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Abstract

We study the consequences of multinational tax avoidance on the structure of government tax revenues. To motivate our analysis, we show that countries with high revenue losses due to profit shifting have lower corporate tax revenues and rates and higher indirect tax revenues and rates. To establish causality, we use German municipal data and analyse how changes in municipal trade tax rates levied on corporate profits affect local tax revenue structure. Following a trade tax rate increase, we find that municipalities with high exposure to aggressive multinationals experience a significant decline in trade tax revenue levels and shares.[1]

Keywords: Corporate Tax Avoidance, Profit Shifting, Multinational Corporations, Government Tax Revenue Structure

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1 Introduction

The revelations from Panama and Paradise papers in 2016 and 2017 exposed a sizeable amount of international tax avoidance by firms, and in particular, multinational corporations (MNCs). This spurred renewed interest in the literature to calculate the extent to which MNCs shift profits to tax havens and the scale of potential tax revenue losses to governments (Bilicka; 2019; Tørsløv et al.; 2022; Fuest, Greil, Hugger and Neumeier; 2022; Garcia-Bernardo and Janský; 2021). The estimates from the literature suggest these tax revenue losses are large. In this paper, we ask what are the consequences of these tax avoidance practices for where governments derive their tax revenues from. To answer this question, we analyse the relationship between corporate tax avoidance and the structure of tax revenues, both at the country and at the local government level.

We motivate our analysis by looking at the relationship between the amount of profits shifted by multinationals and the tax revenue structure at the country level. To do this, we take advantage of the new country-level estimates of profit shifting from Tørsløv et al. (2022). We have three main findings. First, the larger the amount of profits shifted by multinationals, the lower the proportion of tax revenues that a country derives from corporations. This is because MNCs are the largest firms and consequently the largest taxpayers in most countries. When they choose to move taxable profits away from countries, the corporate tax revenue is likely to be affected, and taxing domestic firms may not compensate for that. Second, when corporate tax revenues decline, governments may choose to use other tax instruments to keep the total tax revenues from declining. We find a positive correlation between the amount of shifted profits and the share of revenues derived from indirect taxes, such as, for example, VAT. Third, consistent with the revenue results, we find that countries with a higher share of shifted profits also have lower corporate tax rates and higher indirect tax rates. These results suggest that profit shifting may affect the revenue structure at the country level.

To establish a causal relationship between profit shifting and tax revenue structure, we take advantage of a large variation in municipal trade tax rates across 11,000 municipalities during the period 2008 - 2019 in Germany combined with data on the geographical presence of firms from Orbis Bureau van Dijk. Germany provides a good laboratory to study this issue, as municipalities set their own multipliers on trade tax rates, while the tax *rates* and *bases* are set by the federal government. During our sample period, the resulting effective trade tax rate varies between 7% and 21%. As this tax is levied on corporate profits, it imposes a large burden on firms. Municipalities can also choose their own multipliers for property tax rates. This flexibility in setting two local tax rates independently allows us to

identify the relationship between tax revenue structure and profit shifting at the local level causally.

Our identification strategy relies on exploring the effects of increases in municipal trade tax rates across municipalities that are differentially exposed to aggressive MNCs.[2] Using the event study approach, we trace the effects of those trade tax rate increases on the share of tax revenues that come from trade tax and property tax. As a baseline, we compare municipalities that experienced tax rate increases (treated group) to those that did not (control group), following Fuest et al. (2018). To understand the importance of profit shifting, we use a triple difference-in-differences approach in which we compare municipalities that are more exposed to aggressive MNCs and those that are not relative to the control group before and after a tax rate increase. We define aggressive MNCs as those having at least one tax haven in their ownership structure, following the large literature (Bilicka and Scur; 2021; Davies et al.; 2018; Gumpert et al.; 2016; Hines and Rice; 1994). The local exposure to more aggressive MNCs is defined as a count and a share of subsidiaries that belong to those MNCs relative to the number of all firms in each municipality.[3]

We find that following a trade tax rate increase at the municipal level, the level of trade tax revenues in municipalities that are more exposed to aggressive MNCs falls, even after controlling for trade tax, property tax rates, and municipal characteristics. We calculate the elasticity of trade tax revenues with respect to one-minus-the-tax-rate to be -1.2 for those municipalities that are more exposed to aggressive MNCs. This elasticity is in line with the elasticities from the literature that estimates the response of a firm's pre-tax profits and country tax bases to changes in tax rates to be in the range between -1 and -1.5 (Beer et al.; 2020). The novelty of this paper, relative to that literature, is in understanding the implications of profit shifting for the revenue *structure*. As such, we also consider the effect of tax rate increases on property tax revenues. We find that municipalities do not compensate for a reduction in trade tax revenue with higher property tax revenues or rates. Consequently, they also have a lower share of trade tax revenues in all revenues and a lower level of total tax revenues. We show that treated and control municipalities experience a similar evolution of tax revenue structure before the tax rate change, but diverge afterward, which allows us to causally interpret our findings. Further, we do not find similar effects for municipalities with a larger share of all MNCs, which we use as a placebo test.

There are two possible mechanisms that can explain why tax revenues decline after a tax

[2]Note that 94% of all trade tax rate changes at the municipal level were tax increases during our sample period.

[3]We also use the share of assets, turnover, and employment these firms have.

rate increase. First, MNCs may choose to move profits away from municipalities that levy larger taxes on them towards their foreign locations. Given that profits are mobile across borders, this can potentially be immediately reflected in tax revenues.[4] Second, MNCs may choose to move their affiliates and/or business operations away from the municipalities that levy higher taxes on them. Further, as Bilicka, Qi and Xing (2022) show, profit shifting may be accompanied by this reallocation of real operations. Both of these effects are likely to be stronger for subsidiaries that belong to more aggressive MNCs. To disentangle the real operations from the profit-shifting mechanism, we separately consider the effects of trade tax rate hikes on the real business operations of MNCs in the treated municipalities. We do not find evidence consistent with the real operations reallocation mechanism, similar to Lichter et al. (2021). As such, our results suggest that profit shifting is driving the decline in the levels and shares of trade tax revenues.

