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PROFIT-SHIFTING ELASTICITIES, CHANNELS, AND  
THE ROLE OF TAX HAVENS:  
EVIDENCE FROM MICRO-LEVEL DATA

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# **Profit-shifting elasticities, channels, and the role of tax havens: Evidence from micro-level data\***

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**ABSTRACT:** This chapter reviews the literature providing empirical estimates on the tax-elasticity of multinational profits and discusses the challenges faced when attempting to quantify tax-motivated profit shifting. We first use micro-level data to show that multinational corporations hold a disproportionately large share of profits and financial assets in tax havens, relative to real activities in these countries. We then argue that tax notches associated with anti-tax avoidance legislation may be exploited to better understand tax-motivated profit shifting. This approach suggests a semi-tax elasticity of pre-tax profits of about 0.22, which is substantially smaller than estimates provided in earlier studies.

**Keywords:** Corporate Income Taxes, Profit Shifting, Tax Havens, Multinational Corporations

**JEL Classification:** H25, H26

\*This paper has been prepared for the “Handbook on Tax Havens” (Eds.: Arjan Lejour and Dirk Schindler).

## I. INTRODUCTION

Data from the International Tax Institutions (ITI) database provided by the Research School of International Taxation (RSIT<sup>1</sup>) document that national and international tax institutions are changing rapidly (see Wamser et al., 2023). A key reason why tax systems are under pressure is the extent to which capital and profits have become internationally mobile, which in turn is driven by changes in the fundamentals that affect the production and organization of global firms: the role of intellectual property, new business models (including an increasingly important role for digital services) and technological change. All this leads to a fall in the cost of doing business globally and facilitates international tax avoidance and income shifting of multinational corporations (MNCs). Recent work by Tørsløv et al. (2022) based on 2015 macroeconomic data shows that around 36% of multinational profits are shifted to tax havens. The tax challenges arising from the resulting increase in the share of cross-border equity ownership and in the share of foreign-to-total corporate profits, can only be addressed through international policy coordination.

Over the last 40 years, however, governments have been responding to the most pressing corporate tax issues mainly by unilaterally cutting statutory tax rates. Tax-cutting reforms started in the early 1980s, which is well documented by Devereux et al. (2002). Their sample includes data on industrialized economies, suggesting that the mean of the statutory corporate income tax rate (SCITR) has fallen from 48% in the early 1980s to 35% by the end of the 1990s. The ITI database, which includes tax data for more than 200 economies, supports the view that this process has not come to an end: SCITRs continue to fall; while the mean (median) SCITR in 2001 was about 28% (30%), it has dropped to about 21% (25%) in 2020.

Moreover, governments have responded to the profit-shifting activities of MNCs by tightening rules to limit profit shifting. For example, the US adopted a Base Erosion and Anti-Abuse Tax (BEAT) as part of the 2017 “Tax Cuts and Jobs Act” (TCJA) to prevent firms from shifting profits abroad. Such rules contribute to the already huge body of anti-tax-avoidance legislation pushed forward by the OECD’s Base Erosion and Profit Shifting (BEPS) initiative and the associated action plan. The ITI database documents a substantial number of indicators in this context, subsumed as Anti-Tax-Avoidance Rules (ATARs). When comparing the number of ATARs with

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<sup>1</sup> The RSIT Tübingen is an interdisciplinary team of researchers, working on policy-relevant topics in international taxation and cross-border activities of MNC (see [www.rsit-tuebingen.de](http://www.rsit-tuebingen.de)).

the trends in corporate income tax measures, the pattern is clear: while corporate income taxes continue to fall, the number of ATARs has increased substantially.

A fundamental parameter of interest to researchers is the *tax elasticity of profits* (TEP) – i.e., how changes in corporate tax incentives affect pre-tax profits. Dharmapala (2014) reviews the literature providing estimates of the TEP and suggests that earlier studies find the profit-responsiveness of MNCs to be about three times as large as that estimated by more recent contributions. Dharmapala (2014) argues that this is related to the fact that later work is usually based on micro-level panel data, which allows researchers to control for both observable and time-constant unobservable variables that determine reported income. The latter helps to avoid upward bias by exploiting changes in tax incentives over time.

Most of the estimates on income shifting draw on the seminal contribution by Hines and Rice (1994). This paper uses country-level data to show that pre-tax income varies systematically with tax incentives. One of the first studies to use micro-level information – at the multinational firm and affiliate level – is the one by Huizinga and Laeven (2008). Their findings suggest a semi-TEP with respect to the SCITR of 1.3. Heckemeyer and Overesch (2017) and more recently Beer et al. (2020) review the extensive empirical literature on tax-motivated income shifting and provide meta-studies on the tax-responsiveness of pre-tax income. The former finds a consensus semi-TEP of about 0.8; the latter one a semi-TEP of 1.

In this chapter, we first discuss empirical contributions examining different channels of profit shifting, with a specific focus on tax havens. There are in general two main challenges related to quantifying profit shifting to tax havens. First, tax havens are underrepresented in many micro datasets. We discuss this in Section III and provide some descriptive statistics based on micro-level data to illustrate the role of tax havens in MNC activity. Second, identification of profit shifting can be difficult due to a lack of variation in tax incentives over time. Moreover, tax incentives for profit shifting are often mismeasured. We explore an alternative identification approach in Section IV, where we show how exogenous variation in countries' ATARs can be exploited to estimate an unbiased TEP, as recently proposed by Hansen, Merlo, and Wamser (2023). Section V concludes.

## II. PROFIT-SHIFTING CHANNELS AND THE ROLE OF TAX HAVENS

We first discuss recent papers that shed light on the prominent role of tax havens in profit shifting by analyzing newly available country-by-country (CbC) data. Then, we review empirical papers providing evidence on profit shifting to tax havens, focusing on alternative shifting channels.

