The Effects of Anti-Tax Avoidance Policy on Multinational Firm Behavior

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Chapter 1

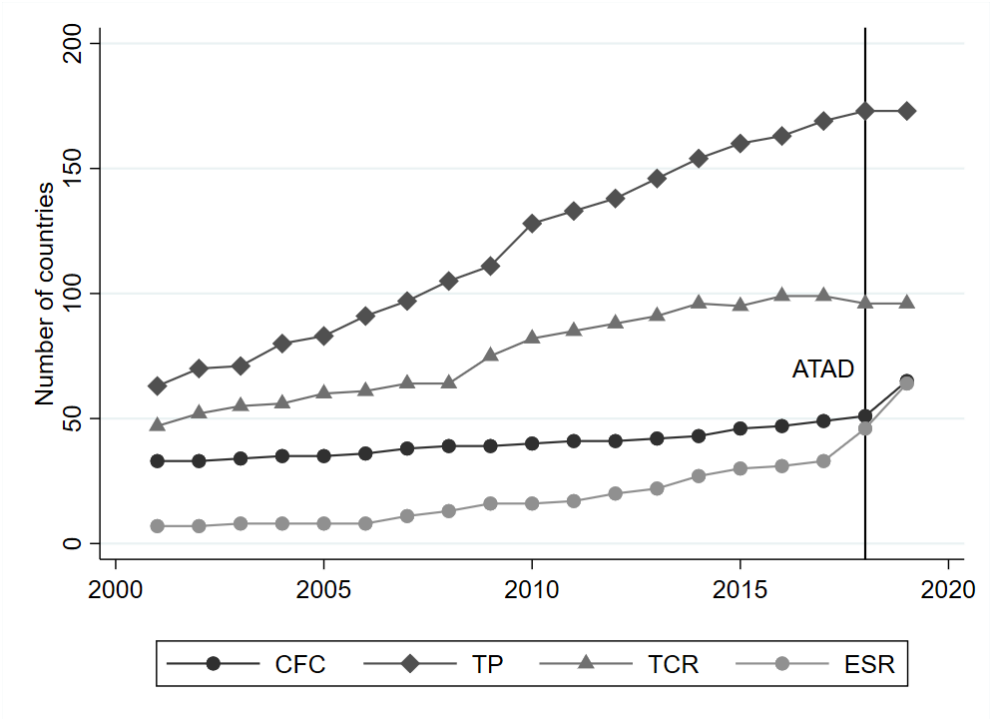
Introduction

The Organization for Economic Co-Operation and Development (OECD) estimates that countries lose 4-10% of global tax revenue from tax avoidance practices by multinational enterprises (MNEs).[1] This behavior puts a heavy burden on public budgets and distorts the competitive landscape between domestic and multinational firms. Hines and Rice (1994) was the first study to empirically document that US multinationals respond to tax differentials between locations by strategically allocating profits to lower their total tax burden. Since then, an extensive literature has investigated the tax-planning strategies of MNEs and their behavioral responses to changes in corporate taxation. At the same time, policymakers have introduced numerous unilateral anti-tax avoidance policies as well as multilateral treaties to limit opportunities for profit shifting. One of the largest coordinated initiatives in the last decade is the OECD's project on Base Erosion and Profit Shifting (BEPS). This framework outlines a 15-point action plan for policymakers that aims to close most channels of tax avoidance and profit shifting.

Figure 1.0.1 illustrates the progress made in policy coordination by showing the number of countries that have implemented different anti-tax avoidance measures into national law. The first set of policies, that Chapter 2 investigates in more detail, are controlled foreign company (CFC) rules. By today, most

[1] See OECD, 2013

Figure 1.0.1: *Introduction of anti-tax avoidance policy*



Number of countries that have introduced controlled foreign company (CFC) rules, thin-capitalization rules (TCR), earning stripping rules (ESR), or transfer pricing legislation (TP)

developed, high-tax countries have implemented some form of CFC regulation to impose domestic taxation on MNEs that operate designated subsidiaries in tax haven locations to shift profits. Most CFC laws stipulate a fixed low-tax threshold for foreign locations below which domestic corporate taxation can be applied. This type of regulation effectively eliminates the attractiveness of tax haven locations when foreign income becomes taxable at the shareholders' domestic location. The European Union (EU) has mandated all member countries to implement CFC rules in their national tax code by 2019 which is reflected in the jump in the number of countries in Figure 1.0.1. The second important type of anti-tax avoidance policy is transfer pricing (TP) regulation. Transfer prices are the prices at which MNEs sell internal services or intermediate goods within their affiliate network and Heckemeyer and Overesch (2017) estimate that transfer mispricing is the overall largest channel of profit shifting. By strategically setting prices, MNEs are able to inflate cost in their high-tax locations while at the same time increasing profits in lower-tax locations. Transfer pricing legis-

lation prevents such behavior by requiring MNEs to extensively document the calculation of their internal prices. The importance of this channel is reflected by the fact that more than 170 countries have implemented transfer pricing regulation by 2019. Chapter 3 looks more closely at how the effect of transfer pricing rules relates to the production network within the MNE. The third tool MNEs use to reduce their tax liability is the use of internal debt. When affiliated entities grant each other internal loans, the associated interest payments can be used to shift income within the group. Generally, interest expenses are fully tax deductible which implies that internal loans can be used to simultaneously lower profits in high-tax locations and shift that income to lower-tax countries. For that reason, most high-tax countries have limited the deductibility of interest expenses either through the use of thin-capitalization rules (TCR) or earnings-stripping rules (ESR). Under a TCR regime, interest is deductible as long as the firm's debt-to-equity ratio does not exceed a pre-defined threshold, while ESR directly limit the amount of deductible interest relative to profits. In spite of these regulations, MNEs face strong tax incentives for the structure of their internal financing. Chapters 4 and 5 discuss these incentives for the structure of internal capital markets and the way they relate to the groups' overall tax planning strategy.

This thesis investigates questions on the behavior of multinational corporations in the context of international taxation with a particular focus on the unintended consequences of anti-tax avoidance policy. It consists of four self-contained chapters that analyze the impact of these policies on the distribution of profits within firm groups, their investment decisions, and the way they structure their internal capital markets. All chapters show that real economic activity adapts to anti-tax avoidance policies and other tax incentives. The associated costs of these regulations can be strongly heterogeneous and difficult to estimate. Taken together, the findings of this dissertation highlight that tax policy can have unintended and sometimes unexpected effects on firm behavior that can come at a significant cost to the regulating country.

Chapter 2 is a joint project with Valeria Merlo and Georg Wamser. It investigates the unintended consequences of controlled foreign company rules that go beyond their impact on profit shifting. While previous studies have shown that CFC rules are effective at eliminating incentives to shift profits into affected locations, Chapter 2 analyzes how MNEs redistribute profits within their network and how that impacts their real activity. A central part of this project is a hand-collected panel on the CFC legislation of 226 countries for the years 2000 to 2020. The data set contains information on the introduction of CFC rules as well as the associated tax thresholds and ownership criteria and it is part of the *International Tax Institutions Database*. In a first step, Chapter 2 confirms the finding that CFC rules effectively reduce financial profits in low-tax locations and extends it to overall earnings before taxes. In our preferred specification, CFC treatment is significantly associated with a reduction in overall profits by 3.3% which translates into a semi-elasticity of 0.22 for the average tax notch. The second part of this analysis focuses on the question of which locations benefit from these profits when low-tax locations fall under CFC legislation. Our analysis reveals that among unaffected affiliates only the ones directly above the relevant cut-off see a significant increase in their profits when more affiliates in the group become subject to CFC legislation. In other words, profits that were previously shifted to low-tax locations are now redirected to locations just above the threshold to avoid the additional tax burden associated with the CFC treatment. This finding holds true both for the absolute tax differential to the cut-off as well as for the relative tax position in the group. Only the "best alternatives", the locations with the lowest tax rate that are not affected by the relevant CFC rule, see a positive and significant effect on their profits. At the same time, we do not find any significant effects on profits at the parents' location. These findings are novel and highlight the tax-optimizing behavior of MNEs. The final part of Chapter 2 extends the analysis to the potential real consequences of CFC regulation. We examine the response of the entire firm group in terms of their investment, productivity, and employment. Notably, affiliates that are not directly affected by CFC legislation

see a significant and positive effect on all margins of their real activity. In line with our previous findings, these effects are decreasing in the local corporate tax rate. Affiliates located just above the relevant threshold thus benefit not only from the relocation of profits but see an increase in their real activity at the same time.

Chapter 3 is joint work with Nadine Riedel, Valeria Merlo, and Georg Wamser. The focus of this project is on the heterogeneous effects of transfer pricing regulation along the global value chain of MNEs. Transfer mispricing generally describes a manipulation of prices between affiliated companies to control the allocation of profits. Sales of intermediate products or internal services can be priced in a way that increases profits in low-tax locations while raising costs for higher-tax affiliates in the same firm group. In that sense, transfer mispricing exploits the firm's internal value chain to shift profits along the production process and tax-optimize the allocation of income. In this chapter, we investigate how anti-tax avoidance rules affect MNE investment behavior at different points of their value chain. In particular, we show that the effects of transfer pricing regulation are strongly heterogeneous across the production process. We employ a measure from the international trade literature, the upstreamness index developed by Antràs and Chor (2018), that reflects the extent to which production is used as an intermediate input rather than sold to final customers. This index is based on sectoral input-output tables and allows us to approximate the global value chain (GVC) position of affiliates in a given country and sector. We find that the introduction of transfer pricing rules with strict documentation requirements only has significant negative effects on corporate investment for the most downstream parts of the value chain. In other words, the only entities that see a significant decrease in their investment rate are those closest to final consumption. The remainder of the paper investigates two potential channels for this finding. First, enforcement of transfer pricing legislation could be more effective for downstream entities such as wholesalers. These firms sell directly to their end customers which could imply that prices are more transparent and more easily comparable than sales within

MNE firm groups that take place higher up in the value chain. As prices become more transparent, price manipulation for tax purposes could become more challenging which would make transfer pricing rules particularly effective. Second, we empirically test if investment response is driven by affiliates with low financial income. We find that the investment effect from our baseline specification becomes insignificant for entities with high levels of financial assets or financial income which are typically located further upstream in their value chain. Our intuition here is that firms which own financial and/or intangible assets could be able to use them for tax-planning purposes which makes them less reliant on transfer mispricing and thus less sensitive to the legislation.

Chapter 4 is joined work with Stefan Goldbach, Arne Nagengast, Valeria Merlo, and Georg Wamser. In this project, we explore the connection between the internal capital markets of MNEs, their internal interest payments, and profit shifting. There is an extensive empirical and theoretical literature that documents how tax incentives shape the allocation of internal debt within MNEs. This strand of research documents that MNEs place over-proportionate amounts of internal debt in high-tax locations since the associated interest payments directly lower the tax base for these affiliates. We contribute to this literature by analyzing the internal interest flows of German MNEs and investigating their contribution to the overall profit shifting activity. Unlike internal debt, internal interest payments are rarely available in firm-level data but this information is crucial for drawing conclusions about debt-shifting motives behind any internal financing. Using monthly data on capital transactions recorded at the German central bank (Deutsche Bundesbank), we first provide extensive descriptive evidence on the interest flows to and from German MNEs. Over the entire sample period, interest payments from Germany significantly exceed the interest income of entities in Germany. While interest income primarily stems from Germany's largest foreign direct investment (FDI) locations such as the US, interest payments are strongly concentrated in the Netherlands and Luxembourg. Taken together, both locations receive on average more than 60% of all interest payments which would be more than 8 bn. Euro in

2020. In the second step, we match the interest data with firm-level information that is provided by the central bank as well. This match allows us to document that most firm groups in Germany do not report any interest flows, while the majority of transactions are carried out by a few, very large corporate groups. These insights are valuable for tax policymakers as they highlight how heterogeneous internal financial activity is across firm groups. The final part of this analysis focuses on the role of tax haven and conduit locations and how interest payments contribute to profit shifting. We show descriptively that conduit locations make up around 5-10% of the total foreign real activity of German MNE, while they receive more than 80% of all interest payments. The final part of the empirical analysis shows that there is a significant correlation between the interest flows from Germany and profits reported by that firm group in other locations. Taken together, our results stress the role of EU conduit locations, in particular, the Netherlands and Luxembourg, for the internal capital markets of MNEs.

Finally, Chapter 5 investigates the role of specialized conduit locations, often referred to as financial centers, in the organization of internal capital markets for MNEs. There are a number of EU countries such as the Netherlands, Luxembourg, and Ireland that have specialized in attracting MNE activity and financial services in particular. This paper investigates to which extent these targeted incentives in financial centers, which are often not reflected in their corporate tax rate, affect the internal capital markets of German MNEs. Using firm-level data provided by the German central bank with detailed information on internal lending positions of foreign affiliates, I analyze how much lending is operated from financial center locations that is not explained by firm characteristics or tax incentives. By matching financial center affiliates to entities with similar characteristics in countries with comparable tax incentives, I find that the average internal lending to assets ratio is still nearly twice as in the matched sample. This finding could reflect distortions in international capital flows that are created by targeted tax legislation in financial centers or even by differences in tax enforcement. The second of this paper investigates, how access to a financial

center location affects the tax response of debt in the remaining group. A large empirical literature has documented that (internal) debt in MNEs responds to changes in tax incentives by allocating more debt in locations with higher corporate taxes. In the second part of this paper, I document that the tax response of internal debt is driven by firm groups that have established at least one subsidiary in a financial center. In groups that are not active in financial centers, internal debt levels do not significantly respond to changes in the tax rate. On the other hand, I show that parental debt levels only respond in groups that do not have access to a financial center location. These results suggest that financial center locations play an important role in the organization of internal capital markets and in turn in the debt response to changes in the corporate tax rate. Taking into consideration the findings from Chapter 4, financial center locations, and in particular, the Netherlands and Luxembourg, seem to be the central locations from which MNEs operate tax-optimized internal financing.

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Chapter 2

Taxes, Profit-Shifting, and the Real Activities of MNEs: Evidence from Corporate Tax Notches [1]

ABSTRACT

This paper exploits exogenous variation in tax notches created by controlled foreign corporation (CFC) rules to better understand the profit-shifting behavior of multinational enterprises (MNEs). Using new data on CFC rules and bilateral parent-affiliate ownership data, our identification approach allows us to estimate an unbiased profit-shifting semi-elasticity of about 0.22. We provide evidence that the unilateral implementation of anti-tax-avoidance regulation at the parent location leads to profit relocation consistent with tax-minimizing behavior – away from treated affiliates to 'next-best' low-tax alternatives. We do not find any significant responses in the parent shareholder, neither in terms of repatriated profits nor in terms of their real economic activity. Other entities in the same group, however, see a significant increase in multiple measures of real activity when the share of affected entities in the firm group increases.

[1] This paper is joint work with Valeria Merlo and Georg Wamser.

2.1 Introduction

International tax issues have become a major policy concern as many high-tax countries see their corporate tax revenue under pressure. The question of how to tax the highly mobile profits of multinational enterprises (MNEs) in an increasingly globalized world dominated the international policy agenda over the last decades and led to major reforms in international tax law. Following the OECD and G20's Base Erosion and Profit Shifting (BEPS) recommendations, most countries have introduced anti-tax-avoidance rules to their tax codes, to prevent the erosion of their tax base.

By now there is ample evidence showing that MNEs' reported profits are highly sensitive to corporate taxation. Still, as pointed out by Beer et al. (2020), many blind spots remain to be addressed. In particular, most studies concerned with profit shifting or the effectiveness of anti-tax-avoidance rules are silent on the effect of tax incentives on the (re)allocation of real activity within MNEs. To the extent that limiting tax avoidance re-introduces the distortive effect of taxes on investment decisions, anti-tax avoidance measures may have consequences for real economic activity and tax payments in all locations of the MNE. Learning about the interaction between profit shifting and investment activities as well as having an accurate measure of the sensitivity of profits by MNEs to tax incentives is crucial for policy design.

This paper contributes to the literature by analyzing the reallocation of profits and real activity within MNEs after a discrete change in profit shifting incentives. We exploit exogenous variation in tax notches created by controlled foreign corporation (CFC) rules. These rules aim at taxing foreign income generated in low-tax locations that would otherwise be exempt from taxation in the parent firm's country. In particular, if CFC legislation at the parent location applies to low-tax affiliates abroad, the (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 MNEs. Once a foreign affiliate is affected by a CFC rule, the relevant corporate tax rate determining profit shifting incentives is no longer the one in the foreign country, but that in the parent's country. Such a notch can be triggered through (i) the introduction or changes to CFC legislation in the home country, (ii) changes in the home country's corporate tax rate, or (iii)

changes in the host country's corporate tax rate. In our sample, we count 202 such notches triggered by 54 new or adjusted CFC legislation, 94 changes in home, and 82 changes in host tax rates. These 202 discrete changes in tax rates substantially affect the profit shifting attractiveness of about 20,000 foreign affiliates (the average tax notch upon treatment in our sample equals 15.0 percentage points). We exploit this exogenous variation in corporate tax notches to address fundamental questions of international tax avoidance and tax policy.

First, discrete changes in the attractiveness of a foreign affiliate as a recipient of profit shifting allow us to identify an unbiased profit shifting elasticity. This key parameter of interest is estimated based on a large bilateral ownership dataset at the parent-affiliate level. The parent-affiliate structure of the data is necessary to identify the notches in tax incentives. In our preferred specification, we find a profit shifting semi-elasticity of about 0.22, which is substantially smaller compared to previous findings.[1] We argue that the variation over time in tax notches correctly captures changes in profit shifting incentives and enables us to consistently identify a true profit shifting elasticity.

Second, we analyze how a change in the profit shifting incentives affects the allocation of both profits and real outcomes within the multinational group. We show that profits are relocated to the 'next-best' alternative within the MNE, i.e. the best affiliate from a tax-optimizing point of view, which is just not affected by the CFC rule. We find no evidence for the relocation of profits to the parent. We examine real outcomes and find a negative effect on employment in treated affiliates that are no longer attractive for profit shifting. Our results suggest that employment is partly relocated to untreated low-tax affiliates that become relatively more attractive as a profit destination. At the same time, these unaffected affiliates experience a significant increase in the stock of their tangible assets and total factor productivity (TFP).

Outcomes measured at the parent level have largely been neglected in previous studies, but are highly relevant, especially for the regulating countries.[2] We do not find any evidence that parent outcomes (tax base and real outcomes) are affected. This

[1] The profit shifting semi-elasticity refers to the elasticity of pre-tax profits with respect to the corporate income tax rate. Alternatively, we provide estimates using the financial profits.

[2] The regulating or home country of the parent firm is the country of the controlling shareholder or majority owner of a foreign affiliate.

finding is consistent with the avoidance and relocation behavior described before. To the best of our knowledge, there are no previous studies that directly identify the impact of profit shifting restrictions on shareholder outcomes in a multi-country parent-affiliate setting.

A general implication of our findings is that unilateral tax regulation leads to further avoidance activities, consistent with MNEs' tax-minimizing behavior. The absence of evidence that CFC rules lead to a repatriation of profits (the coefficients we estimate are close to zero and highly insignificant in all specifications) suggests that parent countries bear the full monitoring and enforcement costs of CFC legislation without benefiting from increased corporate tax revenue. At the same time, however, we do not find evidence that parent firms are negatively affected in any real outcome (real investment, productivity, and employment). The latter may be explained by the finding that firms are able to relocate profits to their next-best alternatives. Our findings are highly relevant to the design of tax reforms. The initiative of the G20 countries to introduce a global minimum tax of 15% is very similar to a binding CFC rule.[3] In fact, to the extent that not all countries participate, we may interpret the global minimum tax as a unilateral measure allowing countries that usually exempt foreign-source income from taxation to attribute the tax base of foreign affiliates to domestic shareholders. Our findings cast doubt on whether a global minimum tax of incomplete coverage will succeed in protecting the domestic tax base of participating countries as intended.[4]

Our paper is related to a small literature on the effects of CFC rules and tax regulation and to a large literature on the tax-motivated profit shifting of MNEs. Ruf and Weichenrieder (2012) show that CFC rules affect the global allocation of passive assets within German MNE groups. Using the same data, Egger and Wamser (2015) examine the effects of CFC rules on foreign affiliates' assets. More closely related to our analysis, Clifford (2019) examines the impact of CFC rules taking into account the relocation of financial profits within the MNE group. She finds a significant reduction in financial profits in affected affiliates and an increase in financial profits in unaffected

[3]The implementation of the minimum 15% rate relies mainly on an income inclusion rule which triggers the inclusion of foreign-sourced profits in the taxable income of the parent company whenever the effective source tax rate is below 15%, which is similar to a CFC rule.

[4]For example, the main motivation of the German government to implement a global minimum tax is to "benefit financially from the new rules". Based on government calculations, "Germany's tax revenue will increase as a result of the minimum tax" (see www.bundesfinanzministerium.de, accessed on October 13, 2021).

affiliates within MNE groups with high exposure to CFC rules. Our paper differs in a number of ways. We focus on the relocation of profits and real activity after a change in relative profit shifting incentives within the group. Our direct-shareholder-affiliate-level data allows us to unambiguously identify the relevant notch in profit shifting incentives, allowing for an estimation of a profit shifting elasticity. We provide additional results regarding the relocation of profits after CFC treatment. Furthermore, we examine real responses to changes in profit shifting incentives across the MNE group and in particular at the shareholder location.

The second strand of literature we contribute to is the work quantifying international corporate tax avoidance (see the meta studies by Beer et al., 2020; Riedel, 2018; Heckemeyer and Overesch, 2017). Recent studies based on macro data suggest that profit shifting leads to substantial tax revenue losses of high-tax countries (see Tørsløv et al., 2022). Earlier work, based on micro data, estimates the tax sensitivity of MNEs' profits to tax incentives (see e.g. Huizinga and Laeven, 2008; Dischinger et al., 2014; Dharmapala and Riedel, 2013). While all studies find evidence for tax-motivated profit reallocation, the estimated tax elasticity of reported pre-tax profits varies largely across studies. Meta-analyses by Heckemeyer and Overesch (2017) and Beer et al. (2020) find typical semi-elasticities of 0.8 and 1 respectively, implying that a 10 percentage point increase in the host country's corporate tax rate reduces reported pre-tax profits by 8% or 10%. Typically, studies using aggregate data find much larger elasticities. But even across studies relying on firm-level data there is considerable variation across estimated elasticities. This is partly due to the fact that estimating a pure profit shifting elasticity is inherently difficult since corporate tax rates determine not only profit shifting incentives but affect the cost of capital and induce changes in real investment. Most studies rely on marginal changes in corporate tax rates or tax rate differentials between home and host countries (see e.g. Hines and Rice 1994, Huizinga and Laeven 2008,Weichenrieder 2009). By exploiting discrete changes in tax differentials that apply only to income that is most probably related to shifting activities, we expect to better capture profit shifting incentives. We find a semi-elasticity for pre-tax profits of 0.22 and argue that this is a more realistic estimate of the profit shifting elasticity. In our setting, only foreign affiliates without substantial real activity actually face a change in tax incentives. In contrast, the effect of marginal changes in (differences in) tax rates on

pre-tax profits may simply reflect distortions in production that affect profits and may thus confound the profit shifting estimate we are after.

We finally contribute to a very small but growing literature addressing the link between profit shifting activities, the regulation thereof, and their effect on real outcomes. Suárez Serrato (2018) is one of the first studies to focus on the effect of anti-tax avoidance policy on real outcomes at the shareholder level. Examining the abolishment of tax exemptions for US multinationals in Puerto Rico, Suárez Serrato (2018) finds large negative effects on wages and investment.[5] Similarly, Bilicka (2021) examines the effects of the UK's regulation of internal debt on the internal labor market of British MNEs finding strong reallocation effects in the UK. In a related study, Bilicka et al. (2022) show that the same reform has led to a decrease in debt held domestically and increased debt in foreign locations of UK MNEs. All of the studies above show that taxation and anti-tax avoidance policy has potentially strong implications for the real activity of MNEs. In our causal setting, we find a positive effect on parent's employment in groups that lose particularly attractive low-tax locations, which suggests a partial relocation of employment from affiliates that are no longer attractive for profit shifting to the parent. We do not find any significant effect of CFC rules on parent firms' profits, tangible assets, or TFP. However, by showing that profits are reallocated to next-best affiliates, this is to the best of our knowledge the first paper providing evidence on why this null result is consistent with MNE behavior.

This paper is organized as follows. Section 2.2 describes the fundamental features of countries' CFC rules and illustrates how they affect profit shifting incentives within MNEs in our data. Section 2.3 summarizes the findings of our causal analysis, including a number of robustness tests. Section 2.4 presents the central findings on the redistribution of profits within the group. Section 2.5 focuses on the effects on real outcomes, both at the level of the parent shareholder as well as the unaffected affiliates within the group. Finally, Section 2.6 concludes.

[5] A few papers focus on the effects of anti-tax-avoidance rules on real outcomes of foreign affiliates (rather than parent outcomes), for example, Buettner et al. (2018), Merlo et al. (2020) and de Mooij and Liu (2021). Bilicka (2019) uses real outcomes as indicators of the relevant profit shifting channel. This literature is clearly related to the mechanism we have in mind – suggesting that restrictions on profit shifting might negatively affect real outcomes.

2.2 Institutional setting, tax incentives, and identifying variation

Controlled Foreign Company (CFC) rules are typically implemented by high-tax countries to prevent MNEs from shifting profits to affiliates located in countries with low or even zero taxes. Under CFC legislation, the income of affiliates in locations where the corporate tax rate falls below a predefined tax threshold may be attributed to their parents' tax base. CFC rules thus eliminate incentives to shift profits associated with tax differentials between parents and their foreign affiliates. We demonstrate how we exploit the variation created by CFC legislation for empirical identification below.

We will first illustrate how CFC rules affect profit shifting incentives with a specific example. Consider a French multinational group. The parent firm and domestic affiliates in France face the French corporate income tax (CIT) rate of 34%. Assume the parent is the majority owner (shareholder) of three foreign affiliates A, B, and C, facing CIT rates of 30%, 20%, and 10%, respectively. The French CFC rule stipulates that any country with a CIT rate lower than 40% of the French rate (i.e. 13.6%) is to be considered a 'low-tax' country. Foreign affiliates located in such countries are deemed 'controlled foreign companies', and their passive income is to be attributed to the parent shareholder in France.[6] In our example, affiliate C falls under the French CFC rule. Assume, for this example, that the host country of affiliate A cuts its tax rate to 13%. Affiliate A is now also subject to CFC *treatment* as it falls underneath the relevant CFC threshold (40% of 34% = 13.6%). Despite the substantial tax cut and even though France has not changed its CFC legislation, the French CFC rule renders affiliate A unattractive from a profit shifting point of view. The tax treatment of its tainted income brings the average tax over the three foreign affiliates closer to the French tax rate, just as in a system of worldwide taxation. Affiliate B has now become the *lowest-tax affiliate* in the group and is thus the most attractive location to which profits can be shifted to save taxes.[7] In this setting, if the cost of profit shift-

[6]The usual exemption of foreign source income is no longer granted by the French tax authorities and foreign passive income is to be taxed immediately in France and not only upon repatriation. Note that the focus on passive income is also called the 'tainted income' approach, as the objective is to remove the privilege of tax exemption if income is associated with profit shifting (see Weichenrieder 1996)

[7]A large literature acknowledges that the tax saving from profit shifting needs to be sufficiently large to account for the cost of these activities (see, e.g. Davies et al., 2018).

ing is sufficiently low, the MNE may relocate some profits to affiliate B to save taxes, instead of repatriating income to the parent (even though the tax differential between parent and affiliate B is small). Hence, given the tax planning of large MNEs and the fact that these firms typically operate many affiliates around the globe (perhaps with a corporation tax just above the 13.6% threshold), we expect that tax-minimizing MNEs relocate profits to the *next-best alternative* in terms of the tax burden (in our example affiliate B), suggesting that the effect of a binding CFC rule on France's tax base and tax revenue remains small or zero.

The relevant tax threshold determining 'low-tax' locations is set either in relative terms to the home country's CIT as in the example above, or as an absolute value. In Germany, for example, foreign subsidiaries can only be treated as CFCs if they are located in low-tax jurisdictions that are defined as countries with a corporate income tax rate lower than 25%. Other criteria of CFC regulations include the degree of control of the resident shareholder. Most countries target foreign affiliates in which resident shareholders own 50% or more of the total voting shares.[8]

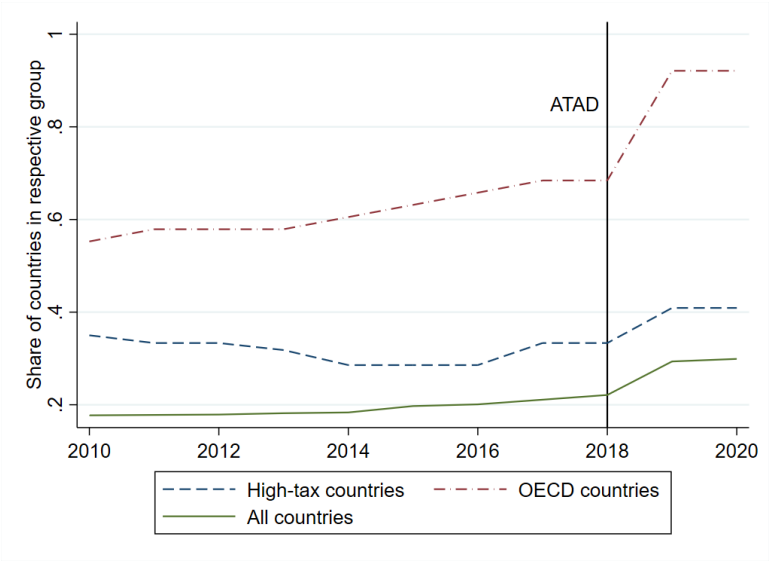
Our analysis is based on new CFC rules and tax data compiled by the research school of international taxation (RSIT). We document that CFC rules have become one of the main instruments to address the tax challenges raised by the activities of MNEs.[9] While only 32 countries had CFC rules in the year 2000, this number increased to 66 in 2020. All OECD member countries except for Switzerland and Costa Rica have implemented some form of CFC legislation.[10]

[8]In many cases CFC regulations also include a substance escape clause. If the foreign affiliate carries out significant business activities and the ratio of passive to active income is below some threshold, then it does not fall under CFC regulation.

[9]The RSIT's International Tax Institutions (ITI) database provides information on a large number of statutory tax measures for over 200 countries and territories, including CFC rules and their application. For more information, see www.rsit-uni-tuebingen.de/data.

[10]This is not surprising given that the OECD expressed in its 1998 report on harmful tax practices "that countries that do not have such rules [should] consider adopting them and that countries that have such rules [should] ensure that they apply in a fashion consistent with the desirability of curbing harmful tax practices." (OECD, 1998). With its BEPS action plan, OECD (2013) spells out this point in Action 3: Strengthen CFC Rules.

Figure 2.2.1: *Global implementation of CFC rules*



"High-tax countries" refers to the 25% of countries with the highest tax rates in 2020, "OECD countries" comprises the 38 OECD countries and the total number of countries is 214; data sources: Global panel on CFC legislation from the ITI database

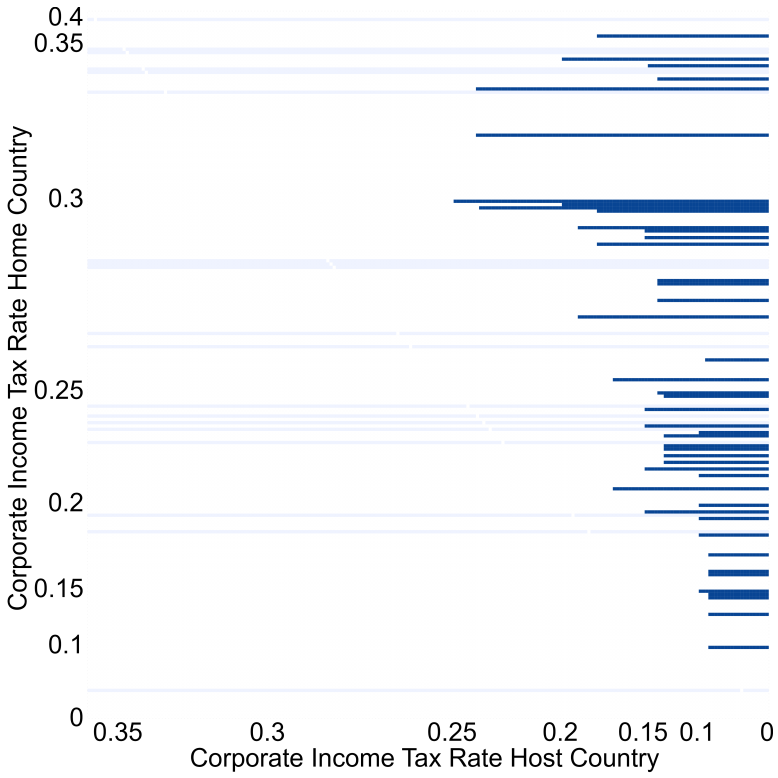
Figure 2.2.1 shows that an increasing number of countries have implemented CFC rules over the last two decades, especially after the EU's Anti-Tax Avoidance Directive (ATAD) came into force. The figure also suggests that this increase is predominantly driven by high-tax and OECD countries.[11] These countries are particularly interested in protecting their domestic tax base and in limiting profit shifting opportunities.