We test the robustness of our findings in three distinct ways. First, instead of firm counts, we use the share of assets, employment, and turnover that subsidiaries which belong to more aggressive MNCs own in each municipality. Our results are consistent with the baseline findings, even though this sample likely overstates the importance of larger firms in each municipality.[5] Second, given the staggered and heterogeneous nature of the tax rate increases across municipalities, we take great care to test the validity of our two-way fixed effects estimates using various newly proposed methods. Our baseline estimates rely on comparing the sample of municipalities that only increased their tax rate once during the sample period to those that did not change their tax rate at all during the sample period. We show that including all of the municipalities does not change out results, as the Goodman-Bacon (2021) decomposition reveals that they mostly rely on the comparison of never treated with treated units. We then provide event study results that account for the negative weights that the staggered and heterogeneous nature of reform introduces by implementing the Callaway and Sant'Anna (2021); De Chaisemartin and d'Haultfoeuille (2020); Sun and Abraham (2021) estimators and find they do not affect our conclusions based on the baseline estimates.

Third, we empirically tackle the issue of tax competition across municipalities. Given the evidence that municipalities, especially smaller ones, can set their tax rates in response to changes in rates of neighbouring municipalities (Buettner; 2003), we control for neighbouring tax rates, as well as weight our results by population. Again, none of these adjustments

[4]Note that given that taxable profits are apportioned according to the share of wages across municipalities within Germany, we do not expect firms to move profits across municipalities.

[5]This is because predominantly larger subsidiaries report financial information in Orbis data, while domestic firms tend not to report any.

significantly change the magnitude of our baseline estimates. Further, Becker et al. (2012) show that German municipalities can use local tax rates to attract *foreign* MNCs as a source of skilled labor, physical capital, and local business tax income. This raises issues of reverse causality when considering the impact of tax rate changes on municipal revenues. However, in our context, competition amongst municipalities for those more aggressive firms is unlikely to yield much local business tax revenue, due to the potential profit-shifting activities of those firms. Empirically, we find that following a trade tax rate increase there is no change in the average trade tax rate of municipalities that neighbour the municipality that is exposed to more aggressive MNCs. Hence, we argue that tax competition, and consequently, reverse causality, are not a potential threat to our specific identification strategy.[6]

Taken together, our country- and municipal-level estimates suggest that the ability of firms to shift profits is strongly related to tax revenue structure and has potential distributional consequences. At the country level, it is related to the share of revenues derived from corporate vs indirect taxes. At the municipal level, it is causally linked with lower revenue shares coming from corporations through the trade tax. As such, profit shifting affects the tax revenue structure and, in particular, the share of revenues coming from corporations. This matters from a policy perspective, as it suggests that countries that are more exposed to profit-shifting multinationals, may choose to rely more on indirect taxes. To the extent that indirect taxes can be viewed as more regressive (Crawford et al.; 2010; Decoster et al.; 2010), this may amplify the inequality in countries that lose more tax revenue due to profit shifting.

This paper contributes to the literature analysing the effects of tax rate changes on local tax revenues. Fajgelbaum et al. (2019) find that heterogeneity in state tax rates leads to aggregate welfare losses and Suárez Serrato and Zidar (2018) estimate the effects of tax rates and tax bases on state tax revenues more generally. In our paper, we focus on implications of profit shifting for this relationship. As such, we ask what happens to tax revenues when firms shift profits away from a country or municipality that increases tax rate on corporations.

More broadly, we also build on the existing studies that analyse the magnitude and consequences of profit shifting for tax revenues and other margins (Dharmapala and Riedel; 2013; Dowd et al.; 2017; Grubert and Mutti; 1991; Hines and Rice; 1994; Huizinga and Laeven; 2008; Weichenrieder; 2009; Wier and Erasmus; 2022). First, recent work has estimated the

[6]Note that we find that after the tax rate increase in a municipality with a *low* share of subsidiaries that belong to more aggressive MNCs, there is a reduction in the average tax rate of neighbouring municipalities, which suggests that tax competition may occur, as Becker et al. (2012) imply, but does not affect our specific research design.

effects of profit shifting on tax revenues lost in developed and developing countries (Garcia-Bernardo and Janský; 2021; Tørsløv et al.; 2022), including the costs of personal and capital gains tax losses (Garcia-Bernardo et al.; 2022). Further, Bilicka (2019) examines the extent of disparity between profits reported by MNCs and domestic firms in the UK using micro-level data, while Fuest, Greil, Hugger and Neumeier (2022) show similar magnitudes of losses for German firms using country-by-country reporting data. Second, growing empirical work has been focusing on examining the consequences of profit shifting on real firm operations (Becker and Riedel; 2012; Bilicka, Qi and Xing; 2022; Egger and Wamser; 2015; Grubert and Slemrod; 1998; Mintz and Smart; 2004; Suárez Serrato; 2018) and the role that local agents play in facilitating profit shifting (Bustos et al.; 2022). Findings from this literature suggest that some profit-shifting restrictions reduce real business operations of firms in countries that introduce them or increase the demand for tax advisory services to enable firms to get around those restrictions. Further, Bilicka, Devereux and Guçeri (2022) show that profit shifting may reduce the cost of investment in productive assets and quantify the resulting trade-off between investment and tax revenue. On the macro level, these real consequences have been shown to affect the estimates of GDP and productivity. Guvenen et al. (2022) find that profit shifting reduces US GDP and productivity estimates in the official statistics and Coppola et al. (2021) find that offshore issuance reduces the scale of portfolio investment from developed countries to emerging market companies. However, none of these studies discuss the consequences of profit shifting on tax revenue structure.

2 Conceptual framework

How do we expect profit shifting to affect tax revenue structure? In this section, we present three building blocks that connect tax rate changes to firm-level responses, profit shifting, and tax revenues at both the municipal and country level. We refer to profit shifting as a practice of MNCs to move profits away from high-tax jurisdictions to low-tax jurisdictions, mostly towards tax havens. Consequently, profits reported by an MNC in a jurisdiction i ($\pi_{corp,i}$) can be expressed as the difference between the "real unobserved profits" (π_i) and profits shifted from the jurisdiction i into tax havens ($\pi_{sh,i}$)

$$\pi_{corp,i} = \pi_i - \pi_{sh,i} \tag{1}$$

Empirical evidence, starting with Hines and Rice (1994), shows that the higher the corporate income tax rate ($\tau_{corp,i}$; or its difference to the tax rate in low-tax jurisdictions where

MNC operates), the higher the amount of profit shifting ($\pi_{sh,i}$) and, consequently, the lower the reported profits. This relationship between corporate tax rates and profit shifting is likely to be stronger for MNCs that have ownership links to tax havens – more tax aggressive ones – as this indicates an opportunity and ability to engage in profit shifting (e.g. Gumpert et al.; 2016). This leads us to form our first hypothesis.