CbC reports were introduced as an instrument to fight tax avoidance in the context of the BEPS project initiated by the OECD and G20.<sup>2</sup> One advantage of these data is the broader coverage of tax havens, which tend to be underrepresented in other datasets (see Chapter 18 by Olbert and Spengel in this handbook, on CbC reporting). Clausing (2020) analyzes aggregate data from CbC reports by US MNCs in 2017 and provides some stylized facts about the importance of tax havens. The paper shows that tax havens play a dominant role for profit shifting by large US firms. Profits and accumulated earnings are disproportionately high in tax havens, with 11 tax havens accounting for 56% of total US multinational foreign profits and 71% of accumulated earnings. At the same time, real economic activity in those locations is disproportionately low: they account for only 5.6% and 24% of total foreign employment and total foreign assets, respectively. Fuest et al. (2022) use information from CbC reports filed in Germany to study profit shifting to tax havens by MNCs and quantify tax-revenue losses due to profit shifting. Their findings suggest that around 40% of the profits reported by large German MNCs in tax havens are the result of profit shifting and estimate the corresponding annual tax-revenue loss for Germany to be about 1.6 billion Euro. They also show that 82% of German MNCs subject to CbC reporting have subsidiaries in tax havens. However, only 9% of those firms' global profits are reported in tax havens, with European tax havens accounting for the majority (87%) of tax haven profits. They find subsidiaries in tax havens to be significantly more profitable than subsidiaries in non-havens; only 4% of German MNCs' tangible assets and 3% of employees are located in tax havens.

In the following, we briefly review empirical literature providing evidence on different *channels* of profit shifting using micro-level data. Note that we present a selection of studies that focus particularly on the contribution of tax haven countries to MNCs' tax-avoidance activities.

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<sup>2</sup> Under BEPS Action 13, large MNCs headquartered in countries that joined the Inclusive Framework on BEPS (with consolidated revenues larger than 750 million Euro) are required to file an annual report disclosing aggregate information on the global allocation of income, profit, taxes paid and economic activity among tax jurisdictions in which they operate.

Mintz and Weichenrieder (2010) provide first systematic evidence on *treaty shopping* using firm-level data. They particularly shed light on the relative importance of different tax havens as conduit locations for German MNCs (see Chapter 8 by Weichenrieder in this handbook). Weyzig (2013) uses micro-level data from Dutch Special Purpose Entities and shows in a censored regression framework that the tax treaties are a key determinant of FDI diverted via Dutch conduits (Special Purpose Entities), especially through the resulting bilateral withholding tax reductions. A more comprehensive analysis of the tax-treaty network can be found in van 't Riet and Lejour (2018). The authors compute the tax-minimizing routes and identify the European tax havens Luxemburg and the Netherlands as the most important conduit countries (along with the UK). They find that not all tax havens play a crucial role for the avoidance of repatriation taxes – only tax havens that are important financial centers do.

Büttner and Wamser (2013) analyze the role of *internal debt* as a vehicle to shift profits to low-tax countries. They use an affiliate-level dataset on the universe of German MNCs, including many foreign entities in tax havens. They descriptively show that internal debt is used more heavily by MNCs with tax haven presence. In panel fixed effects regressions, they demonstrate that the amount of internal loans received by an affiliate in the group increases in the tax distance between that affiliate and the lowest-tax affiliate in the group. However, their analysis suggests that internal debt is a rather unimportant profit-shifting channel for German MNCs and argue that the German CFC rule effectively prevent profit shifting to tax havens via internal debt.

Davies et al. (2018) show that the bulk of profit shifting through *transfer pricing* is driven by a few large firms' exports to a few tax havens. They analyze tax-motivated manipulation of transfer prices by MNCs. The analysis relies on a rich dataset of French exporting firms, which includes information on both intra-firm and arm's-length quantities and prices at the level of firms, products, and destination countries. The authors exploit this fine data granularity to compare intra-firm prices for a particular firm and product across destination markets with arms' length prices for the same product and market. They find that the price of intra-firm exports is systematically lower in markets with a higher tax rate. The role of tax havens seems to be substantial: they find no evidence for transfer-price manipulation when excluding tax haven destinations. They estimate tax losses to amount to about 1% of total corporate tax revenue in France.

Hebous and Johannesen (2021) provide first evidence on profit shifting through *intra-firm services trade* with tax havens. They combine firm-level data on German MNCs' service exports

and imports by destination and service type with information on the location of their foreign affiliates. The authors document that in aggregate international trade statistics tax havens play a substantial role in international trade in services. To disentangle the role of profit shifting from any real comparative advantage of tax havens in the production of services, they test whether services trade with tax havens where the firm has an affiliate is systematically skewed towards imports. They find intra-firm trade patterns to be consistent with profit shifting: the propensity to import services from a tax haven is significantly higher if the firm has an affiliate there. Furthermore, they show that affiliates in tax havens selling services to the German parent are systematically more profitable than affiliates in non-havens. They estimate that the resulting yearly tax revenue loss for Germany amounts to less than 1 billion Euro.

Laffitte and Toubal (2022) use US foreign affiliate data to illustrate that an important source of profits reported in tax havens originates through *sales shifting*. Their fixed-effects analysis shows that the share of foreign sales recorded in tax havens is disproportionately larger than in other countries. They predict the share of foreign sales in any country, accounting for market access (as in Head and Mayer, 2011) and production cost as well as tax determinants. They estimate the contribution of sales shifting to total foreign profits shifted to tax havens to amount to 68%. Their results suggest that sales shifting accounts for the bulk of profits shifted to small tax havens like Bermuda or Barbados.

Karkinsky and Riedel (2012) show that European MNCs distort the *strategic location of intellectual property (IP)* towards low-tax affiliates. Baumann et al. (2020) find that patents with above-average value are systematically relocated to tax havens. Their results further suggest that CFC rules are effective in deterring tax-driven relocation of patents to tax havens. Koethenbueger et al. (2018) assess the effect of patent box regimes on profit shifting by MNCs and they explore the interplay of patent box use with other profit-shifting instruments. The introduction of a patent box regime leads to 11% higher pre-tax profits for affiliates without a link to a tax haven within the MNC group. The effect is smaller for affiliates of MNC groups with tax haven presence (i.e. with one or more tax haven affiliates) and disappears if the shareholder is located in a tax haven.

The above discussed evidence shows that the importance of tax havens differs across profit-shifting channels. While they play a prominent role in profit shifting via transfer price manipulation of goods and services as well as sales shifting, CFC regulation appears to effectively prevent profit shifting to tax havens via internal debt or the strategic location of IP. Patent box

regimes appear to be more effective in luring profits to non-havens. Moreover, some of the papers imply that specific characteristics of tax havens matter; for example, only financial-center tax havens play a central role in treaty shopping.