Figure 3.A.1 displays a *treatment matrix*. The horizontal and vertical axes list all countries and territories ordered by their statutory corporate income tax rates in 2020. The vertical axis represents home countries and the horizontal axis represents host countries that are potentially affected by the home country's CFC legislation. The fields of the heatmap are colored in light or dark blue if there is a binding CFC rule in place. The light blue lines indicate home countries that have implemented CFC rules without a low-tax threshold (i.e. that apply to all host countries irrespective of their CIT rate). The dark blue lines correspond to countries that use a relative or absolute low-tax threshold to treat only *some* potential host countries as CFC locations. This matrix highlights the variation created by the CFC thresholds. Higher tax countries (top-end of the vertical axis) tend to have higher thresholds and therefore treat more of

[11] In Figure 2.2.1, "high-tax" refers to countries in the upper quartile of tax rate distribution in the year 2020.

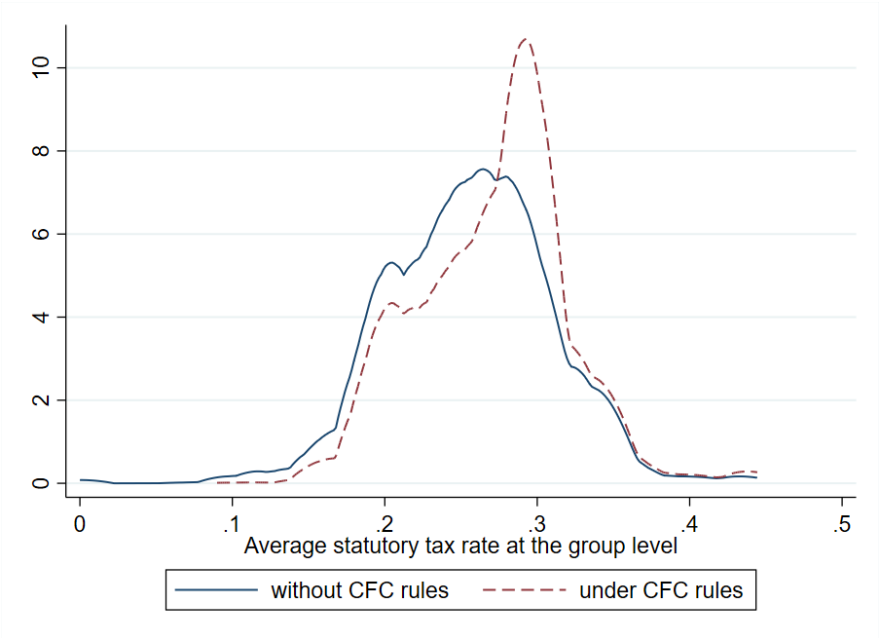
their potential host locations. The lower the tax rate in a given host location (right-end of the horizontal axis), the more likely it is that local subsidiaries are treated by MNEs' home countries as CFC cases.

Figure 2.2.2: *CFC treatment matrix*



The average tax notch arising upon CFC treatment (i.e. the difference between host and home CIT), is 15 percentage points for the set of affiliates moving below the respective low-tax threshold stipulated by CFC legislation. In our example above, the tax differential of affiliate A changes from 14% (34%-20%) before treatment to 0% (34%-34%) after treatment. For a respective country pair, the rules become binding in the sense that the tax incentives to use foreign affiliates in these host countries for the only purpose of profit shifting are fully taken away.

Figure 2.2.3: *Distribution of average host tax rates*



Comparison between the actual distribution of group-level average host tax rates (red dashed line) and the hypothetical distribution in our sample if all CFC rules were eliminated.

Figure 2.2.3 plots the distribution of average host tax rates across all foreign affiliates of an MNE group. The red dashed line plots the distribution of effective tax rates under the actual CFC regime. As outlined above, if the CFC rule applies to a bilateral pair (affiliate-parent), then the low-tax affiliate's (passive) income is attributed to the shareholder's tax base. This way, CFC treatment implies that the relevant tax rate for the affiliate is no longer its lower host-country tax rate but the higher domestic rate. The blue solid line indicates the counterfactual tax distribution, i.e. if no CFC rule had been in place. This counterfactual distribution lies clearly to the left of the actual tax rate distribution after taking binding CFCs into account. This suggests that tax incentives within the MNE change quite substantially once a CFC rule becomes binding. We exploit this change in incentives to investigate profit reallocation within MNE groups. In our data, binding CFC rules increase the average foreign affiliate tax rate by 8 percentage points, from 20.7% to 28.7%.

Our empirical investigation makes use of the different tax thresholds defined in countries' CFC legislation. We define a CFC indicator variable CFC_{ijt} that equals one if the corporate tax rate of affiliate i's host country is below the threshold stipulated by parent j's home country at time t, i.e.

$$CFC_{ijt} = \begin{cases} 1 \text{ if } CIT_{it} < \overline{T}_{ijt} \\ 0 \text{ otherwise,} \end{cases}$$

where $\overline{T}_{ijt}$ denotes the respective threshold, and CIT_{it} the corporate income tax rate that applies to affiliate i at time t. Thus, affiliates located in low-tax host countries are treated if the parent country's CFC rules are binding. Note that treatment depends on the ijt-specific threshold. The empirical variation we are ultimately exploiting may thus comes from changes in $\overline{T}_{ijt}$ (including cases where new rules are implemented) or from changes in corporate tax rates in the home or host countries shifting affiliates above or below a given threshold.

Our identification approach relies on variation over time t in the host-home-country-specific CFC indicator switching from $CFC_{ijt} = 0$ to $CFC_{ijt+1} = 1$, and vice versa. Such switches trigger a tax notch ($CIT_{jt} - CIT_{it}$) which fundamentally changes profit shifting incentives. Note that most countries allow foreign affiliates to escape from CFC treatment if a sufficient amount of active business is documented. This is, however, irrelevant to our identification approach: once $CFC_{ijt} = 1$, a foreign affiliate cannot be used as a pure profit shifting entity anymore.[12]

We can distinguish the variation in our data based on the sources of change in treatment. Changes in treatment – both into treatment and out of treatment – can be caused by the implementation of new CFC rules or changes in the tax rate of either the home country or the host country. Sometimes, both countries change their tax rates in the same year so that a shift falls into both categories.

Our analysis relies on firm-level information provided by Bureau van Dijk's ORBIS database. ORBIS is a firm-level dataset that comprises information on firms' financial statements and their ownership relationships. The specific shareholder-affiliate ownership relation is crucial in the context of CFC legislation and CFC treatment.[13] For

[12]Note that this is a main difference to the paper by Egger and Wamser (2015), who focus on the German CFC rule and fixed assets abroad. In this case, it is really important to account for the passive income threshold as well (to learn about real treatment).

[13]We exploit detailed ownership information in ORBIS to identify the direct majority shareholder of an affiliate. Although most countries include direct and indirect shareholders in their definition of a parent company, complex ownership structures within MNE networks can create conflicts in the applicability of CFC rules. For instance, if a Czech affiliate is directly held by a Japanese shareholder it can be subject to Japanese CFC legislation. However, if this Czech affiliate is ultimately owned by a German holding, it would be exempt from CFC ruling from the

our analysis, we exclude any affiliates that are classified as banks as they are generally subject to different regulations.

Table 2.2.1: *Changes in CFC_{ijt} over time (country-pair level)*

Type of change	*Number of changes*	*Average tax notch*	*Affected affiliates*
Into treatment	106	15.0pp	22,195
Change in host CIT_{it}	52	13.8pp	18,484
Change in home CIT_{jt}	24	25.0pp	9,438
Change in T_{jt}	0		
New CFC rule	43	15.2pp	1,283
Out of treatment	96	10.7pp	19,175
Change in host CIT_{it}	30	0.5pp	2,245
Change in home CIT_{jt}	70	11.1pp	16,590
Change in T_{jt}	11	10.4pp	1,430
Repeal of CFC rule	0		

A change in T_{jt} refers to a change in the threshold stipulated in the existing CFC legislation in the home country. Changes are counted at the country-pair level only including changes for which we observe affected affiliates in our sample. The average tax notch is an unweighted average for all affected affiliates.

Table 2.2.1 summarizes the different types of treatment changes in our sample. These numbers reflect the country-pair level changes observed in our sample together with the average (unweighted) tax notch associated with these changes. The average tax notch from *moving into treatment* is larger than the notch when *moving out of treatment*. This is intuitive as CFC treatment typically applies to pairs with a large tax differential between home and host country. Moving out of treatment means that both tax rates are becoming more similar and thus the tax notch becomes smaller. Note that each type of change at the country-pair level affects thousands of firms when analyzing micro-level data.

holding's perspective since Germany exempts EU countries from its legislation. For this reason, and from our point of view, it is always preferable to base the analysis and CFC application on the controlling direct shareholders rather than ORBIS' ultimate owners.

Table 2.2.2: *Summary statistics*

	Observations	Mean	S.D.	Median
Treated affiliates				
Pre-tax profits$_{it}$	92,955	3.18	44.67	0.21
Fixed assets$_{it}$	92,955	42.32	1628.12	0.29
Tangible Fixed assets$_{it}$	92,732	7.12	87.27	0.17
Employees$_{it}$	92,955	126.92	593.50	22.00
Sales$_{it}$	76,488	25.13	159.35	2.50
Cost of Employees$_{it}$	76,969	3.26	21.48	0.54
TFP_{it}	65,356	3.45	1.06	3.37
CIT_{it}	92,955	0.16	0.06	0.16
Distance to cut-off$_{it}$	92,955	-0.06	0.04	-0.06
Group exposure$_{it}$	92,955	0.73	0.32	1.00
GDP_{it}	92,955	704.82	1046.27	356.89
GDP p.c.$_{it}$	92,955	30.28	12.05	27.14
GDP growth$_{it}$	92,955	2.81	2.80	2.82
Inflation$_{it}$	92,955	2.36	3.29	1.81
Unemployment$_{it}$	92,955	8.28	4.46	6.95
Corruption$_{it}$	92,955	0.35	0.82	0.24
Untreated affiliates				
Pre-tax profits$_{it}$	941,130	8.66	127.24	0.41
Fixed assets$_{it}$	941,130	62.75	1025.05	0.70
Tangible Fixed assets$_{it}$	939,864	20.36	456.34	0.26
Employees$_{it}$	941,130	195.68	1951.64	26.00
Sales$_{it}$	764,859	89.25	1182.78	6.50
Cost of Employees$_{it}$	749,925	8.12	134.11	1.20
TFP_{it}	660,865	3.93	1.05	3.98
CIT_{it}	941,130	0.24	0.07	0.25
Distance to cut-off$_{it}$	475,566	0.09	0.06	0.09
Group exposure$_{it}$	941,130	0.02	0.09	0.00
GDP p.c.$_{it}$	941,130	36.55	12.66	39.53
GDP growth$_{it}$	941,130	1.91	2.33	1.91
Inflation$_{it}$	941,130	2.22	3.88	1.47
Unemployment$_{it}$	941,130	9.15	5.32	7.80
Corruption$_{it}$	941,130	0.72	0.96	0.65
Parent shareholders				
Pre-tax profits$_{jt}$	206,673	49.51	452.57	2.14
Fixed assets$_{jt}$	206,673	577.27	6035.81	10.99
Tangible Fixed assets$_{jt}$	206,396	116.94	2005.09	1.87
Employees$_{jt}$	206,673	655.75	8155.99	75.00
Sales$_{jt}$	173,275	403.90	3294.57	28.43
Cost of Employees$_{jt}$	176,565	29.32	353.31	3.93
TFP_{jt}	159,713	4.11	0.98	4.05
CIT_{jt}	206,673	0.26	0.07	0.28
Av. tax notch$_{jt}$	206,673	0.01	0.04	0.00
Max. tax notch$_{jt}$	206,673	0.02	0.06	0.00
Group exposure$_{jt}$	206,673	0.09	0.24	0.00

Firm-level variables measured in million USD, GDP measured in billion USD.

Descriptive statistics on the firm-level data, tax variables, as well as additional country-level data (taken from the World Bank's *World Development Indicators* database) are presented in Table 2.2.2.[14] These summary statistics highlight the important advantages of our dataset, including parent- as well as affiliate-level information with complete financial statements for both parties. This allows us to analyze the impact of CFC treatment on *(i)* directly affected affiliates, *(ii)* their direct shareholders, as well as *(iii)* indirectly affected affiliates in the same group.

2.3 Profit shifting elasticity

2.3.1 Benchmark results

We first assess the effect of a change in profit shifting incentives on profits reported by foreign affiliates affected by CFC rules. The variable CFC_{ijt} indicates whether a CFC rule is actually binding in a bilateral parent-affiliate relationship. Our empirical specification closely follows Huizinga and Laeven (2008):

$$log(PTP_{it}) = \beta_0 + \beta_1 CIT_{it} + \beta_2 CFC_{ijt} + \beta_3 (CIT_{it} \times CFC_{ijt}) + \mathbf{X_{it}}\beta + \gamma_\mathbf{i} + \gamma_\mathbf{t} + \epsilon_\mathbf{it}. \quad (2.3.1)$$

The dependent variable $log(PTP_{it})$ denotes profits before taxes of affiliate i in year t. We measure profitability in terms of pre-tax profits which comprises both operating and financial profits.[15] Although CFC rules generally aim at taxing passive income, we expect CFC rule treatment to reduce the overall attractiveness of an affiliate as a profit shifting entity.[16] While many profit shifting channels such as debt shifting or licensing will reflect in financial profits, transfer price manipulation affects operating profits. Therefore, we expect the overall profitability of affiliates to be the most suitable

[14] See Table 2.*A*.2 for a detailed description of all variables and their respective sources. In Section 2.5, we use total factor productivity (TFP) and investment as additional outcome variables to obtain a better understanding of the driving factors behind the observed effects. TFP is estimated following the methodology proposed by Levinsohn and Petrin (2003), using material inputs as a proxy for unobserved productivity shocks.

[15] See Heckemeyer and Overesch (2017) for a discussion on the tax-sensitivity of pre-tax profits versus earnings before interest and taxation.

[16] When a foreign affiliate is identified as a potential CFC (according to the tax threshold), the home country's tax authority starts a review process to determine whether a shareholder has significant influence over the foreign affiliate, and whether or not the foreign affiliate is eligible for CFC exemption. This involves an in-depth review of their business activities and assets. We expect this review process to discourage any kind of profit shifting activity.

measure.[17]

Previous literature interprets the estimate on CIT_{it} – the statutory corporate income tax rate at the host location – as a profit shifting semi-elasticity. We argue, however, that the coefficient on β_2, which captures the effect of the tax notch created by the CFC rule, reflects the response to profit shifting incentives more adequately. We also include an interaction term between the host-country tax rate CIT_{it} and the CFC indicator to further analyze firms' tax sensitivity. We would expect that firms under CFC treatment are no longer sensitive to their host country tax rate – if treated, tainted income would now be taxed at the parent location.

Furthermore, we include firm and country-specific control variables, captured by $\mathbf{X_{it}}$. Following Huizinga and Laeven (2008), we condition on the log of the number of employees and log of fixed assets reported by affiliate i to control for firm size effects. On the country level, we control for the inflation rate, unemployment, and corruption as well as the host country's GDP level, GDP per capita, and GDP growth. In this way, we capture time-varying economic trends that are not absorbed by the fixed effects. All specifications include year and affiliate fixed effects, denoted by γ_i and γ_t, respectively.

We start by including only CIT_{it} in column (1), Table 2.3.1. Column (2) augments the estimation by including the CFC indicator. As expected, the coefficient is significant and negative, suggesting that CFC treatment reduces pre-tax profits by 3.3%. This effect is smaller than previous estimates for financial profits (see Clifford 2019). Column (3) explores the interaction between CFC rules and the local tax rate. In this specification, the host country tax rate is centered around 15.6%, which is the mean tax rate among all treated affiliates. Therefore, the main effect for the CFC dummy denotes the average treatment effect for affiliates facing the average tax rate. The interaction term is insignificant for firms where $CFC_{ijt} = 1$. This supports our initial hypothesis that treated firms become insensitive to their host country's tax rate as their income becomes subject to domestic taxation. The coefficient on $(1 - CFC_{ijt}) \times \overline{CIT_{it}}$ suggests a slightly increased tax responsiveness, compared to column (1), for those affiliates that are not restricted by CFC rules. The estimates also suggest that the parent tax rate is positively related to $log(PTP_{it})$, as expected.

Our findings are broadly in line with previous estimates. Both $log(FA_{it})$ and

[17]Section 2.A.2 provides evidence that CFC treatment has an even larger effect on financial profits.

Table 2.3.1: *Benchmark results*

Dep. variable: $log(PTP_{it})$	(1)	(2)	(3)
CFC_{ijt}		-0.0329**	-0.0470***
		(0.014)	(0.016)
CIT_{it}	-0.593***	-0.637***	
	(0.083)	(0.085)	
$CFC_{ijt} \times \overline{CIT_{it}}$			-0.0132
			(0.263)
$(1 - CFC_{ijt}) \times \overline{CIT_{it}}$			-0.659***
			(0.086)
CIT_{jt}	0.0832	0.126	0.133*
	(0.076)	(0.078)	(0.078)
$log(FA_{it})$	0.102***	0.102***	0.102***
	(0.002)	(0.002)	(0.002)
$log(EMP_{it})$	0.266***	0.266***	0.266***
	(0.004)	(0.004)	(0.004)
$log(GDP_{it})$	-0.388***	-0.372***	-0.378***
	(0.133)	(0.133)	(0.133)
$log(GDP\ p.c._{it})$	0.839***	0.823***	0.834***
	(0.136)	(0.136)	(0.136)
$GDP\ growth_{it}$	0.0124***	0.0124***	0.0124***
	(0.001)	(0.001)	(0.001)
$Inflation_{it}$	-0.00500***	-0.00499***	-0.00498***
	(0.001)	(0.001)	(0.001)
$Unemployment_{it}$	-0.00702***	-0.00705***	-0.00693***
	(0.001)	(0.001)	(0.001)
$Corruption_{it}$	-0.130***	-0.130***	-0.131***
	(0.016)	(0.016)	(0.016)
N	1,034,085	1,034,085	1,034,085
R^2	0.883	0.883	0.883
Firm & Year FE	YES	YES	YES

CFC binary is an indicator variable that takes the value 1 if the respective affiliate is in a host country with a corporate income tax below the specified threshold. Host CIT is centered around the mean tax rate for all treated affiliates in column (3). Standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

$log(EMP_{it})$ are positively related to $log(PTP_{it})$ which is in line with previous empirical studies (see Huizinga and Laeven 2008). The coefficient on $log(GDP_{it})$ is significant and negative, while it is positive and (weakly) significant for $GDP\ growth$ and $log(GDP\ p.c._{it})$. The three variables are strongly correlated but suggest an overall positive relationship between the size of an economy and firm profits. The three remaining

control variables $Inflation$, $Unemployment$ and $Corruption$ capture (macroeconomic) trends at the country-level that are not absorbed by our year fixed effects. The coefficients on all three variables are significant and negative, suggesting that unfavorable economic and institutional conditions negatively impact firm profitability.

On average, a treated affiliate (CFC_{ijt} switching from 0 to 1 or from 1 to 0) faces a tax notch of 15 percentage points, which is computed as the difference between the host country's and the home country's tax rates. Using the average tax notch and the CFC treatment effect, we obtain a semi-elasticity for pre-tax profits of 0.22. A 10 percentage point increase in the relevant tax rate would thus be associated with a 2.2% reduction in reported profits. We argue that this is an unbiased estimate of the profit shifting elasticity as we identify it from discrete changes in tax incentives affecting only foreign affiliates that are very likely used for profit shifting. Those affiliates with substantial real activity that do escape CFC regulation do not face a change in tax incentives. In contrast, the effect of marginal changes in CIT_{it} (or CIT_{jt}-CIT_{it}) on pre-tax profits may simply reflect distortions in production (causing a negative effect on profits) and may thus confound the profit shifting effect we are ultimately interested in.

Table 2.A.3 in the Appendix provides estimates for the effects of CFC treatment on financial profits. CFC_{ijt} has a significant negative effect on financial profits across all specifications. In our preferred specification, CFC treatment is associated with a 13.6% reduction in financial profits, suggesting a semi-elasticity close to one. Furthermore, Table 2.A.4 provides evidence on the robustness of the estimates in Table 2.3.1 to different sets of fixed effects. In particular, we show that our results are robust to the specification using affiliate, host-year and home-year fixed effects proposed by Clifford (2019).

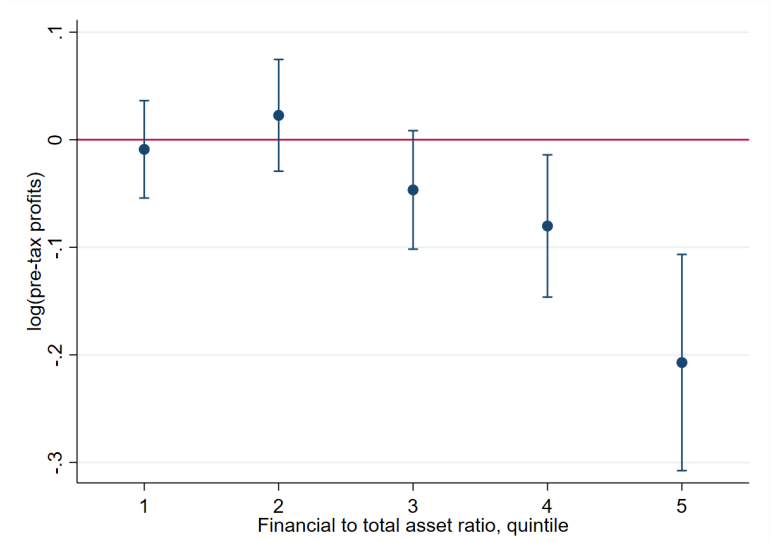
2.3.2 Heterogeneous, asymmetric and dynamic responses

CFC rules explicitly aim at limiting profit shifting and preventing MNEs from using shell companies to reduce their tax liability. In most countries there are exemptions available for "active businesses", that is, if the shareholder can demonstrate that an affiliate is mostly engaged in real economic activity. The latter affiliates are then exempt from CFC rule treatment. The CFC legislation of countries often stipulates additional thresholds for affiliates' "passive income" (see Egger and Wamser 2015). Passive income

comprises profits from interest, royalties, or other financial income sources. That way, the legislation aims at regulating affiliates installed for the purpose of tax avoidance, without affecting real foreign activity by resident shareholders. From our data, we are not able to test whether individual affiliates fulfill the specific criteria for passive income. Note also that we are not concerned about this as neglecting passive income thresholds should not be a source of bias in our context: We argue that once a foreign affiliate is below the tax threshold and the CFC rule may be binding, it will no longer be used as a pure profit shifting entity (which then leads to a relocation of profits). This argument is valid, irrespective of whether a passive income threshold applies or not.

We can proxy, however, for the degree of passive income of an affiliate by computing the share of financial in total assets.[18] For each firm, we compute the share of financial assets in total assets and for each firm group and year, we define the quintiles of the asset ratio. This allows us to estimate a heterogeneous treatment effect on CFC_{ijt}.

Figure 2.3.1: *Heterogeneous treatment effects*



Depicts the coefficients for the interaction between the CFC dummy and within firm quintile of the financial to total asset ratio. The estimation includes affiliate and year fixed effects, affiliate controls include log(Fix.Assets), log(EMP), country controls include home and host CIT, inflation, corruption, unemployment, GDP level, growth, and GDP per capita. Standard errors clustered at the firm group level.

The results in Figure 2.3.1 show that the treatment effect varies considerably with

[18]Note that accounting standards on financial assets vary across countries and that Orbis reporting on "Other or financial assets" is therefore only an approximation of the financial asset structure.

the relative level of financial assets. It appears that CFC legislation is effectively targeting affiliates that engage in financial activities. Compared to Table 2.3.1, the estimates become considerably larger when we look at firms in the highest quintile. Here, the reduction in profits exceeds 20% of reported profits. We take that as evidence that the affiliates with the highest levels of financial assets have a strong propensity to be used as profit shifting entities and thus react very intensely to changes in tax regulations.

We also test for asymmetries in the response to CFC treatment. We define the dummy variables Out_{it} and $Into_{it}$ that indicate if a firm ever switches out of or into treatment, excluding those that switch multiple times. The panel structure of our data thus allows us to compare affiliates coming out of and into treatment before and after their change in CFC status.

Table 2.3.2: *Asymmetric response estimation*

Dep. variable: $log(PTP_{it})$	(1)	(2)	(3)
CFC_{ijt}	-0.0329**		
	(0.014)		
$Into_{it} \times CFC_{ijt}$		-0.0324*	
		(0.017)	
$Out_{it} \times (1 - CFC_{ijt})$			0.0333*
			(0.018)
CIT_{it}	-0.637***	-0.619***	-0.620***
	(0.085)	(0.084)	(0.084)
CIT_{jt}	0.126	0.111	0.116
	(0.078)	(0.078)	(0.078)
N	1,034,085	1,034,085	1,034,085
R^2	0.883	0.883	0.883
Firm & Year FE	YES	YES	YES

Includes affiliate and year fixed effects, affiliate controls include $log(FA)$, $log(EMP)$, country controls include home and host CIT, inflation, corruption, unemployment, GDP level, growth, and GDP per capita. Standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.3.2 presents the results of this estimation. Column (1) replicates the benchmark specification from Table 2.3.1 as a point of reference. In column (2), we estimate that firms falling into treatment face a decrease in profits by 3.33% on average. Column (3) focuses on the treatment effect specifically for firms that come *out* of CFC

treatment. Here, the interaction term $Out_i \times (1 - CFC_{ijt})$ measures the effect of no longer being affected by the CFC rule. Firms coming out of CFC treatment thus report on average 3.24% more profits after their change in treatment status. From this estimation, it seems that the profit response is very symmetric for firms moving into or out of treatment.

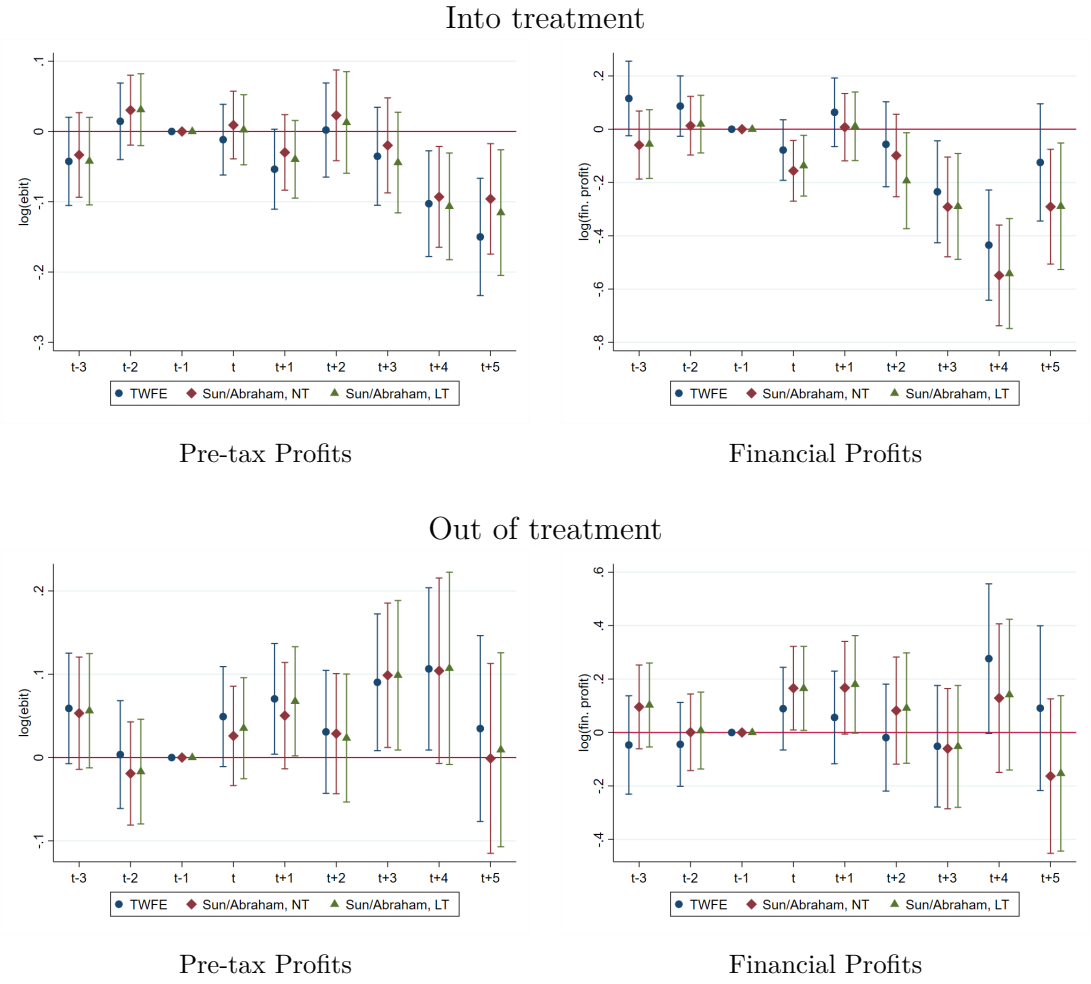
The response to CFC treatment could also be heterogeneous over time as firms adapt their profit allocation to the changing tax incentives. To analyze the dynamic adjustment process, we implement an event-study estimation for directly affected affiliates. Following the recent developments in the literature on event study estimation, we focus on the subsample of affiliates that experience a staggered shift in their CFC treatment, i.e. those that have changed their treatment status exactly once during the sample period. We further split our sample into two groups, those that were initially not treated and have shifted into treatment and those that have shifted out of treatment to capture the asymmetry documented in Table 2.3.2. There is a growing econometric literature on the potential pitfalls of using conventional two-way fixed effects (TWFE) estimators in event study settings (see e.g. Baker et al., 2022; Callaway and Sant'Anna, 2021; de Chaisemartin and D'Haultfœuille, 2020; Sun and Abraham, 2021; Goodman-Bacon, 2021). This literature highlights how heterogeneous treatment effects can lead to biased estimates for the time-specific treatment effects in TWFE and proposes several alternative estimators that address this shortcoming. In our analysis, we use the estimator developed by Sun and Abraham (2021) that allows for heterogeneous treatment effects over groups and time. Additionally, this estimator allows us to use either the firms that were never treated or the last treated cohort in our sample as the control group. We test both approaches and contrast the results to the estimates obtained from TWFE to assess the importance of heterogeneous effects. We estimate the following event study specification:

$$y_{it} = \gamma_i + \gamma_t + \sum_{l=-3}^{-2} \mu_l D_{it}^l + \sum_{l=0}^{5} \mu_l D_{it}^l + \mathbf{X_{it}}\beta + \epsilon_{\mathbf{it}} \tag{2.3.2}$$

where the dependent variable is either the log of pre-tax profits or financial profits of firm i at time t. $\sum_{l=-3}^{-2} \mu_l$ and $\sum_{l=0}^{5} \mu_l$ denote indicator variables for the relative time periods before and after the change in CFC treatment, while D^l measures the respective treatment effect for period l. The vector X_{it} includes the same control

variables as Table 2.3.1: home and host country corporate tax rate, the log fixed assets and employees, the log of GDP and GDP per capita, GDP growth, the inflation and unemployment rate and the perception of corruption index.

Figure 2.3.2: *Event study estimates*



Event study specifications with either the log of pre-tax profits (left) or financial profits (right) as the dependent variables. We use the sub-sample of firms that have been shifted out of treatment. We show estimates using two-way fixed effects (TWFE) and the estimator proposed by Sun and Abraham (2021) using either the never-treated (NT) or latest-treated (LT) cohort as the control group. Standard errors clustered at the firm group level.

Figure 2.3.2 illustrates the event study results. Note that all effects are normalized relative to the period $t-1$. We report TWFE estimates (blue dots) and the estimator proposed by Sun and Abraham (2021) using the never-treated as a control group (red

diamond) and using the last treated cohort as the control group (green triangle). The three estimators yield very comparable coefficients across all outcomes.

The upper panel of Figure 2.3.2 shows the effects of biding CFC rules on pre-tax profits (left plot) and financial profits (right plot). We find significant negative effects on profits four to five years after a CFC binds. Financial profits react immediately and continue to fall over the following 5 years. The lower panel shows the effects of moving out of CFC treatment. We observe a similar time lag but larger standard errors for the estimates. There is a significant positive effect on pre-tax profits in year $t+3$ that has a similar magnitude as the negative effects reported in the first panel. The estimates for financial profits are noisier but the general pattern is consistent. Intuitively, moving out of treatment could be a less significant change in the tax incentives of the firm group. It opens an additional opportunity for profit shifting whereas a shift into treatment forces the group to reallocate profits to avoid a substantial increase in the tax burden.