Hypothesis 1 A tax rate increase will reduce the amount of profits reported by an aggressive MNC by more than those reported by a non-aggressive MNC.

This hypothesis is the first building block in our analysis. Since a large body of empirical evidence supports this hypothesis, we merely confirm these findings in the context of firms located in German municipalities between 2008-2019 and report the results using firm-level data in Appendix C. We summarize our findings in Table C1 and in Figure C1, where we show a decline in reported profitability, effective tax rates, and the logarithm of tax paid for subsidiaries of more aggressive MNCs after a tax rate increase in a given municipality. We define a more aggressive MNC as one that has a tax haven subsidiary in its ownership structure. We also show no significant effects on real firm-level operations. In what follows, we focus our analysis on testing the implications of tax rate changes on municipal and country-level tax revenue structure, rather than firm-level outcomes.

What are the consequences of profit shifting for tax revenue structure? Let us define total tax revenue, T_i, of a government i, either at the country or municipality level, as:

$$T_i = \pi_{corp,i} \times \tau_{corp,i} + \sum_t (B_{t,i} \times \tau_{t,i}), \tag{2}$$

which is comprised of firm-level corporate tax revenues, computed as the product of the tax base $\pi_{corp,i}$ and tax rate $\tau_{corp,i}$, and the revenues from other taxes t, which are all equal to the product of the corresponding tax base $B_{t,i}$ and tax rate $\tau_{t,i}$. Since the corporate tax base is the difference between the actual unobserved profits and profits shifted by multinationals, the effect of profit shifting on tax revenues follows.

Hypothesis 2 An increase in profit shifting reduces corporate tax revenues.

The existing literature attempts to quantify the magnitude of the corporate tax revenue lost due to profit shifting. Although no definitive estimate exists, most studies point to a range of tens to two hundreds of billions of US dollars lost annually (e.g., Bilicka; 2019; Tørsløv

et al.; 2022; Fuest, Greil, Hugger and Neumeier; 2022; Garcia-Bernardo and Janský; 2021). The consequences of profit shifting for corporate income tax revenue are also substantial for Germany specifically (e.g., Fuest, Hugger and Neumeier 2022; Godar 2021; Weichenrieder 2009).

What are the implications of Hypotheses 1 and 2 for country and municipal revenues? The larger the amount of profit shifted by MNCs, the lower the corporate tax revenue at the country level. At the municipal level, following a tax rate increase, we expect municipalities with a larger share of more aggressive MNCs to reduce the amount of profits reported in that municipality by a larger amount (Hypothesis 1) and, consequently, we expect to see lower corporate tax revenues in municipalities more exposed to those aggressive MNCs (Hypothesis 2).

Following this revenue loss, do governments actively try to compensate for the lost corporate tax revenues with other tax instruments to increase tax revenues collected from other sources? For example, Slemrod and Wilson (2009) present a model in which governments of non-haven countries attempt to limit the transfer of tax revenue from capital taxation to parasitic tax havens. This implies that in the presence of corporate tax revenue losses induced by profit shifting, governments may reduce their overall levels of public expenditures or may rely more heavily on the taxation of labour rather than capital.[7] Further, in their model Álvarez-Martínez et al. (2021) estimate the scale of profit shifting by assuming that government revenues remain constant. Specifically, any decrease in the corporate income tax revenues due to profit shifting leads to a reduction in consumption taxes (i.e., value-added tax rates) which is welfare decreasing. Consequently, in our context, if no changes to tax rates or tax bases for other types of taxes occur, this may lead to a reduction in government expenditures or an increase in government deficits, if the corporate tax revenue remains low.

At the country level, instruments available to governments include personal, indirect (e.g., VAT), payroll, or property tax rates. Else, countries can choose to expand tax bases. In the context of Germany, at the municipal level, the only available instrument is the property tax rate, since the tax base and all other tax rates are determined at the country level. This leads us to form our final hypothesis.

Hypothesis 3 Governments increase tax revenue from other sources in response to profit shifting. If they do not do that, they will need to reduce expenditures or increase debt.

[7] Authors show that such increased taxation of labour creates an additional source of deadweight loss and is thus welfare decreasing

The implications of Hypothesis 3 at the country level are that increase in profit shifting is likely to increase tax revenues coming from alternative tax revenue sources, outside of corporate tax revenues. At the municipal level in Germany, an increase in the municipal corporate tax rate that increases profit shifting and reduces corporate tax revenues may increase revenues coming from property taxes. Whether governments choose to do that is an empirical question of interest that we explore in this paper.

At the country level, governments have a wider variety of tax instruments, as well as borrowing capacity and flexibility, at their disposal to make changes that would compensate for the lost corporate tax revenues. As such, one may expect that country governments may be more successful in maintaining the overall tax revenue constant than municipality governments. At the municipal level in Germany, it is possible that having only one instrument – property tax rate – may not be sufficient enough and municipalities may lose overall tax revenue when exposed to profit shifting. This may have implications for local expenditures and borrowing.

3 Motivation: country-level estimates

We start our analysis by showing simple country-level correlations between the new estimates of profit shifting and tax revenue structure. We focus on tax revenue shares coming from corporations, individuals, sales of goods and services (and VAT), and others. Note that we do not claim causality here, but simply present cross-country correlations suggestive of the mechanism we explore causally at the municipal level.

Data and methodology The main data source for the country-level tax structure is the UNU-WIDER Government Revenue Dataset (2021) which we complement with the IMF Government Finance Statistics (2021) and the UNCTAD statistical data (2021). We obtain tax rates from the KPMG Tax rates online data (2021). The combined dataset includes country-level information on the tax revenue structure, GDP per capita, population, inward stock of foreign direct investment, top corporate, individual, and sales tax rates, and employer and employee social security tax rates.