### **III. THE ROLE OF TAX HAVENS IN MICRO-LEVEL DATA**

As mentioned above, the advantage of CbC data is their broader coverage of tax havens. Unfortunately, they are only accessible for a limited number of countries. In this section, we provide descriptive statistics on the role of tax havens in MNC activity using the commercial dataset Orbis (Bureau van Dijk) with world-wide coverage. For this purpose, we use the definition of tax haven country provided by Hines (2010) and complement that list with countries considered as tax havens in Tørsløv, Wier, and Zucman (2022).

Our version of Orbis includes more than 74 million (pooled) firm-entity observations, about 13 million individual firm-entities (including affiliates of MNCs), which are located in 140 countries, and are held by approximately 10 million ultimate owners. Almost 10% of all observations are associated with firm-entities located in tax haven countries. Only a part of these, however, are affiliates of MNCs. To be precise, 15,747,113 pooled observations (over the years 2001 to 2019) belong to MNCs. Almost 9% of all foreign affiliates of MNCs are located in tax haven countries.

Perhaps surprisingly, Orbis includes data on about 222,000 affiliates that belong to GUOs located in one of 45 different tax havens. While European tax havens and Cyprus are important GUO locations, non-European ones are important as well: the British Virgin Islands (5.87% of the observations with a tax haven GUO), the Cayman Islands (5.01%), or Bermuda (2.47%).

The 9% tax haven affiliates mentioned above are located in 29 different tax haven countries. Again, many of those are European ones such as the Netherlands, Ireland, or Luxembourg. Non-European countries are not irrelevant, though: almost 10% of all tax haven observations are in Singapore, for example.

Table 1 presents the shares of different aggregate firm outcomes accounted for by (i) affiliates located in a tax haven ( $THA=1$ ) but held by a GUO that is not in a tax haven ( $THG=0$ ); (ii) affiliates located in non-havens ( $THA=0$ ) with a GUO that is not in a tax haven ( $THG=0$ ); and (iii) affiliates located in non-havens ( $THA=0$ ) but with the respective GUO located in a tax haven

( $THG=1$ ).<sup>3</sup> To interpret Table 1, it is important to primarily focus on the ranking of the shares in different outcomes. While almost 30% of the financial profits ( $FIP$ ) are in tax haven countries ( $THA=1&THG=0$ ), only a meager 3% of the number of employees ( $EMP$ ) is located there. Also, profit before taxes ( $PBT$ ) and intangible fixed assets ( $IFAS$ ), both associated with profit shifting, are to a substantial extent located in tax haven countries. Moreover, the share of other current liabilities ( $OCL$ ) is very low when  $THA=1$  and  $THG=0$ . This seems plausible as the variable  $OCL$  includes, for example, payroll due, payroll taxes, interest payable, accrued interest, and short-term debt. In non-haven countries ( $THA=0&THG=0$ ), the sorting of the outcome shares is almost in reverse order: the share of total employee costs ( $STAF$ ),  $OCL$ , and  $EMP$  are about 80% or higher, while only about 66% of the financial profits are located there.

For those foreign affiliates that are held from global ultimate owners located in tax haven countries,  $THG=1&THA=0$ , we would expect, for example, that the share of the financial assets (relative to the share of employment) is particularly low. This is indeed what we see: about 17% of all employees are located in affiliates that are held by ultimate owners in tax haven countries; however, only about 3.5% of the financial profits are located in these affiliates. The latter may be explained by the rational to shift financial profits to ultimate owners in tax havens.

We may finally take the ratios of the shares to highlight the difference in the rankings across groups. For example, dividing the share of  $EMP$  by the share of  $FIP$  suggests that the number of employees in affiliates where the ultimate owner is in a tax haven ( $THG=1&THA=0$ ) is larger by a factor of almost 5 ( $0.170/0.035=4.86$ ); if  $THA=0$  and  $THG=0$ , this ratio is 1.21 ( $0.790/0.655$ ); if  $THA=1$  and  $THG=0$ , it is 0.1 ( $0.03/0.292$ ).

### **Comparison using census-type German MNC data**

The main pattern from above also reflects in data provided by the German central bank. The *MiDi* data (Microdata Directinvestment, Deutsche Bundesbank), a census-type dataset, records information on all German MNCs and their foreign affiliates.<sup>4</sup>

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<sup>3</sup> Note that the shares in Table 1 do not add to one, as a residual group corresponds to those where both affiliate and GUO are located in a tax haven.

<sup>4</sup> The paper by Weichenrieder (2008) uses MiDi to estimate a TEP.

**Table 1: Shares of aggregate outcomes by group**

<i>Outcomes sorted by share: Tax haven affiliates</i>								
<b>Outcome:</b>	<i>FIP</i>	<i>PBT</i>	<i>IFAS</i>	<i>TFAS</i>	<i>TURN</i>	<i>OCL</i>	<i>STAF</i>	<i>EMP</i>
Rank:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b><i>THA=1&amp;THG=0</i></b>	0.292	0.196	0.157	0.141	0.130	0.077	0.040	0.030
<i>Outcomes sorted by share: Non-haven affiliates</i>								
<b>Outcome:</b>	<i>STAF</i>	<i>OCL</i>	<i>EMP</i>	<i>TURN</i>	<i>TFAS</i>	<i>PBT</i>	<i>IFAS</i>	<i>FIP</i>
Rank:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b><i>THA=0&amp;THG=0</i></b>	0.851	0.807	0.790	0.738	0.720	0.700	0.672	0.655
<i>Outcomes sorted by share: Non-haven affiliates with tax-haven GUO</i>								
<b>Outcome:</b>	<i>EMP</i>	<i>IFAS</i>	<i>TFAS</i>	<i>TURN</i>	<i>STAF</i>	<i>OCL</i>	<i>PBT</i>	<i>FIP</i>
Rank:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b><i>THG=1&amp;THA=0</i></b>	0.170	0.133	0.111	0.104	0.098	0.092	0.071	0.035
<i>Notes: Data taken from Orbis. All variables are measured at the affiliate level and then aggregated over groups. EMP denotes the number of employees; FIP measures financial profit and loss; IFAS denotes intangible fixed assets; (iv) OCL denotes other current liabilities; PBT denotes profit and loss before taxes; STAF measures total costs of employees; TFAS denotes tangible fixed assets, and TURN denotes affiliates' sales. THA is an indicator variable equal to one if an affiliate is located in a tax haven country, zero otherwise; THG is an indicator variable equal to one if the GUO is located in a tax haven, zero otherwise.</i>								

Following Laffitte and Toubal (2022), we run a fixed effects regression where the dependent variable corresponds to *after-tax profits per employee* (PPEMP) of an affiliate in a given year.<sup>5</sup> PPEMP is explained by a set of fixed effects: country-year, industry-year, industry-country, and parent-year fixed effects. We then sort and plot the average country-specific effect in Figure 1. Countries located on the left are ones with *excess profitability* (above average profitability) relative to the other countries. The black bars indicate tax haven countries according to the tax haven definition mentioned above. PPEMP tends to be very high in black-bar tax haven countries as most of those countries are clustered on the left side of the graph. Note that the empirical approach makes sure that the pattern is not driven by a selection of relatively profitable industries

<sup>5</sup> Profits are measured in 1,000 Euro.

or MNCs into these countries but is related to some country-specific feature (e.g., being a tax haven location).