2.4 Profit reallocation after treatment

The objective of policymakers when implementing CFC rules is to incentivize MNEs to stop shifting profits from their home location. The alternative choice a large MNE can make, however, is to reallocate profits to other low-tax affiliates unaffected by CFC rules. The following part of the analysis, thus, aims at identifying the effect of CFC rules on both parent shareholders and other unaffected affiliates, while controlling for firm and group characteristics. While this clearly seems of interest, to the best of our knowledge, no previous study has looked at such effects.

For this analysis, we cannot capture CFC treatment in a dummy variable as in the estimation above – because there may be multiple potential treatments impacting a firm group in a given year. Instead, we define a *group exposure* variable, EXP_{jt}, that captures the fraction of treated affiliates in a group.[19]

2.4.1 Parent shareholder

Since the main objective of CFC rules is to limit profit shifting from domestic shareholders to their foreign affiliates, we first turn to the parents' profits to learn about

[19] A similar indicator has been used in the literature (see Clifford 2019)

domestic tax base effects. We estimate

$$log(y_{jt}) = \beta_0 + \beta_1 EXP_{jt} + \mathbf{X_{jt}}\beta + \gamma_{\mathbf{j}} + \gamma_{\mathbf{ht}} + \epsilon_{\mathbf{jt}}, \tag{2.4.1}$$

where EXP_{jt} is the exposure to CFC treatment of shareholder j in time t. $\mathbf{X_{jt}}$ is a set of shareholder-level control variables, and γ_j and γ_{ht} represent shareholder-j and home-country-h-year-t fixed effects, respectively. It seems to be critical (and possible, given our data) to control for home-country-time effects to ensure that aggregate country-year shocks do not lead to a bias in β_1. Thus, we condition on a home country's tax policy and all other types of variables which are $h-t-$specific.[20] In other words, by controlling for γ_{ht}, β_1 captures only variation that is directly driven by changes in CFC exposure of shareholder j. To measure exposure, we use the (unweighted) continuous share of treated affiliates and a dummy variable CFC_{jt} that is equal to 1 if shareholder j holds at least one affiliate which is affected by $h's$ CFC rule at time t.

Table 2.4.1 summarizes the regression results for the pre-tax profits of shareholders. In all of our specifications, the coefficient for group exposure remains small and clearly insignificant (and also close to zero). These results are in line with our expectations from the previous sections. Even when restricting the sample to parents that hold only a single affiliate in columns (2), the coefficient on group exposure remains insignificant. As discussed above, even though CFC exposure makes profit shifting less attractive from the perspective of the parent, it does not necessarily increase the domestic tax base. This is fully consistent with the findings above that profits are shifted to third locations (best alternatives), rather than to the parent. Additionally, we interact the CFC exposure measure with the shift in the group's average corporate tax rate in column (3) and the maximum tax notch in a given year in column (4). All coefficients for the interaction effects remain insignificant.

2.4.2 Untreated affiliates

Within the group unaffected affiliates, we expect those just above the respective low-tax threshold to benefit the most from CFC treatment at other locations in their firm group. As indicated above, we may denote these affiliates as the *next-best alternative*.

[20] Note, though, that our results are robust if we include just aggregate time effects.

Table 2.4.1: *Parent profits*

Dep. variable: $log(PTP_{it})$	(1)	(2)	(3)	(4)
EXP_{jt}	0.0216	0.0132	-0.00615	-0.00254
	(0.028)	(0.076)	(0.059)	(0.058)
$AV.NOTCH_{jt}$			-0.169	
			(0.608)	
$EXP_{jt} \times AV.NOTCH_{jt}$			0.427	
			(0.538)	
$MAX.NOTCH_{jt}$				-0.127
				(0.140)
$EXP_{jt} \times MAX.NOTCH_{jt}$				0.338
				(0.422)
$log(FA_{jt})$	0.128***	0.0753***	0.128***	0.128***
	(0.007)	(0.015)	(0.007)	(0.007)
$log(Empl_{jt})$	0.219***	0.291***	0.219***	0.219***
	(0.010)	(0.030)	(0.010)	(0.010)
N	206,673	31,854	206,673	206,673
R^2	0.886	0.859	0.886	0.886
Firm & Country-year FE	YES	YES	YES	YES
Sample	Full	Single Af.	Full	Full

EXP measures the share of affiliates directly affected by CFC rules in a given group and year, $AV.NOTCH_{jt}$ is the group's average tax notch caused by CFC rules and $MAX.NOTCH_{jt}$ refers to the maximum tax notch experienced by the group in a given year. Standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To test this hypothesis, we implement the following analysis, based on differences in tax incentives. We construct dummy variables for 2 percentage point bins of the normalized tax rate[21] and indicator variables that measure a group's exposure to CFC treatment. To be specific, we estimate

$$log(PTP_{it}) = \sum_{b=1}^{B} \alpha_b \times \mathbb{1}[tax_{it} \in tax_b] \times EXP_{jt} + \mathbf{X_{it}}\beta + \gamma_{\mathbf{i}} + \gamma_{\mathbf{t}} + \epsilon_{\mathbf{it}}, \qquad (2.4.2)$$

where $log(PTP_{it})$ denotes the log of an affiliate's pre-tax profits. The first part of equation 2.4.2 is an interaction term, where $\mathbb{1}[tax_{it} \in tax_b]$ is a dummy variable that is equal to 1 if the affiliate's host country tax rate in time t falls into bin b.[22] Therefore,

[21]The normalized tax rate is the distance between an affiliate's host country CIT and its relevant CFC threshold.

[22]To give an example, in 2017, an Albanian affiliate of an Italian shareholder falls into *bin 1* because the Italian CFC threshold is at 13.9% and Albania had a statutory tax rate of 15%.

Figure 2.4.1: *Group exposure*

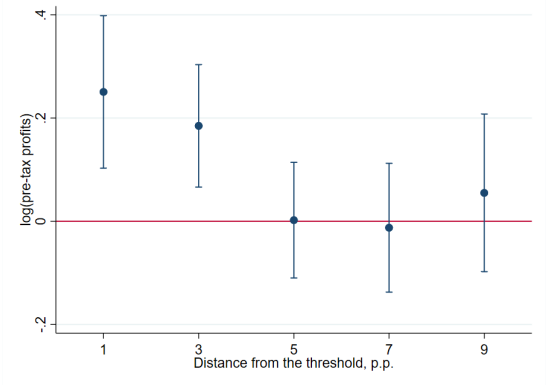
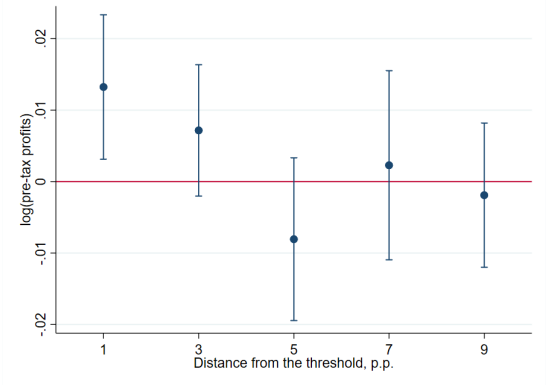


Figure 2.4.2: *Number of treatments*



Dependent variable $log(PTP_{it})$ of the affiliate. Estimations include controls for fixed assets, employees, GDP level, growth and GDP per capita, inflation, unemployment, and corruption. Affiliate and year fixed effects included, standard errors clustered at the firm-group level. Vertical lines represent 95% confidence intervals. For more precision, these estimations include only the first five bins, that is affiliates 0 to 10 percentage points above their threshold. Extending the analysis to all affiliates above the threshold leaves the results virtually unchanged, see Figure 2.A.1 .

α_b measures the effect of EXP_{it} on firms in bin b.[23] Equation 2.4.2 also conditions on $\mathbf{X_{it}}$, which includes firm-level and host-country control variables; γ_i and γ_t denote affiliate and time fixed-effects, as above. As an alternative measure of exposure to CFC treatment, we use the total number of treated affiliates in the group. This second indicator ignores the size of an MNE.

Figures 2.4.1 and 2.4.2 present the estimation results graphically. The pattern impressively confirms our initial hypothesis that affiliates just above the threshold are most likely to benefit from increased CFC exposure. For both measures, the estimated coefficients on the interaction terms are significant and positive for firms with $CITs$ between 0 and 2 percentage points above the relevant thresholds. For affiliates further away from the threshold, the effect turns insignificant. This finding is novel and highlights that MNEs seek second-best solutions whenever they are treated at some location.

Concerning the magnitude of the effects, the median group size in this sample is nine affiliates. If one of them is treated by a CFC rule, group exposure increases from 0 to 11%. For untreated affiliates just above the threshold, this would be associated

[23]Table 2.A.5 in the Appendix provides summary statistics for the individual bins of unaffected affiliates.

with an average increase in pre-tax profits of about 3%. However, none of the firms within a window of zero to two percentage points above the threshold are domestic.[24] In the second bin, two to four percentage points above the threshold, the effect becomes slightly weaker. The ratio of domestic to foreign firms in this bin is roughly 1:36.

The significant effect for firms in the second bin above the threshold might be driven by firm groups where the untreated affiliate with the lowest tax rate in the group is further away from the cut-off. We exploit the group structure provided by the data to rank affiliates according to their tax rate, from lowest to highest, within their firm group. Similar to equation (2.4.2), we interact group exposure with the rank of the unaffected affiliate. Here, we estimate

$$log(PTP_{it}) = \sum_{n=1}^{N} \alpha_n \times \mathbb{1}[rank_{it}] \times EXP_{it} + \mathbf{X_{it}}\beta + \gamma_\mathbf{i} + \gamma_\mathbf{t} + \epsilon_\mathbf{it}, \tag{2.4.3}$$

where $\mathbb{1}[rank_{it}]$ is a categorical variable that indicates the low-tax rank of a given affiliate. For example, a value of 1 would denote the affiliate with the lowest tax rate that is just not CFC treated within the group.[25] Foreign affiliates with $rank = 1$ have an average tax differential of 7 percentage points to their shareholder.

Table 2.4.2 presents the results. It clearly shows that only the nearest 'tax-neighbor', i.e., the affiliates with the lowest tax rate in the group just not affected by the CFC rule, see a significant effect from increased group exposure. The point estimates for all other ranks are (mostly) positive but insignificant. The coefficient is smaller compared to the estimates in Figure 2.4.1, which may relate to the fact that a low rank may not necessarily suggest that we are close to the respective threshold. The regression in Table 2.4.2, to be specific, also includes groups whose next best alternative might be a domestic affiliate or even a foreign affiliate with a higher tax rate. In these cases, the incentive to redirect profits away from the CFC location to a third country is reduced or eliminated. Moreover, some groups have affiliates in different locations that share the same rank when the statutory tax rates are identical.

We may summarize: If a CFC rule is implemented, the tax advantage is taken away and profits are shifted to less-optimal locations (but still the best alternatives).

[24] See table 2.A.5 for detailed summary statistics.

[25] Note, however, that there can be affiliates in different locations sharing a rank if these locations have the same CIT.

Table 2.4.2: *Ranked affiliates*

Dep. variable: $log(PTP_{it})$		
$\mathbb{1}[Rank = 1] \times EXP$	0.0911**	(0.037)
$\mathbb{1}[Rank = 2] \times EXP$	0.0576	(0.051)
$\mathbb{1}[Rank = 3] \times EXP$	0.0571	(0.062)
$\mathbb{1}[Rank = 4] \times EXP$	0.0777	(0.072)
$\mathbb{1}[Rank = 5] \times EXP$	0.0182	(0.080)
$\mathbb{1}[Rank = 6] \times EXP$	-0.0881	(0.102)
$\mathbb{1}[Rank = 7] \times EXP$	-0.121	(0.114)
$\mathbb{1}[Rank = 8] \times EXP$	0.132	(0.138)
$\mathbb{1}[Rank = 9] \times EXP$	-0.0100	(0.171)
$\mathbb{1}[Rank = 10] \times EXP$	-0.00540	(0.177)
$\mathbb{1}[Rank = 11] \times EXP$	0.221	(0.242)
$\mathbb{1}[Rank = 12] \times EXP$	0.294	(0.215)
$\mathbb{1}[Rank = 13] \times EXP$	0.219	(0.240)
$\mathbb{1}[Rank = 14] \times EXP$	0.314	(0.282)
$\mathbb{1}[Rank = 15] \times EXP$	0.189	(0.297)
$\mathbb{1}[Rank = 16] \times EXP$	-0.115	(0.390)
$\mathbb{1}[Rank = 17] \times EXP$	0.0885	(0.426)
$\mathbb{1}[Rank = 18] \times EXP$	-0.203	(0.460)
$\mathbb{1}[Rank = 19] \times EXP$	-0.361	(0.375)
N	932,377	
R^2	0.884	
Firm & Year FE	YES	

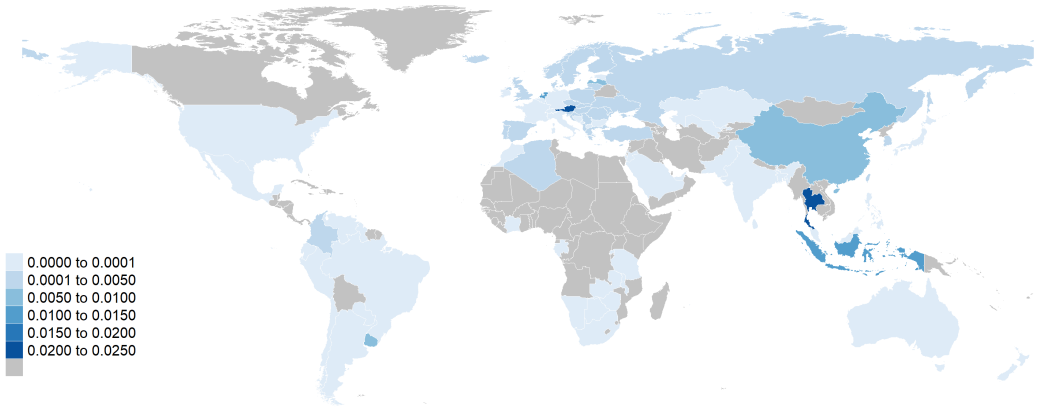
Includes only unaffected affiliates ranked 1st to 19th lowest tax neighbors (which includes 99% of all affiliates that are unaffected by CFC rules in our ample). Includes affiliate and year fixed effects, affiliate controls include the log of fixed assets and employment, country controls include home CIT, inflation, corruption, unemployment, GDP level, growth, and GDP per capita. Standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Consistent with this, we show below that it is not the parent's location that benefits – in terms of relocation of profits to the parent firm – after a CFC rule becomes binding.

The specifics of CFC regulation allow us to implement a simple robustness check of our results by leveraging the domestic affiliates of affected groups. If an MNE becomes exposed to CFC treatment in its low-tax locations, we expect that some share of these profits will be reallocated to other, unaffected locations. However, there is no incentive for the MNE to redirect profits to domestic affiliates as they face the same tax rate as the treated low-tax affiliates. Reallocation of profits is only beneficial to the group if there are unaffected third locations available – whose corporate tax rate is lower

than the domestic rate. Table 2.A.6 in the Appendix reports the results of this test. We interact the group's exposure level with a dummy variable for domestic affiliates. In this specification, group exposure only has a significant effect on foreign unaffected affiliates but not on domestic ones.

Figure 2.4.3: *Who gains from the current CFC regime? – Back of the envelop calculation*



Estimated effects of CFC legislation on untreated affiliates by country. Back-of-the-envelop calculation: Coefficient on bin 1 from Table 2.3.1 multiplied by the group exposure of affiliates in this bin, average effect per country over the sample period. The effect thus refers to the estimated gain in profits driven by affiliates located just above the threshold.

Let us further provide some back-of-the-envelope calculations to better understand which countries benefit the most from redirected profits after CFC treatment. The countries that benefit most will typically host many affiliates that are located just above their relevant threshold and that are in groups with high exposure to CFC treatment in other countries. Using our benchmark estimation in Table 2.3.1, we can approximate the gains for host countries falling into the first bin above the threshold. To do so, we multiply the average exposure level of every affiliate in *bin 1* by the coefficient estimates in Table 2.3.1. At the country level, the exposure level measures how many affiliates in *other countries* are directly affected by CFC treatment which would make the *local* affiliates in bin 1 attractive profit shifting alternatives. We interpret this effect as the gain in profits associated with CFC treatment of other firms in the same group. Figure

2.4.3 illustrates the results of this exercise.[26] Some countries that benefit strongly from being nearest-tax neighbors under the current CFC regime are the Netherlands, Austria, and Thailand. With a statutory tax rate of 25% the Netherlands and Austria are exactly at the German low-tax cut-off, while Thailand is at the Japanese cut-off at 20% for most years in our sample.

Some countries such as Lithuania can be their own best alternative to low-tax locations. Lithuania is a lower-tax country with a corporate tax rate of 15% and a CFC rule. To be precise, the Lithuanian CFC rule stipulates a relative threshold of 75% so that every host country with a tax rate below 11.25% would fall under CFC treatment. This leaves a very small window between the threshold and the domestic tax rate and makes it difficult for Lithuanian multinationals to find alternative locations and redirect their shifted profits.

A concern about the estimates presented above may be that there is systematic incorporation after CFC treatment. Such behavior may bias our estimates if the decision to incorporate is correlated to unobservable firm characteristics. We provide a simple but powerful test of whether this dynamic influences our results. We replicate the estimations in equations (2.4.2) and (2.4.3), excluding all affiliates incorporated within the time frame of our sample. This way, the estimation sample does not include any affiliates that were potentially incorporated because of the changes in CFC treatment documented in our sample period. Tables 2.A.8 and 2.A.7 in the Appendix present the results of this exercise. They clearly show that the coefficients of interest are very close to the results presented above. The pattern of profit redistribution to the nearest tax neighbor is persistent. We are thus confident that endogenous changes in the firm structure do not create substantial biases in our estimation.

As an additional robustness test for the estimation in Figure 2.4.1, we implement a simple, non-parametric permutation test. For each iteration, we randomly reassign the tax bins of all affiliates in the estimation sample, estimate equation (2.4.2) on the resulting sample, and collect the coefficient for *bin 1*. By replicating this procedure 5,000 times, we obtain a distribution of placebo estimates that we can compare to the

[26]Note that this calculation focuses on the countries benefiting from being just narrowly above a relevant CFC cut-off. This calculation is not sufficient to exactly quantify the redirection of profits associated with the current CFC regime. Instead, the goal of Figure 2.4.3 is to give an intuition about which countries are most likely to be beneficiaries of the current regimes.

coefficient estimated from the real data with the true tax bins. Figure 2.A.2 illustrates the distribution and the critical values of the associated normal distribution. The vertical line shows that the true estimate from Figure 2.4.1 is placed far to the right of the upper critical value.

2.5 Real consequences of CFC treatment

Beyond the allocation of profits, changes in the shareholder's scope for tax planning might influence real business activities for all parts of the firm group. The purpose of this section is to better understand the relationship between profit shifting restrictions (here, CFC rules) and parent activity. To the extent that firms cannot avoid taxation, the resulting increase in the cost of capital may have negative implications for real investment activity (see e.g. Egger et al., 2014; Egger and Wamser, 2015; de Mooij and Liu, 2021; Suárez Serrato, 2018). On the other hand, the increase in cash flow in the "new" profit shifting destinations may lead to more investment (see e.g. Egger et al., 2015; Boissel and Matray, 2022).

To capture a variety of potential real effects, we examine four outcome variables: (1) the log of tangible fixed assets (2) the log of the total number of employees, and (3) the log of total factor productivity (TFP). We include the one-period lag of the log of turnover (denoted as $Sales$) and of the cost for employees to control for size effects. As in the previous specification, we include country-by-year fixed effects. In the following, we analyze the real consequences of CFC legislation for the directly treated affiliates, the remaining group, and the parent shareholder.

Table 2.5.1 presents the results for those affiliates that are directly affected by CFC treatment. We are not able to identify any significant effects on the change in tangible assets of firms that fall under CFC legislation. The same holds true for the productivity of these affiliates, the effect on TFP is insignificant and close to zero. However, we are able to identify a significant negative effect on the number of employees which is estimated to decrease by about 1.3% following CFC treatment.

To analyze the real consequences of a shift in profit shifting incentives for the rest of the group we use the exposure measure EXP as defined in the previous section. Table 2.5.2 presents the estimation results for the parent shareholder. We find that

Table 2.5.1: *Real outcomes - treated affiliates*

	(1) $log(TFAS)$	(2) $log(EMP)$	(3) $log(TFP)$
CFC_{ijt}	0.0199	-0.0133**	0.00140
	(0.014)	(0.006)	(0.003)
$log(Sales_{it-1})$	0.127***	0.0836***	0.0352***
	(0.003)	(0.002)	(0.001)
$log(Empl.Cost_{it-1})$	0.182***	0.267***	-0.0238***
	(0.004)	(0.003)	(0.001)
Firm & Country-year FE	YES	YES	YES
N	1,103,626	1,032,495	778,128
R^2	0.939	0.967	0.776

Standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

increased exposure to CFC rules has no effect on shareholders' tangible assets or TFP. We do find a positive effect on shareholder employment. The last column of table 2.5.2 shows that this positive effect is driven by those shareholders for which CFC regulation shuts especially attractive low-tax locations. The variable $MAX.NOTCH_{jt}$ is the maximum tax notch experienced by the group in a given year. Including this variable and interaction thereof with our exposure measure reveals that it is the size of the tax penalty suffered that drives the effect.

A potential concern here might be related to our definition of the firm group. The direct majority shareholder of an affiliate could be a holding company or some other form of financial intermediary company. Typically, these firms do not carry out any real activity which might also explain our finding in Table 2.5.2. However, looking at the industry composition of parent shareholders in our sample (see Table 2.A.9 in the Appendix), we see that the majority of firms are either in manufacturing (NACE sector C) or wholesales (NACE sector G), whereas only 6% of all parents is active in the financial services industry (NACE sector K). This industry composition makes it unlikely that our findings are driven by economically inactive holding companies.

Table 2.5.3 presents the results for the group's affiliates which weren't affected by CFC rules. Columns 1-3 show that increased group exposure to CFC rules is associated with a significant positive effect on tangible asset investment, employment, and TFP for untreated affiliates in the group. Columns 4-7 reveal that the positive effect is particu-

Table 2.5.2: *Real outcomes - parent shareholder*

	(1) $log(TFAS)$	(2) $log(EMP)$	(3) $log(TFP)$	(4) $log(EMP)$	(5) $log(EMP)$
EXP_{jt}	0.0154	0.0263**	0.00323	-0.0272	-0.0321
	(0.028)	(0.012)	(0.004)	(0.051)	(0.025)
$EXP_{jt} \times CIT_{jt}$				0.174	
				(0.160)	
$MAX.NOTCH_{jt}$					0.186**
					(0.081)
$EXP_{jt} \times MAX.NOTCH_{jt}$					0.182
					(0.183)
$log(Sales_{it-1})$	0.164***	0.0905***	0.0288***	0.0905***	0.0904***
	(0.009)	(0.005)	(0.003)	(0.005)	(0.005)
$log(Empl.Cost_{it-1})$	0.225***	0.351***	-0.0354***	0.351***	0.351***
	(0.011)	(0.009)	(0.003)	(0.009)	(0.009)
Firm & Country-year FE	YES	YES	YES	YES	YES
N	192,948	179,352	153,389	179,352	179,352
R^2	0.950	0.975	0.761	0.975	0.975

The variable $MAX.NOTCH_{jt}$ measures the maximum change in the affiliate tax rate caused by CFC treatment. Standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

larly large for affiliates with the best tax position in the group. Interacting the group exposure with the local tax rate CIT_{it} we find that the positive effect on assets and employment vanishes in locations with higher tax rates and even turns negative if the corporate tax rate is high enough (columns 4 and 5). We also include an interaction with the individual distance to the CFC cut-off. The variable $CITDIST_{ijt} = CIT_{it} - \overline{T}_{ijt}$ measures the *tax-distance* to the relevant CFC threshold. Again, the results show that those affiliates closest to the cut-off and hence more attractive as a profit shifting destination experience the largest increases in investment and employment. Consequently, we observe that the same affiliates that experience an increase in their profits as group exposure to CFC rules increases, also increase in their investment activity.

Summarizing, we find that shutting down incentives to shift profits to particular low-tax affiliates leads to a relocation of both profits and real activity. Employment in affected low-tax affiliates that are no longer attractive for profit shifting goes back. Our findings suggest that employment is partly relocated to other low-tax affiliates that remain relatively attractive as profit shifting destinations. These affiliates also experience an increase in tangible assets and TFP.

We find evidence for relocation of employment to the parent shareholder for groups

Table 2.5.3: *Real outcomes - untreated affiliates*

	(1) $log(TFAS)$	(2) $log(EMP)$	(3) $log(TFP)$	(4) $log(TFAS)$	(5) $log(EMP)$	(6) $log(TFAS)$	(7) $log(EMP)$
EXP_{jt}	0.125***	0.0511***	0.0162***	0.317***	0.242***	0.191***	0.0846***
	(0.031)	(0.013)	(0.005)	(0.119)	(0.053)	(0.049)	(0.020)
$EXP_{jt} \times CIT_{it}$				-0.642*	-0.651***		
				(0.374)	(0.172)		
$CITDIST_{ijt}$						-0.204	0.0132
						(0.209)	(0.087)
$EXPit \times CITDIST_{ijt}$						-0.783*	-0.452**
						(0.400)	(0.182)
$log(Sales_{it-1})$	0.126***	0.0839***	0.0341***	0.126***	0.0839***	0.130***	0.0880***
	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.005)	(0.003)
$log(Empl.Cost_{it-1})$	0.182***	0.265***	-0.0231***	0.182***	0.265***	0.184***	0.260***
	(0.004)	(0.003)	(0.001)	(0.004)	(0.003)	(0.006)	(0.004)
Firm & Country-year FE	YES	YES	YES	YES	YES	YES	YES
N	1,003,700	934,425	707,574	1,003,700	934,425	524,283	484,852
R^2	0.940	0.967	0.776	0.940	0.967	0.942	0.970

The variable $CITDIST_{ijt} = CIT_{it} - \overline{T}_{ijt}$ measures the tax-distance to the relevant CFC threshold. Standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

that lose particularly attractive profit shifting opportunities. We find no evidence of an increase in shareholders' tangible assets or TFP.

Taken together with the evidence from Section 2.4 – suggesting that profits are reallocated to third countries to avoid CFC rules and domestic taxation – this implies that governments fail in their goal of reclaiming tax revenue.[27] Anyway, the small expected revenue effects should be weighed against the considerable administrative cost associated with the monitoring and enforcement of such a policy.

2.6 Conclusions

We analyze the reallocation of profits and real activity within multinational firms after an exogenous change in incentives to shift profit to particular locations. Our results illustrate that unilateral measures to prevent profit shifting - such as CFC rules - are effective in restricting profit shifting to particular locations, but have unintended consequences. While affected foreign affiliates are no longer used as entities to which profits are shifted, we do not find evidence that the domestic tax base increases. This highlights that mobile firms can easily avoid unilateral tax policies by reorganizing their

[27] Our findings are also consistent with the results in Wamser (2014). This paper shows that thin-capitalization rules on internal debt are easily avoided by substituting external for internal debt. The reason is that external debt is often not subject to thin-capitalization regulation.

tax-planning activities.

A central contribution of our paper is that we examine the specific reallocation behavior within MNEs. We provide conclusive evidence that MNEs re-optimize their profit shifting strategies if governments change their scope for tax planning. Our evidence suggests that the remaining tax differentials (which may still be substantial) and tax incentives to shift profits that are not covered by CFC rules allow firms to circumvent domestic taxation. It seems that home countries benefit very little compared to third countries above the threshold in terms of tax revenue. In additional robustness checks, we do not find any significant effect on domestic affiliates or profits at the shareholder level, while pre-tax profits in foreign subsidiaries just above the relevant threshold (determining treatment) increase significantly.

We also find that profit reallocation goes together with the reallocation of real activity. Employment declines in affected low-tax affiliates that are no longer attractive for profit shifting. Affiliates that become attractive as profit shifting destinations experience an increase not only in profits but also in real outcomes. In contrast, parent firms do not seem to be affected. We only find positive employment effects for parents that lose particularly attractive low-tax affiliates.

Let us note that our findings do not imply that CFC rules should be abolished altogether. The findings in previous literature as well as the results above suggest that CFC rules do have effects on MNEs' profit allocation. Without these policies in place, multinationals would have even more scope to exploit tax havens and avoid corporate taxation. CFC rules can also be a helpful measure to create a more level playing field for fully domestic firms that cannot engage in international tax planning. In fact, our findings provide additional support for initiatives of international tax coordination (closing tax loopholes) or a global minimum tax (with worldwide coverage).

Our results have policy implications. For all government actions and especially the recent tax policy initiatives, the case for state intervention seems to be straightforward. However, this intervention should be globally coordinated and it is absolutely key to get low-tax and tax haven countries on board. The costs of unilateral measures – more avoidance behavior, administrative and monitoring cost – clearly exceed the benefits. In fact, the latter seems to be non-existent when looking at bilateral parent-affiliate relationships.

2.A Appendix

2.A.1 Data

Table 2.A.1: *CFC legislation 2020*

	Country	ISO3	Ownership	Tax Threshold
1	Australia	AUS	50%	-
2	Argentina	ARG	50%	$CIT_{it} < 75\%\ CIT_{jt}$
3	Austria	AUT	50%	$CIT_{it} < 12{,}5\%$
4	Azerbaijan	AZE	20%	$CIT_{it} < 50\%\ CIT_{jt}$
5	Belgium	BEL	50%	$CIT_{it} < 50\%\ CIT_{jt}$
6	Brazil	BRA	50%	-
7	Bulgaria	BGR	5%	$CIT_{it} < 50\%\ CIT_{jt}$
8	Cabo Verde	CPV	25%	-
9	Canada	CAN	10%	-
10	Chile	CHL	50%	$CIT_{it} < 17{,}5\%$
11	China	CHN	50%	$CIT_{it} < 50\%\ CIT_{jt}$
12	Colombia	COL	50%	-
13	Croatia	HRV	50%	$CIT_{it} < 50\%\ CIT_{jt}$
14	Cyprus	CYP	50%	$CIT_{it} < 50\%\ CIT_{jt}$
15	Czech Republic	CZE	50%	$CIT_{it} < 50\%\ CIT_{jt}$
16	Denmark	DNK	50%	-
17	Estonia	EST	50%	-
18	Finland	FIN	25%	$CIT_{it} < 60\%\ CIT_{jt}$
19	France	FRA	50%	$CIT_{it} < 40\%\ CIT_{jt}$
20	Germany	DEU	50%	$CIT_{it} < 25\%$
21	Greece	GRC	50%	$CIT_{it} < 50\%\ CIT_{jt}$
22	Hungary	HUN	50%	$CIT_{it} < 50\%\ CIT_{jt}$
23	Iceland	ISL	50%	$CIT_{it} < 66.6\%\ CIT_{jt}$
24	Indonesia	IDN	50%	-
25	Ireland	IRE	50%	$CIT_{it} < 50\%\ CIT_{jt}$
26	Israel	ISR	50%	$CIT_{it} < 15\%$
27	Italy	ITA	50%	$CIT_{it} < 50\%\ CIT_{jt}$
28	Japan	JPN	50%	$CIT_{it} < 20\%$
29	Kazakhstan	KAZ	25%	$CIT_{it} < 10\%$
30	Korea, Rep.	KOR	10%	$CIT_{it} < 15\%$

31	Latvia	LVA	50%	-
32	Lithuania	LTU	50%	$CIT_{it} < 50\%\ CIT_{jt}$
33	Luxembourg	LUX	50%	$CIT_{it} < 50\%\ CIT_{jt}$
34	Malta	MLT	50%	$CIT_{it} < 50\%\ CIT_{jt}$
35	Mauritius	MUS	25%	$CIT_{it} < 50\%\ CIT_{jt}$
36	Mexico	MEX	0	$CIT_{it} < 75\%\ CIT_{jt}$
37	Mozambique	MOZ	25%	$CIT_{it} < 60\%\ CIT_{jt}$
38	Netherlands	NLD	50%	$CIT_{it} < 9\%$
39	New Zealand	NZL	50%	-
40	Norway	NOR	50%	$CIT_{it} < 67\%\ CIT_{jt}$
41	Pakistan	PAK	50%	$CIT_{it} < 60\%\ CIT_{jt}$
42	Peru	PER	50%	$CIT_{it} < 75\%\ CIT_{jt}$
43	Poland	POL	50%	$CIT_{it} < 50\%\ CIT_{jt}$
44	Portugal	PRT	25%	$CIT_{it} < 50\%\ CIT_{jt}$
45	Romania	ROU	50%	$CIT_{it} < 50\%\ CIT_{jt}$
46	Russian Federation	RUS	15%	$CIT_{it} < 75\%\ CIT_{jt}$
47	Sao Tome and Principe	STP	25%	$CIT_{it} < 60\%\ CIT_{jt}$
48	Slovak Republic	SVK	50%	$CIT_{it} < 50\%\ CIT_{jt}$
49	Slovenia	SVN	50%	$CIT_{it} < 50\%\ CIT_{jt}$
50	South Africa	ZAF	50%	$CIT_{it} < 67.5\%\ CIT_{jt}$
51	Spain	ESP	50%	$CIT_{it} < 75\%\ CIT_{jt}$
52	Sweden	SWE	25%	$CIT_{it} < 55\%\ CIT_{jt}$
53	Tajikistan	TJK	10%	$CIT_{it} < 70\%\ CIT_{jt}$
54	Turkey	TUR	50%	$CIT_{it} < 10\%$
55	United Kingdom	GBR	50%	$CIT_{it} < 75\%\ CIT_{jt}$
56	United States	USA	50%	-
57	Venezuela	VEN	0	$CIT_{it} < 20\%\ CIT_{jt}$

CFC rule details for all host countries in our sample. CIT_{it} denotes the affiliate country tax rate and CIT_{jt} denotes the parent country tax rate. For example, $CIT_{it} < 75\%\ CIT_{jt}$ thus implies that country j regards all host locations i with a tax rate lower then 75% of its own as a potential CFC location at time t.