We combine this data with country-level profit shifting estimates, relying on the leading set of estimates from Tørsløv et al. (2022). They compare the profits-to-wage ratio of foreign and local firms, using foreign affiliates statistics to show that affiliates' of foreign MNCs are substantially more profitable than local firms in a number of low-tax countries. From this differential profitability, they derive time-series estimates for 2015—2018. Given that Tørsløv

et al. (2022) estimates vary across years in a non-systematic manner, we do not rely on the time series variation but rather pool these across years. Hence, we estimate the following equation as a baseline for our analysis:

$$Y_{it} = \beta_0 + \beta_1 T_{it} + \beta_n X_{it} + \psi_t + \epsilon_{it} \tag{3}$$

where Y_{it} is a set of tax structure measures, such as percent of corporate tax revenues in total tax revenues, percent of individual tax revenues in total tax revenues, percent of indirect tax revenues in total tax revenues, and other tax revenue contributions (also as shares of GDP); T_{it} is a share of profits shifted to tax havens as a percentage of GDP from each country during the 2015-2018 period; X_{it} are country-level control variables, ψ_t are year fixed effects, and ϵ_{it} is an error term. As country controls, we use the logarithm of GDP per capita, the stock of foreign direct investment as a percent of GDP, the logarithm of population, and employer and employee social security rates. We also examine the correlations between tax rates and profit shifting estimates using tax rates as outcome variables in equation (3).

Baseline correlations In Figure 1, we present coefficient estimates from our simple regression framework, as outlined in equation 3. We summarise results across three different types of dependent variables: (1) the share of each tax revenue type as a fraction of total tax revenues, (2) as a fraction of GDP, and (3) tax rates. In the left panel, we provide baseline estimates for the correlations without controls, in the right panel, we include a host of country-level business cycle, size, and tax system controls. The corresponding coefficient estimates are presented in Table D1 in the Appendix.

First, we find a significant strong negative correlation between profits shifted and the share of tax revenues derived from corporations. Specifically, a 1 percentage point increase in the amount of profits shifted out of the country, reduces the share of revenues derived from corporations by 1.5 percentage points. Controlling for country-level observables decreases the magnitude of that estimate to 0.4 percentage points. This suggests that there is no substitution from domestic firms to make up for the lost corporate tax revenues coming from profit-shifting multinationals.

Second, we show a positive significant relationship between profits shifted and the share of individual tax revenues in all tax revenues. The magnitude of the coefficient suggests that a 1 percentage point increase in the share of shifted profits, increases the share of revenues from individuals by 3.5 percentage points (or 0.9 in a specification with controls). Countries with a larger share of profits shifted, likely have a larger multinational presence and these

firms employ a large share of the population. With MNC wages being higher than domestic firm ones (e.g Alstadsæter et al.; 2022; Setzler and Tintelnot; 2021), this may generate larger shares of individual tax revenues in these countries. Third, there is a positive relationship between profit shifting and sales and goods tax share, especially in countries that use VAT. Finally, there is no significant association between other types of tax revenues and profit shifting. Our results suggest that countries may be substituting the lower corporate tax revenue shares with indirect tax revenues.

In the second panel in Figure 1 we quantify the correlations between profit shifting estimates and tax rates. We find that a 1 percentage point increase in the amount of profits shifted out of the country reduces the corporate tax rate by 3 percentage points. At the same time, it increases the indirect tax rate by 3.2 percentage points. We find no additional significant relationship between other tax rates and the amount of profits shifted. These results suggest that countries that potentially lose a large share of their revenues due to profit shifting attempt to keep the multinational profits in their countries by having lower tax rates. These lower tax rates, of course, reduce the share of corporate tax revenues in those countries. Further, countries where multinationals shift a large portion of tax revenues may try to directly offset these losses with higher indirect tax rates, which is then reflected in the indirect tax revenues, especially in countries with VAT tax systems.

In the third panel in Figure 1 we provide estimates where the outcome variable is the share of tax revenue components as a percentage of GDP. Additionally, in Table D2 in the Appendix, we show results for expenditures. These results are consistent with the baseline and additionally show that there is a positive correlation between total tax revenue as a share of GDP and profit shifting as well as total expenditures and profit shifting. This suggests that countries that lose a share of corporate tax revenues due to profit shifting are more than able to compensate for that lost share using other types of tax instruments. Hence, we should not be concerned about the effect of profit shifting on overall tax revenues, but about the distributional consequences profit shifting may potentially have as countries may be switching from taxing individuals indirectly through corporate taxes to taxing individuals directly through individual taxes and indirectly through VAT.[8]

Even though we interpret our results with a particular direction of causality in mind – profit shifting causes differences in tax revenue structure between countries – the aim of this

[8]Using an alternative set of profit shifting estimates from Garcia-Bernardo and Janský (2021), we find qualitatively similar results that we report in Table D4 and Figure D1. We also show that there is heterogeneity in our estimates according to country income levels, with low-income countries potentially more exposed to these revenue losses. However, the sample size is too small to make a meaningful inference.

motivational analysis is not to prove causality but to document suggestive correlations. One potential issue with interpreting our results with this particular direction of causality is the role of tax competition between countries (Devereux et al.; 2008; Keen and Konrad; 2013; Mardan and Stimmelmayr; 2020). Since we find that countries with more shifted profits also have lower corporate tax rates, not just shares of corporate tax revenues, it may be that these countries choose to set their tax rates low and keep their corporate revenue shares low to attract foreign capital through MNCs. We discuss tax competition in more detail in our municipal-level analysis.

Summary The country-level results provide suggestive evidence that a larger share of shifted profits is related to lower corporate tax revenue shares, which likely come from lower tax rates, and higher indirect tax revenue shares, that likely come from higher indirect tax rates. Depending on the incidence of corporate tax rates and the progressivity of the indirect and individual tax rates schedule, these results point towards potentially large distributional consequences of profit shifting. Given the cross-sectional nature of the sample, however, we cannot draw any causal conclusions from these country-level results. To obtain causal estimates linking tax revenue structure and profit shifting, we turn to municipal-level data.

4 Municipal-level context and data

To establish the causal relationship between profit shifting and tax revenue structure, we use municipal-level data on tax rates and tax revenues in Germany combined with firm-level information. Our identification strategy relies on the municipal variation in trade tax rates and the presence of aggressive multinationals.

4.1 Institutional context

Tax revenue in Germany is collected at the federal, state, and municipal level. Each governmental unit has control over different types of taxes: the federal government has exclusive power over customs duties and fiscal monopolies; income tax and corporation tax revenues are shared by state and the federal government; 75% of VAT is redistributed across states (European Committee of the Regions; n.d.). Municipalities collect trade tax and property tax revenues and get a share of income tax and corporate tax revenues from the federal government (Deloitte; n.d.). With over 11,000 municipalities and 16 states, the share of tax revenue collected at the municipal level is 15%, at the state level (Länder) it is 43%, at the

federal level it is 39%, and EU contributions form the remaining 4%. Since in this paper, we consider the effects of municipal tax rate changes on local tax revenue structure, we describe how the tax revenue collection at the municipal level is organised in detail.