Among the first ten countries on the left side are well-known tax havens such as Malta, Bermuda, Mauritius, the Cayman Islands, and the Channel Islands of Guernsey and Jersey. The tenth bar corresponds to the USA. The two red bars are Luxembourg and the Netherlands, which are considered as important *conduit locations* through which profits are often channeled to tax havens (see van 't Riet and Lejour, 2018).

We finally use *MiDi* to document that when looking at the allocation of profits and assets, it is primarily the European tax haven countries that are relevant for German MNCs. Let us use the same type of statistic as above – the share of profits, assets, and employees in tax haven countries relative to all profits, assets, and employees in *MiDi*. Figure 2 displays the shares of (i) *profits*,<sup>6</sup> (ii) *total assets*, (iii) *fixed assets*, (iv) *financial assets*, and (v) *number of employees* in tax haven countries. While the blue (left) bars in Figure 2 aggregate overall tax havens, the orange (right) ones focus on European tax haven countries. What is interesting to see is that it is mainly the European tax havens that matter for Germany MNCs. In fact, the bulk of all tax haven activity happens in four European countries: the Netherlands, Switzerland, Luxembourg and Ireland. Also interesting is that the pattern in Orbis is very similar, compared to the census-type data: while the share of employees in tax havens is below 0.04, the share of financial assets is above 0.18.

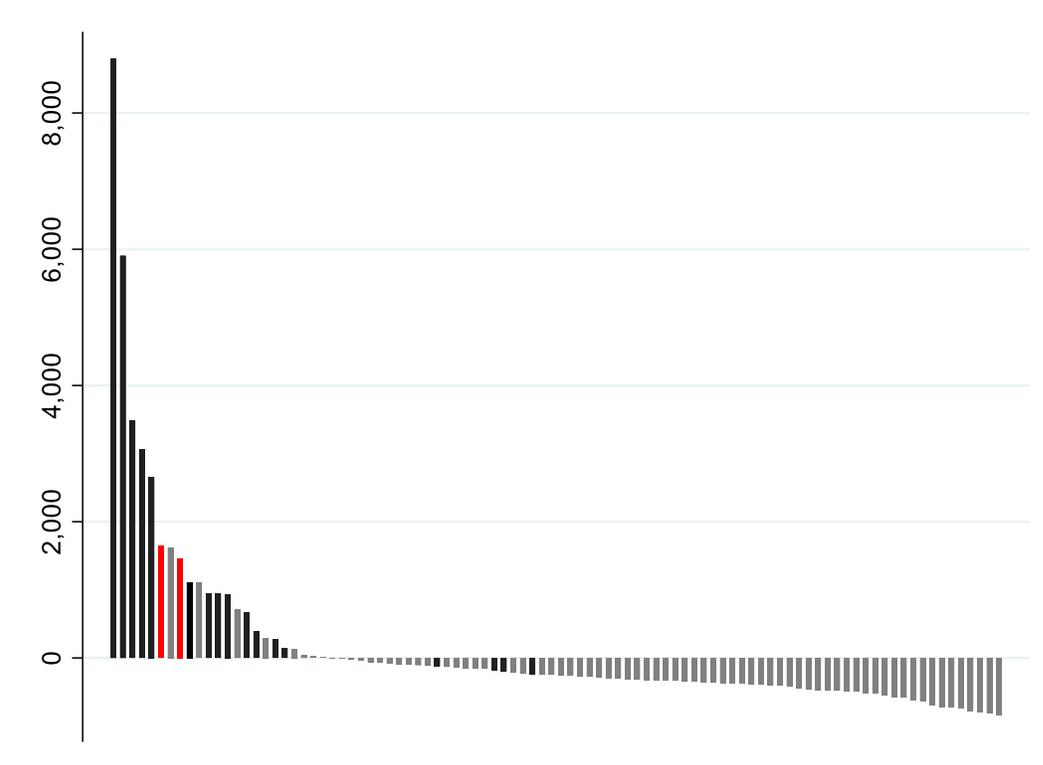
### **MNC Size and Tax Haven Activities**

One important finding is that a few large MNCs account for most of international profit shifting (e.g., Davies et al., 2018). Based on a finite mixture modeling approach, which allows distinguishing tax avoiders from non-avoiders stochastically from a mixture of distributions of the two types of firms, Egger et al. (2014) find that about 11% of affiliates of German MNCs are avoiders. Their investments account, however, for about 58% of the stock of foreign fixed assets held by German MNCs.