Table 2.A.2: *Variable definitions and sources*

Variable	Definition and Source
$log(PTP_{it})$	Log of reported pre-tax profits of affiliate i at time t *Source: Orbis database*
$log(FA_{it})$	Log of fixed assets of affiliate i at time t *Source: Orbis database*
$log(TFAS_{it})$	Log of tangible fixed assets of affiliate i at time t *Source: Orbis database*
$log(EMP_{it})$	Log of number of employees of affiliate i at time t *Source: Orbis database*
$log(Sales_{it})$	Log of turnover of affiliate i at time t *Source: Orbis database*
$log(Empl.Cost_{it})$	Log of the cost of employees i at time t *Source: Orbis database*
$log(TFP_{it})$	Log of total factor productivity of affiliate i at time t *Source: Orbis database, own calculation*
CFC_{jit}	Dummy variable equal to one if country i is affected by country $j's$ CFC rule at time t *Source: RSIT ITI database*
CIT_{it}	Statutory corporate income tax rate of country i at time t *Source: RSIT ITI database*
EXP_{it}	Share of affiliates affected by CFC treatment in the firm group of affiliate i at time t *Source: Orbis database and RSIT ITI database*
$CITDIST_{it}$	Difference between the local CIT and the relevant CFC cut-off for affiliate i at time t *Source: Orbis database and RSIT ITI database*
$AV.NOTCH_{jt}$	Average tax notch at the affiliate level experienced by shareholder j at time t *Source: Orbis database and RSIT ITI database*
$MAX.NOTCH_{jt}$	Maximum tax notch at the affiliate level experienced by shareholder j at time t *Source: Orbis database and RSIT ITI database*
$log(GDP_{it})$	GDP at PPP in constant 2017 prices in country i at time t *Source: World Bank, World Development Indicators*
$log(GDP\ p.c._{it})$	GDP per capita in country i at time t *Source: World Bank, World Development Indicators*
$GDP\ growth_{it}$	GDP growth (annual %) in country i at time t *Source: World Bank, World Development Indicators*
$Inflation_{it}$	Inflation rate (annual %) in country i at time t *Source: World Bank, World Development Indicators*
$Unemployment_{it}$	Unemployment (% of total labor force) in country i at time t *Source: International Labour Organization, ILOSTAT*
$Corruption_{it}$	Control of Corruption index [-2.5; 2.5] in country i at time t *Source: World Bank, World Governance Indicators*

2.A.2 Additional results

Table 2.A.3: *CFC rules and financial profits*

Dep. variable: $log(Financial\ profits_{it})$	(1)	(2)	(3)	(4)
CFC_{ijt}	-0.134***	-0.160***	-0.111***	-0.136***
	(0.037)	(0.037)	(0.037)	(0.037)
CIT_{jt}	-0.00658	-0.0915	-0.0918	-0.150
	(0.201)	(0.203)	(0.207)	(0.209)
CIT_{it}	-0.377*	-0.212		
	(0.219)	(0.221)		
$log(FA_{it})$	0.184***		0.179***	
	(0.006)		(0.005)	
$log(Empl_{it})$	0.156***	0.110***	0.167***	0.117***
	(0.008)	(0.008)	(0.009)	(0.009)
$log(Sales_{it})$		0.221***		0.222***
		(0.007)		(0.007)
$log(GDP_{it})$	0.0176	-0.144		
	(0.582)	(0.568)		
$log(GDP\ p.c._{it})$	0.772	0.954		
	(0.601)	(0.585)		
$GDP\ growth_{it}$	-0.0293***	-0.0292***		
	(0.003)	(0.003)		
$Inflation_{it}$	-0.0139***	-0.0131***		
	(0.002)	(0.002)		
$Unemployment_{it}$	0.0157***	0.0167***		
	(0.003)	(0.003)		
$Corruption_{it}$	0.351***	0.369***		
	(0.047)	(0.048)		
Affiliate FE	YES	YES	YES	YES
Year FE	YES	YES		
Host-Year FE			YES	YES
N	404,621	397,991	404,680	398,052
R^2	0.872	0.876	0.874	0.878

CFC binary is an indicator variable that takes the value 1 if the respective affiliate is in a host country with a corporate income tax below the specified threshold. $\overline{CIT_{it}}$ *is centered around the mean tax rate for all treated affiliates in column (3). Standard errors clustered at the firm group level.*

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.A.4: *Effectiveness of CFC rules - robustness check*

Dep. variable: $log(PTP_{it})$	(1)	(2)	(3)	(4)
CFC_{ijt}	-0.0113	-0.0329**	-0.0528***	-0.0470***
	(0.015)	(0.014)	(0.017)	(0.016)
CIT_{it}		-0.637***		
		(0.085)		
$(1 - CFC_{ijt}) \times \overline{CIT_{it}}$			-0.659***	-0.659***
			(0.091)	(0.086)
$CFC_{ijt} \times \overline{CIT_{it}}$			-0.189	-0.0132
			(0.275)	(0.264)
CIT_{jt}		0.126		0.133*
		(0.078)		(0.079)
$log(FA_{it})$	0.0952***	0.102***	0.100***	0.102***
	(0.002)	(0.002)	(0.002)	(0.002)
$log(Empl_{it})$	0.290***	0.266***	0.271***	0.266***
	(0.004)	(0.004)	(0.004)	(0.004)
$log(Sales_{it})$				
$log(GDP_{it})$		-0.372***	-0.382***	-0.378***
		(0.133)	(0.144)	(0.133)
$log(GDP\ p.c._{it})$		0.823***	0.816***	0.834***
		(0.136)	(0.147)	(0.136)
$GDP\ growth_{it}$		0.0124***	0.00988***	0.0124***
		(0.001)	(0.001)	(0.001)
$Inflation_{it}$		-0.00499***	-0.00431***	-0.00498***
		(0.001)	(0.001)	(0.001)
$Unemployment_{it}$		-0.00705***	-0.00678***	-0.00693***
		(0.001)	(0.001)	(0.001)
$Corruption_{it}$		-0.130***	-0.118***	-0.131***
		(0.016)	(0.017)	(0.016)
Affiliate FE	YES	YES	YES	YES
Year FE		YES		YES
Pair FE		YES	YES	YES
Host-Year FE	YES			
Home-Year FE	YES		YES	
N	1,034,030	1,034,085	1,033,875	1,034,085
R^2	0.884	0.883	0.883	0.883

CFC binary is an indicator variable that takes the value 1 if the respective affiliate is in a host country with a corporate income tax below the specified threshold. Host CIT is centered around the mean tax rate for all treated affiliates in column (3) and (4). Standard errors clustered at the firm group level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.A.5: *Summary statistics - tax bins*

Bin	*Obs.*	*tax differential to parent*	*distance to threshold*	*affiliate tax rate*	*share of foreign affiliates*	*share with* $CIT_{it}<$ CIT_{jt}
1	102,454	0,08	0,01	0,22	1,00	1,00
2	73,164	0,07	0,03	0,21	0,97	0,96
3	301,782	0,02	0,05	0,24	0,30	0,26
4	184,917	0,01	0,07	0,26	0,41	0,27
5	165,680	0,00	0,09	0,25	0,40	0,15
6	87,750	0,00	0,11	0,26	0,76	0,29
7	104,051	-0,01	0,13	0,28	0,55	0,24
8	113,408	-0,02	0,15	0,31	0,41	0,12
9	109,534	-0,01	0,17	0,34	0,18	0,05
10	51,957	-0,03	0,19	0,36	0,34	0
11	28,220	-0,06	0,23	0,41	0,49	0

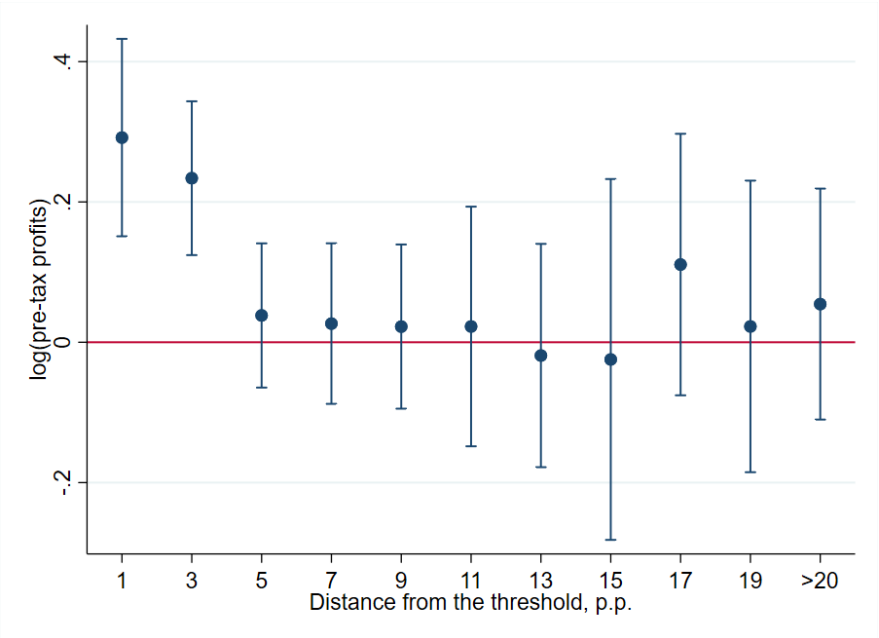
Mean values for each defined bin of affiliates above their threshold

Table 2.A.6: *Group exposure on domestic affiliates*

Dep. variable: $log(PTP_{it})$		
$(1 - DOM_{it}) \times EXP_{it}$	0.104**	(0.050)
$DOM_{it} \times EXP_{it}$	0.0540	(0.046)
CIT_{jt}	-0.124	(0.079)
$log(FA_{it})$	0.104***	(0.002)
$log(Empl_{it})$	0.261***	(0.004)
$log(GDP_{it})$	-0.187	(0.141)
$log(GDP\ p.c._{it})$	0.594***	(0.143)
$GDP\ growth_{it}$	0.0142***	(0.001)
$Inflation_{it}$	-0.00398***	(0.001)
$Unemployment_{it}$	-0.00941***	(0.001)
$Corruption_{it}$	-0.131***	(0.017)
N	939,832	
R^2	0.885	
Firm & Year FE	YES	

Includes affiliate and year fixed effects, affiliate controls include log(Fix.Assets), log(Empl), country controls include home and host CIT, inflation, corruption, unemployment, GDP level, growth and GDP per capita. Standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 2.A.1 : *Heterogeneity analysis - CIT bins, full sample*



Dependent variable log(pre-tax profit$_{it}$) of the affiliate. Estimations control for the log of fixed assets and employment, GDP level, growth and GDP per capita, inflation, unemployment and corruption. Affiliate and year fixed effects included, standard errors clustered at the firm-group level. Vertical lines represent 95% confidence intervals.

Figure 2.A.2 : *Profit reallocation after treatment - permutation test*

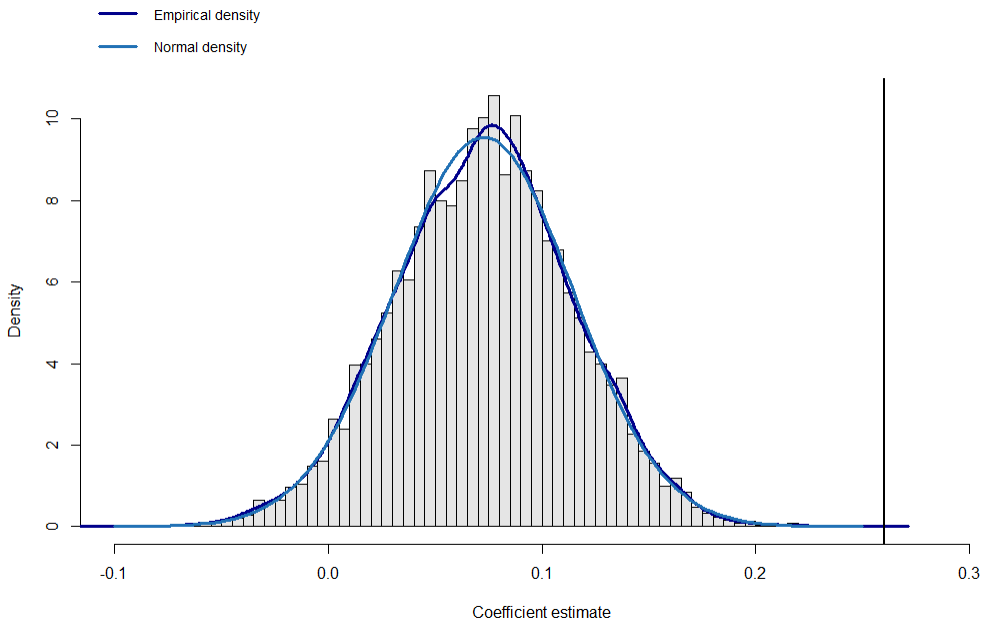


Figure shows the distribution of placebo estimates for coefficient on the interaction term $[tax_{it} \in tax_1] \times EXP_{it}$*, e.g., the effect of group exposure on affiliates located not more than 2 percentage points above their relevant CFC threshold. For each estimate, we randomly reassign the ranks of all affiliates in the estimation sample. The estimation is repeated 5000 times and results in the distribution of coefficients shown in the figure. The critical values of the fitted normal distribution are (-0.01 0.154), the coefficient estimated on the true ranks is* $\alpha_1 = 0.268$ *and is marked by the black vertical line.*

Table 2.A.7: *Robustness test - excluding all affiliates incorporated during the sample period (from 2010)*

Dep. variable: $log(PTP_{it})$		
$\mathbb{1}[Bin = 1] \times EXP$	0.336***	(0.074)
$\mathbb{1}[Bin = 2] \times EXP$	0.273***	(0.058)
$\mathbb{1}[Bin = 3] \times EXP$	0.0748	(0.054)
$\mathbb{1}[Bin = 4] \times EXP$	0.0419	(0.061)
$\mathbb{1}[Bin = 5] \times EXP$	0.0684	(0.062)
$\mathbb{1}[Bin = 6] \times EXP$	0.0256	(0.090)
$\mathbb{1}[Bin = 7] \times EXP$	-0.0182	(0.085)
$\mathbb{1}[Bin = 8] \times EXP$	-0.0336	(0.140)
$\mathbb{1}[Bin = 9] \times EXP$	0.0771	(0.098)
$\mathbb{1}[Bin = 10] \times EXP$	0.0252	(0.109)
$\mathbb{1}[Bin = 11] \times EXP$	0.121	(0.086)
N	787,200	
R^2	0.881	
Firm & Year FE	YES	

Includes only unaffected affiliates ranked 1st to 19th lowest tax neighbors (which includes 99% of all affiliates that are unaffected by CFC rules in our ample) in parent countries that have a defined CFC threshold. Includes affiliate and year fixed effects, affiliate controls include the log of fixed assets and employment, country controls include home and host CIT, inflation, corruption, unemployment, GDP level, growth and GDP per capita. Standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.A.8: *Robustness test - excluding all affiliates incorporated during the sample period (from 2010)*

Dep. variable: $log(PTP_{it})$		
$\mathbb{1}[Rank = 1] \times EXP$	0.120***	(0.038)
$\mathbb{1}[Rank = 2] \times EXP$	0.106**	(0.053)
$\mathbb{1}[Rank = 3] \times EXP$	0.0936	(0.064)
$\mathbb{1}[Rank = 4] \times EXP$	0.0604	(0.074)
$\mathbb{1}[Rank = 5] \times EXP$	0.0236	(0.081)
$\mathbb{1}[Rank = 6] \times EXP$	-0.0530	(0.104)
$\mathbb{1}[Rank = 7] \times EXP$	-0.116	(0.117)
$\mathbb{1}[Rank = 8] \times EXP$	0.141	(0.139)
$\mathbb{1}[Rank = 9] \times EXP$	0.0402	(0.167)
$\mathbb{1}[Rank = 10] \times EXP$	-0.0588	(0.175)
$\mathbb{1}[Rank = 11] \times EXP$	0.0946	(0.217)
$\mathbb{1}[Rank = 12] \times EXP$	0.294	(0.216)
$\mathbb{1}[Rank = 13] \times EXP$	0.147	(0.241)
$\mathbb{1}[Rank = 14] \times EXP$	0.189	(0.296)
$\mathbb{1}[Rank = 15] \times EXP$	0.197	(0.293)
$\mathbb{1}[Rank = 16] \times EXP$	-0.264	(0.405)
$\mathbb{1}[Rank = 17] \times EXP$	-0.153	(0.432)
$\mathbb{1}[Rank = 18] \times EXP$	-0.202	(0.465)
$\mathbb{1}[Rank = 19] \times EXP$	-0.379	(0.382)
N	780,265	
R^2	0.881	
Firm & Year FE	YES	

Includes only unaffected affiliates ranked 1st to 19th lowest tax neighbors (which includes 99% of all affiliates that are unaffected by CFC rules in our ample) in parent countries that have a defined CFC threshold. Includes affiliate and year fixed effects, affiliate controls include the log of fixed assets and employment, country controls include home and host CIT, inflation, corruption, unemployment, GDP level, growth and GDP per capita. Standard errors clustered at the firm group level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.A.9: *Industry composition of parent shareholders*

NACE sector	Number of shareholder firms	Relative frequency
A	1,271	0,6%
B	1,101	0,5%
C	72,943	35,3%
D	1,710	0,8%
E	907	0,4%
F	82,38	4,0%
G	41,514	20,1%
H	8,506	4,1%
I	1,485	0,7%
J	15,066	7,3%
K	13,056	6,3%
L	4,081	2,0%
M	24,160	11,7%
N	9,160	4,4%
O	99	0,0%
P	552	0,3%
Q	853	0,4%
R	826	0,4%
S	863	0,4%
T	2	0,0%
Total	206,393	100%

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Chapter 3

The Heterogeneous Effects of Tax Policy Along the Global Value Chain of MNEs [1]

ABSTRACT

This paper analyzes the real investment effects of different anti-tax avoidance rules (ATARs) on multinational enterprises (MNEs) in the context of their global value chain (GVC). By introducing a proxy for GVC positioning from the international trade literature, we show that the real effects of tax policy are highly heterogeneous along the production chain. In particular, we show that the introduction of transfer pricing (TP) regulation only has a significant negative impact on investment at the downstream end of the GVC. The analysis explores two potential explanations for this heterogeneity across firms.

[1] This paper is joint work with Nadine Riedel, Valeria Merlo and Georg Wamser.

3.1 Introduction

International organizations such as the Organization for Economic Co-operation and Development (OECD) and the European Union (EU) have long recognized the need to limit profit shifting by MNEs to protect their tax base and ensure the competitiveness of domestic enterprises. The OECD's project against Base Erosion and Profit Shifting (BEPS) is the largest comprehensive policy initiative to date that aims at limiting tax avoidance through various channels. The initiative proposes legal minimum standards related to firm financing, intra-firm sales, and the abuse of bilateral tax treaties. At the EU level, the anti-tax avoidance directive (ATAD) ensures the implementation of the OECD's guidelines into national law. Since its release in 2016, the ATAD has mandated all EU member countries to implement controlled foreign company legislation, some limitation of interest deduction, and more general anti-tax avoidance provisions in their national tax law. While the ATAD has not yet mandated any EU-wide standards for the regulation of transfer pricing, all EU and OECD countries have implemented some regulation on internal pricing over the past decade. Most countries even tightened their rules and require MNEs to provide detailed documentation on their internal pricing process.

Nevertheless, these policies affect more than the profit allocation within the firm group. There is extensive empirical and theoretical evidence that anti-tax avoidance measures can increase the cost of capital for MNEs and thus potentially have adverse investment effects (see Egger and Wamser, 2015; Buettner et al., 2018; Heckemeyer and Overesch, 2017, for a meta-study on the general tax elasticity of investment). Moreover, tighter anti-tax avoidance policies are often associated with substantial compliance costs to MNEs as they often require extensive legal documentation. To evaluate policy reforms such as the EU's ATAD, it is thus central to consider not only their effectiveness against profit shifting but also their potential economic cost. Conventionally, studies that focus on the economic cost of tax policy have done so by focusing on average effects which might lead to imprecise conclusions when there is a strong, underlying heterogeneity in the firms' responses. In this paper, we investigate one important yet under-explored dimension of firm heterogeneity which is their position in the global value chain. Having a global network of affiliates and exploiting their supply relationships is what allows large MNEs to effectively control the allocation of their profits. Transfer mispricing,

which is estimated to be the largest channel of profit shifting, in particular builds on intra-firm sales of intermediate goods and is thus inseparable from the analysis of GVC. At the country level, this analysis could help us to better understand the asymmetric effects of coordinated policy changes. The share of firms at each GVC position varies significantly at the country level which would lead to strongly differing real effects if there is a large heterogeneity of responses along the GVC. This paper is the first to provide descriptive evidence on the connection between taxes and GVC positioning and addresses the research questions: *How does an affiliate's position in the global value chain affect its response to changes in tax policy? Which channels can explain the heterogeneity in responses?*

We analyze these questions by combining an extensive hand-collected tax policy data set with firm-level data and a measure of GVC positioning from the international trade literature. This combination of data sources then allows us to assess the impact of tax policy changes at different points in the GVC. The baseline specification estimates the investment effect of changes in the local corporate tax rate and the introduction of the three most common anti-tax avoidance rules: controlled foreign company rules (CFC), thin-capitalization rules (TCR), and the introduction of strict transfer pricing rules (TP). The pattern that emerges from this analysis shows that firms at the downstream end of the global value chain, that is those closest to final consumption, are substantially more responsive to changes in the tax rate and TP regulation than other firms. For CFC rules and TCR, the pattern is pronounced. Most strikingly, the response to TP regulation appears to be solely driven by the most downstream affiliates that exhibit a strongly negative and significant response to the introduction of the policy. While it appears intuitive that transfer mispricing, which essentially shifts profits along an MNEs' value chain, has strongly heterogeneous investment effects, we provide extensive robustness tests for this finding. It is robust to different sizes of firm groups, the absence of tax haven locations in a group, and the presence of other ATARs. Finally, we discuss two potential channels for the behavior of downstream suppliers. One conceivable explanation would be that differences in enforcement (and enforceability) of transfer pricing rules along the GVC drive this pattern. The second potential explanation would be that upstream firms can more easily substitute transfer mispricing with alternative profit shifting channels which mitigates their investment

response. We provide suggestive evidence that affiliates with more passive income are also less responsive to TP regulation which supports this hypothesis.

This paper contributes to several strands of the literature. First, it adds to the general literature on the real effects of tax policy. There is an extensive literature studying the real effects associated with changes in the corporate tax rate and heterogeneous responses. There is a large literature on the tax elasticity of corporate investment, de Mooij and Ederveen (2003), de Mooij and Ederveen (2008) and Feld and Heckemeyer (2011) provide overviews of the empirical evidence as well as meta-analyses for the elasticity of foreign direct investment. We contribute to this literature by exploring the effect of GVC positioning on the elasticity of corporate investment. In our baseline estimation, the elasticity of corporate investment is nearly twice as strong for downstream affiliates compared to other firms. The subsequent analysis of profit shifting behavior and opportunities along the GVC helps us to understand the mechanisms behind this result.

The second, related strand of literature this paper contributes to is concerned with the real effect of ATARs. Buettner et al. (2018) jointly examine the investment effects of TP rules and TCR on German multinationals, while Egger and Wamser (2015) focus on the foreign direct investment response to CFC rules. Both studies find significant, negative effects on investment at the affiliate level. We extend this research by jointly analyzing transfer pricing, controlled foreign company, and thin-capitalization rules and examining investment responses of a global sample of MNEs. Closely related to our paper are de Mooij and Liu (2018) and de Mooij and Li Liu (2021) who examine the real effects of transfer pricing and thin-capitalization rules respectively. Both papers show that these ATARs raise the cost of capital for affected affiliates and thus reduce MNEs investment in these locations. de Mooij and Liu (2018) analyzes the investment effects of transfer pricing legislation in a difference-in-difference framework. The study shows that *on average* the introduction or tightening of TP rules has significant, negative effects. While we find similar (albeit smaller) effects on average, our baseline estimation shows that the response is almost solely driven by the downstream end of the value chain. de Mooij and Li Liu (2021) shows that TCR reduce the level of investment spending at the affiliate level and that this effect is increasing in the strictness of the TCR (measured by the associated safe-haven ratio), the firm-level debt-to-equity

ratio, and the local statutory tax rate. We contribute to this research by highlighting the importance of heterogeneous responses to tax policy along the GVC. Moreover, to the best of our knowledge, this is the first paper to jointly examine the real effects of the most common ATARs.

Third, it adds to the small but growing literature that investigates the connection between international trade and taxation. For our measure of GVC positioning, the upstreamness from final demand, we are building on the contributions by Antràs and Chor (2018) and Antràs (2020). Both studies describe the measurement of globalized production and outline the evolution of GVC over time. While there are many empirical studies that derive evidence for transfer mispricing from trade data (see Davies et al., 2018; Liu et al., 2020; Egger and Seidel, 2013; Cristea and Nguyen, 2016), there is only very limited evidence on the connection between intra-firm trade and profit shifting. Most closely related, Laffitte and Toubal (2019) show that U.S. MNEs often strategically place wholesale entities in low-tax locations while sourcing goods from manufacturers in more high-tax locations. We contribute to this literature by providing further evidence at the global level that sales entities, e.g. the downstream end of the value chain, are critically involved in transfer mispricing schemes. Moreover, to the best of our knowledge, this is the first paper to document that this asymmetry in profit shifting behavior also leads to asymmetric investment effects when transfer mispricing is limited by regulation.

The remainder of the paper is structured as follows: Section 5.3 presents our data sources and our empirical approach and introduces our measure of GVC positioning with descriptive correlations. Section 5.4 presents our baseline results for the heterogeneous responses to tax policy along the GVC. Section 3.4 provides extensive robustness tests for our findings and explores potential mechanisms while section 3.5 concludes.

3.2 Data and empiric approach

Our empirical analysis is based on an extensive firm-level dataset stemming from Bureau van Dijk's Orbis database for the time span between 2010 and 2019. The final dataset includes unconsolidated financial statements for over 700,000 affiliate-year observations together with information on the controlling shareholder of any given affiliate.

Table 3.2.1: *Descriptive statistics*

	Observations	Mean	S.D.	Median
Firm-level variables				
Investment spending	705,083	1.00	3.31	0.18
Sales	705,083	661.99	7829.71	53.84
Employees	705,083	140.62	760.91	22.00
Tax variables				
STR_{host}	705,083	0.27	0.07	0.27
STR_{home}	705,083	0.24	0.08	0.25
TP	705,083	0.86	0.35	1.00
$CFC_{bilateral}$	705,083	0.10	0.29	0.00
TCR	705,083	0.90	0.30	1.00
Country-level variables				
GDP	705,083	1316.19	1209.24	537.85
$GDP\ growth$	705,083	1.82	2.02	1.91
$Inflation$	705,083	1.37	1.44	1.23
$Unemployment\ rate$	705,083	9.89	5.20	8.81
$Corruption$	705,083	0.74	0.77	0.59
$Financial\ freedom$	705,083	65.74	10.29	70.00

Sales measured in 100,000 USD , GDP measured in billions.

Departing from Orbis' global ultimate owner structure, we construct firm groups centered around direct majority shareholders and their affiliates. This approach focuses on ownership relations in which the parent firm exerts a direct *controlling* influence over its affiliates. We assume that this controlling influence allows shareholders to engage their affiliates in profit shifting activities and thus reflects the relevant tax incentives more accurately. Furthermore, compared to the ultimate owner approach that includes indirect ownership, our definition of firm groups results in clear bilateral tax incentives from the owner's perspective. We exclude all affiliates that are not classified as "corporate" firms, e.g. all banks, insurance companies, and other financial institutions as they are often affected by specific tax regulations. We furthermore exclude all host locations with less than 100 affiliate observations so that the final dataset includes 125,406 unique affiliates in 33 countries.[1]

Firm-level variables. To examine the real effects of ATARs at the firm level, we focus on the yearly *investment rate* as our dependent variable. Following de Mooij and Liu (2018), investment spending is defined as the yearly change in tangible fixed assets

[1]See Table 3.A.2 for more detailed country statistics.

plus depreciation, scaled by the stock of tangible fixed assets in the previous year. This measure thus reflects the rate at which existing investment at the firm is renewed and extended. In the analysis, we include as the one-year lag of the log of sales and the number of employees to control for firm size.

Tax variables. All tax variables are taken from the RSIT's *international tax institution database* (ITI) which provides hand-collected datasets on statutory corporate tax rates and all relevant ATARs for a large sample of countries.[2] This source allows us to fully capture MNEs' tax incentives that are not only shaped by statutory and effective tax rates but also fundamentally impacted by *all* anti-tax avoidance measures in place. To the best of our knowledge, this is the first study to jointly examine the real effects of different ATARs in such a broad scope. While we focus on the effects of transfer price regulation, we are able to control for incentives from CFC rules and thin-capitalization rules. Both CFC rules and TCR directly affect investment at the affiliate level through an increase in the cost of capital (see Egger and Wamser, 2015; de Mooij and Li Liu, 2021). Therefore, it is essential to take them into consideration in our panel data context. Table 3.2.1 summarizes descriptive statistics for all variables. In line with Lohse and Riedel (2013), we recognize the importance of differences in the enforcement of transfer pricing regulation. Over the past years, as documented in Figure 3.A.1, more and more countries have implemented strict documentation requirements. Following OECD guidelines, many countries with existing TP rules have tightened their legislation and require MNEs to provide extensive documentation on their internal pricing processes. Consequently, the dummy variable TP indicates which countries have transfer pricing regulation *with* legally required documentation in place. In addition to the TP dummy variable, we are using the variable CFC to indicate if an affiliate is treated by a CFC rule in the resident country of its parent shareholder. For TCR, we summarize all countries that have implemented some limitation on the deductability of interest expenses, either in the form of a thin-capitalization or an earnings-stripping rule, with the variable TCR.

