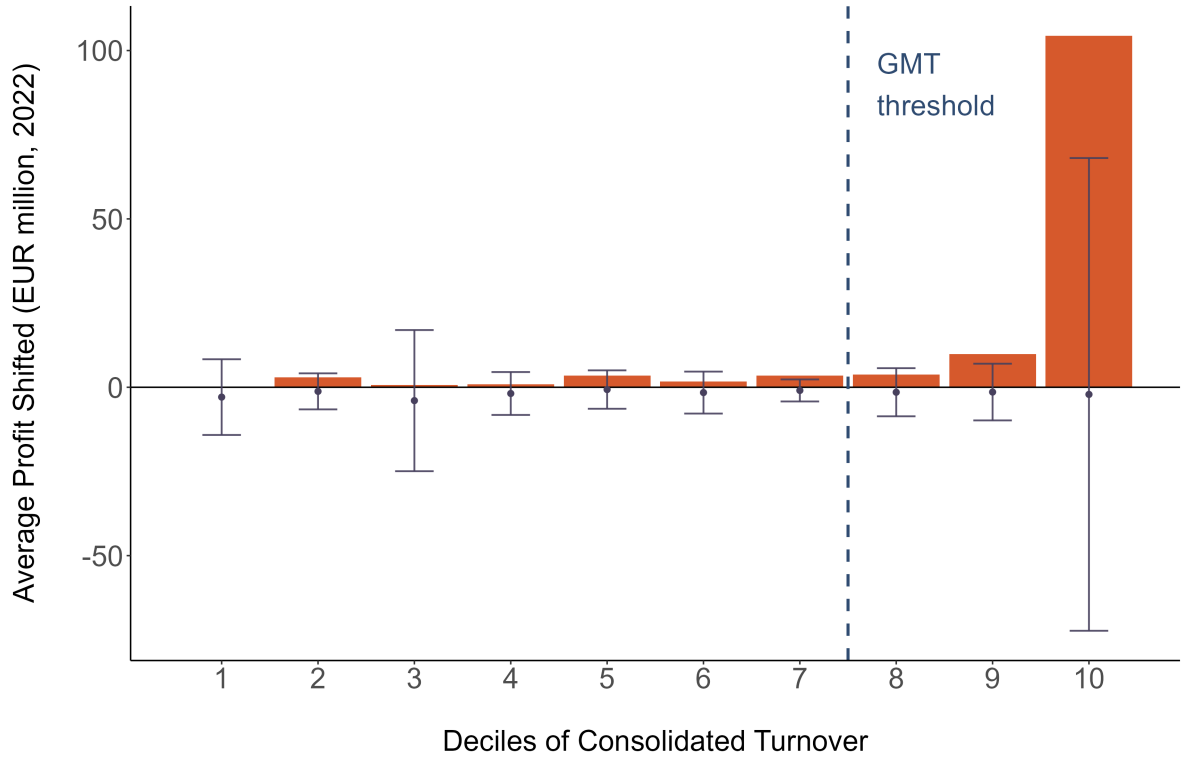


Notes: This figure shows the results of the event study testing reactions of the tax-to-turnover ratio (TTR) to the emergence of tax haven subsidiaries at the group level. Our estimation compares the TTR of the ex ante existing non-haven subsidiary aggregated for the entire group that that creates a tax haven subsidiary to groups that create non-haven subsidiaries. Standard errors are clustered at the group level and 95% confidence bands plotted.

Table A.1: List of tax havens

Tax Havens	**Tax Havens with economic substance**
Andorra, Anguilla, Antigua & Barbuda, Aruba, Bahamas, Bahrain, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Cook Islands, Cyprus, Dominica, Gibraltar, Grenada, Guernsey, Hong Kong SAR, Isle of Man, Jersey, Jordan, Lebanon, Liberia, Liechtenstein, Macao SAR, Malaysia, Maldives, Malta, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Niue, Panama, Samoa, San Marino, Seychelles, Sint Maarten, St. Kitts & Nevis, St. Lucia, St. Vincent & Grenadines, Tonga, Trinidad & Tobago, Turks & Caicos Islands, U.S. Virgin Islands, Vanuatu	The Netherlands, Belgium, Hong Kong, Ireland, Luxembourg, Singapore, Switzerland

Figure A.3: Profit shifted across group size, Placebo using means as observations



Notes: This figure plots the profit shifted gradient across group size. Consolidated turnover bins are plotted on the horizontal axis. On the vertical axis, we plot the average profits shifted per group in each decile. The dashed line shows the GMT threshold which lies close to the beginning of the 8th decile. The black dots and confidence bands show the mean and 95% confidence bands treating the 100 placebo means as independent observations instead of means across MNE groups within each decile.