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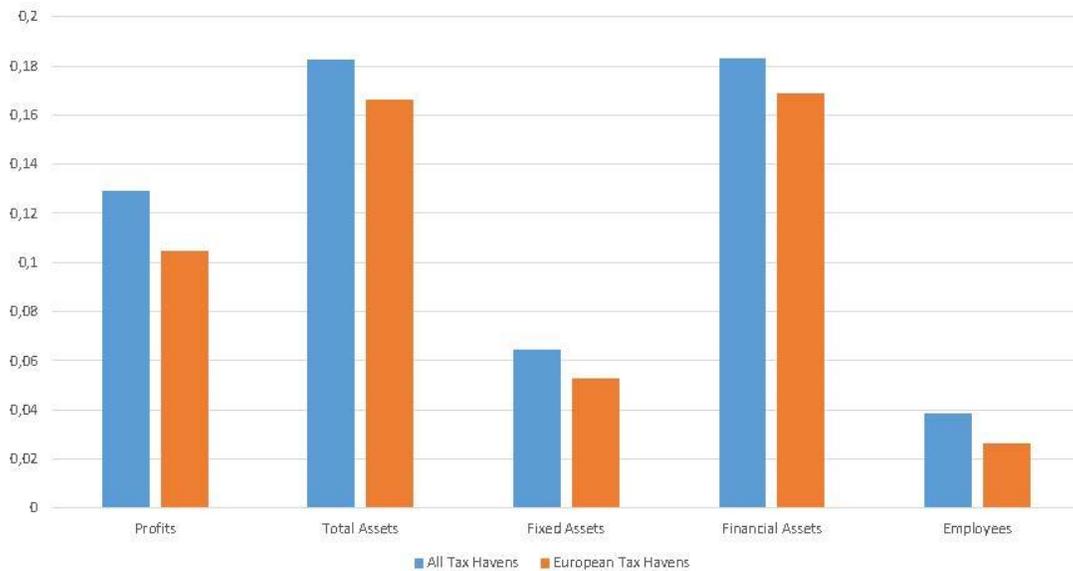
<sup>6</sup> Note that *MiDi* records “profit after taxes”, whereas Orbis includes measures on pre-tax profits.

**Figure 1: Country-specific profit-to-employee ratios**



*Notes:* Based on fixed effects regression using *MiDi*. Profits in 1,000 Euro per employee. Bars in dark color correspond to tax haven countries.

**Figure 2: Share of tax haven activities relative to total activity**



*Notes:* Based on data from *MiDi*. Orange bars correspond to European tax haven countries.

Large MNCs may have many more options to shift profits to tax haven countries, given that tax differentials between countries are often substantial. Moreover, the fact that some of these global firms operate many affiliates in tax haven countries makes the empirical analysis a challenging task. In Orbis, about 78% of all affiliates belong to MNCs that consist of one or two foreign affiliates;<sup>7</sup> 5.6% (2.2%) of the affiliates belong to MNCs operating between three and five (six and eight) foreign affiliates; 1.4% (12.8%) of the affiliates are held by MNCs that consist of nine to eleven (more than eleven) foreign affiliates. More than 400 MNCs in our sample hold at least 100 foreign affiliates in a given year.

Table 2 displays averages of different variables of interest across MNC group size classes and provides a number of interesting insights. First, larger MNCs – which we measure by the size of the group in terms of number of affiliates – also hold affiliates that are larger, on average. For example, the average number of employees (*EMPL*) of the average firm-entity in *class 5* (i.e., those MNCs that hold more than 11 affiliates) equals 287, while the mean *class 1* affiliate is substantially smaller, with about 15 employees on average. Second, on average, *class 5* MNCs have established almost 5 new affiliates (variable *NEWAFF*) per year over the time period for which we have data on. Third, the mean statutory tax burden (measured by *SCITR*) across groups is not that different. While the average *SCITR* in group 1 is 22%, the mean *SCITR* across groups 2 to 5 is about 25%. Although this is surprising, the distinct characteristic of *class 5* in terms of taxes becomes clear when looking at alternative tax measures, such as *MINTAX* – the minimum *SCITR* within an MNC – and *WTAX* – an asset weighted within MNC tax differential (for a definition of both variables, see the Table notes). Fourth, the average *MINTAX* in *class 5* is about 10 percentage points lower than the one in *class 1*. Note that some MNCs have access to zero-tax tax haven countries, but *MINTAX* is just the average value over all firms that are part of *class 5*. Fifth, we find the same pattern for *WTAX*, which becomes more negative the larger the MNC. As *WTAX* measures something like the relative tax-position within the group, this implies that, on average, low-tax affiliates (relative to high-tax affiliates) become more important in *class 5*. Sixth, the last column impressively shows that the average number of tax haven affiliates is substantial for *class 5* MNCs (in *class 1*, it naturally is mostly zero). This of course explains the lower *MINTAX*. Note, however, that a few MNCs operate even more than 1,000 foreign affiliates in a given year. Some of those foreign entities are located in tax haven countries.

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<sup>7</sup> Note that if an MNC consists of one foreign affiliate, the ultimate owner is necessarily located in a different country – i.e. not the host country of the foreign affiliate.

**Table 2: Mean Values by Group-Size Class**

<i>Variables</i>								
<i>Class</i>	<i>TOAS</i>	<i>DEBT</i>	<i>EMPL</i>	<i>NEWAFF</i>	<i>SCITR</i>	<i>MINTAX</i>	<i>WTAX</i>	<i>NOTHA</i>
<b>1</b>	11.42	11.29	15.26	0.05	0.22	0.22	0.000	0.08
<b>2</b>	13.72	13.04	73.30	0.10	0.24	0.23	-0.005	0.66
<b>3</b>	14.25	13.61	98.71	0.17	0.25	0.21	-0.007	1.09
<b>4</b>	14.55	13.86	123.40	0.23	0.25	0.20	-0.008	1.60
<b>5</b>	15.27	14.61	286.99	4.89	0.26	0.12	-0.010	29.12

*Notes:* Data taken from Orbis. Entries are mean values over all observations in a given size class. Size classes: (1) 1-2 affiliates; (2) 3-5 affiliates; (3) 6-8 affiliates; (4) 9-11 affiliates; (5) more than 11 affiliates. *TOAS* denotes log affiliates' total assets; *DEBT* denotes log affiliates' long-term debt; *EMPL* denotes number of employees; *NEWAFF* measures the total number of newly set up affiliates per MNC in a given year (we use the "date of incorporation" in Orbis to calculate *NEWAFF*); *SCITR* is the statutory corporate income tax rate in affiliates' host countries; *MINTAX* is the minimum tax within the MNC; *WTAX* is an asset-share-weighted tax differential between the affiliate's *SCITR* and the average *SCITR* in the group (see Goldbach et al., 2021 for a precise definition of *WTAX*); *NOTHA* is the number of affiliates in tax haven countries.