Municipalities have discretion over two major sources of their tax revenues: trade tax and property tax. 38% of their revenues comes from trade tax and 14% comes from property tax. The rest comes from federal and state tax apportionment.[9] Specifically, municipalities get a share of wage and assessed income tax and final withholding tax (€41 billion, 38%) and a share of value-added tax (€9 billion, 8%). In return, municipalities have to apportion a share of their trade tax revenue to state and federal government; in 2020, they apportioned around 10%: €4 billion out of total €41 billion trade tax revenue.

Trade tax (Gewerbesteuer) is a tax on companies' profits and the tax rate is a combination of a base rate of 3.5% (f), uniform across Germany, and a municipal multiplier (Hebesatz), determined by each municipality, applicable according to where the companies' permanent establishments are located. Municipalities vote on the next year's multiplier annually and when changed, the multiplier is valid for at least one full budget year. There is no ceiling on the multiplier, but a floor was introduced in 2004, before our data sample starts.[10] The tax rate is determined with the multiplier (m_i) in the following way: $t_i = m_i \times f$. In 2019, the last year in our sample, the effective trade tax rate varied between 7% and 21%, with an average rate of 12.5%. Important for us, municipalities control the multiplier, but not the tax base, which is slightly different than for corporate income tax purposes and includes operating profits earned within the boundaries of a municipality. Further, if a firm has multiple establishments across municipalities, the taxable profits are allocated across firm locations according to each municipality's wage bill share.[11] In addition to trade tax collected by municipalities, corporate profits are taxed by the federal government at a uniform rate of 15.825% (including a solidarity surcharge).

Property tax (Grundsteuer) is a tax on the assessed value of the property and the tax rate is a combination of a base rate (depends on the type of property, but is uniform across Germany and mostly 0.35%) and the local multiplier, determined by each municipality. Similar to trade tax, the municipal council makes decisions about the local multiplier and can

[9] Other municipal taxes such as a tax on dog ownership are negligible (€1 billion, 1%).

[10] Foremny and Riedel (2014) observe a political cycle in tax setting as the growth in the multiplier is significantly reduced in the election year and the year prior to the election, while it significantly increases in the year after the election. Also for Germany, Riedel and Simmler (2021) find that municipalities that host large firms tend to have lower trade tax rates.

[11] Note that trade tax is levied not only on corporations but also on the non-incorporated sector such as sole proprietorships and partnerships. Our firm-level data only includes corporations, so we will focus on those in the remainder of the paper.

do so every year. Further, all the other characteristics and regulations of the property tax are set at the national level and, hence, are uniform across the municipalities.[12]

4.2 Data and methodology

Municipal-level data Germany provides a good laboratory to study the relationship between profit shifting and tax revenue structure due to the availability of high-quality municipal- and firm-level data. Detailed information on tax structure is available from the German Office of Statistics for each of the 11,000 municipalities and each of them chooses its own rate of trade tax and property tax. This level of local autonomy is rare. The municipal level data includes information on total tax revenue, which includes the amounts apportioned to and from federal and state governments, trade tax revenue, and property tax revenue. We use this data to construct a share of trade tax and property tax in total tax revenue as well as a logarithm of both trade and property tax revenue. We also include results using overall tax revenues and property tax rate as outcome variables. Given that we rely on the variation in trade tax rates to identify the relationship between tax revenue structure and profit shifting, we consider trade tax rates as an outcome variable to allow us to calculate the magnitude of elasticities only. We have data at the municipal level available between 2008 and 2019.

Firm-level data The firm-level data comes from the Bureau van Dijk Orbis dataset and includes the location of over 3.9 million German firms. We have a detailed firm address, postcode, and city for each of those firms. We match each of those firm addresses to the municipal location using GIS software and we find a match for 85% of our firm-level observations. We use Orbis ownership data from 2019 to identify firms into domestic standalones, domestic groups, foreign multinationals, and domestic multinationals. We do not utilize the historical ownership data, as the coverage is limited relative to the static data and biased towards larger, multinational firms. Note that this requires us to assume that ownership did not change during the analysed period; 2008—2019. This is a plausible assumption used in other papers in this literature, e.g. Bilicka (2019), but it does constitute a limitation of this study.

We define foreign multinationals as those firms with headquarters outside of Germany and domestic multinationals as firms that are headquartered in Germany but have at least one foreign affiliate that they own by more than 50%. This assumption ensures that we only

[12]The 2019 reform that gave more flexibility to states in designing the tax starting from 2022 does not influence the period covered by our analysis.

include subsidiaries that are directly controlled by MNCs and are more likely to be used by them for profit-shifting purposes. In our main analysis, we consider subsidiaries of both domestic and foreign multinationals together and show results separately in section 5.5. Our sample includes over 4,000 subsidiaries of foreign MNCs and 16,000 subsidiaries of domestic MNCs, which are 4.8% and 19.8% of all German firms with known parents, correspondingly.[13] Using the ownership structure of firms, we define aggressive multinationals, as those that have at least one affiliate in a tax haven (Bilicka and Scur; 2021; Gumpert et al.; 2016; Hines and Rice; 1994).[14] We identify over 8,000 affiliates that belong to more aggressive MNCs of which 835 belong to foreign MNCs and the remainder to domestic MNCs. We then collect unconsolidated balance sheet information for all firms in Germany (when available), which allows us to have total assets, fixed assets, employment, profits, and other variables at the affiliate level.

Unit of analysis We conduct our analysis at the municipality-year level. As such, we collapse the firm-level data by the municipality in which these firms are located. This results in 111,534 observations across 9,317 municipalities for the period 2008—2019. The identifying variation we explore in this paper is the presence of affiliates that belong to more tax-aggressive multinationals across German municipalities. For that purpose, we consider both the count of these affiliates and their share in all firms in each municipality. We also use the share of real business operations to define municipalities more exposed to aggressive MNCs. In placebo tests, we use the count and share of all multinational affiliates. On average, a municipality has 486 firms with 2 domestic MNC affiliates and 0.5 foreign affiliates. 1 of those 2.5 affiliates is aggressive. As such, the share of MNCs in each municipality firm count is, on average, 0.2%, with a large variation ranging from municipalities that have no MNC presence to those that have over 3.5% of their firms belonging to multinationals. We provide descriptive statistics on these municipalities in Table A1 and information outlining the municipal variation in trade tax rates and exposure to aggressive MNCs in Appendix B.

[13] Note that there are 3,945,304 German firms in Orbis, most of which are small domestic standalones, for which no ownership information data is provided.