GVC positioning. There is only very limited literature on the link between tax policy and global value chains. One challenge in this field is to capture the production stage of a given firm together with its responses to changes in taxation. Data on intra-

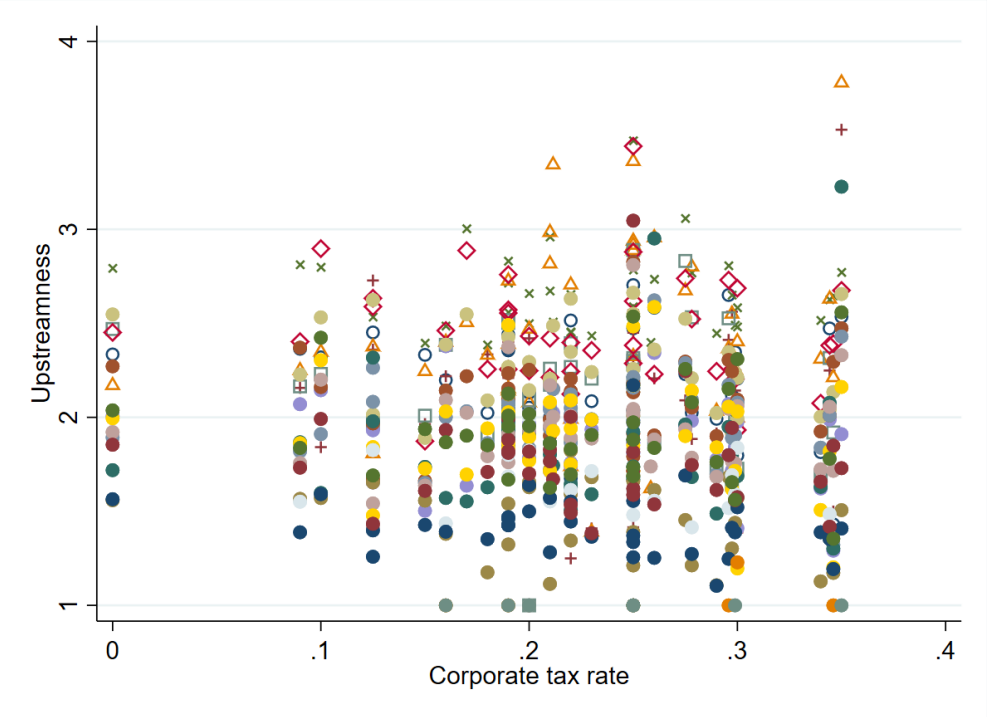
[2]For more information, see www.rsit-uni-tuebingen.de/data.

firm trade within MNEs would be the most precise way to measure the production linkages between affiliated companies. This type of firm-level trade data, however, is only available for a very limited number of countries and is thus not sufficient to study GVC in the context of international taxation.[3] Since we are particularly interested in the value chains within MNE, we overcome this limitation by building on a measure of GVC positioning developed by Antràs and Chor (2018). The authors use international input-output tables that contain the usage of intermediate goods from any given country-industry pair in the production of other country-industries. The measure we are exploiting in our analysis, the *upstreamness from final consumption*, thus reflects the share of a country-industry cell's output that is used as intermediates in another production stage compared to the share that is sold to final customers. Rather than simply calculating the share of final consumption in the total output of any industry, Antràs and Chor (2018) additionally considers variation in the stage that intermediate goods enter into other industries' production chains. By iteratively computing the contribution to the final output of downstream intermediates, they create an index that ranks industries more upstream if their output enters earlier in the production process. We compute their index using the World Input-Output Database (WIOD) (Timmer et al. (2015)) for all available years. In doing so, we obtain a measure of upstreamness for each country-industry combination in the WIOD that we can map to the firms in our sample. This mapping implies the assumption that every firm within a country-industry cluster operates at the same GVC position.

Figure 3.2.1 illustrates the relationship between taxes and GVC positioning at the sectoral level for the latest year in our data. Individual symbols represent different industries across countries, giving us a sense of the dispersion of upstreamness within and across sectors. Unsurprisingly, there is no clear correlation between the corporate tax rate and the value chain position. Although there is empirical evidence that taxation affects the location choice of firms (see Merlo et al., 2020), other factors such as labor and transportation cost heavily influence the geographical pattern of industries. In Figure 3.2.1, the same type of dot represents the same industry across countries revealing that, while some industries are generally more upstream than others, there is

[3]Carvalho et al. (2021) analyze the impact of the great earthquake in 2011 on Japanese supply chains using detailed data on intra-firm trade, while Dhyne et al. (2021) use Belgian firm-level data to calibrate a model of shock propagation through intra-firm linkages

Figure 3.2.1: *Taxes and GVC positioning, 2019*



Dots represent country-industry pairs, symbols represent individual industries.

substantial cross-country variation. The aim of the following analysis is to investigate patterns in the response to tax changes that are related to this heterogeneity in GVC positioning exploiting both the variation across industries and countries. We hypothesize that the position a firm takes within its MNE network fundamentally affects its ability to adapt to changes in taxation. Following Buettner et al. (2018), we assume that firms with better profit shifting opportunities will be less responsive to changes in taxation as they are able to partially avoid any additional tax burden. In the following, we investigate whether the underlying production network of the MNE can explain some of the heterogeneity in profit shifting opportunities. Analyzing the link between GVC position and tax response is critical for understanding the distribution of economic cost following changes in tax policy.

Country-level variables. We are supplementing the firm-level data with country-level control variables from the World Bank's World Development and Governance Indicators. Market size and economic growth are important determinants for firms' investment behavior, so we include the log of a country's GDP and the GDP growth rate in all specifications. Additionally, we control for the inflation rate, the unemployment

rate, the perception of corruption to account for business cycle and institutional factors, as well as an index of financial freedom from the Heritage Foundation to capture the accessibility of financial markets.

We denote the dependent variable, the investment rate, as y_{it} for affiliate i at time t in industry k. To test whether TP regulation affects firm outcome, we estimate

$$y_{ikt} = \sum_{j=1}^{5} \beta_j \times TAX_{it} \times \mathbb{1}[i \in Quintile_j] + \beta_x X_{it} + \alpha_i + \alpha_{kt} + \epsilon_{ikt}, \tag{3.2.1}$$

where α_i refers to affiliate-specific fixed effects and α_{kt} captures industry-year-specific fixed effects. X_{it} represents the vector of control variables and ϵ_{ikt} an error term. To examine the effects of tax policy changes along the global value chain, we define yearly *quintiles* of the upstreamness index that we introduced before. So within each year, we assign each country-sector to its position in the value chain. The variable TAX_{it} will represent the *statutory tax rate* or a dummy variable representing the presence of *transfer pricing*, *controlled foreign company* or *thin-capitalization rules* respectively.[4] When TAX_{it} represents the STR, the coefficient β_j estimates the elasticity of investment in the j_{th} quintile. This way, we are able to uncover heterogeneous tax elasticities along the GVC. Similarly, interacting the ATAR dummy variables with the quintile indicator gives us heterogeneous estimates for the effects of anti-profit shifting legislation at different production stages. All specifications include affiliate and industry-year fixed effects to account for time-constant characteristics, while the reported standard errors are clustered at the host country-year level to account for potential serial correlation.

3.3 Baseline results

This section presents our results on MNEs' heterogeneous responses to taxes and anti-tax avoidance policies along their GVC. This is the first analysis to jointly examine the real effects of all relevant ATARs and the role of GVC positioning. We begin by presenting the baseline results estimating equation 3.2.1, followed by a series of robustness tests and the discussion of potential channels for our findings.

Table 3.3.1 presents the baseline estimation results. The dependent variable in each

[4] We summarize thin-capitalization and earnings-stripping rules under one dummy variable as they both impose limits on interest deductions.

specification is *investment spending* and columns (1)-(4) explore the heterogeneous investment effects of the statutory tax rate and our anti-tax avoidance rules. Column (1) focuses on the investment response to changes in the corporate tax rate. By interacting the statutory tax rate with the indicator variables for each quintile, we estimate the investment response within each group. The point estimates suggest that the response in the first quintile Q_1, which is the most *downstream* group, is almost twice as strong compared to all other sectors. Quantitatively, a 1 percentage point increase in the tax rate translates into a 1.45 percentage points reduction of the investment rate (which is defined as the investment relative to the stock of tangible fixed assets). In comparison, in Q_5, the most upstream quintile, the same increase in corporate taxes only leads to a 0.66 percentage point decrease in the investment rate.[5] This is the first substantial heterogeneity that we uncover. Firms at the downstream end of the GVC are significantly more responsive to changes in their host country's tax rate.

Specifications (2)-(4) similarly explore the heterogeneous effects of ATARs along the GVC. The *Tax measure* in Table 3.3.1 refers to the respective rule and we additionally control for the local statutory tax rate in all specifications. Starting with the introduction of strict transfer pricing regulation in column (2), we find a similar pattern. While the coefficients for all quintiles are negative, only firms in Q_1 display a significant negative response to TP regulation. The point estimate indicates that these firms with strict TP rules in their host country display a 16.7 percentage points lower investment rate on average compared to firms in the same quintile without such regulations. For firms in the more upstream quintiles, the effect ranges from -2.95 to 0.56 percentage points but remains statistically insignificant. However, this does not necessarily mean that only downstream firms are affected by TP regulation. The lack of a significant investment response might also be explained by a substitution to other profit shifting channels. In section 3.4, we explore this heterogeneity in the reaction to TP rules more closely and discuss potential channels.

Columns (3) and (4) use CFC rules and TCR as the relevant anti-tax avoidance measure. Within the quintiles of our upstreamness measure, CFC rules are not associ-

[5]Since the dependent variable here is the investment rate, we cannot directly interpret the coefficients directly as (semi-) elasticities. However, referring to the descriptive statistics presented in Table 3.2.1 shows that the mean investment rate is very close to 1. This implies that the coefficients in Table 3.3.1 are approximations to the percentage change at the sample mean. Additionally, Table 3.4.1 reports the sub-sample specific mean for each estimation.

Table 3.3.1: *Investment effects and GVC positioning*

	Tax measure			
Dep. variable:	(1)	(2)	(3)	(4)
Investment spending	STR	TP	CFC	TCR
Tax measure $\times Q_1$	-1.445***	-0.167**	-0.0638	-0.129*
	(0.367)	(0.077)	(0.095)	(0.067)
Tax measure $\times Q_2$	-0.892**	-0.00103	-0.154	-0.00707
	(0.345)	(0.060)	(0.109)	(0.064)
Tax measure $\times Q_3$	-0.580**	0.00566	-0.0801	0.0275
	(0.270)	(0.043)	(0.066)	(0.034)
Tax measure $\times Q_4$	-0.670**	-0.00979	-0.0489	-0.00772
	(0.272)	(0.037)	(0.040)	(0.039)
Tax measure $\times Q_5$	-0.655**	-0.0295	-0.0457	0.00282
	(0.270)	(0.036)	(0.038)	(0.042)
STR		-0.714***	-0.772***	-0.743***
		(0.255)	(0.268)	(0.262)
$log(sales_{t-1})$	-0.120***	-0.120***	-0.120***	-0.120***
	(0.015)	(0.015)	(0.015)	(0.015)
$log(empl_{t-1})$	-0.337***	-0.337***	-0.337***	-0.337***
	(0.019)	(0.019)	(0.019)	(0.019)
$log(GDP)$	-0.217	-0.220	-0.219	-0.208
	(0.267)	(0.271)	(0.272)	(0.272)
$GDP\ growth$	0.00606	0.00671	0.00670	0.00616
	(0.006)	(0.006)	(0.006)	(0.006)
$Inflation$	-0.00183	-0.00127	-0.00187	-0.00218
	(0.009)	(0.009)	(0.009)	(0.009)
$Financial\ freedom$	0.00174	0.00185	0.00184	0.00192
	(0.002)	(0.002)	(0.002)	(0.002)
$Corruption$	-0.328***	-0.334***	-0.335***	-0.338***
	(0.074)	(0.074)	(0.074)	(0.074)
Firm & Year FE	YES	YES	YES	YES
R^2	0.414	0.414	0.414	0.414
N	705,083	705,083	705,083	705,083

Standard errors clustered at the country-year level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

ated with a significant investment response. Table 3.A.3 in the Appendix reports the level effects for each measure as a comparison where we observe a weakly significant negative effect for CFC rules. For TCR, there is a weakly significant negative effect in the most downstream quintile, while the point estimate in Table 3.A.3 remains insignificant. Across all specifications the statutory corporate tax rate has a significant negative effect on investment.

3.4 Robustness tests and channels

To test the robustness of our results, we conduct several robustness checks summarized in Table 3.4.1. We are mainly interested in the finding from Table 3.3.1 that downstream affiliates are the most responsive to changes in TP regulation. In this section, we test the robustness of this result and investigate potential mechanisms. As most robustness tests involve a reduction in sample size, we are not using the full set of quintiles from Section 3.3. Instead, this section compares the reaction of the most downstream subsidiaries in any given group, indicated by the variable $salesfirm$, to the remaining firm group. In line with the findings from Table 3.3.1, we expect these firms to display a significantly stronger reaction to TP regulation compared to other firms in the same group. We begin our set of robustness tests by testing the findings from above on different subsamples in Table 3.4.1. Then, we briefly discuss the dynamics of the investment response before analyzing potential mechanisms behind our results in Table 3.4.2.

Column (1) of Table 3.4.1 replicates the finding from Table 3.3.1 for the $salesfirm$ dummy variable. The interaction between the transfer pricing and the $salesfirm$ dummy variable capture the *difference* in response between the most downstream entity of a group, the $salesfirm$ and the remaining group. In columns (2) and (3) of Table 3.4.1, we explore the robustness of the effect to different sizes of firm groups. A potential concern about our interpretation of the results from Table 3.3.1 could be that they are driven by very small firm groups whose affiliates happen to fall into a very downstream industry. By limiting the sample to larger firm groups in columns (2) and (3), we can ensure that the effects are not solely driven by the smallest groups. The coefficients for the interaction term decrease from -0.125 to -0.333 when including all groups with $N \geqq 5$ affiliates and even to -0.564 when we limit the sample to groups with $N \geqq 10$ affiliates. This implies that the effect on the most downstream affiliates relative to the remaining firm group becomes *stronger* the larger the group size in the sample. This result also makes us confident that our findings reflect a significant difference between the most downstream part of an MNE and the remaining group.

Typically, the downstream part of the firm network belongs to the *wholesale and retail* sector. These firms operate as selling points for the goods manufactured more upstream in the GVC. We suspect that these wholesale units are a driving factor for the heterogeneity observed in Table 3.3.1. Therefore, column (4) excludes *all wholesale*

entities from the sample, but the difference between the $salesfirm$ and the rest of the group remains significant and similar in size to the effect in column (1). This finding indicates that the most downstream entities within an MNE respond to the introduction of transfer pricing rules, even when they are not wholesalers. Excluding wholesalers drastically reduces the sample size compared to 3.3.1 which also suggests that they make up a significant share of all affiliates in our estimation. Later in this section, we attempt to further analyze firm-level characteristics that could help to understand this response heterogeneity.

An additional characteristic of firm groups that might affect their response to tax policy is their access to profit shifting opportunities. MNEs with access to tax haven locations might be overall less responsive to changes in tax policy as they are able to partially avoid the additional tax burden by shifting profits to their tax haven affiliates. Therefore, in column (5), we exclude all firm groups from the estimation that hold at least one subsidiary in a tax haven location.[6] The results are quantitatively very close to those in column (1), tax haven access does not appear to have a significant impact on the reaction pattern to TP regulation. In the context of our analysis and in conjunction with the pattern from 3.3.1, this result further suggests that profit shifting through transfer mispricing along the GVC and profit shifting through financial income schemes are operated independently of each other. Tax haven access does not appear to mitigate the investment effects of TP regulation for affected downstream suppliers.

When analyzing the investment response at the firm level, it is important to distinguish between profit and loss-making firms. An increase in the tax burden does not immediately affect loss-making firms, in particular, if they are able to carry their losses forward into later periods. Moreover, loss-making firms are likely also liquidity-constraint which further limits their investment capacity. In column (6), we thus exclude all affiliates reporting positive profits from our sample. The interaction term turns insignificant for this sample, while the coefficient for the introduction of TP rules even turns positive and weakly significant. Additionally, the effect of the local corporate tax rate also becomes insignificant and positive. Loss-making firms are thus responding markedly different to changes in their tax incentives compared to profitable entities.

[6] We follow Hines (2010) in the definition of tax haven locations

Table 3.4.1: *Robustness tests - transfer pricing*

Dep. variable: Investment spending	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
STR	-0.705***	-0.353	-0.111	-0.741***	-0.722***	0.391	-1.421	-0.727**
	(0.255)	(0.247)	(0.284)	(0.260)	(0.258)	(0.500)	(0.860)	(0.284)
TP	0.0135	-0.0318	-0.0243	0.0347	0.0217	0.212*	-1.001*	0.0162
	(0.032)	(0.033)	(0.051)	(0.033)	(0.034)	(0.127)	(0.602)	(0.033)
$salesfirm$	0.0456	0.243	0.518*	0.0663	0.0412	-0.127	0.0496	0.0445
	(0.043)	(0.157)	(0.278)	(0.057)	(0.046)	(0.143)	(0.162)	(0.044)
$TP \times salesfirm$	-0.125***	-0.333**	-0.564*	-0.133**	-0.134***	-0.00146	-0.268	-0.126***
	(0.043)	(0.164)	(0.294)	(0.057)	(0.047)	(0.145)	(0.207)	(0.043)
$log(sales_{t-1})$	-0.120***	-0.147***	-0.159***	-0.140***	-0.114***	-0.0475**	-0.109***	-0.122***
	(0.015)	(0.026)	(0.032)	(0.015)	(0.015)	(0.019)	(0.022)	(0.017)
$log(empl_{t-1})$	-0.337***	-0.352***	-0.337***	-0.293***	-0.332***	-0.347***	-0.327***	-0.365***
	(0.019)	(0.033)	(0.038)	(0.020)	(0.021)	(0.033)	(0.046)	(0.018)
$log(GDP)$	-0.232	0.590*	1.460***	-0.363	-0.399	-1.082**	-1.018	-0.333
	(0.275)	(0.323)	(0.386)	(0.281)	(0.266)	(0.452)	(0.680)	(0.280)
$GDP\ growth$	0.00701	0.0175***	0.0170**	0.0110*	0.00445	-0.000642	0.00985	0.00943
	(0.006)	(0.007)	(0.008)	(0.006)	(0.006)	(0.011)	(0.012)	(0.007)
$Inflation$	-0.00181	0.00495	0.00435	-0.00213	-0.000514	-0.00379	0.00406	-0.00316
	(0.009)	(0.010)	(0.013)	(0.009)	(0.009)	(0.014)	(0.011)	(0.010)
$Financial\ freedom$	0.00172	-0.00129	0.000673	0.00123	0.00142	0.00171	0.00994	0.00241
	(0.002)	(0.003)	(0.004)	(0.003)	(0.002)	(0.005)	(0.007)	(0.002)
$Corruption$	-0.328***	-0.238***	-0.314***	-0.323***	-0.329***	-0.360***	0.208	-0.346***
	(0.074)	(0.083)	(0.100)	(0.077)	(0.072)	(0.110)	(0.138)	(0.077)
Sample	Full	$N \geqq 5$	$N \geqq 10$	Exclude Wholesale	No tax haven access	Loss-making firms	Affected by CFC rule	TCR in place
Mean invest. rate	0.998	0.983	0.937	0.965	0.991	1.027	0.800	0.990
Firm & Year FE	YES	YES	YES	YES	YES	YES	YES	YES
N	705,083	244,658	132,656	493,530	629,693	152,280	65,747	631,631
R^2	0.414	0.461	0.460	0.437	0.414	0.553	0.312	0.422

Standard errors in parentheses clustered at the host country-by-year level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Lastly, columns (7) and (8) explore the effect the presence of other ATARs has on the reaction to TP legislation. Column (7) only includes affiliates that are directly affected by the CFC legislation imposed by their parent's home country. The effects are more similar to sample of loss-making firms. The effect of TP rules is negative and weakly significant, while the interaction term remains insignificant. Affiliates that are affected by CFC rules are typically located in low-tax and tax haven locations and carry out only little real economic activity which could explain why we do not observe the same pattern in their investment effects. In column (8), we focus on locations that have thin-capitalization rules in place. Here, the estimates are very close to the benchmark specification in column (1). Almost all countries in our sample period have implemented some form of TCR, which likely explains this finding.

We also want to provide a brief discussion on the dynamics of the investment response. Figures 3.A.2 and 3.A.3 in the Appendix provide event-study estimates for the implementation of strict TP regulation. We test for anticipatory effects up to two periods prior to the change in legislation and delayed responses up to three years after. For this estimation, we employ a novel event study estimator developed by Sun and Abraham (2021). This estimator is part of an emerging econometric literature that explicitly addresses the shortcomings of conventional two-way fixed effects estimators in staggered event study settings. Additionally, the approach by Sun and Abraham (2021) allows us to use either the never-treated (NT) group or the last-treated (LT) group of affiliates as the control group. Our preferred specification uses the last-treated cohort as the number of countries that never introduce TP regulation is rather small. 3.A.2 uses the entire sample, while Figure 3.A.3 limits the sample to entities in the wholesale sector. Wholesalers are generally the closest to final demand, so this sample split allows us to further validate our findings from Table 3.4.1. As expected, the effects are more pronounced in the wholesale sample. The effect only becomes significant and negative in the first period after the change, while all other coefficients remain insignificant. The magnitude of effects is in line with our baseline estimates and we conclude that most of the investment response manifests in the first period after the regulatory change.

In the following, we examine two potential channels behind the observed heterogeneity along the GVC. The first mechanism relates to the enforcement of transfer pricing regulation. Downstream firms and wholesale companies could be particularly

affected by TP rules because they are generally active in markets with better comparable prices. Consumer goods typically have transparent market prices that can be easily compared. Manufacturers, in particular those upstream in the value chain, often produce highly specific input goods that are not sold outside of the firm group. This would make it harder for tax authorities to determine what the "fair market value" of the transaction would be. Moreover, transfer prices for firm-specific inputs are often calculated using a so-called cost-plus method. In the cost-plus approach, transfer prices are determined by the cost of production on the suppliers' side. This eliminates the need for comparable uncontrolled prices but at the same time, it might give firms more leeway on their price setting, for example, by overstating the research and development cost for an intermediate. In their transfer pricing guidelines (OECD, 2022), the OECD recommends, whenever feasible, to use comparable uncontrolled prices as the benchmark value which highlights the additional challenges for enforcement under the cost-plus approach.

The second channel is related to tax avoidance strategies in a broader sense. Even if enforcement was equally feasible for all firms, we might find heterogeneous real effects if some firms are not as involved in transfer pricing or can substitute it for different profit shifting channels. Naturally, we cannot directly observe to which extent firms use different tax avoidance strategies. We are able, however, to observe some firm characteristics that are indicative of financial planning. Figure 3.A.4 plots the distribution of the log of intangible assets for wholesale and manufacturing firms respectively.[7] It illustrates how retail and wholesale firms have fewer intangible assets compared to manufacturers, their distribution is shifted to the left. The stock of intangible assets could include intellectual property rights, patents, or other non-physical assets. In the case of manufacturing firms, we could think of patent rights for highly specialized production processes. Apart from protecting intellectual property, these intangible assets can also be used to control the allocation of profits within the firm group. While Figure 3.A.4 descriptively shows the difference between wholesale and manufacturing firms, Table 3.4.2 includes financial income in the estimation above. Column (1) includes an interaction of our transfer pricing rule dummy and the log of intangible assets. As noted

[7]Note that intangible assets are an imperfect measure since self-developed assets are not necessarily reported in firms' balance sheets. This measure can only give an approximation of firms' passive assets but it nevertheless allows for a useful comparison across sectors.

Table 3.4.2: *Financial income channel*

Dep. variable: Investment spending	(1)	(2)	(3)
STR	-0.946***	-0.826***	-0.762***
	(0.328)	(0.235)	(0.256)
TP	-1.487***	-0.0947	
	(0.117)	(0.062)	
$TP \times log(int.assets)$	0.130***		
	(0.009)		
$TP \times log(fin.assets)$		0.00828*	
		(0.004)	
$TP \times Q1_{income\ ratio}$			-0.0938*
			(0.049)
$TP \times Q2_{income\ ratio}$			-0.0655
			(0.048)
$TP \times Q3_{income\ ratio}$			-0.0509
			(0.049)
$TP \times Q4_{income\ ratio}$			-0.0743
			(0.052)
$TP \times Q5_{income\ ratio}$			-0.0689
			(0.051)
Firm & Year FE	YES	YES	YES
N	403,275	413,026	504,997
R^2	0.517	0.464	0.420

Includes firm and country-level control variables. Standard errors clustered at the host country-by-year level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

before, the reporting of intangible assets in balance sheet data can be flawed. Nevertheless, we find that, in line with expectations, the firms with the lowest intangible assets show the strongest reaction to TP rules. The same holds true when we exchange our measure of passive assets for financial assets reported in our data. Since both intangible and financial assets are reported only for a smaller subsample of our data, column (3) uses the financial-to-operating profit ratio as a proxy for passive income. This substantially increases our sample even though we can only include firms with positive operating profits. We find the same pattern, firms with the lowest financial activity are the most responsive to transfer pricing regulation. Here, we conclude that the observed heterogeneity along the global value chain is at least partially explained by differences in profit shifting strategies. Firms with limited access to profit shifting through financial schemes significantly reduce their investment spending in response to

transfer pricing regulation.

This explanation is further supported by the findings in Laffitte and Toubal (2019). Their analysis shows that U.S. MNEs over-proportionally use low-tax locations to operate their sales. If these affiliates are predominantly established for tax purposes, stricter transfer pricing rules (and thus higher costs for transfer mispricing) plausibly explain the significant reduction of investment in these locations.

3.5 Conclusion

This paper analyzes the real economic effects associated with the most common anti-tax avoidance rules. We focus on the quantitatively largest channel, transfer mispricing, where we uncover substantial effect heterogeneity along the supply chain. Building on a measure of global value chain positioning from the international trade literature, this paper is the first to discuss the importance of production stages for the effects of tax policy. The empirical results show that while the average effect of strict TP legislation is significant and negative, it appears to be driven solely by the firms most downstream in the global value chain. Specifically, we find that wholesale companies reduce their investment spending by approximately 11.3% which is more than twice as much as estimated in the benchmark specification. We propose two potential explanations for the strong reaction of downstream firms: First, being active in more transparent consumer markets could simplify enforcement for tax authorities. Second, affiliates more upstream could be less engaged in transfer mispricing or might find it easier to substitute other channels of profit shifting. This pattern is unique to the introduction of strict transfer pricing rules. CFC and thin-capitalization rules that are targeted at profit shifting through financial schemes, do not follow the same pattern. Since these profit shifting strategies are independent of the production process, there are no significant heterogeneities along the value chain. This finding highlights the relevance of global value chains for profit shifting and tax policy. In the last part of the analysis, we explore how the location choice of MNEs reacts to changes in the tax environment. Using data on new bilateral incorporations, our extensive dataset on tax policy variables, and a fractional probit model, we are able to quantify the negative impact of corporate tax and ATARs on firms' location choice. There are sizable negative effects of tax rates

and ATARs on the bilateral share of incorporations. The effects of ATARs are most pronounced for the host countries with the lowest tax rates.

These findings are relevant for policymakers and coordinated policy initiatives such as the BEPS project. Limiting profit shifting by MNEs is feasible through the various unilateral policy measure outlined in this study. However, these policies are associated with economic cost in the form of lost real investment. These losses will most likely affect countries asymmetrically, depending on the global value chain positioning. One drawback of our analysis is that we are not able to weigh the gains in tax revenue against the losses in real investment. Future research could focus more specifically on this trade-off at the country level.

3.A Appendix

3.A.1 Data

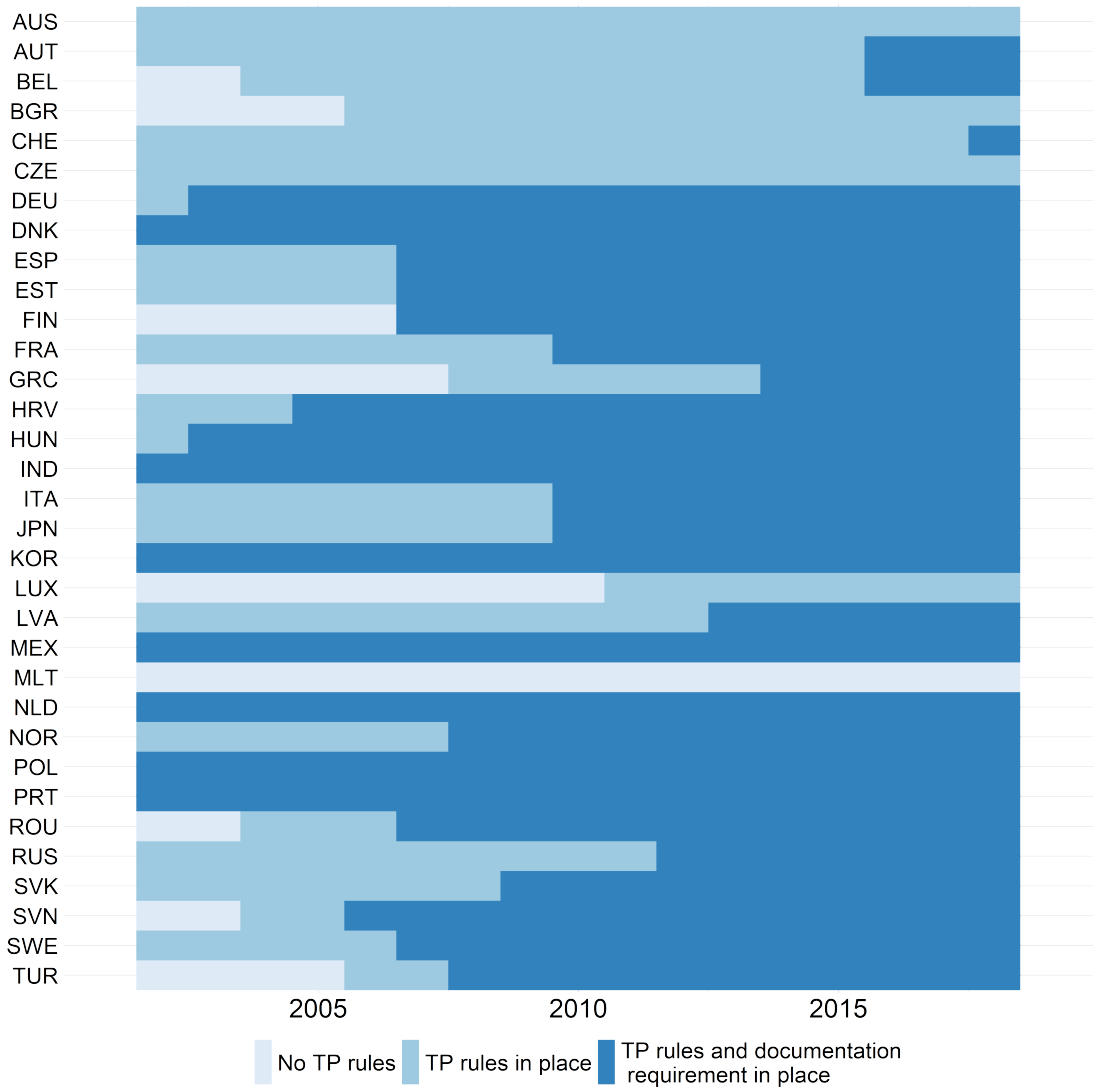
Table 3.A.1: *Variable definitions*

Variable	Definition and Source
STR	Statutory corporate income tax rate of the affiliate country *Source: RSIT ITI database*
TP	Dummy variable equal to one if the affiliate country has implemented a strict TP rule (incl. documentation requirements) *Source: RSIT ITI database*
TCR	Dummy variable equal to one if the affiliate country has implemented a TCR *Source: RSIT ITI database*
CFC	Dummy variable equal to one if the affiliate country is affected by the parent country's CFC rule *Source: RSIT ITI database*
$log(sales_{t-1})$	Log of total sales in the previous period *Source: Orbis database*
$log(empl_{t-1})$	Log of the number of employees in the previous period *Source: Orbis database*
$log(GDP)$	GDP at PPP in constant 2017 prices *Source: World Bank, World Development Indicators*
$GDP\ growth_{it}$	GDP growth (annual %) *Source: World Bank, World Development Indicators*
$Inflation_{it}$	Inflation rate (annual %) *Source: World Bank, World Development Indicators*
$Financial\ freedom$	Financial freedom index [0;100] *Source: Heritage foundation*
$Corruption_{it}$	Control of Corruption index [-2.5; 2.5] *Source: World Bank, World Governance Indicators*

Table 3.A.2: *Country statistics*

Country	Introduction year of documentation requirements (strict TP rules)	Freq.
AUS	-	280
AUT	2016	6,475
BEL	2016	31,287
BGR	-	25,885
CHE	2018	50
CZE	-	49,327
DEU	2003	30,609
DNK	1999	3,291
ESP	2006	78,588
EST	2007	9,206
FIN	2007	14,591
FRA	2010	67,781
GRC	2014	4,100
HRV	2005	16,494
HUN	2003	10,802
IND	2001	32
ITA	2010	110,215
JPN	2010	4,158
KOR	1996	9,900
LUX	-	1,534
LVA	2013	1,108
MEX	1997	2
MLT	-	71
NLD	2002	2,720
NOR	2008	8,551
POL	2000	12,043
PRT	2002	28,127
ROU	2007	85,403
RUS	2012	209
SVK	2009	38,262
SVN	2006	11,183
SWE	2007	42,791
TUR	2007	8
Total		705,083