#### IV. IDENTIFYING TAX-MOTIVATED PROFIT SHIFTING

The literature mentioned in Section II is usually based on a version of the following empirical estimation, drawing on the seminal contribution by Hines and Rice (1994):

$$\log(P_{it}) = \alpha_1 TAX_{it} + \beta X_{it} + \theta_t + \omega_i + u_{it}, \quad (1)$$

where  $P_{it}$  denotes some measure of profits (often earnings before interest and taxes) of affiliate  $i$  in period  $t$ .  $TAX_{it}$  denotes alternative tax measures to capture tax incentives at  $i$ . Many of the more recent papers estimate the key parameter of interest, i.e. the semi-elasticity of pre-tax income  $\alpha_1$ , conditional on the  $i$ -specific fixed effect  $\omega_i$ . Controlling for unobserved affiliate-heterogeneity  $\omega_i$  is key for estimating  $\alpha_1$  without bias – it captures confounding, unobserved characteristics of  $i$  such as high "intangibility" (see Dharmapala, 2014). It is also crucial that the vector of control variables  $X_{it}$  includes measures of labor and capital inputs (see Hines and Rice, 1994) as determinants of  $P_{it}$ .

Note that including the fixed effect  $\omega_i$  removes all time-constant cross-affiliate, cross-industry, and cross-country variation in the data. As mentioned above, this is helpful when the main goal is to obtain an unbiased estimate on  $\alpha_1$ . A key requirement, however, is that there is sufficient variation in the tax measure  $TAX_{it}$  over time. Thus, even if micro-level data cover a lot of tax haven affiliates, this alone does not contribute to identifying the tax effect as most tax havens do not change their tax rates frequently (for example, many of the Caribbean tax haven countries, such as the Cayman Islands, have tax rates equal to zero and this does not change over time). Riedel (2018) highlights several measurement and selection issues that may lead to bias in the estimated tax effects and points at two alternative methods that have been used to identify tax-motivated profit shifting. First, Dharmapala and Riedel (2013) exploit profitability shocks to affiliates of MNCs to learn about profit shifting. Second, Egger et al. (2010) as well as Bilicka (2019) use propensity score matching to estimate profit shifting by comparing domestic to multinational firms.

A recent study, using Orbis data and multi-country parent-affiliate ownership links, shows that exogenous variation in controlled foreign corporation (CFC) rules may be exploited to obtain an unbiased estimate on the semi-TEP. Hansen et al. (2023) exploit exogenous variation in tax incentives to shift profits created by CFC rules. These rules aim at taxing foreign income generated in low-tax locations that would otherwise be exempt from taxation at the parent firm's country. If CFC legislation at the parent location applies to low-tax affiliates abroad, (passive) income of the foreign entities is attributed to the shareholder's (the parent's) tax base. The specific design of CFC rules creates a discontinuous jump – a notch – in tax incentives determining the tax avoidance behavior of MNCs. In Hansen et al. (2023), these tax notches are substantial – on average, about 15 percentage points. Once a foreign affiliate is affected by a CFC rule, profit-shifting incentives should no longer be determined by the foreign country's corporation tax but by the one of the parent country (for a given foreign affiliate, in the absence of changes in ownership and affiliate structure at the MNC level). In terms of empirical specification, Hansen et al. (2023) augment equation (1) by including a  $CFC_{ijt}$  indicator variable, which bears an  $ijt$ -index, as CFC treatment is typically affiliate- $i$ -, parent- or shareholder- $j$ -, as well as time  $t$ -specific. The  $CFC_{ijt}$  indicator equals one if CFC legislation is binding, otherwise it is zero. The fact that CFC rules create tax notches, as well as the substantial additional variation through CFC rules improves identification

significantly. For the latter, in contrast to the host-country-time variation in  $TAX_{it}$ , the bilateral nature of CFC treatment is particularly relevant. The estimation equation is

$$\log(P)_{it} = \alpha_1 TAX_{it} + \alpha_2 CFC_{ijt} + \boldsymbol{\rho} \mathbf{Z}_{it} + \theta_t + \omega_i + u_{it}, \quad (2)$$

where  $\mathbf{Z}_{it}$  includes the same control variables as before. The main result in Hansen et al. (2023) suggests a tax semi-elasticity of 0.22, which is substantially smaller than the consensus estimate of 0.8 in Heckemeyer and Overesch (2017). The paper argues that the lower estimate is more accurate because the identification approach captures actual profit-shifting incentives, which allows estimating an unbiased TEP.

In Figures 3 and 4, we illustrate the treatment effect in Hansen et al. (2023) – which is then used to calculate the semi-elasticity of 0.22. For this, we first normalize the foreign (host) tax rate by the respective CFC threshold that applies to a bilateral country pair. The centered tax variable then corresponds to the tax-distance to the relevant CFC threshold. For example, given Germany’s CFC threshold of 25%, for a host country tax rate equal to 0.1 (or 10%), distance-to-the-threshold is -0.15 (10%-25%=-15%).<sup>8</sup> Accordingly in Figure 1, the bold vertical line (where the tax-distance equals zero) splits observations in treated (left of the vertical line, where the distance to the CFC threshold is negative) and non-treated (right of the vertical line, where the distance of the CFC threshold is positive). At the zero-cutoff, the CFC rules create a discontinuous jump in tax incentives, which we exploit to measure the semi-TEP. The red bold lines in the figure indicate predicted profits (with log EBIT as the dependent variable), based on a regression such as displayed in equation (2); the dotted lines correspond to confidence intervals. The normalized tax differential (tax-distance) to the threshold enters as a polynomial function of order 5.<sup>9</sup> Note that, given specification (2), the CFC effect is identified by exploiting variation therein over time, conditional on unobserved affiliate characteristics. As this identification approach – exploiting variation over time in CFC treatment – is very effective, we do not resort to a classical regression discontinuity identification, which focuses on cross-sectional variation at the discontinuity.<sup>10</sup>

Figure 2 nicely illustrates that the tax-responsiveness to the left of the threshold is basically zero as CFC rules are effectively preventing profit shifting (the red line is relatively flat). Focusing

<sup>8</sup> For a complete list of CFC thresholds as well as more specific examples thereof, see Hansen et al. (2023).

<sup>9</sup> Our results are robust to alternative specifications, but testing suggests an optimal polynomial of order 5.

<sup>10</sup> Note that the idea of Figures 3 and 4 is explicitly not to implement a regression discontinuity design, but to illustrate the CFC treatment effect on outcome, which is identified from changes in CFC application over time.