[14] As Tørsløv et al. (2022) point out Orbis data has poor coverage for financial information in tax havens, but firms do report a presence in tax havens and this is the only information we require here. Bilicka and Scur (2021) use this same nomenclature to define more plausibly tax-aggressive firms.

5 Municipal-level estimates

5.1 Identification strategy

Our identification strategy uses increases in trade tax rates at the municipal level across the years. As such, we identify municipalities that increased their trade tax rates and use these changes to show the effect of tax rate increases on tax revenue structure for municipalities with different exposures to aggressive MNCs.[15] We stack each of these tax rate increases to occur at time t=0. In that, we use a stacked event study framework that follows Fuest et al. (2018), who look at municipal trade tax rate changes and their effect on wages. In our data, we identify 9,606 events when the municipality increased the trade tax rate. This means that around 5,800 municipalities experienced at least 1 trade tax rate increase and these form our treatment group. Within that treatment group, 61% of municipalities increased their trade tax rate once during the sample period, 24% twice, and the remainder increased these rates multiple times. 3,370 municipalities never experienced a trade tax rate increase and they form the control group. In the main analysis, we limit the treatment sample to municipalities that only experienced one tax rate increase to estimate the magnitude of the revenue effect related to a single tax rate change.[16]

To compare the effects of tax rate increases between municipalities that are more or less exposed to aggressive MNCs, we use two exposure variables. First, we convert the continuous variable on the share of affiliates that belong to aggressive MNCs to a binary variable that splits the share according to a median across municipalities. Second, we use the count of subsidiaries that belong to aggressive MNCs. The identifying assumption is that the treated municipalities did not evolve differentially from the control group before the reform. To test the plausibility of this assumption and to provide a dynamic evolution of the effects, we estimate the following event study model:

$$T_{it} = \alpha + \sum_{\kappa=-4}^{4} \delta_t \mathbb{1}[t=\kappa] + \sum_{\kappa=-4}^{4} \beta_t \left(\mathbb{1}[t=\kappa] \times hMNC_i\right) + \sigma_1 X_{it}^{'} + \eta_i + \delta_t + \epsilon_{it} \tag{4}$$

where T_{it} is a share of tax revenues coming from corporations, property taxes, the log of tax revenues coming from each source, and property tax rates. $\sum_{\kappa=-4}^{4} \mathbb{1}[t=\kappa]$ is a series of year

[15] The majority of municipal rate changes are trade tax rate increases. In fact, only 6% of trade tax rate changes in our sample are tax decreases.

[16] In section 5.5 we show that our results remain unchanged when we use the full set of tax rate increases.

dummies that equal one when the tax reform was κ years away, with the dummy variable corresponding to $\kappa = -1$ as the omitted category. Note that these dummies are equal to zero for the municipalities where no trade tax rate changes occur, i.e. for our control group. $hMNC_i$ is a dummy equal to 1 when the share of subsidiaries of aggressive MNCs in a given municipality is larger than the median or count of the number of those subsidiaries. X_{it} includes municipal and property tax rates, the number of firms in each municipality, and the population. η_i are municipality fixed effects and δ_t are year fixed effects. We cluster standard errors at the municipal level in each estimation. The coefficients of interest are the β_t: they estimate the differences in the outcome variables between municipalities with high and low exposure to aggressive MNCs, κ years before or after the reform, relative to the control group of municipalities that did not change their trade tax rate at all.[17]

Our identification strategy relies on using the traditional two-way fixed effects approach. However, this approach may raise concerns due to the staggered and heterogeneous nature of reform implementation across municipalities and years. There is a possibility that the estimated effects may be contaminated when "already-treated" observations are used as a control group, as they introduce negative weights into the regression analysis. To address these concerns, we adopt three strategies. First, in our baseline regressions, we only use municipalities that experienced one tax rate increase as our treated group and municipalities that experienced no tax rate increases or decreases as our control group. As such, we exclude municipalities that changed their tax rates multiple times and municipalities that reduced their rate. This strategy limits the exposure to the staggered implementation, as we do not use the already treated municipalities as a control group. Second, when we include the full sample of tax rate increases, we decompose our estimator into its sources of variation, showing that our estimates rely predominantly on the comparison of "treated" with "never-treated" groups (Goodman-Bacon; 2021). Third, we use alternative estimators to correct for the remaining concerns about the heterogeneous treatment effects in a staggered difference-in-differences framework, including those provided by De Chaisemartin and d'Haultfoeuille (2020), Sun and Abraham (2021), and Callaway and Sant'Anna (2021), when estimating the event study models with two-way fixed effects.

[17]Following McCrary (2007), we bin event dummies at endpoints of the event window (in our case, at $t = -4$ and $t = 4$) such that the end dummies include any years beyond the window. This is to account for the different timing of tax rate cuts across municipalities, which yields an unbalanced panel for event times. The binning at the end-points of the window is the reason we do not plot the endpoint estimates in the event study graphs.

5.2 Results

We start by pooling all of the post-reform coefficients for periods t=1 up to t=+3 as a post dummy equal to 1 and all coefficients before as post dummy equal to zero. Note that the post dummy is also equal to zero for all the municipalities that did not change their trade tax rate during the sample period. We summarise results from this simplified estimation in Table 1 using the share of subsidiaries that belong to aggressive MNCs in all firms in the municipality as an interaction in Panel A and the number of those subsidiaries that belong to aggressive MNCs in Panel B. We start with describing results in Panel A. On average, in municipalities with *low* exposure to aggressive MNCs, the increase in trade tax rate is 7.3% (column 1 coefficient on post=1) and this does not lead to any significant changes in trade tax revenue (column 3) or property tax revenue (column 6) relative to the control group, though the direction of the coefficient suggests positive adjustments to trade tax revenue.