Figure 3.A.1: *Introduction of transfer pricing rules*



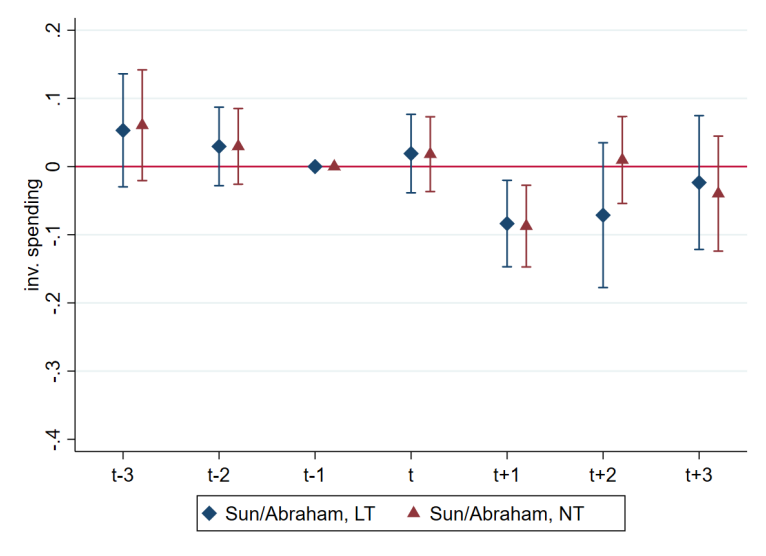
3.A.2 Additional results

Table 3.A.3: *Benchmark results - investment rate*

Dep. variable: Investment spending	(1)	(2)	(3)	(4)
STR	-0.728***	-0.722***	-0.769***	-0.728***
	(0.259)	(0.257)	(0.267)	(0.261)
TP		-0.0193		
		(0.033)		
CFC			-0.0624*	
			(0.034)	
TCR				0.00143
				(0.034)
$log(sales_{t-1})$	-0.120***	-0.120***	-0.120***	-0.120***
	(0.015)	(0.015)	(0.015)	(0.015)
$log(empl_{t-1})$	-0.337***	-0.337***	-0.337***	-0.337***
	(0.019)	(0.019)	(0.019)	(0.019)
GDP	-0.210	-0.224	-0.217	-0.210
	(0.271)	(0.275)	(0.273)	(0.272)
$GDP\ growth$	0.00671	0.00665	0.00676	0.00672
	(0.006)	(0.006)	(0.006)	(0.006)
$Inflation$	-0.00208	-0.00187	-0.00188	-0.00207
	(0.009)	(0.009)	(0.009)	(0.009)
$Financial\ freedom$	0.00170	0.00174	0.00183	0.00170
	(0.002)	(0.002)	(0.002)	(0.002)
$Corruption$	-0.334***	-0.334***	-0.335***	-0.334***
	(0.074)	(0.074)	(0.074)	(0.074)
Firm & Year FE	YES	YES	YES	YES
R^2	0.414	0.410	0.414	0.414
N	705,083	705,083	705,083	705,083

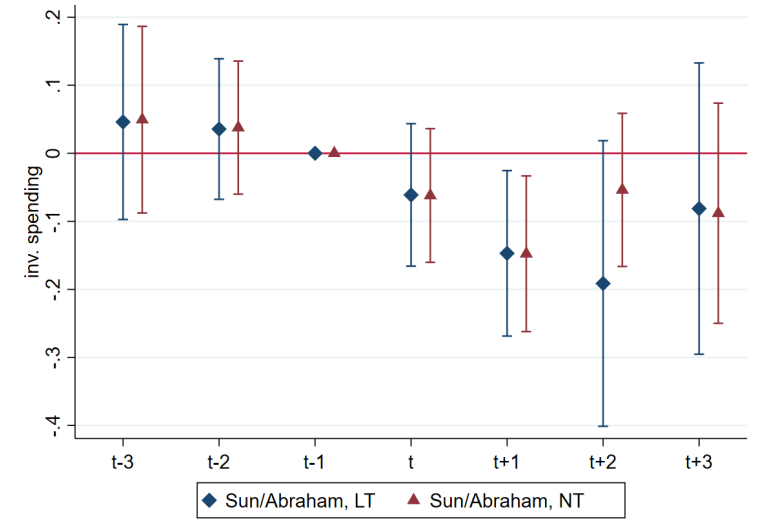
Standard errors clustered at the country-year level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 3.A.2: *Event study estimates - full sample*



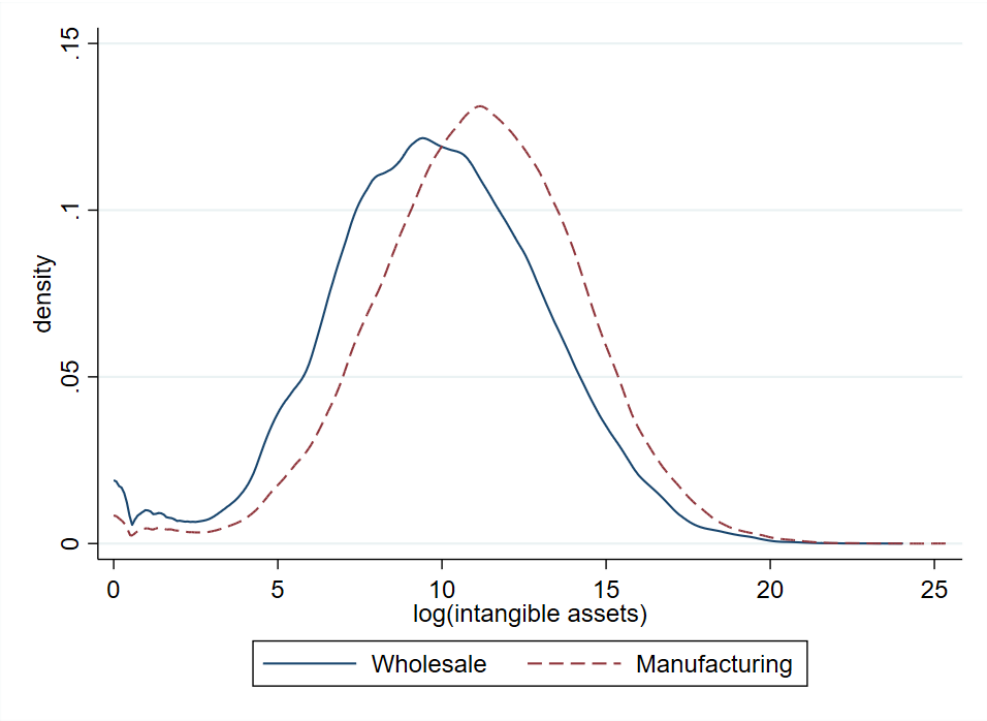
Event study estimation following Sun and Abraham (2021), includes firm and country control variables, uses robust standard errors for depicted 95% confidence intervals.

Figure 3.A.3: *Event study estimates - wholesale sample*



Event study estimation following Sun and Abraham (2021), includes firm and country control variables, uses robust standard errors for depicted 95% confidence intervals.

Figure 3.A.4: *Distributions of intangible assets*



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Chapter 4

Internal Debt Markets and Profit Shifting of Multinational Corporations [1]

ABSTRACT

This article contributes to our understanding of internal capital markets of multinational enterprises (MNEs). We particularly focus on the role of internal debt (and internal interest flows) as a vehicle to shift profits to tax haven countries and quantify the contribution of internal debt to MNEs' total profit shifting. Using a unique dataset on German MNEs and their internal interest flows, we descriptively analyze cross-border interest flows and their relation to internal debt stocks. Additionally, we estimate how much interest flows contribute to the reported profits of conduit and tax haven affiliates of German MNEs.

[1] This paper is joint work with Stefan Goldbach, Arne Nagengast, Valeria Merlo and Georg Wamser.

4.1 Introduction

Internal capital markets are a central tool for multinational corporations to efficiently provide capital to their affiliate network. The use of internal debt can help to mitigate frictions of the external financial market and help MNEs to secure financing for investment projects with higher risks. Internal capital markets can be organized in different forms with the direct shareholder or other affiliated enterprises as the lending party for internal loans. Some groups even operate designated subsidiaries to provide financial services to the remaining group. Since interest expenses are generally fully tax-deductible, internal loans can be leveraged to reduce profits in high-tax locations and to shift income to lower-tax locations. Financing affiliates in high-tax locations through loans from lower-tax subsidiaries in the same group creates steady interest flows that reduce the tax bases of high-tax affiliates. Unlike fully domestic firm groups, MNEs thus have an incentive to structure their internal capital markets in a way that favors debt in higher-tax countries and equity in lower-tax countries. A large strand of empirical literature has documented this behavior and has quantified the tax response of debt within MNEs (see Mintz and Smart, 2004; Huizinga et al., 2008; Møen et al., 2019). At the same time, policymakers have long recognized this issue and most countries have limited the deductibility of interest by introducing thin-capitalization or earnings-stripping rules (see Buettner et al., 2012).

This paper aims at a better understanding of the internal debt markets within multinational firm networks and how they contribute to firms' profit shifting activities. Our analysis makes use of two unique datasets compiled by the German central bank (Deutsche Bundesbank). The first, "Statistics on International Financial and Capital Transactions" (SIFCT), allows us to observe internal interest flows between (i) German parent firms and foreign affiliates, (ii) between foreign affiliates and German parents, (iii) between foreign parents and German affiliates, and (iv) between German affiliates and foreign parents.[1] We match the SIFCT data with detailed balance sheet information from our second dataset, the Microdatabase Direct investment (MiDi).[2] The

[1]The analysis was carried out as a guest researcher (GaFo) in multiple research stays at the Research Data and Service Centre between September 2022 and April 2023 under the project ID 2022/0077. For further information on the SIFCT database, see Biewen et al. (2022) (DOI: 10.12757/Bbk.SIFCT.200101-202112.01.01).

[2]For further information on the Microdatabase Direct Investment, see Friederich et al. (2021) and Blank et al. (2020) (DOI: 10.12757/BBk.MiDi.9919.07.08).

MiDi dataset comprises yearly balance sheet information for foreign affiliates held by German MNEs (Reporting to the Deutsche Bundesbank is mandatory for all German MNEs depending on a size threshold and the ownership criteria outlined in Blank et al. (2020)).

To the best of our knowledge, this paper is the first to combine to these datasets to analyze cross-border interest flows in the context of MNE taxation. First, we offer a thorough description of the interest inflows and outflows of German MNEs over the past two decades. We observe a strong and increasing concentration of interest payments from Germany to "conduit" locations such as the Netherlands or Luxembourg. In 2020, 43.83% (more than 5 bn. Euro) of all interest payments from German firms went to the Netherlands. Lejour (2021) offers a comprehensive review of reason why MNEs choose to use conduit locations in the context of dividend repatriation. Using a network analysis, the author shows that foreign direct investment (FDI) in conduit locations is strongly motivated by opportunities for "treaty shopping" that allow MNEs to route profits into tax havens at a low cost. Besides profit shifting motives, these locations typically offer access to highly efficient financial markets which makes them attractive locations for the provision of financial services.

Total interest outflows from Germany significantly exceed total inflows over the entire sample period. Interest income in Germany mostly stems from the conduit locations and countries that receive substantial amounts of FDI from Germany such as the US where 20.92% of all interest income (exceeding 1.5 bn. Euro) reported in 2020 came from. Connecting these two datasets furthermore allows us to analyze the characteristics of firms with high interest payments. The majority of German parent shareholders do not report any cross-border interest payments.[3] We see that interest payments are strongly concentrated in the largest firms groups. Parent firms in the highest quartile of interest payments report yearly interest outflows of 28 mil. Euro while operating 21 affiliates in 9 locations on average. Similarly, we can link the interest income that German affiliates receive from their multinational firm group to their balance sheet information.

The final part of the analysis aims at understanding how interest payments from German affiliates contribute to the profit-shifting activity of large MNEs. As a first

[3]E.g. any payment above the mandatory reporting threshold of 12,500 Euro per month, country, and transaction type.

step, we analyze which firm characteristics are associated with higher reported interest flows. Focusing on the internal capital structure reveals that internal debt increases interest payments more than a rise in the parental debt ratio. On the other hand, an increase in the internal loan stock of an affiliate significantly increases its interest income. Finally, the scope of this dataset allows us to analyze the relationship between interest payments from German shareholders and the reported profits of their foreign affiliates. We find that particularly in conduit locations, increased interest payments from Germany are associated with significantly higher profits.

This paper contributes to the literature on internal capital markets and their importance for profit shifting. Mintz and Smart (2004) is one of the first studies that show theoretically and empirically how these tax incentives can distort the capital structure of MNE affiliates. There is an extensive empirical literature that estimates the tax response of (internal) debt (see Desai et al., 2004; Aggarwal and Kyaw, 2008; Huizinga et al., 2008; Egger et al., 2014; Møen et al., 2019). In particular, Goldbach et al. (2021) offer an extensive review of the tax responses in internal capital markets where they show that (internal) debt levels of MNE affiliates increase with rising tax rates which is tax-optimizing at the level of the firm group. However, increasing internal debt is only an indirect indicator of profit shifting activity as the interest flows associated with internal lending are typically not recorded in firm-level data. We contribute to this literature by documenting that the relationship between tax rates and interest flows is not as straightforward. Interest flows are heavily biased toward financial centers and conduit locations and potentially rerouted to low or zero-tax locations.

The remainder of the paper is structured as follows: Section 5.3 explains the data structure in more detail and defines the interest flow variables used in the analysis. Section 4.3 provides extensive descriptive statistics on the composition and development of interest income and payments reported by German enterprises. Section 4.4 analyzes descriptively how interest payments relate to other firm-level outcomes, while Section 4.5 focuses more narrowly on interest payments to tax havens. Lastly, Section 4.6 estimates the contribution of interest payments to overall profit shifting by analyzing whether payments to conduit countries translate into tax haven profits.

4.2 Data and variable definition

Our primary data source is the SIFCT dataset on internal cross-border capital transactions provided by the German central bank. From this dataset, we particularly focus on the primary income from direct investment of non-financial firms related to interest on loans. The dataset covers the universe of interest transactions since all enterprises located in Germany are required to report cross-border payments in excess of 12,500 Euro, allowing the central bank to compile the monthly transaction statistics. The micro-level data are confidential; they are only accessible in anonymized form at the headquarters of the central bank in Frankfurt, Germany. For each single transaction, the value (in Euro) and the partner country is provided, along with the name and address of the reporting unit (German parent company or German affiliates of foreign investors) as well as detailed information on the type of transaction and the ownership relation between the transaction partners. In particular, income from a direct investment loan may result from internal lending by German parent companies to foreign affiliates or by German affiliates to foreign parent companies. Similarly, we can distinguish whether payments derive from internal loans by foreign affiliates to German parent companies or by foreign parent companies to German affiliates. In addition, payments to foreign affiliates and foreign financial entities are reported separately. The frequency of the data is monthly, with information provided at the end of the month. The interest flow information covers the period from 2001 to 2021.[4] In addition to this transaction level data, we use balance sheet information from the Microdatabase Direct Investment (MiDi). This dataset is also provided by the Bundesbank and subject to the same data confidentiality rules as the capital transaction statistics. Since this data set is based on an annual data collection, we aggregate the transaction data to a yearly frequency.

In our data, we can distinguish capital flows by the direction of payment (from affiliate to parent or vice versa) and by the counterpart that is located in Germany. Table 4.2.1 illustrates the four main types of interest flows we observe:

We observe four types of interest flows, $IPAY^{AP}$, $IPAY^{PA}$, $IREC^{AP}$ and $IREC^{PA}$ in our data. First, we distinguish between inflows ($IREC$) into and outflows ($IPAY$)

[4]The MiDi database is currently available from 1999 to 2019, while the SIFCT database is available for the years 2001 to 2021. When both data sets are combined, the sample is thus limited to the period from 2001 to 2019.

Table 4.2.1: *Interest flow types in the SIFCT database*

Variable	Definition	Reporting unit
$IPAY^{AP}$	Interest paid by German affiliate to foreign parent (outflow)	German Affiliate
$IPAY^{PA}$	Interest paid by German parent to foreign affiliate (outflow)	German Parent
$IREC^{AP}$	Interest paid by foreign affiliate to German parent (inflow)	German Parent
$IREC^{PA}$	Interest paid by foreign parent to German affiliate (inflow)	German Affiliate

out of Germany. Secondly, since the reporting unit in our data is always located in Germany, we are able to further distinguish inflows and outflows based on the counterpart that is resident in Germany. The superscripts on each flow denote the direction of the interest payment, so that $IPAY^{AP}$ would denote an interest payment made from Germany by a resident affiliate to its foreign parent shareholder.[5] For some parts of our analysis, we use *aggregate* interest income ($IREC^{AP} + IREC^{PA}$) or payments ($IPAY^{AP} + IPAY^{PA}$) at the national level by aggregating the reported flows.

For the final part of our analysis, we supplement the SIFCT and MiDi databases with country level corporate tax rates from the RSIT's International Tax Institutions Database and additional country-level variables from the World Bank's Global Development Indicators.[6]

4.3 Descriptive analysis of internal interest flows

4.3.1 Aggregate statistics

Table 4.3.1 provides summary statistics for the interest flows in our data. It shows that most of the reported interest flows go from an affiliate to their parent, where $IPAY^{AP}$ denotes payments from German affiliates to their foreign shareholders and $IREC^{AP}$ denotes interest flows from foreign affiliates to their German shareholders. This suggests that most interest payments are associated with parental debt, e.g. affiliates borrowing from their parental shareholders. Interest flows from parents to their affiliates, $IPAY^{PA}$ with a German parent and $IREC^{PA}$ with a foreign parent, are rarer but comparable in magnitude to the interest income of subsidiaries in Germany. Payments to a foreign shareholder $IPAY^{AP}$ from Germany, however, are the largest

[5]Note that the SIFCT database also records interest flows between affiliated companies but coverage is very limited for these flows.

[6]For more information, see www.rsit-uni-tuebingen.de/data.

flows on average at 3,176,00 Euro and more than twice as high as the average yearly income from foreign affiliates $IREC^{AP}$ with 1,536,00 Euro. Comparing the mean and median sizes of all transactions shows that the distribution of payments is skewed to the right, indicating a high number of very large yearly payments.

Table 4.3.1: *Summary statistics*

	Mean	S.D.	p25	Median	p75	Obs
$IPAY^{AP}$	3,176	30,082	55	224	1,031	34,636
$IREC^{AP}$	1,536	18,502	36	139	568	60,988
$IPAY^{PA}$	1,556	8,759	28	114	549	19,507
$IREC^{PA}$	1,898	16,378	42	185	827	5,156

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), 2001-2021.
Yearly payments in 1,000 Euro at the affiliate level.

Table 4.3.2 provides an overview of the development for all types of interest flows in our data. Note that any changes in the number of observations reflect actual changes in the number of transactions since reporting is mandatory. At the firm level, we observe that the number of countries as well as the average size of payment has been relatively stable over the sample period. For all types of interest flows the median number of partner countries suggests that most firms are part of only one financing relationship in which they pay or receive interest. At the aggregate level, we see that in particular interest income has increased between 2005 and 2020. Total interest income, both from foreign parents and foreign subsidiaries, has more than doubled in the sample period. Interest payments, on the other hand, appear to be more stable over time.

Figure 4.3.1 gives a more detailed picture of the development over time. During the entire sample period, aggregate interest payments from Germany have exceeded interest income by at least 5 billion Euro yearly. This difference is substantial and persistent over time. In the particular case of Germany, it might be driven by tax-optimized internal financing. Germany has one of the highest corporate income tax rates (29.9% in 2020 including the average local trade tax) which makes it beneficial for MNEs to allocate an over-proportionate amount of internal debt in Germany. The resulting interest payments then reduce profits and thus tax liabilities in Germany, while the interest income becomes taxable in a lower-tax location.

Table 4.3.2: *Firm-level summary statistics*

	$IPAY^{PA}$		$IREC^{PA}$		$IPAY^{AP}$		$IREC^{AP}$	
	2005	2020	2005	2020	2005	2020	2005	2020
Firm level								
Number of countries								
Mean	1.3	1.1	2.4	3.0	3.0	3.1	1.2	1.1
Median	1	1	1	1	1	1	1	1
SD	1.1	0.5	4.0	4.2	4.1	4.7	0.7	0.6
Payments (mil. Euro)								
Mean	3.4	3.1	2.6	3.5	7.5	3.5	1.3	1.2
Median	0.2	0.4	0.2	0.3	0.3	0.2	0.4	0.2
SD	30.0	17.2	11.3	16.0	36.4	14.1	2.2	3.4
Aggregate level								
Number of obs.	1,915	1,593	2,023	4,023	520	1,135	93	274
Number of firms	1,442	1,423	830	1,363	174	366	80	243
Number of countries	69	69	112	128	56	95	17	38
Payments (mil. Euro)	4,845.6	4,353.5	2,191.8	4,736.0	1,299.8	1,274.4	107.2	294.2

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), 2001-2021.
Yearly payment statistics.

Figure 4.3.1: *Aggregate interest flows*

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), 2001-2021.
Each dot represents the total yearly interest income or payments reported by all German firms, including German MNEs and German affiliates of foreign MNEs in bn. Euro.

4.3.2 Country-level statistics

While the total interest income and expenses have remained relatively stable over the past two decades, the composition of partners has changed over time. Table 4.3.3 highlights the development of relative interest income across all recipient countries, while Figure 4.3.2 illustrates the absolute interest income for the largest recipient countries in 2020.

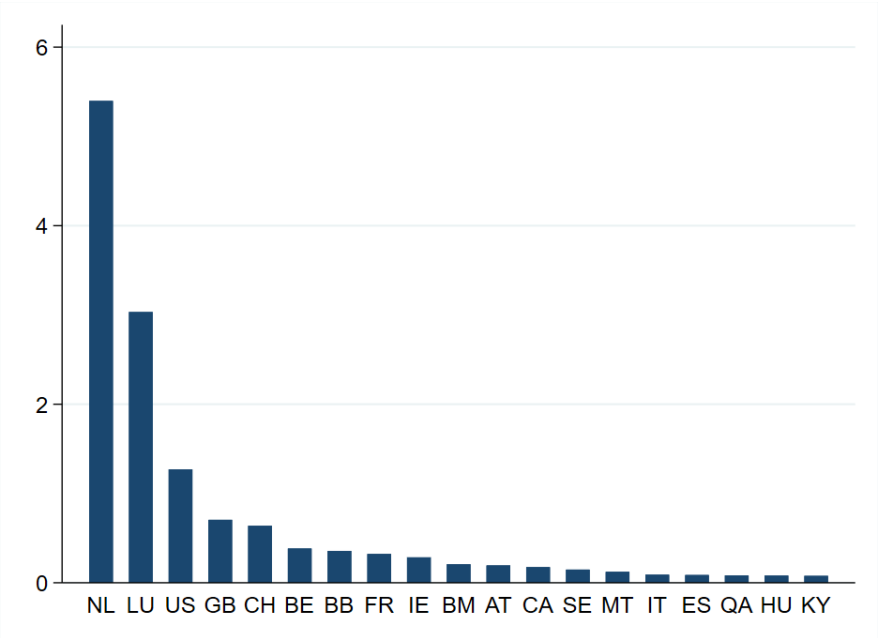
Table 4.3.3 presents some interesting facts about the composition of interest outflows from Germany over time. Across all years, the Netherlands has been the largest recipient of interest income from Germany. Compared to other locations, the Netherlands have received particularly large interest payments: While only 8.6% of all recorded transaction were payments to Dutch affiliates, these transactions account on average for 43.86% of the yearly interest paid from Germany to foreign enterprises. However, the yearly share of interest paid to the Netherlands has decreased from 56.72% in 2005 to 35.3% in 2020, while the payments to Luxembourg have increased from 11.28% to 21.13% in the same time span.

Table 4.3.3: *Total interest payments*

	2005 share	2010 share	2015 share	2020 share	av. share	av. obs. share
NL	56.72	53.60	42.80	35.30	43.86	8.60
LU	11.28	14.64	19.75	21.13	16.92	6.52
US	7.38	5.23	7.75	6.36	8.24	7.81
GB	4.49	3.49	5.15	5.43	5.57	6.75
BE	3.28	4.37	4.26	2.04	4.42	3.73
CH	3.98	2.33	3.59	4.54	3.51	7.13
FR	3.11	1.64	1.28	2.25	2.56	6.33
IE	1.60	2.10	0.89	1.52	2.06	1.72
BM	0.79	3.02	1.90	1.59	1.88	0.32
AT	0.42	0.71	1.43	1.44	0.99	4.28
SE	1.07	0.45	0.61	1.11	0.79	2.30
ES	0.84	0.30	0.45	0.56	0.79	3.42

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), 2001-2021.
Share in total interest outflows from Germany, ordered by average share across all year.

Figure 4.3.2: *Interest payments by country*



Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), 2001-2021, own calculations.
Aggregate interest payments by country in 2020, in bn. Euro.

Figure 4.3.2 illustrates the absolute payments in 2020 and reveals that the Netherlands and Luxembourg have received around 8 bn. Euro. in interest income combined. Other countries in this figure are important FDI locations for Germany such as the United States (US) and Great Britain (GB) and other EU countries such as Belgium (BE), France (FR), or Austria (AT). Notably, small tax haven and conduit locations such as Switzerland (CH), Barbados (BB), Ireland (IE), Bermuda (BM), Malta (MT), Qatar (QA), and the Cayman Islands (KY) are also among the 20 largest recipient countries.

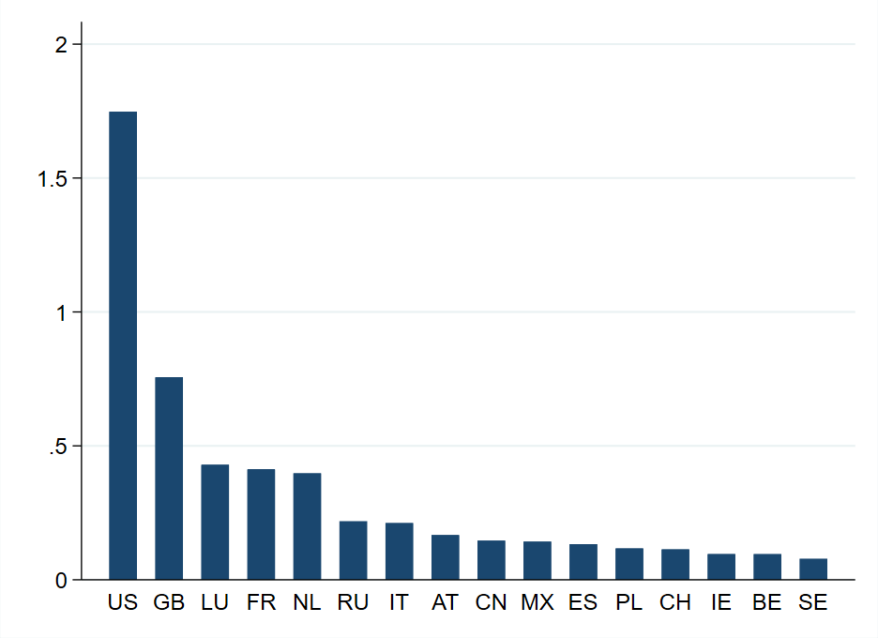
Interest income in Germany, however, mostly comes from its largest FDI locations. Table 4.3.4 presents the relative sizes of interest inflows to Germany at the country level. While the US has been the largest source of interest payments for the last decade, interest inflows are much less concentrated than the corresponding outflows from Germany. Over the sample period, on average 20.29% of all interest paid to Germany came from the US. These interest payments most likely stem from parental debt given from German MNEs to their US affiliates as initial financing. Other important source countries of interest income are the Netherlands, Great Britain, and France which make up a combined share of 35.34% of the average yearly interest inflow to Germany. Some

Table 4.3.4: *Total interest income*

	2005 share	2010 share	2015 share	2020 share	av. share	av. obs. share
US	22.87	8.69	18.23	23.79	20.29	7.81
NL	18.70	36.40	9.93	6.18	15.45	8.60
GB	15.19	13.97	13.74	13.52	12.51	6.75
FR	6.01	4.24	10.26	4.71	7.38	6.33
LU	3.06	1.17	6.89	5.92	3.95	6.52
IT	2.60	3.09	3.12	4.57	3.31	3.35
RU	0.38	2.47	4.65	3.13	2.85	1.55
ES	2.21	4.89	1.55	1.97	2.67	3.42
CH	2.90	2.57	2.67	1.73	2.60	7.13
SE	3.19	2.28	1.24	1.47	2.27	2.30
BE	1.21	1.36	2.60	1.16	2.25	3.73
AT	2.64	0.93	2.99	2.77	2.05	4.28

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), 2001-2021.
Share in total interest outflows from Germany, ordered by average share across all year.

Figure 4.3.3: *Interest income by country*



Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), 2001-2021.
Aggregate interest income by country in 2020, in bn. Euro.

smaller sources of interest income include Russia (RU), Spain (ES), Switzerland (CH), Sweden (SE), Belgium (BE), and Austria (AT) which each make up around 2% of the

average yearly interest inflow.

Figure 4.3.3 illustrates the absolute interest inflows from the largest source countries in 2020. As pointed out before, interest flows from Germany tend to be smaller than the outgoing interest payments by German MNEs. In 2020, US subsidiaries paid more than 1.5 bn. Euro to their parent shareholder or to other affiliates located in Germany, while the second largest contributor was Great Britain with more than 0.5 bn. Euro.

4.4 Interest flows and firm outcomes

The match between the interest flow dataset SIFCT and firm-level information from the MiDi database allows us to learn more about the characteristics of the MNEs that are most active in international interest transactions.

Table 4.4.1: *Summary statistics firm groups, by interest flows*

	No payments	Q1	Q2	Q3	Q4
Interest paid (total)	0.000	38.747	198.945	870.194	2.8e+04
Corporate tax rate	0.282	0.274	0.271	0.272	0.267
Number of locations	2.488	5.548	5.469	5.988	8.796
Number of affiliates	3.454	7.612	7.970	9.556	20.815
Number of CFC locations	0.968	2.383	2.541	2.987	5.939
Number of conduit locations	0.524	0.964	1.044	1.136	2.803
Number of tax haven locations	0.054	0.057	0.108	0.109	0.298
	No income	Q1	Q2	Q3	Q4
Interest received (total)	0.000	30.620	162.339	698.909	1.5e+04
Corporate tax rate	0.282	0.269	0.268	0.269	0.271
Number of locations	2.337	4.281	5.005	6.058	10.618
Number of affiliates	3.201	5.504	6.637	8.932	23.920
Number of CFC locations	0.870	1.778	2.129	2.937	7.255
Number of conduit locations	0.501	0.675	0.846	1.147	2.966
Number of tax haven locations	0.052	0.049	0.044	0.081	0.380

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), Microdatabase Direct Investment (MiDi), combined dataset 2001-2019, own calculations.
Measured at the level of German headquarters. Yearly interest flows measured in 1,000 Euro, Q1 through Q4 denote the average value in the first to last quartile.

Table 4.4.1 presents summary statistics on the group structure of German MNEs along with the distribution of interest payments and income of the German parent shareholder. Groups in which the parent shareholder does not report any interest transaction tend to be smaller both in terms of the number of locations that they

operate from as well as the number of affiliates. On average, groups that do not report any interest income are active in 2.5 different locations where they operate 3.5 (foreign) affiliates.[7] Coverage of tax haven entities is often limited in available firm-level datasets. However, due to the German reporting requirements, we observe the entire network of majority-owned foreign affiliates for all MNEs in our data, including tax haven locations. While MNEs without any reported interest payments or income operate on average 0.5 affiliates in conduit locations and 0.05 affiliates in tax havens, the groups with the highest reported interest flows operate almost 3 conduit affiliates and 0.3 tax haven subsidiaries on average. Another important insight from Table 4.4.1 is that interest flows are strongly concentrated among the largest MNEs. The average yearly interest payment in the highest quartile of interest payments is more than 700 times larger than the average payment in the lowest quartile. Similarly, the average interest inflow in the highest quartile is almost 500 times larger than the average yearly interest income in the lowest quartile. These figures suggest that the vast majority of interest transaction is reported by a few very large firm groups.

For the subsample of German affiliates that belong to foreign MNEs, we are able to match interest transactions and balance sheet information on a yearly basis. Table 4.4.2 examines firm characteristics of these affiliates by the quartile of their interest income. This table shows that interest income and expenses are strongly correlated with other measures of firm size. Affiliates in Germany with the highest reported interest flows also report the highest sales, the most employees, and the highest stock of fixed and intangible assets. Entities that do not report any interest flows, however, are smaller across all measures of firm size. The same relationship holds true when we examine interest inflows.

Furthermore, Table 4.4.2 shows how interest flows correlate with the affiliates' capital structure. We observe the internal and parental debt ratios which are defined as the ratio between an affiliate's liabilities towards other entities in the same group or the parent shareholder and its total capital.[8] We observe that affiliates that do not report any interest payments have an internal debt ratio of 0.32 and a parental debt ratio of

[7] Note that we do not have any information on the number of domestic, e.g. German, affiliates of these groups.

[8] Total capital consists of the entities subscribed capital, capital and revenue reserves, and total liabilities.