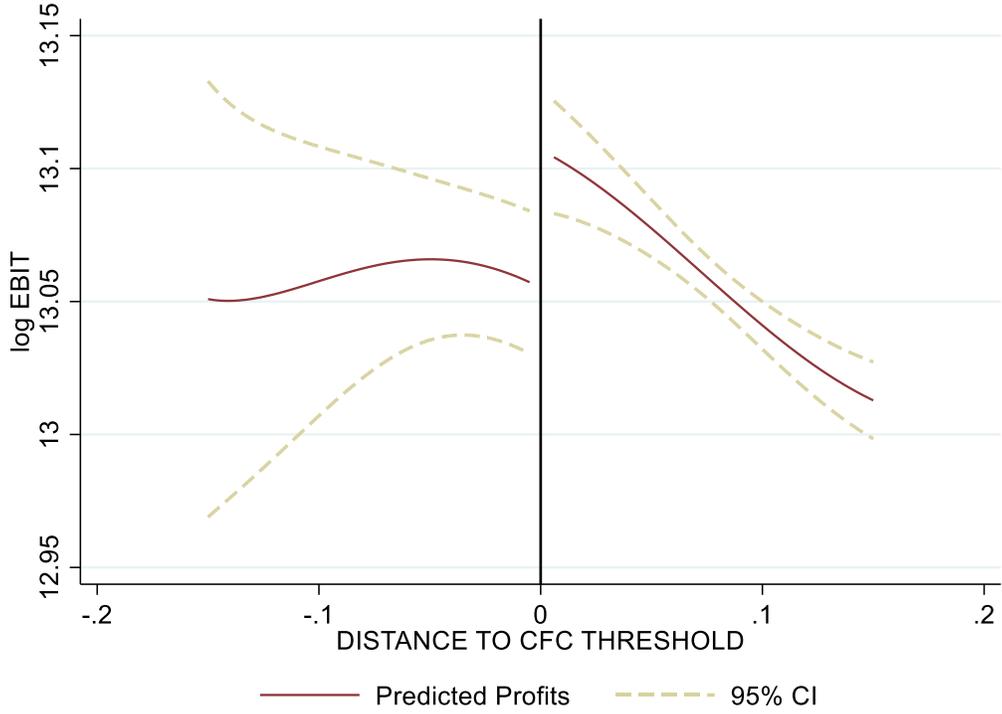
first on the estimates to the right of the CFC cutoff, we can see that profits decrease in the tax rate (the negatively sloped red curve). This is the relationship that previous literature has presented as a profit-shifting effect – the higher the tax, the lower profits.<sup>11</sup> Coming back to the left-hand side, where affiliates are treated by parents’ CFC rules, the predicted relationship between tax rate and profits is relatively flat. This does not necessarily mean that there is no profit shifting to low-tax or tax haven countries. Only the tax-responsiveness under CFC rule treatment goes to zero (see also Hansen et al., 2023, where this is explicitly tested) as the incentives for tax-motivated income shifting are removed. Our estimates become more imprecise, however, when moving away from the cutoff.

We may finally illustrate, using the same approach, that CFC rules effectively prevent MNCs from locating financial assets in low-tax countries. Figure 3 is based on the same regression approach but uses the log of the financial assets as the dependent variable. The figure suggests that CFC rules effectively limit the use of financial assets in low-tax countries. Note, again, that the jump at the cut-off of zero is identified from variation in CFC rule treatment over time. In this case, the CFC rule takes away all tax incentives to locate any financial assets in low-tax countries (the financial assets become lower, the lower the tax rate). This result seems plausible as the “tainted income approach” taxes income from passive or financial assets with the parent firm’s tax rate (which is typically higher in case of treatment). The finding is consistent with the findings in Ruf and Weichenrieder (2012), showing that the German CFC rule effectively removes tax incentives to allocate financial or passive assets to low-tax countries.

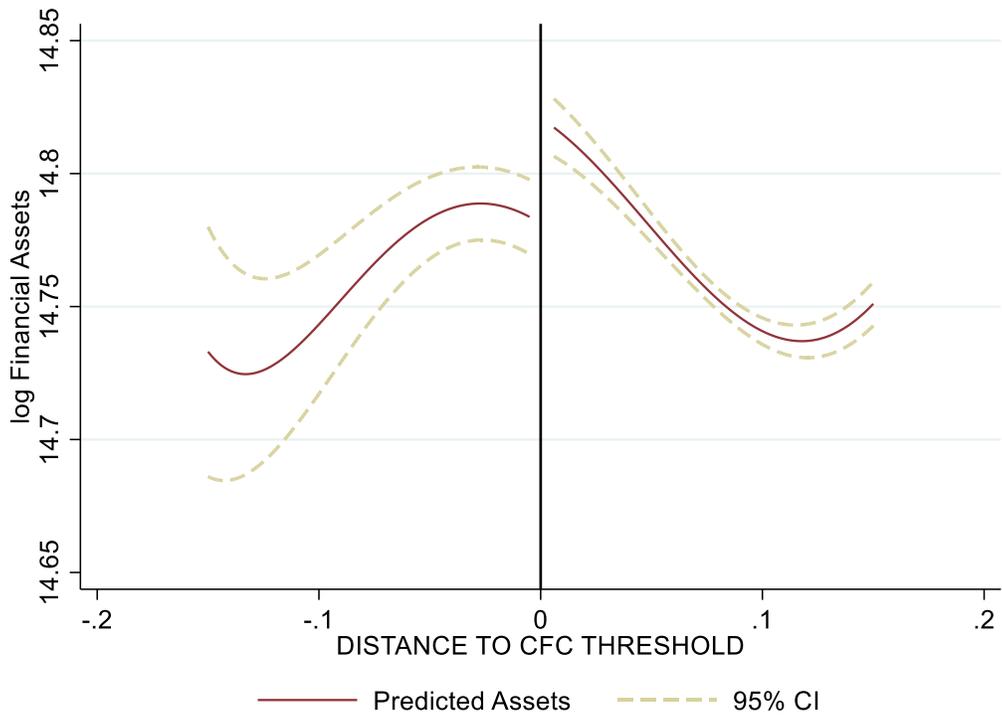
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<sup>11</sup> Note that the estimated slope parameter substantially depends on the polynomial specification of the tax-distance.

**Figure 3 CFC rules and profit shifting**



**Figure 4: CFC rules and financial assets**



## V. CONCLUSIONS

Based on micro-level data, we show descriptively that the share of financial assets and profits located in tax haven countries (and European tax havens in particular) is disproportionately large compared to the share of real activities such as employees. Further exploring the multinational firm data suggests that especially the largest MNCs have access to tax haven countries.