However, municipalities with more exposure to aggressive MNCs significantly reduce the level and the share of tax revenue they derive from trade taxes, following a trade tax rate increase. Specifically, results from column (3) indicate that municipalities with a high share of subsidiaries that belong to aggressive MNCs see a reduction in trade tax revenues of about 7.8% (=0.7-8.5) relative to the control group, despite the fact that the average tax rate in those municipalities increases by a smaller magnitude, 6.5% (=7.3-0.8), than in the municipalities with lower exposure to aggressive MNCs. The shares result from column (4) suggests that these municipalities also have a 2.6% (=0.1-2.7) lower share of trade tax revenue in all revenues relative to the control group. Consequently, this means that they lose about 5.4% (=0.6-6) of total tax revenues following the tax rate increase (column 5).[18]

Further, we find that changes in trade tax rates are often accompanied by changes in property tax rates of similar magnitudes. Specifically, following a trade tax rate increase of 7.3% (column 1), the property tax rates increase by an average of 6.5% (column 2) across all municipalities. This relationship is no different between those municipalities that are more or less exposed to aggressive MNCs. This suggests that municipalities that increase the trade tax rates may be using property tax rates as an instrument to increase their total tax revenues as well. However, despite the property tax rate increases, we find no evidence of changes in property tax revenues. The increase in the share of property tax revenues in all tax revenue for municipalities that are more exposed to aggressive MNCs documented in column (7) is not large enough to prevent the overall loss of municipal tax revenue, as documented in column (5). One way to interpret these results is that property tax is not a

[18] All these magnitudes are computed by adding up coefficients on post and post × high share.

strong enough instrument to offset changes in trade tax revenue.

We find very similar results in Panel B, using the number of subsidiaries that belong to aggressive MNCs, instead of shares of subsidiaries. An advantage of this estimation is that the coefficients are easy to interpret. For example, results from column 3 suggest that an additional subsidiary that belongs to an aggressive MNC in a municipality would reduce the trade tax revenue following a tax rate increase by 0.5% relative to a municipality that did not have any such subsidiaries. The average number of subsidiaries that belong to aggressive MNCs is 0.9, but 83.6% of municipalities do not have any. Amongst those that have at least 1 such subsidiary, the average is 5.5 subsidiaries. As such, for an average municipality that is exposed to aggressive MNCs, the loss in trade tax revenue is about 2.75% relative to an average municipality that is not exposed to any aggressive MNCs. As a consequence of this trade tax revenue reduction, the share of trade tax revenues in all revenues fall by 0.2% and the total tax revenue by 0.6% relative to a municipality that is not exposed to any aggressive MNCs.

To show the evolution of tax revenue structure around the tax rate increase, we plot the event study coefficients in Figure 2. In this figure, we use the above and below median shares of subsidiaries that belong to more aggressive MNCs as an exposure variable. As such, these results are analogous to Panel A from Table 1. We start by showing the evolution of tax rate changes. In Panel (a), we show the changes in trade tax rates for municipalities with low exposure to aggressive MNCs relative to the control group. In Panel (b), we plot the trade tax rate changes for municipalities more exposed to aggressive MNCs relative to those less exposed only. The magnitudes correspond to those in column (1), Panel A in Table 1. Further, these plots suggest that the trade tax rate changes we consider are, by construction, highly persistent.

Panel (c) shows the evolution of the share of trade tax and property tax in total tax revenue across years in our sample for municipalities with higher exposure to aggressive MNCs relative to those with lower exposure. We find that following a trade tax rate increase there is a steady decline in the share of trade tax revenues in more exposed municipalities, but no significant change in the share of property tax revenues. Before the trade tax rate increase, there is no difference in the evolution of tax revenue shares between the two types of municipalities in any of the time periods. In Panel (d), we break it down into changes in trade tax and property tax revenues and show almost no change in property tax revenues and a large decline in trade tax revenues around the reform time. These changes are reflected in a reduction in the overall tax revenue following a trade tax rate increase. Further, we find no evidence of a differential evolution in tax revenue structure components between

municipalities that are more or less exposed to aggressive MNCs before the reform.

We show that these effects are not symmetric. In Figure A1 we plot the event study coefficients from regressions where we consider municipalities in which the trade tax rate decreased relative to those where the trade tax rate did not change at all, analogous to panels c and d from Figure 2. We find no significant effects for either shares or levels of trade tax revenues or total tax revenues. There are two potential explanations for this finding. First, the number of tax rate decreases is very small relative to tax rate increases, hence the sample size is smaller and could explain insignificant effects. Second, when a trade tax rate declines, an aggressive MNC is unlikely to bring profits back to Germany, as Germany is generally a high-tax rate country. As such, these results support the conceptual framework in which MNCs move profits out of municipalities that increase their trade tax rates but do not move them back when the trade tax rate declines.

5.3 Elasticity calculations

We use our estimates to calculate the elasticity of the trade tax revenues response with respect to the one-minus-the-trade-tax-rate for the municipalities with low and high exposure to more aggressive MNCs. For that, we use the results from columns 1 and 3 in Panel A of Table 1. We use the standard elasticity formula: $elasticity_{\tau rev} = \Delta Y_i/[(\tau_{new} - \tau_{old})/(1 - \tau_{old})]$, where ΔY_i is a change in trade tax revenue in response to the tax increase, τ_{new} is the average tax rate after the tax rate increase and τ_{old} is the previous tax rate. Given the evidence from Figure 2, we can assume that $(\tau_{new} - \tau_{old}) = 7.3\%$ for municipalities with low exposure to aggressive MNCs, while the change in tax rate is 6.5% for those with high exposure. We can also assume that τ_{old} is zero in both cases, as this is what the pre-trends imply. As such, $elasticity_{\tau rev} = \Delta Y_i/(7.3\%)$ in case of low exposure municipalities and $elasticity_{\tau rev} = \Delta Y_i/(6.5\%)$ in case of higher exposure ones.

Consequently, with the average change in trade tax revenue of 0.7% (column 3), we obtain an elasticity of 0.1 for low-exposure municipalities. With the average change in trade tax revenue of 7.8% for high-exposure municipalities, we obtain an elasticity of 1.2. The estimate is not significant in the case of low-exposure municipalities, but it is broadly similar in magnitude to comparable elasticities by Devereux et al. (2014), who exploit UK tax returns data and two kinks in the tax schedule to estimate it to be 0.13 and 0.17 for one kink and 0.53 and 0.56 for another kink. The effect of trade tax rate increase on trade tax revenues is significant in the case of high-exposure municipalities and its magnitude of -1.2 is consistent with profit shifting elasticities such as those in the meta-analysis by Beer et al.; 2020, who

estimate the elasticity to be -1.0 for their whole sample and -1.5 for the most recent years.

5.4 Potential mechanisms

There are two potential reasons why the level and share of trade tax revenues at the municipal level may decline as a result of trade tax rate increases. First, multinationals may choose to move profits away from municipalities that levy larger taxes on them. In principle, they can move these profits either to other municipalities in Germany that have lower tax rates or move them abroad to their other affiliates in low-tax countries. Since within Germany, the tax liability is apportioned according to the share of wages across municipalities, we do not expect moving profits across municipalities to play a role in our setting. However, given that profits are mobile across country borders, an increase in trade tax rate can potentially be immediately reflected in corporate profits and consequently in municipal tax revenues, if MNCs move profits abroad. This mechanism is consistent with the profit-shifting explanation that we propose in the paper.