Table 4.4.2: *Firm characteristics, by interest flows*

	No payments	Q1	Q2	Q3	Q4
log(sales)	9.91	10.25	10.03	10.40	10.69
log(employees)	4.09	4.47	4.50	4.32	3.89
log(assets)	7.43	8.24	8.70	8.73	8.17
Internal debt ratio	0.32	0.36	0.43	0.50	0.57
Parental debt ratio	0.08	0.10	0.15	0.15	0.16
Internal loans	4193.37	5136.02	5850.04	7703.76	59885.92
Interest paid (total)		60.75	305.26	1250.09	22263.24
to parent		47.28	226.69	856.94	13360.24
to subsidiary		3.46	12.34	48.67	656.22
to fellow affiliates		9.74	64.18	339.15	7565.72
	No income	Q1	Q2	Q3	Q4
log(sales)	10.08	10.80	10.90	11.27	11.84
log(employees)	4.17	4.69	4.71	4.94	5.16
log(assets)	8.41	8.26	8.33	8.70	8.96
Internal debt ratio	0.47	0.34	0.35	0.34	0.35
Parental debt ratio	0.16	0.06	0.05	0.05	0.04
Internal loans	14380.76	14489.06	10172.35	24101.07	92867.81
Interest received (total)		33.30	185.22	742.85	8932.92
from parent		15.94	82.80	334.51	4012.38
from subsidiary		9.21	49.05	203.26	2513.17
from fellow affiliates		8.05	53.25	204.15	2401.33

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), Microdatabase Direct Investment (MiDi), combined dataset 2001-2019, own calculations.
Sample of German affiliates that belong to foreign MNE. Yearly interest flows measured in 1,000 Euro, Q1 through Q4 denote the average value in the first to last quartile.

0.08. These firms report internal debt but no internal interest payments, presumably because the monthly transactions are below the reporting threshold of 12,500 Euro. For firms in the highest quartile of interest payments, these numbers are almost twice as high. Interestingly, firms with high interest payments report higher internal loan stocks as well. This relationship could indicate that larger firms and firm groups have more active internal capital markets that result in higher interest payments and income at the same time. Interest income, on the other hand, does not seem to be correlated with internal and parental debt. In our sample, the entities that report the highest debt level are those that do not report any interest income. Affiliates in the highest

quartile of interest income have the lowest parental debt ratio, while the internal debt ratio is relatively stable at 0.35 across all groups. Here, we observe the strongest relation between interest income and the stock of internal loans. The affiliates that receive the most interest income report almost 6.5 times as much in internal loans compared to affiliates without any interest income. Again, firms that do not report any interest income but a positive stock of internal loans, might still receive some interest income that falls below the reporting threshold.

Table 4.4.2 further allows us to examine the composition of interest flows in more detail. Interest payments are highly concentrated among the largest firms. Firms in the highest quartile report more than 300 times as much value in interest payments as firms in the lowest quartile. The relative size of the interest recipients however is remarkably stable across the distribution. Across all firms, the majority of interest payments go to the foreign parent shareholder that receives 60 to 75% of the total interest outflows from Germany. Interest payments to fellow affiliates in the same group are the second largest recipient, 15 to 30% of the total interest expenses go to this group. Comparing these numbers to the composition of interest income in Germany shows, similar to Figure 4.3.1, that interest outflows from Germany significantly exceed interest inflows. The largest source of interest income is the foreign parent shareholder, while fellow affiliates and majority-owned subsidiaries make a comparable contribution to the total interest income.

4.5 Interest flows to tax havens

Debt shifting is one of the main channels that MNEs use to shift profits from high-tax affiliates into lower-tax locations. Therefore, the following section provides more detailed statistics on cross-border interest payments to tax haven and conduit locations.[9] Tables 4.A.3 and 4.A.4 in the Appendix offer an overview of the relation between group size, interest flows, and tax haven access. Both tables highlight the fact that the majority of interest flows are operated from large MNE groups with access to tax haven locations.

Table 4.5.1 presents three groups of countries and their yearly shares in the total

[9]The definitions for tax haven countries and conduit locations follow Hines Jr. (2010) and Lejour (2021) and can be found in Table 4.A.1 and 4.A.2 respectively

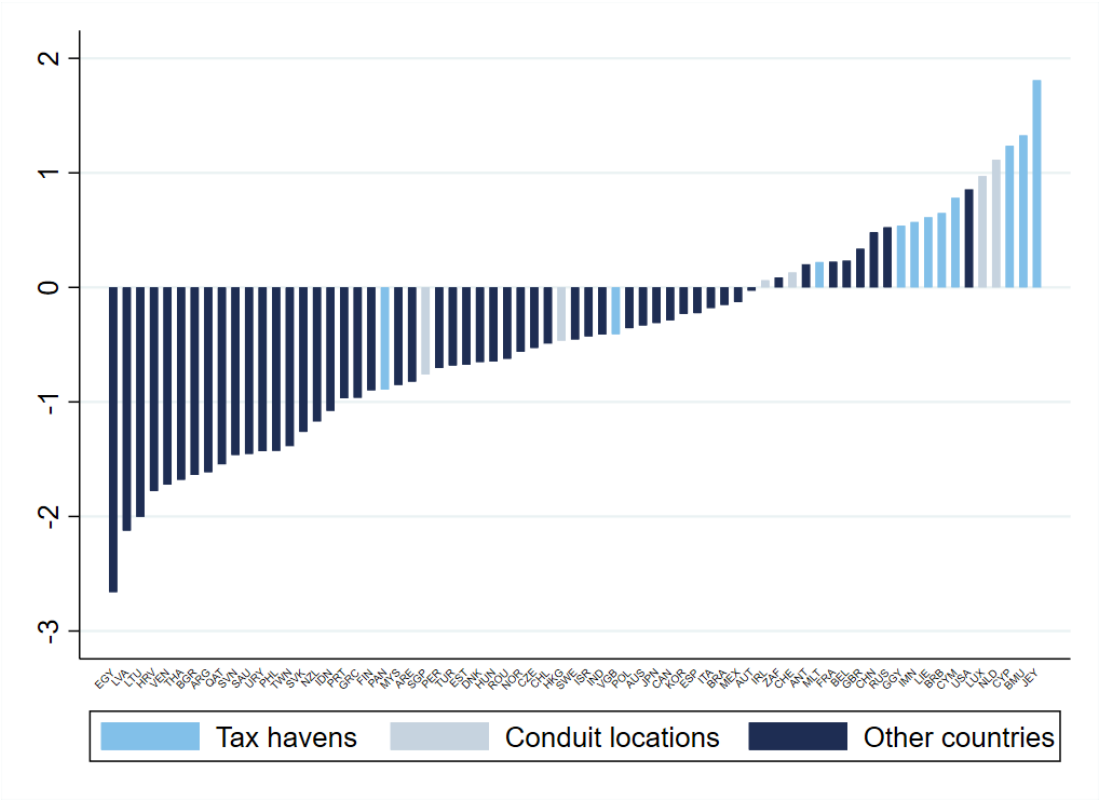
number of employees, the value of sales, and the total received interest of all foreign affiliates to German MNEs. We compare these shares across tax havens, conduit locations, and other countries. The distribution of total sales across these groups is stable over time and shows that almost 90% of all sales are operated from countries that are neither tax havens nor conduits. Conduit locations account for around 10% of all sales, while less than 1% of all sales are reported from a tax haven. The distribution of employees looks very similar. Almost 95% of employees at foreign locations of German MNEs are outside of tax havens and conduit locations, while 5% work in conduit locations. These numbers document clearly that only a very small part of real economic activity is conducted in the set of conduit locations and even less in tax havens. Conversely, when we look at the distribution of interest payments, more than 80% of all interest paid in 2019 went to the six defined conduit locations. This observation is in line with the relative and absolute numbers documented in Table 4.3.3 and Figure 4.3.2. While accounting for only 5 to 10% of real economic measures, conduit locations attract more than 80% of all interest payments. These findings suggest that subsidiaries in conduit locations that specialize in the provision of financial services play a central role in the functioning of internal capital markets.

Table 4.5.1: *Comparison of economic activity across country groups*

	Share of total sales			**Share of employees**			**Share of income**		
	Others	Haven	Conduit	Other	Haven	Conduit	Other	Haven	Conduit
2010	0.882	0.004	0.114	0.938	0.003	0.059	0.102	0.000	0.897
2011	0.882	0.004	0.113	0.941	0.003	0.056	0.129	0.003	0.868
2012	0.887	0.005	0.109	0.943	0.003	0.053	0.152	0.000	0.847
2013	0.886	0.005	0.109	0.944	0.003	0.053	0.141	0.001	0.858
2014	0.890	0.005	0.105	0.944	0.003	0.053	0.143	0.001	0.855
2015	0.894	0.005	0.100	0.943	0.003	0.053	0.167	0.001	0.831
2016	0.891	0.005	0.104	0.943	0.003	0.054	0.208	0.003	0.789
2017	0.897	0.005	0.098	0.944	0.004	0.052	0.129	0.001	0.871
2018	0.893	0.006	0.101	0.944	0.004	0.052	0.169	0.001	0.830
2019	0.892	0.006	0.102	0.944	0.004	0.052	0.183	0.006	0.811

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), Microdatabase Direct Investment (MiDi), combined dataset 2001-2019, own calculations.

Figure 4.5.1: *Country-level fixed effects*



Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), 2001-2021, own calculations.
Dependent variable: log(interest income), average country-by-year fixed effects ordered by magnitude.

Additionally, to assess the role of tax haven and conduit locations, we employ a fixed effects analysis. We regress the yearly interest income per country on a set of country-by-year and parent-by-year fixed effects. Figure 4.5.1 displays the estimated country-fixed effects. Intuitively, they capture the contribution to interest income of any features at the country(-year) level that affect all firms in the location. These features are often unobserved and hard to measure such as the institutional quality or the strength of enforcement.

The countries in Figure 4.5.1 are ordered by the magnitude of their average estimated country-fixed effects. The largest country effects are estimated for Jersey, the Bahamas, and the Cayman Islands. For these tax havens, the average interest income per affiliate is very high which leads to the high estimated effects. The next countries in the ranking are two conduit locations, the Netherlands and Luxembourg which both receive high total interest inflow. The only country that is neither a tax haven nor a

conduit location in the 10 highest-ranked countries is the United States which is one of the most important FDI locations for Germany.

These effects capture the shift in the *average* reported interest income for each country. For that reason, tax havens such as Jersey that receive a relatively small share of the total income (see Table 4.3.4) can have large country fixed effects if most or all affiliates there receive high interest inflows. Countries such as the Netherlands and Luxembourg receive high absolute inflows of interest because the number of affiliates located there is many times higher compared to small tax-haven countries such as the Cayman Islands or the Bahamas. For that reason, a lower country-fixed effect can translate into higher total interest income at the country level.

4.6 Interest flows and profit shifting

The final part of this paper focuses more narrowly on the contribution of interest payment to profit shifting activities of MNEs. To investigate this relationship, we first analyze which affiliates in Germany are most likely to pay and receive interest. Second, we exploit the cross-border dimension of the data and aggregate it to the level of German MNEs by year and partner country. This way, we can estimate how the reported foreign profits of German MNEs change with interest outflows from Germany.

For the first part of this analysis, we estimate a two-way fixed effects regression using the following specification:

$$y_{it} = \beta_0 + \beta X_{it} + \gamma_i + \gamma_t + \varepsilon_{it} \tag{4.6.1}$$

where y_{it} is either a dummy variable that takes on the value one if a given firm reports any interest flows in a given year or the log of the reported interest flow.[10] To investigate which firm characteristics are correlated with interest flows, the vector X_{it} includes information on firms' internal loan stock, their internal and parental debt ratio as well as the log of their sales, fixed assets, their profitability, and the tax rate at the parent location. Note that we do not need to include additional country control variables as all affiliates in this sample are located in Germany.

[10] In the specifications where the dependent variable is binary, we thus estimate a linear probability model.

Table 4.6.1: *Determinants of interest payment and income*

	(1) $\mathbb{1}[payment]$	(2) $log(payment)$	(3) $log(payment)$	(4) $\mathbb{1}[income]$	(5) $log(income)$	(6) $log(income)$
log(int.loans)	0.00319***	-0.0111	-0.0119	0.00727***	0.0487***	0.0595***
	(0.001)	(0.010)	(0.010)	(0.001)	(0.013)	(0.013)
Internal debt ratio	0.0704***	1.109***	1.065***	0.000426	-0.299*	-0.345**
	(0.005)	(0.098)	(0.097)	(0.003)	(0.170)	(0.175)
Parental debt ratio	0.0401***	0.167*	0.111	0.00262	-0.317	-0.439
	(0.007)	(0.093)	(0.098)	(0.003)	(0.271)	(0.295)
Tax rate (parent)	0.00163	-0.705	-0.697	0.0311	0.420	-0.0402
	(0.024)	(0.539)	(0.551)	(0.021)	(0.786)	(0.875)
log(sales)	0.00609***	0.0976**	0.100***	0.00300**	0.135**	0.0821*
	(0.002)	(0.038)	(0.037)	(0.001)	(0.053)	(0.049)
log(fixed assets)	0.00789***	0.0516**	0.0469**	0.000357	0.0371	0.0167
	(0.001)	(0.023)	(0.023)	(0.001)	(0.030)	(0.033)
profitability	-0.0000816	-0.214*	-0.261**	0.000714	0.357	0.348
	(0.007)	(0.127)	(0.128)	(0.004)	(0.314)	(0.330)
N	180303	13677	13457	180303	6311	6096
R^2	0.521	0.755	0.777	0.491	0.679	0.725
Affiliate FE	X	X	X	X	X	X
Year FE	X	X		X	X	
Industry-year FE			X			X

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), Microdatabase Direct Investment (MiDi), combined dataset 2001-2019, own calculations.
Standard errors clustered at the group level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.6.1 presents the regression results following Equation 4.6.1. Columns (1) to (3) use reported interest *payments* as the dependent variable, while columns (4) to (6) focus on the determinants of interest income. Column (1), which reports the linear probability model for reporting a non-zero interest income, shows that an affiliate with a higher internal loan stock and higher debt levels is more likely to report a positive interest payment. Similarly, larger firms are more likely to report internal interest outflows. Columns (2) and (3) use the log of the total interest paid per year as their dependent variable. Here, the most important determinant is the internal debt ratio, while the parental debt ratio becomes insignificant once we control for industry-year fixed effects. If internal debt increases interest payments more strongly than parental debt, this could suggest that internal loans are operated with higher internal interest rates for profit shifting purposes. On the other hand, columns (4) to (6) show that affiliates with higher interest income report *lower* internal debt ratios and higher internal loan stocks. The corporate tax rate of the parent remains insignificant in all locations.

For the second part of this analysis where we estimate the contribution of interest payments to the reported foreign of German MNEs, we aggregate our data to the firm group by partner country and year level. For every German MNE, we thus compute the interest paid to each of their affiliate locations and measure how the average reported profits in that location change with interest payments over time. We estimate the following specification:

$$\bar{y}_{jkt} = \beta_0 + \beta_1 log(interest_{jkt}) + \beta \bar{X}_{jkt} + \theta Z_{kt} + \gamma_j + \gamma_k + \gamma_t + \varepsilon_{it} \tag{4.6.2}$$

where the dependent variable $\bar{y}_{jkt}$ is the average profits reported by all affiliates of MNE j in location k at time t and $log(interest_{jkt})$ is the aggregate interest flow from the German parent firm j to location k at time t. The vector $\bar{X}_{jkt}$ includes the average log of sales, fixed assets, and employees of all affiliates of group j in location k while the vector Z_{kt} contains additional control variables for country k. Depending on the specification, we include fixed effects for the year (γ_t), the MNE group (γ_k), or the affiliate location (γ_k).

Table 4.6.2 summarizes the results. Columns (1) to (3) focus on the relationship between interest paid from Germany to the reported profits in a given location. In our preferred specification in column (1), a 10% increase in interest inflows translates to an increase in profits of around 1.1%. This effect is highly significant and robust to the inclusion of group-fixed effects. The control variables in this specification have the expected signs. An increase in the local corporate tax rate leads to a strong and significant decrease in the reported profits. Moreover, locations with higher total sales, a higher stock of fixed assets, and more employees report significantly more profits. In line with the descriptive findings outlined above, larger parent companies tend to have higher profits in foreign locations. In terms of country characteristics, we observe that larger countries report more affiliate-level profits, while the level of corruption and the local inflation rate are not significantly associated with the level of profits in any specification.

In columns (4) to (6), we try to disentangle which locations benefit in particular from interest inflows. By interacting the log of the interest inflow at the country level with indicator variables for low-tax countries, tax havens, and conduit locations, we can

Table 4.6.2: *Foreign affiliate profits and German interest payments*

Dep. variable: *log(profits)*	(1)	(2)	(3)	(4)	(5)	(6)
log(interest inflow)	0.110***	0.114***	0.0910***	0.110***	0.105***	0.0767***
	(0.023)	(0.023)	(0.015)	(0.023)	(0.025)	(0.014)
Low tax x log(interest inflow)				0.00283		
				(0.032)		
Tax haven x log(interest inflow)					0.0438	
					(0.055)	
Conduit x log(interest inflow)						0.113***
						(0.030)
Corporate tax rate	-2.243***	-0.622	-2.078***	-2.239***	-2.252***	-2.270***
	(0.739)	(0.629)	(0.733)	(0.746)	(0.732)	(0.701)
log(sales)	0.589***	0.647***	0.610***	0.589***	0.587***	0.590***
	(0.034)	(0.065)	(0.060)	(0.034)	(0.036)	(0.033)
log(fixed assets)	0.102***	0.0481**	0.0511**	0.102***	0.102***	0.105***
	(0.019)	(0.021)	(0.024)	(0.019)	(0.020)	(0.020)
log(employees)	0.0715***	0.0897**	0.131***	0.0716***	0.0729***	0.0724***
	(0.025)	(0.034)	(0.037)	(0.025)	(0.025)	(0.025)
log(total assets parent)	0.352***	0.410***	0.355***	0.352***	0.354***	0.351***
	(0.062)	(0.091)	(0.078)	(0.062)	(0.062)	(0.057)
log(GDP)	2.497**	-0.0753**	1.548	2.501**	2.547**	2.570**
	(1.068)	(0.035)	(1.009)	(1.083)	(1.092)	(1.042)
log(GDP p.c.)	-2.442*	0.0277	-1.738	-2.448*	-2.475**	-2.491**
	(1.226)	(0.126)	(1.158)	(1.249)	(1.231)	(1.199)
Corruption	-0.130	0.0983	-0.0384	-0.129	-0.136	-0.148
	(0.183)	(0.079)	(0.144)	(0.184)	(0.182)	(0.177)
Inflation rate	0.0147	0.0185	0.0186	0.0147	0.0150	0.0164
	(0.013)	(0.015)	(0.012)	(0.013)	(0.013)	(0.014)
N	6,723	6,493	6,488	6,723	6,723	6,723
R^2	0.708	0.773	0.785	0.708	0.709	0.711
Country FE	X		X	X	X	X
MNE FE		X	X			
Year FE	X	X	X	X	X	X

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), Microdatabase Direct Investment (MiDi), combined dataset 2001-2019, own calculations.
Standard errors clustered at the group level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

compare these groups to the average location.[11] The only group that sees a significantly higher effect of interest inflows on profits is the group of conduit locations. In column (6), the estimated effect of a 10% increase in received interest is a 1.9% increase in profits. For both the low-tax and tax haven locations, there is no significant difference in the effect compared to all other locations.

[11]Low-tax countries are defined as locations with a corporate tax rate lower than 10%, tax havens, and conduit locations are defined in Table 4.A.1 and 4.A.2 respectively.

4.7 Conclusion

In this paper we present a newly matched dataset on the international interest transaction of German multinational corporations. The dataset includes the universe of German MNEs and their cross-border payments for a time span of the past 20 years which allows us to investigate internal capital markets in granular detail.

From our analysis, we can draw three novel insights about internal capital markets and the role of interest payments: Firstly, interest outflows are highly concentrated. On average, nearly 60% of all interest paid from Germany flows to the Netherlands and Luxembourg. While both countries have moderately high corporate taxes (25.8 and 24.9% respectively), they are known to offer preferential tax treatment for investment entities. These incentives strongly reflect in the interest flows from Germany; taken together the Netherlands and Luxembourg received around 8 bn. Euro in interest payments in 2020. The second conclusion concerns the distribution of interest flows across firms. The unique structure of our dataset reveals that both interest payments and income are highly concentrated among the largest multinationals. While MNEs that do not report any transactions have less than four affiliates on average, groups with the highest interest payments are active in more than eight locations and operate more than 20 affiliates. In the final part of this paper, where we examine interest payments to conduit and tax haven locations, a clear pattern emerges. Across locations, increased interest income is associated with higher reported profits, in particular for conduit locations.

This paper contributes to the existing literature on debt shifting and internal capital markets by highlighting the central role of conduit locations for international capital flows. Conduit locations, in particular those within the EU, appear to facilitate the largest share of internal financing and the potentially associated debt shifting. On the hand, they generally face less scrutiny from international anti-tax avoidance initiatives such as the OECD's BEPS program compared to traditional tax havens. The findings of this paper suggest that policymakers should be more mindful of the opportunities for profit and debt shifting that can arise even within fully BEPS-compliant jurisdictions.

Building on these results, further research could help to improve our understanding of the factors that make certain conduit locations appealing. Different conduit locations could be attractive to MNEs for different reasons such as favorable double taxation

treaties, zero withholding taxes, or even advanced taxation agreements for individual firm groups. It is challenging to disentangle the effects of these individual features of the tax system. To design effective anti-tax avoidance policies, however, it is imperative to understand which factors exactly attracts the large inflow of interest to conduit locations.

4.A Appendix

4.A.1 Data

Table 4.A.1: *Tax haven locations following Hines Jr. (2010) excl. conduit locations*

Andorra	Anguilla	Antigua and Barbuda
Aruba	Bahamas	Bahrain
Barbados	Belize	Bermuda
Brit. Virgin Islands	Cayman Islands	Cook Islands
Costa Rica	Curaçao	Cyprus
Djibouti	Dominica	Gibraltar
Grenada	Guernsey	Isle of Man
Jersey	Jordan	Lebanon
Liberia	Liechtenstein	Macao
Maldives	Malta	Marshall Islands
Mauritius	Micronesia	Monaco
Montserrat	Nauru	BES-Islands
Sint Maarten	Niue	Panama
Samoa	Seychelles	Singapore
St. Kitts and Nevis	St. Lucia	St. Vincent and the Grenadines
Tonga	Turks and Caicos Islands	Vanuatu

Table 4.A.2: *Conduit locations following Lejour (2021)*

Hong Kong	Ireland	Luxembourg
Netherlands	Singapore	Switzerland

4.A.2 Additional results

Table 4.A.3: *Multinationals and interest flows*

	(1) Single Aff.	(2) Multiple Aff.	(3) Multiple Aff. (per Aff.)
Received from affiliates (total)	690.583	1554.288	327.117
Paid to affiliates (total)	158.713	508.513	100.960
Paid to fin. affiliates (total)	672.723	1882.838	728.932

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), Microdatabase Direct Investment (MiDi), combined dataset 2001-2019, own calculations.

Table 4.A.4: *Interest flows and tax haven access*

	(1) Access TH	(2) No Access TH	(3) Overall
Received from affiliates (total)	2855.878	930.826	2169.527
Paid to affiliates (total)	2456.218	789.494	2112.443
Paid to fin. affiliates (total)	1.3e+05	2.1e+05	1.4e+05

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Statistics on International Financial and Capital Transactions (SIFCT), Microdatabase Direct Investment (MiDi), combined dataset 2001-2019,own calculations.

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Chapter 5

The Role of Financial Centers for Internal Capital Markets

ABSTRACT

This paper empirically investigates the importance of financial center locations for the internal capital structure of German multinational enterprises (MNEs). Extensive theoretical and empirical research has shown that internal debt levels of MNEs strongly respond to tax incentives. Using detailed data on internal lending and debt positions within German MNEs, I test if the allocation of internal lending is tax-optimized in a similar way. The empirical analysis shows that tax incentives are poor predictors of internal lending, which is predominantly operated from locations that offer specialized financial market environments. Controlling for tax incentives and firm characteristics, the internal lending to assets ratios are on average twice as high in these financial center locations. Lastly, this paper finds that the tax response of internal debt appears to be driven by firm groups with access to financial centers.

5.1 Introduction

There is a growing concern within the European Union (EU) about the role of financial center countries. In a contribution to the economic bulletin of the European Central Bank, Di Nino et al. (2020) express their concern about growing external liabilities in some EU economies that appear to be driven by the financial activities of large multinational enterprises. They define the six EU countries with the highest external imbalances, Belgium, Cyprus, Ireland, Luxembourg, Malta, and the Netherlands, as "financial center" locations. While the average corporate tax rate in these countries was 23.25% in 2019, all of them provide targeted incentives to attract multinational investment. Despite their membership in international anti-tax avoidance initiatives such as the OECD's project against Base Erosion and Profit Shifting (BEPS), financial centers are regularly critiqued for attracting mobile profits and capital either through low tax enforcement, reduced tax liabilities for investment entities, tax secrecy or favorable double tax treaties outside of the EU (see Vleggeert and Vording, 2019; Wayne, 2014). These targeted tax incentives have strong implications for the economic activity of all MNEs operating in the EU.

Internal capital markets allow MNEs to efficiently allocate funds across their affiliate network. Besides the expected return to capital, tax incentives play an important role in the structure of the internal capital market. From a theoretical point of view, MNEs have an incentive to allocate internal debt in high-tax countries as interest payments are fully tax deductible and to have the beneficiary of the corresponding loans in lower tax environments (see Mintz and Smart, 2004; Huizinga et al., 2008; Goldbach et al., 2021). According to this literature, MNEs would optimally choose the location with the lowest corporate tax rate to receive all interest income from internal loans. However, for a large multinational corporation that is choosing a location to operate its internal financial services from, other locational factors are important as well. Access to large financial markets and a reliable institutional environment are critical factors to operate financial services, in particular at a large scale. Empirical evidence on the use of "internal banks", affiliates that operate financial services for their firm group, however, is relatively scarce. The *Microdatabase Direct Investment* (MiDi) provided by the German central bank (Deutsche Bundesbank) is a unique data set that contains detailed, annual balance sheet

information on foreign affiliates of German multinationals.[1] The database includes information on the affiliate-level capital structure and thus allows me to trace the allocation of debt and internal lending within German MNEs. Information on internal lending positions is rarely available in firm-level data sets. By matching this data set with corporate tax rate information from the RSIT's International Tax Institutions (ITI) database, I am able to thoroughly analyze the relationship between tax incentives, financial center locations, and internal lending.

This paper thus addresses the following research questions: *Is there a bias in internal lending towards financial center locations and how strong is it? Are internal banks enablers for debt shifting?*

I aim to answer these questions in three steps: First, using the unique structure of the MiDi database, this paper offers extensive descriptive statistics on the internal lending positions of German MNEs. Descriptively comparing the lending behavior in financial centers to other countries shows a significant concentration of intra-firm lending in financial centers. The descriptive part of the analysis further reveals that intra-firm lending is extremely concentrated among a few firms and that (statutory) tax incentives cannot sufficiently explain the allocation of lending positions. By matching affiliates from financial centers to other affiliates with similar intra-group tax positions, I show that there is a strong concentration of equity in high-tax EU financial centers. Matching affiliates on statutory tax incentives and firm characteristics reveals that entities in financial centers show an internal lending ratio 1.77 times higher compared to similar affiliates with the same tax incentives in other countries. By matching affiliates of comparable tax positions and observable firm characteristics, I obtain a non-parametric estimate of the "excess" lending operated in financial centers.

The last part of the analysis focuses on the role of financial center access for the tax-elasticity of debt within MNEs. Using a fractional probit model, I show that only groups that have at least one affiliate in a financial center location have a significant response of their internal debt ratio to changes in the local tax rate. Groups without access to a financial center on the other hand display a significant response in their parental

[1]The analysis was carried out as a guest researcher (GaFo) in multiple research stays at the Research Data and Service Centre between September 2022 and April 2023 under the project ID 2022/0057. For further information on the Microdatabase Direct Investment, see Friederich et al. (2021) and Blank et al. (2020) (DOI: 10.12757/BBk.MiDi.9919.07.08).

debt ratio. Responses in the external debt ratio are similar across both groups. These findings highlight that the structure of the internal capital market is highly important for the tax response of debt and debt-shifting strategies.

This paper contributes to the larger literature that analyzes the tax sensitivity of debt across different locations of MNEs. An extensive empirical literature documents that MNEs strategically allocate more debt in locations with higher tax rates. Desai et al. (2004) analyze the tax response of debt in a panel of U.S. multinationals and document that an increase in the local tax rate is associated with a significant increase in the debt-to-asset ratio. Furthermore, they show that this response is stronger for parental debt than it is for external debt. Similarly, Huizinga et al. (2008) show theoretically and empirically how tax incentives at the group level affect the allocation of external debt. Using a panel of European MNEs, they estimate that an increase in the local tax rate by 10% leads to an increase in leverage by 1.6%.

Many studies on the tax response of internal debt rely on the MiDi database which is one of the only available data sets that contains detailed information on internal loan positions of MNEs. Buettner et al. (2009) use this dataset to analyze the tax response of debt in German MNEs. However, they do not document a significant difference in the elasticity of internal versus external debt. Møen et al. (2019) extend the theoretical model proposed by Huizinga et al. (2008) to allow for the use of internal debt. Their model shows that MNEs will optimally use both internal and external debt to minimize the global tax burden. Most recently, Goldbach et al. (2021) offer a comprehensive analysis of the tax sensitivity of the different debt types. Egger et al. (2014) argue that a second important motivation for the use of internal capital, besides debt-shifting opportunities, is to overcome imperfections of the financial market. Their theoretical model includes financially-constraint affiliates that particularly benefit from an efficient internal capital market.

This paper contributes to this literature by highlighting the role of financial and conduit locations for the internal capital markets of MNEs. The analysis shows that the tax elasticity of internal debt is driven by large MNEs that have access to financial center locations where they operate internal financial services at a large scale. This finding helps to understand the role of specialized external financial markets for the organization of internal financial markets and emphasizes the role of conduit locations

for profit shifting strategies. The results suggest that within the EU, debt shifting as a profit shifting channel is primarily used by very large MNEs that strategically operate their internal financial services from one of the outlined financial centers.

The remainder of the paper is organized as follows: Section 5.2 reviews the institutional set-up, the tax incentives of internal lending, and the characterizing features of financial center locations. Section 5.3 presents the data set and the methodology used in this paper. Section 5.4 first presents the descriptive results on the capital structure of financial center affiliates. Then, it presents the results on which groups operate from these locations and their impact on the group-wide tax-elasticity of debt. Finally, Section 5.5 concludes.

5.2 Internal capital markets and financial centers

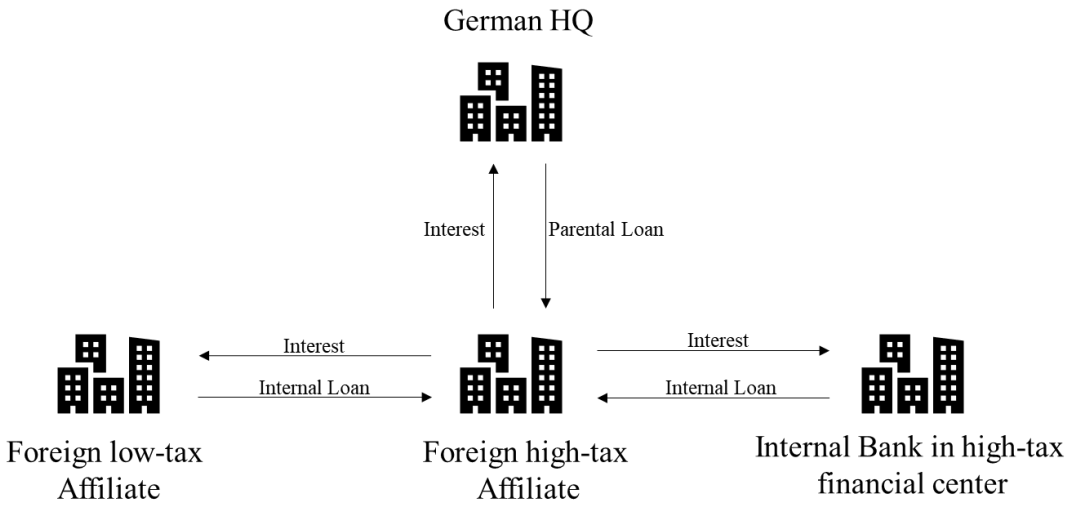
The goal of this paper is to assess the importance of financial center affiliates for the capital structure of MNEs. The following section thus reviews the decision margins an MNE faces for its internal financing and capital structure. Moreover, it discusses the institutional features of financial center locations and the implications for internal capital markets.

When the parent firm (e.g. the group's headquarter (HQ)) of a multinational group decides to install a new affiliate, it can choose to finance this entity through debt or equity. Debt financing can be further divided into external and internal debt, depending on the sources of the capital. Figure 5.2.1 gives a stylized overview of the internal financing decision an MNE can make to finance its affiliates and the associated tax implications. The first option of internal lending is parental debt. In this case, the parent firm (which is always the German HQ in our data) directly gives a loan to the subsidiary and receives interest income in return. If the affiliate is located in a country with a higher corporate tax rate than Germany, parental loans reduce the total tax burden of the firm group as interest expenses are generally fully deductible in the higher tax affiliate country.[2] There is extensive research showing that the use of

[2]The only exception here is if the affiliate country applies a limitation on interest deductibility such as a thin-capitalization or earnings-stripping rule.

parental debt is responsive to these tax incentives (Desai et al. (2004) provide evidence on the tax sensitivity of parental lending and Büttner and Wamser (2007) exploit the introduction of thin-capitalization rules to highlight the tax-saving motivation of parental debt).