We review literature using micro-economic data to estimate tax-motivated profit shifting to tax havens. The prominence of tax havens in the tax-avoidance activities of MNCs seems to differ across different profit-shifting channels. We discuss the challenges faced when attempting to quantify international tax avoidance and illustrate how exogenous variation on CFC rules creates discrete changes in profit-shifting incentives that can be exploited to estimate an unbiased profit-shifting elasticity. Such an approach delivers a substantially smaller tax-responsiveness of pre-tax-profits to taxes compared to previous research. The new global minimum tax initiative will change MNCs' profit-shifting incentives in a fundamental way. Future research may investigate firm responses to this major reform of the international tax system to better understand and quantify profit-shifting behavior.

## VI. REFERENCES

Baumann, M., T. Boehm, B. Knoll, and N. Riedel. 2020. Corporate taxes, patent shifting, and anti-avoidance rules: Empirical evidence. *Public Finance Review* 48 (4): 467–504.

Beer, S., R. de Mooij, and L. Liu. 2020. International corporate tax avoidance: A review of the channels, magnitudes, and blind spots. *Journal of Economic Surveys* 34 (3): 549-580.

Bilicka, K. A. 2019. Comparing UK tax returns of foreign multinationals to matched domestic firms. *American Economic Review* 109 (8): 2921-2953.

Buettner, T., and G. Wamser. 2013. Internal debt and multinational profit shifting: Empirical evidence from firm-level panel data. *National Tax Journal* 66 (1): 63–95.

Clausing, K. A. 2020. Five lessons on profit shifting from the U.S. country by country data. *Tax Notes Federal* 169: 925-940.

Davies, R. B., J. Martin, M. Parenti, and F. Toubal. 2018. Knocking on tax haven's door: Multinational firms and transfer pricing. *The Review of Economics and Statistics* 100 (1): 120-134.

Devereux, M. P., R. Griffith, and A. Klemm. 2002. Corporate income tax reforms and international tax competition. *Economic Policy* 17 (35): 449-495.

Dharmapala, D. 2014. What do we know about base erosion and profit shifting? A review of the empirical literature. *Fiscal Studies* 35 (4): 421-448.

Dharmapala, D. 2019. Profit shifting in a globalized world. *American Economic Association Papers and Proceedings* 109: 488-492.

Dharmapala, D., and N. Riedel. 2013. Earnings shocks and tax-motivated income-shifting: Evidence from European multinationals. *Journal of Public Economics* 97: 95-107.

Egger, P., W. Eggert, and H. Winner. 2010. Saving taxes through foreign plant ownership. *Journal of International Economics* 81 (1): 99-108.

Egger, P., V. Merlo, and G. Wamser. 2014. Unobserved tax avoidance and the tax elasticity of FDI. *Journal of Economic Behavior & Organization* 108: 1-18.

Fuest, C., F. Hugger, and F. Neumeier. 2022. Corporate profit shifting and the role of tax havens: Evidence from German country-by-country reporting data. *Journal of Economic Behavior & Organization* 194: 454-477.

Goldbach, S., J. Møen, D. Schindler, G. Schjelderup, and G. Wamser. 2021. The tax-efficient use of debt in multinational corporations. *Journal of Corporate Finance* 71: 102119.

Hansen, J., V. Merlo, and G. Wamser. 2023. Taxes, profit shifting, and the real activities of MNEs: Evidence from corporate tax notches. *RSIT Working Paper*.

Head, K., and T. Mayer. 2011. Gravity, Market Potential and Economic Development. *Journal of Economic Geography* 11(2): 281-94.

Hebous, S., and N. Johannesen. 2021. At your service! The role of tax havens in international trade with services. *European Economic Review* 135 (June): 103737.

Heckemeyer, J., and M. Overesch. 2017. Multinationals' profit response to tax differentials: Effect size and shifting channels. *Canadian Journal of Economics/Revue canadienne d'économique* 50 (4): 965-994.

Hines, J. R. 2010. Treasure islands. *Journal of Economic Perspectives* 24 (4): 103-126.

Hines, J. R., and E. M Rice. 1994. Fiscal paradise: Foreign tax havens and American business. *The Quarterly Journal of Economics* 109 (1): 149-182.

Huizinga, H., and L. Laeven. 2008. International profit shifting within multinational firms: A multi-country perspective. *Journal of Public Economics* 92 (5-6): 1164-1182.

Karkinsky, T., and N. Riedel. 2012. Corporate taxation and the choice of patent location within multinational firms. *Journal of International Economics* 88 (1): 176-85.

Köthenbürger, M., F. Liberini, and M. Stimmelmayer. 2018. Is it just luring reported profit? The case of European patent boxes. SSRN Scholarly Paper. Rochester, NY. <https://doi.org/10.2139/ssrn.3211147>.

Laffitte, S., and F. Toubal. 2022. Multinationals' sales and profit shifting in tax havens. *American Economic Journal: Economic Policy* 14 (4): 371-396.

Mintz, J. M. and A. J. Weichenrieder. 2010. *The Indirect side of Direct Investment: Multinational Company Finance and Taxation*. The MIT Press.

Riedel, N. 2018. Quantifying international tax avoidance: A review of the academic literature. *Review of Economics* 69 (2): 169-181.

Ruf, M., A. Weichenrieder. 2012. The taxation of passive foreign investment: Lessons from German experience. *Canadian Journal of Economics* 45(4): 1504-1528.

Tørsløv, T., L.T. Wier, and G. Zucman. 2023. The missing profits of nations. *The Review of Economic Studies* 90 (3): 1499-1534.

van 't Riet, M., and A. Lejour. 2018. Optimal tax routing: network analysis of FDI diversion. *International Tax and Public Finance* 25 (5): 1321-1371.

Wamser, G., V. Merlo, M. Ruf, F. Stähler, K. Strohmaier, J. Eklund, J. Hansen, S. Laudage, S. McAuliffe, J. Paraknewitz, and G. U. Thuncke. 2023. A new database on international tax institutions. *RSIT Working Paper* (forthcoming).

Weichenrieder, A. J. 2009. Profit shifting in the EU: evidence from Germany. *International Tax and Public Finance* 16 (3): 281-297.

Weyzig, F. 2013. Tax treaty shopping: Structural determinants of foreign direct investment routed through the Netherlands. *International Tax and Public Finance* 20 (6): 910–37.