Figure 5.2.1: *Intra-firm financing decisions*



Alternatively, loans *between* affiliated companies can be used to finance individual subsidiaries. From a theoretical point of view, the parent shareholder has an incentive to allocate these intra-firm loans (and thus the associated interest income) to the location with the lowest tax rate in the group to minimize the tax liability on interest payments. However, corporate tax rates are not the only determinants for the allocation of loans. Access to an efficient financial market and institutional stability are also central to operating internal financial services.

There is a number of smaller EU countries that have specialized in providing an ideal investment environment for these financial entities. Vleggeert and Vording (2019) outline the characteristic features of a financial hub for the case of the Netherlands. The authors point out developments in the Dutch tax code that supported its status as the most important conduit location to date. Historically, the Netherlands became known for very favorable tax treaty opportunities that allowed enterprises to reroute profits to zero-tax locations at a very low cost. Additionally, the Netherlands did not levy any withholding taxes on interest or royalties until the beginning of 2021. Belgium on the other hand has become known as a financial center by providing specific tax exemptions

for so-called coordination centers. These exemptions were aimed at entities that provide internal services for the remaining group at a significantly lower tax rate than the regular Belgian corporate tax rate.[3] These institutional features help financial centers to attract large volumes of international investment and financial services despite their moderately high corporate tax rates.

5.3 Data and empirical methods

5.3.1 Data

The empirical analysis is based on a yearly panel of foreign affiliates of German MNEs for a time period from 2000 to 2019.[4] The dataset contains balance sheet information on foreign subsidiaries and their ownership relations to the German headquarter. Most importantly, the MiDi database is one of the only data sets that includes detailed information on the capital structure of all affiliates. Besides the (internal) debt and equity positions, it further includes lending positions towards shareholders and affiliated companies. Taken together, this information allows for a comprehensive analysis of the internal capital markets of German MNEs. The final dataset includes 55,513 foreign subsidiaries in 183 host countries that belong to 11,164 firm groups. About 10 percent of all affiliates in the sample are located in financial center locations.

The first part of the following analysis is focused on internal lending positions at the affiliate level and how tax incentives shape the allocation of these positions. To account for firm size, I define the internal lending ratio as the share of loans to foreign and resident affiliated companies in total assets.[5] Table 5.3.1 summarizes information on the firms' capital structure, their tax environment, and other firm characteristics, variable definitions can be found in Table 5.A.1. These summary statistics illustrate the bias towards internal lending from financial centers that this paper investigates. On average, affiliates of German MNEs located in a financial center report that 4.1%

[3]Note that in 2003, the EU Commission has classified the Belgian coordination center regime as state aid and therefore non-compliant to the Common Market laws. However, exisiting coordination centers were granted tax exemptions until 2010 (see Rainer, 2006).

[4]The MiDi database is currently available from 1999 to 2019. However, due to limitations in other variables, the sample is restricted to the years 2000 to 2019 for the empirical analysis.

[5]In the context of the MiDi dataset, resident refers to domestic affiliates of German MNEs. Total assets comprise fixed and intangible assets, financial assets, current and other assets of the affiliate. Any lending positions are counted towards the affiliate's financial assets.

Table 5.3.1: *Summary statistics*

	Financial Centers				*Other Countries*			
	Mean	S.D.	Median	Obs.	Mean	S.D.	Median	Obs.
Internal lending ratio	**0.041**	0.16	0.00	34,953	**0.015**	0.09	0.00	306,408
Internal lending	70,027	841,055	0.00	34,953	8,141	252,434	0.00	306,436
Debt ratio	0.542	0.38	0.61	34,946	0.600	0.33	0.66	306,283
Corporate tax rate	0.265	0.06	0.25	34,953	0.257	0.08	0.25	306,420
Tax differential	0.006	0.05	0.00	34,953	-0.000	0.06	-0.00	306,420
log(sales)	6.57	4.82	8.85	34,953	8.33	3.89	9.47	306,436
Loss carried forward	0.44	0.50	0.00	34,953	0.50	0.50	1.00	306,436
Tangibility	0.18	0.28	0.02	34,953	0.24	0.28	0.12	306,409
GDP growth	2.22	2.57	1.96	34,953	2.66	2.45	2.26	304,342

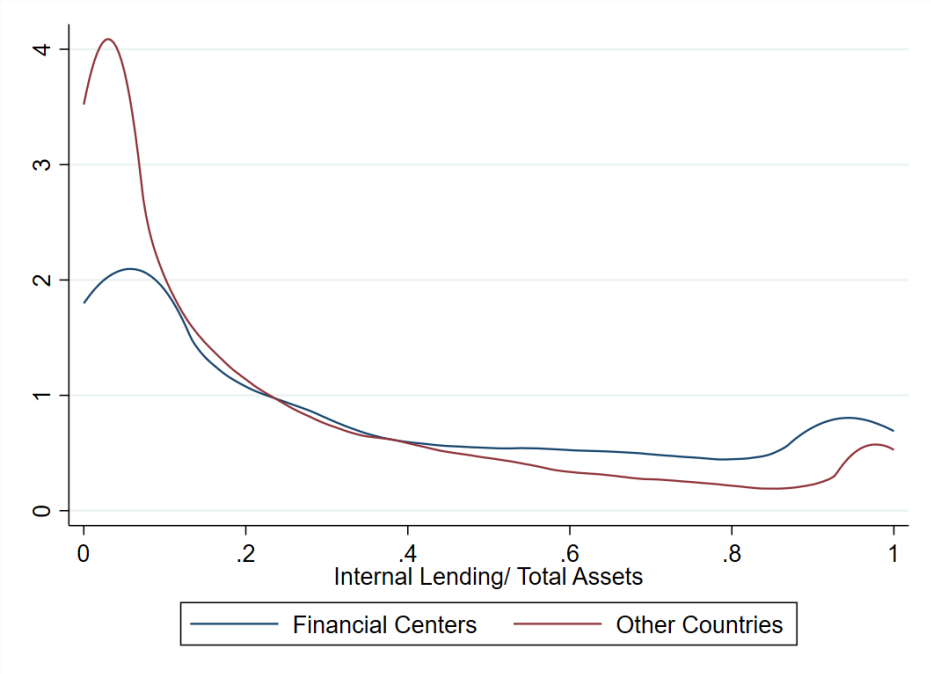
Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.
Internal lending measured in 1,000€.

of their total assets consist of internal lending compared to just 1.5% for affiliates in all other locations. In absolute terms, this translates to outstanding loan positions of more than 70,000,000€ in financial center affiliates and around 8,000,000€ for non-financial center affiliates on average. In both cases, the median lending is zero which is, as shown in Table 5.A.2 and Figure 5.3.1, explained by the strong concentration of internal lending.

Additionally, Table 5.3.1 includes the firms' debt ratio, e.g. their outstanding debt relative to their total capital. The debt ratio is another central key figure in a firm's capital structure. Financial center affiliates on average have a slightly *lower* debt ratio than other countries.[6] Table 5.3.1 further allows for a comparison of the tax incentives between financial centers and other locations. Notably, the average corporate tax rate is slightly *higher* in financial center locations. These summary statistics are puzzling from a theoretical point of view. To limit tax liability, it would be optimal to allocate lending in low-tax locations since interest income increases profits. This paper aims to quantify how much the allocation of lending is distorted by the presence of financial centers. Other firm characteristics are more similar across all locations. There are no notable differences in their turnover, the probability of having a positive loss carried forward from previous periods, or their tangibility (e.g. the share of fixed and intangible

[6]This is relevant when considering if lending is operated as a "conduit" activity, e.g. if lending is merely channeled through EU financial centers while the ultimate beneficiary is another affiliate within the group. In the conduit case, higher internal lending should be associated with an increasing debt ratio which does not appear to be the case here.

Figure 5.3.1: *Distribution of the internal lending ratio*



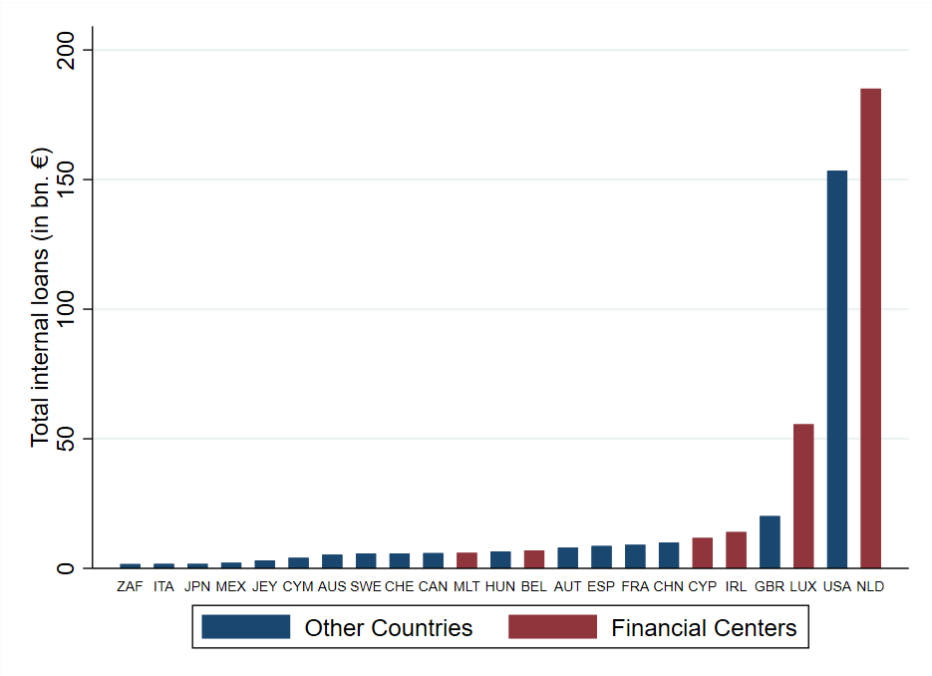
Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.

assets in their balance sheet total).

Figure 5.3.1 illustrates the concentration of intra-firm lending among financial center locations. Both distributions reveal that most affiliates either report zero or very low levels of intra-company loans on their balance sheet, while others report very high levels with some stating that internal lending makes up almost all of their assets (reflected by an internal lending ratio close to one). This concentration suggests that some MNE groups operate affiliates whose main purpose is to operate intra-group financing. Figure 5.3.1 also reveals that financial centers host many *fewer* affiliates with low internal lending rates and *more* affiliates that report higher internal lending rates.

Figure 5.3.2 complements this description by comparing the total outstanding internal loans of the most important affiliate location for German MNEs. The largest stock of foreign loans is located in the Netherlands with a yearly average of nearly 200 bn. Euro. The second largest lender is the US, which is one of the largest destinations of German direct investment, followed by Luxembourg in third. Generally, lending to German subsidiaries is over-proportionately held through financial center locations.

Figure 5.3.2: *Outstanding internal loans, yearly average*



Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.

5.3.2 Empirical specifications

The first part of the analysis estimates by how much lending from financial center location exceeds lending from other countries, controlling for tax incentives and firm characteristics. The methodology closely follows Egger et al. (2010) who estimate the effect of foreign ownership on the affiliate-level capital structure. By matching foreign-owned affiliates to domestically owned ones with similar observable characteristics, Egger et al. (2010) overcome the underlying selection issue. In doing so, they obtain an estimate for the effect of foreign ownership on the debt ratio that allows for an endogenous choice of acquisition by foreign owners. I adapt this approach to estimate the effects of an affiliate being located in a financial center country while controlling for tax incentives and firm characteristics. The propensity score matching approach allows me to construct a comparison group of non-financial center affiliates that are much more similar in their tax position and their characteristics to subsidiaries in financial centers. Table 5.A.3 shows how this matching approach balances out the observable characteristics between financial center affiliates and the control group. Comparing the internal lending rate of the two groups can thus be interpreted as a non-parametric

estimate of "excess lending" that is operated from financial center locations that cannot be explained by tax incentives or observable firm characteristics. Another strand of literature that often uses a similar methodology is found in the empirical research on the wage disparity between male and female employees. For instance, Meara et al. (2020) estimate the gender pay gap in the US by matching on different worker and occupation characteristics. By matching on observable characteristics, they obtain a wage differential that accounts for measured differences between both groups.

For the second part of the analysis, Section 5.4.2 investigates which groups will operate a financial center affiliate. I use a probit estimation to determine how firm characteristics affect the probability that a given MNE operates an affiliate in any of the defined financial center locations. I estimate the following equation:

$$Y_{jt} = \beta_0 + \zeta X_{jt} + \varepsilon_{it}, \tag{5.3.1}$$

where Y_{jt} is a binary variable that indicates whether firm group j operates a financial center affiliate at time t and X_{jt} is vector of control variables at the group level.

Finally, Section 5.4.3 estimates how financial center access impacts the tax response of debt in the remaining firm group. The variables of interest here are the *internal debt ratio*, the *external debt ratio*, and the *parental debt ratio*. The internal debt ratio is defined as the ratio of total liabilities to affiliated companies to total capital, the external debt ratio is the share of external liabilities in total capital and the parental debt ratio is the share of parental loans in total capital. These ratios are by definition bound between zero and one, which cannot be accommodated by conventional linear fixed-effects estimator. Instead, this section employs the fractional probit approach suggested by Papke and Wooldridge (2008). By conditioning on the appropriate sample means, this estimator builds on Mundlak (1978) and is thus able to account for time-invariant, unobserved effects in a way that does not impose a linear functional form. The model is estimated with the following specification:

$$Y_{it} = \beta_0 + \zeta X_{it} + \vartheta \bar{X}_{it} + \gamma_t + \varepsilon_{it}, \tag{5.3.2}$$

where Y_{it} is either the internal, parental, or external debt ratio of firm i at time t and

X_{it} is the vector of control variables that includes the local corporate tax rate, the log of sales, a dummy variable indicating whether the firm reports a loss carried forward (LCF), the affiliates tangibility and the GDP growth rate of its host country. Year dummies are captured by γ_t and $\bar{X}_{it}$ represents the time averages for all explanatory variables.

5.4 Results

5.4.1 Descriptive findings

Table 5.4.1 presents the results of the matching approach outlined in Section 5.3.2. The first column names the step of the matching approach, the second and third column denote the average internal lending rate for financial centers and other countries, respectively. The fourth and fifth column show the difference between both groups with the bootstrapped standard error, while the last two columns denote the number of observations.

Table 5.4.1: *Average effect of financial center location on internal lending ratio*

		Average lending rate				Observations	
		Fin. Centers	Others	Difference	s.e.	Fin. Centers	Others
(1)	Unmatched Sample	.04064	.01361	.02703	.00062	34,953	147,370
(2)	Matched on taxes	.04064	.0083	.03234	.00356	34,953	147,370
(3)	+firm variables	.04064	.01824	.02241	.00344	34,953	147,370
(4)	+industry dummies	.04064	.0229	.01775	.00334	34,953	147,370
(5)	Excl. CYP&IRL	.04089	.02305	.01785	.0034	31,965	147,370
(6)	Excl. NLD	.0418	.02356	.01827	.00416	18,902	147,307

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.
Nearest-neighbor matching approach, all standard errors are bootstrapped.

Line (1) compares the internal lending ratio of financial center locations to the internal lending rate in other locations. Comparing both groups directly shows that financial center affiliates have an internal lending rate that is roughly three times higher than it is in other locations. The following line compares the internal lending ratio in financial center locations to a subsample of all other affiliates that have been matched on the statutory tax rate and a dummy variable that equals one if an affiliate is located

in the group's lowest tax location to capture the tax incentives for lending. The average lending rate in the matched sample *decreases* which indicates that affiliates with similar tax incentives in locations that would not be considered financial centers have *lower* levels of internal lending. This leads to an increase in the estimated difference between both groups. Tax incentives, however, are not the only determinant of internal lending. When additionally matching on the log of sales, a dummy for positive of losses carried forward and the share of tangible assets, the estimated difference in the lending rate decreases substantially. These firm characteristics, in particular the level of sales and the measure of tangibility, are generally seen as indicators of real economic activity within an affiliate. Financial service providers on the other hand are characterized by low sales and low levels of tangible assets. Matching on these variables thus helps to construct a more suitable group for comparison which leads to the lower estimated difference between both groups. Nevertheless, the lending rate in the matched sample is still only half the rate of the financial center sample and the difference remains highly significant. The final matching additionally includes industry dummies to account for potential differences in the industry composition across both sets of countries. The estimated difference slightly decreases to 0.01775 but remains highly significant.

To summarize, the final matching specification in line (4) compares financial center affiliates to a matched sample of entities from other countries with a similar tax position, similar firm characteristics, and if possible within the same NACE industry. The "residual" difference in the internal lending ratio is still nearly 2 percentage points and highly significant. Matching on available and observable firm and group level variables results in a control group where the internal lending ratio is still only 56% of the average ratio in a financial center.

These estimates are robust to a number of tests. The last two lines in Table 5.4.1 test if the findings are potentially driven by the lower-tax financial centers, Cyprus and Ireland, or by the largest conduit location, the Netherlands. Both estimations include the same matching variables as line (4). The estimated differences in lines (5) and (6) are remarkably close to the previous estimate, indicating that no particular financial center is driving the effect. Another potential concern is the 1:1 nearest-neighbor matching approach where each financial center affiliate is matched to exactly one affiliate in the other locations. Table 5.A.4 thus replicates the specifications from Table

5.4.1 using the 50 closest neighbors for the comparison group. The estimated differences become slightly smaller but the overall effect is persistent and remains strongly significant.

5.4.2 Which MNEs operate financial center affiliates?

Next, the following section presents the results on which firm groups are most likely to operate in a financial center. For this estimation, the dependent variable is a dummy variable that is equal to one if there is at least one financial center affiliate in the group and the data is aggregated at the group level. The goal here is to understand which firm and group-level characteristics correlate with financial center presence.

Table 5.4.2 presents the estimates from equation 5.3.1. Columns (1) and (3) present the coefficients of the probit model, while columns (2) and (4) show the corresponding average partial effects (APE). Both specifications show that MNEs that operate financial center affiliates have higher sales at the affiliate level and the group level. This finding is in line with Goldbach et al. (2021) and suggests that primarily large groups operate internal financing from financial centers. Another interesting finding in Table 5.4.2 is that the average affiliate tax rate is not significantly associated with the probability of operating in a financial center location but the minimum corporate tax rate of the group is significantly negatively related to the probability. A potential explanation here could be that in especially MNEs that are not active in low-tax countries are using financial centers and their internal capital market to lower their aggregate tax burden.

Table 5.4.2: *Probit estimates for financial center access*

	(1) Coef.	(2) APE	(3) Coef.	(4) APE
Mean Corporate tax rate	-0.0694	-0.0169		
	(0.257)	(0.063)		
Minimum Corporate tax rate			-5.154***	-1.156***
			(0.244)	(0.051)
log(sales aff.)	0.0543***	0.0132***	0.0646***	0.0145***
	(0.014)	(0.004)	(0.015)	(0.003)
log(emp aff.)	-0.0350***	-0.00850***	-0.0443***	-0.00994***
	(0.013)	(0.003)	(0.013)	(0.003)
log(sales group)	0.146***	0.0355***	0.128***	0.0288***
	(0.019)	(0.005)	(0.020)	(0.004)
log(emp group)	-0.00223	-0.000543	-0.0128	-0.00288
	(0.019)	(0.005)	(0.019)	(0.004)
Mean GDP growth	0.00151	0.000368	-0.0322***	-0.00722***
	(0.006)	(0.002)	(0.008)	(0.002)
Mean Inflation	0.0300***	0.00728***	0.0300***	0.00674***
	(0.006)	(0.001)	(0.007)	(0.002)
Mean Corruption	0.671***	0.163***	0.788***	0.177***
	(0.028)	(0.007)	(0.030)	(0.007)
N	42,148	42,148	42,148	42,148
R^2	0.136		0.202	

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.
Dep. variable: Dummy variable for financial center access. log(sales group) and log(emp. group) are measured for the entire group, all other variables are yearly averages at the affiliate level, standard errors clusted at the group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.4.3 The effects on internal lending

The following section analyzes how financial center access affects the tax sensitivity of debt in the remaining group. Table 5.4.3 presents a descriptive comparison between multinational groups that operate an affiliate in a financial center and groups without such an entity within their network.

Table 5.4.3 compares the internal, external, and parental debt ratios across these groups. Notably, affiliates of MNEs that have access to lending from a financial center have a much higher internal debt to total capital ratio (average of 0.19 compared to 0.10). Similarly, they report lower levels of external debt than groups without access (average of 0.28 compared to 0.35). These statistics suggest that there is a systematic

Table 5.4.3: *Summary statistics - financial center access*

	Access		*No Access*		*Overall*	
	Mean	Median	Mean	Median	Mean	Median
Internal Debt	**0.191**	0.036	**0.103**	0.002	0.118	0.003
External Debt	**0.277**	0.170	**0.354**	0.281	0.340	0.259
Parental Debt	0.044	0.000	0.076	0.000	0.070	0.000
N	57,490		280,780		341,229	

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.
Financial center affiliates excluded.

difference in the capital structure of groups that have access to a financial center location and groups that do not.

Table 5.4.4 presents the fractional probit estimates from equation 5.3.2 for the internal debt share. Column (1) is the baseline estimate, while column (2) includes the interaction between the corporate tax rate and the dummy variable indicating financial center access. One advantage of the fractional probit approach is the option to evaluate average partial effects (APE) at different levels of the independent variables. Columns (3) and (4) therefore present the APEs evaluated for affiliates without and with financial center access, respectively. All other variables are evaluated at the sample mean.

For the internal debt ratio in Table 5.4.4, the corporate tax rate has the expected sign but the coefficient remains insignificant in the baseline specification. When the interaction with *access* is included, the interaction term in column (2) becomes strongly significant. This suggests that only for affiliates that have access to a financial center location in their group, increases in their local tax rate are associated with significant increases in their internal debt ratio. Examining the partial effects in columns (3) and (4) reveals that for affiliates that have access to a financial center location, an increase in their local corporate tax rate by 10% is associated with a significant increase in their internal debt ratio by 0.54 percentage points.

This estimate is smaller than most estimates found in previous studies which might partly be explained by the fixed effects structure. Affiliates without access to a financial center location do not respond significantly to changes in their local tax rate. For the other control variables in Table 5.4.4, we see that larger affiliates, those with a loss carried forward, and those with less tangible assets use significantly more internal debt.

Table 5.4.4: *Internal debt sensitivity and financial center access*

	Coefficient		*APE*	
			$access = 0$	$access = 1$
	(1)	(2)	(3)	(4)
Corporate tax rate	0.127	-0.0521	-0.00963	0.0543***
	(0.084)	(0.093)	(0.017)	(0.018)
Corporate tax rate x access		0.318***		
		(0.062)		
log(sales)	0.00989***	0.00961***	0.00178***	0.00196***
	(0.002)	(0.002)	(0.000)	(0.000)
Loss carried forward	0.0227***	0.0233***	0.00431***	0.00474***
	(0.006)	(0.007)	(0.001)	(0.001)
Tangibility	-0.0498**	-0.0475**	-0.00878**	-0.00968**
	(0.024)	(0.024)	(0.004)	(0.005)
GDP growth	-0.00293**	-0.00289**	-0.000535**	-0.000589**
	(0.001)	(0.001)	(0.000)	(0.000)
N	304,154	304,154	304,154	304154

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.
Dep. variable: Internal debt share, includes time dummies and time-averages of all independent variables, standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Similarly, affiliates in locations with lower economic growth use more internal debt. All coefficients have the expected signs but the magnitude of effects is again somewhat smaller compared to previous estimates.

Table 5.4.5 presents the same specification using external debt as the dependent variable. Here, the coefficient on the corporate tax rate is positive and significant both for the baseline specification in column (1) and when including the interaction term in column (2), while the interaction effect remains insignificant. Therefore, affiliates with and without access to financial center locations exhibit similar tax elasticities for external debt. For those affiliates that do not have a financial center subsidiary in their group, an increase in the local corporate tax rate of 10% is associated with an increase in their external debt ratio by 1.42 percentage points. For subsidiaries of groups with financial center access, the same increase in the tax rate implies an increase in the external debt ratio of 1.24 percentage points. This finding is not surprising if MNEs with and without financial center access have similar access to the external financial

Table 5.4.5: *External debt sensitivity and financial center access*

	Coefficient		*APE*	
			$access = 0$	$access = 1$
	(1)	(2)	(3)	(4)
Corporate tax rate	0.377***	0.401***	0.142***	0.124***
	(0.059)	(0.063)	(0.022)	(0.022)
Corporate tax rate x access		-0.0495		
		(0.045)		
log(sales)	0.0230***	0.0232***	0.00820***	0.00816***
	(0.001)	(0.001)	(0.000)	(0.000)
Loss carried forward	0.133***	0.134***	0.0473***	0.0471***
	(0.005)	(0.005)	(0.002)	(0.002)
Tangibility	0.0704***	0.0699***	0.0247***	0.0246***
	(0.018)	(0.018)	(0.007)	(0.006)
GDP growth	0.00289***	0.00286***	0.00101***	0.00101***
	(0.001)	(0.001)	(0.000)	(0.000)
N	304,154	304,154	304,154	304154

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.
Dep. variable: External debt share, includes time dummies and time-averages of all independent variables, standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

market. The coefficients on the control variables are very similar for both groups as well.

Table 5.4.6 presents the results for the use of external debt. The coefficient for the corporate tax rate is positive and significant in the baseline specification in column (1) which indicates that on average, increases in the local tax rate significantly increase the use of parental debt. However, including the interaction term in column (2) reveals that this effect is driven by affiliates that do not have access to internal debt through a financial center within their group. For these affiliates, a 10% increase in the local corporate tax rate is associated with a significant increase in the parental debt ratio by 0.6 percentage points, while the effect remains insignificant and close to zero for the other group of affiliates.

Overall, these estimates suggest that MNE groups that have at least one subsidiary in a financial center location use this entity to provide internal capital for the remaining group. Tax incentives on the use of debt are strongly dependent on access to different

Table 5.4.6: *Parental debt sensitivity and financial center access*

	Coefficient		*APE*	
			$access = 0$	$access = 1$
	(1)	(2)	(3)	(4)
Corporate tax rate	0.236**	0.408***	0.0600***	0.000547
	(0.099)	(0.104)	(0.016)	(0.013)
Corporate tax rate x access		-0.404***		
		(0.072)		
log(sales)	0.00315*	0.00333*	0.000490*	0.000421*
	(0.002)	(0.002)	(0.000)	(0.000)
Loss carried forward	-0.0121	-0.0115	-0.00170	-0.00146
	(0.008)	(0.008)	(0.001)	(0.001)
Tangibility	0.144***	0.143***	0.0211***	0.0181***
	(0.028)	(0.028)	(0.004)	(0.004)
GDP growth	-0.00126	-0.00127	-0.000187	-0.000160
	(0.001)	(0.001)	(0.000)	(0.000)
N	304,154	304,154	304,154	304154

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.
Dep. variable: Parental debt share, includes time dummies and time-averages of all independent variables, standard errors clustered at the firm group level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

financial markets. Groups that are not active in financial center locations appear to rely more on parental debt than on debt between affiliates.

5.5 Conclusion

This paper investigates the importance of EU financial centers for the internal capital markets of German MNEs deriving two main findings. First, it documents that internal loans are most often operated from a financial center location. Matching financial center affiliates with other subsidiaries with similar characteristics and tax incentives shows that their internal loans-to-assets ratio is nearly twice as high as it is for comparable subsidiaries in other countries. The second important finding in this paper is that financial centers have important implications for the tax sensitivity of debt in the remaining group. The finding in previous studies that (internal) debt increases with higher corporate taxes appears to be driven by groups that have access to financial center locations. The fractional probit approach in this paper reveals that for these

groups, increases in the corporate tax rate lead to significant increases in the internal debt ratio, while groups without financial center access show a similar reaction in their parental debt ratio. Overall, these results suggest that some MNEs rely more on parental debt, while other groups establish designated affiliates in financial centers that provide internal capital. Groups that establish such an internal bank tend to be larger, both in terms of their entire group size as well as in their average affiliate size.

These findings have important policy implications. Financial centers have succeeded in creating strong incentives to attract international investment and capital flows. Policy initiatives against debt shifting such as thin-capitalization or earnings-stripping rules generally do not consider this dynamic. While these rules limit the amount of deductible interest in high-tax locations, they do not address the tax benefits that most financial centers grant to financial entities. This disparity gives large MNEs that centralize their internal capital market in a financial center a distinct advantage compared to smaller MNEs or domestic firms. International initiatives against tax avoidance should pay closer attention to the effects of target tax incentives for mobile capital at the national level.

Building on these results, further research could examine the contribution of financial centers to overall profit shifting in more detail. It is challenging to disentangle to which extent internal financing is motivated by tax avoidance rather than by the goal of efficiently allocating capital. However, understanding this relationship is crucial for policymakers that aim to curb profit shifting.

5.A Appendix

5.A.1 Data

Table 5.A.1: *Variable definitions*

Variable	Definition and Source
Internal lending	Loans to foreign and domestic affiliated companies *Source: Microdatabase Direct Investment, Deutsche Bundesbank*
Internal lending ratio	Internal liabilities divided by total assets *Source: Microdatabase Direct Investment, Deutsche Bundesbank*
Debt ratio	Liabilities divided by total capital *Source: Microdatabase Direct Investment, Deutsche Bundesbank*
log(sales)	Logarithm of turnover *Source: Microdatabase Direct Investment, Deutsche Bundesbank*
Loss carried forward	Binary indicator for a positive loss carried forward *Source: Microdatabase Direct Investment, Deutsche Bundesbank*
Tangibility	Ratio of fixed and intangible assets to total assets *Source: Microdatabase Direct Investment, Deutsche Bundesbank*
Corporate tax rate	Corporate income tax rate *Source: RSIT ITI Database*
Tax differential	Difference between own and group average tax corporate tax rate *Source: RSIT ITI Database*
GDP growth	GDP growth (annual %) *Source: World Governance Indicators, World Bank*
Inflation	Inflation rate (annual %) *Source: World Governance Indicators, World Bank*
Corruption	Control of Corruption index [-2.5; 2.5] *Source: World Governance Indicators, World Bank*

Table 5.A.2: *Concentration of internal lending ratio*

	Financial Centers	*Other Countries*
Percentile	Internal lending ratio	
p90	0.0103	0
p91	0.0324	0
p92	0.0711	0
p93	0.128	0
p94	0.208	0.000456
p95	0.304	0.0128
p96	0.449	0.0525
p97	0.612	0.129
p98	0.789	0.267
p99	0.960	0.540
p99.9	1.000	1.000

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.

5.A.2 Additional results

Table 5.A.3: *Covariate balancing - nearest neighbor matching*

Variable	Sample	Mean FC	Mean Others	%bias	red.	t	p>|t|
Tax rate	Matched	.27805	.25847	25.8		32.42	0.000
	Unmatched	.27804	.28279	-6.3	75.7	-5.78	0.000
Tax diff.	Matched	.01451	2.5e-05	25.4		36.04	0.000
	Unmatched	.01449	.02095	-11.3	55.4	-9.62	0.000
Min. tax	Matched	.15633	.20284	-48.5		-69.52	0.000
	Unmatched	.15635	.1505	6.1	87.4	5.36	0.000
log(sales)	Matched	6.5997	8.2229	-38.3		-55.86	0.000
	Unmatched	6.6	6.909	-7.3	81.0	-6.53	0.000
Loss carried	Matched	.45979	.49846	-7.7		-10.01	0.000
forward	Unmatched	.45987	.48331	-4.7	39.4	-4.57	0.000
Tangibility	Matched	.18284	.271	-30.0		-38.98	0.000
	Unmatched	.18276	.19215	-3.2	89.4	-3.14	0.002

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Table 5.A.4: *Robustness test - average effect of financial center location*

		Average lending rate				Observations	
		Fin. Centers	Others	Difference	s.e.	Fin. Centers	Others
(1)	Unmatched Sample	.04064	.01361	.02703	.00062	34953	147370
(2)	Matched on taxes	.04064	.01256	.02808	.00138	34953	147370
(3)	+firm variables	.04064	.02305	.01759	.00134	34953	147370
(4)	+industry dummies	.04064	.02559	.01507	.00117	34953	147370
(5)	Excl CYP&IRL	.04089	.02668	.01422	.00134	31965	147370
(6)	Excl NLD	.0418	.02677	.01506	.00172	18902	147307

Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, Microdatabase Direct Investment (MiDi), 1999-2019, own calculations.
50 Nearest-neighbor matching approach, all standard errors are bootstrapped.

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