The second possibility is that a trade tax rate increase results in the reallocation of firms' or business operations away from municipalities that enact those tax rate hikes. To the extent that incentives for the reallocation of real operations should not differ between more and less aggressive MNCs, we provide placebo tests using the share of all MNCs in each municipality to show no tax revenue effects of trade tax rate hikes in municipalities simply more exposed to MNCs.

However, a possibility exists that profit shifting may be accompanied by reallocation of real operations, as in Bilicka, Qi and Xing (2022). In that case, municipalities more exposed to aggressive MNCs may be more prone to real business operations reallocation. To test whether that occurs in our sample, we look at employment, total assets, turnover, and the number of firms as outcome variables using the specification outlined in equation (4). We plot the results in Figure 3 which follows the exposure from Figure 2.[19] If anything, we find an increase in employment, assets, and turnover in municipalities that are more exposed to aggressive MNCs relative to those less exposed. However, these changes do not seem to be causally related to the trade tax increases, as they follow an increasing trend throughout the sample duration. These results suggest that firms in municipalities that are more exposed to aggressive MNCs are generally growing relative to firms in municipalities that are less exposed. We do find a decline in the number of firms at the municipal level, but similarly

[19] We report the aggregated post coefficients in Table A3 in the Appendix, following the format of results presented in Table 1.

to the real business operations, this decline starts prior to the trade tax rate increase. Note that the location data we have is static, as we only observe the latest address. This means we can observe the entry and exit of new firms in Germany, but not the reallocation of the same firm across municipalities. This limits our ability to draw broader conclusions from the firm count variable.

The lack of changes in real business operations that correspond to changes in trade tax rates suggests that we can rule out real responses where firms move their real business operations out of Germany in response to local business tax rate increases. This is similar to what Lichter et al. (2021) find. As such, our results support the main mechanism we propose to be at play — profit shifting.

5.5 Robustness tests

Accounting for firm size and operations In our baseline estimates, we use the number of subsidiaries that belong to aggressive multinationals to calculate the exposure to more aggressive MNCs. In principle, the more assets, profits, turnover, or employment these MNCs have in each municipality, the larger the exposure and the potential responses to trade tax rate increases. Orbis data collects information on these real business operations, but the data has a much smaller coverage. In Table A2 in the Appendix we summarise the municipal-level coverage for financial information in Orbis for all firms (Panel A) and multinational firms (Panel B). On average, the coverage is quite poor, with about 13% of firms reporting employment and turnover and 2% reporting profits. Multinationals have better coverage with over 40% of their subsidiaries having information on employment and turnover and 20% on profits.

In Table 2 we use the real business operation weights and consider the effects of a trade tax rate increase on the logarithm of trade tax revenues (Panel A), the share of trade tax revenues in all tax revenues (Panel B), and the logarithm of total tax revenues (Panel C). As such, these results are comparable to those from columns 3, 4, and 5 from Table 1, respectively. Here, instead of dummies for high and low exposure to aggressive MNCs, we use real business operation shares to proxy for municipal exposure to more aggressive MNCs. Specifically, we use the share of assets, the share of employment, the share of turnover, and the share of profits respectively. The caveat with these results is that we have a much smaller coverage of real business operations that is highly skewed towards MNCs. Nevertheless, we find results consistent with our baseline estimates. The trade tax revenue falls after a tax rate increase in municipalities with a higher share of business operations owned by subsidiaries

that belong to more aggressive MNCs, relative to those with no such subsidiaries. This result is statistically significant and persistent across assets, employment, and turnover, but not for profits. This is consistent with the notion that these subsidiaries are taking part in MNCs' profit shifting and profits do not reflect the actual size of their real business operations in these municipalities.

The magnitude of the effect in column (1) in Panel (A), for example, suggests that if subsidiaries belonging to aggressive MNCs hold 14% of assets in a given municipality, an increase in the trade tax rate would bring no additional trade tax revenues (=0.041-0.14 $\times$ 0.279). If these subsidiaries hold more than 14% of assets, there will be a decline in trade tax revenue. Most municipalities, 93.5%, do not have any assets that can be attributed to aggressive MNCs (see Figure B2). However, amongst those that do, the average amount of assets held by subsidiaries that belong to aggressive MNCs is 15.7%. Hence, similar to baseline results, an average municipality that is more exposed to aggressive MNCs loses trade tax revenues following a trade tax rate increase.

Placebo with all MNCs One potential concern with our identification strategy could be that what we pick up is the presence of subsidiaries that belong to MNCs in each municipality more generally, rather than the presence of subsidiaries that belong to aggressive MNCs. This could mean that our result may be related to competition between domestic and multinational firms instead.

To attenuate this concern in Table 3 we show results using a share of subsidiaries that belong to MNCs in Panel A and the count of these subsidiaries in Panel B. We follow the exposition from Table 1. First, in column 1, we find no statistically significant or economically meaningful decline in trade tax revenues in municipalities with a higher share (or higher number) of subsidiaries that belong to any MNCs. Consequently, we see no effect on the share of revenues coming from trade taxes. There is a general decline in total tax revenues in municipalities with more multinational firms that could perhaps be attributed to a general movement of MNC subsidiaries, that are plausibly more mobile, away from municipalities with higher tax rates. This would be in line with the tax competition argument proposed by Becker et al. (2012). However, the magnitude of the effect we find here is very small and barely statistically significant, especially relative to the large effects we observe for municipalities more exposed to aggressive MNCs.

Other robustness tests We then turn to testing the robustness of our baseline findings. We summarise our results in Figure 4 in which we show the interaction coefficients between a

high share of subsidiaries that belong to aggressive MNCs and post=1 dummies only, omitting post=1 dummy for the clarity of exposition. We present four sets of figures, each looking at a different outcome variable: the logarithm of trade tax revenues (panel a), the logarithm of property tax revenues (panel b), the share of trade tax revenues in total tax revenues (panel c), and the logarithm of total tax revenues (panel d). Within each figure we show the robustness of the baseline result by comparing the interaction coefficient, labeled baseline and represented by a black diamond, using various sample cuts and variable definitions.

First, we consider the effect of using all tax rate increases and consequently all municipalities in our treatment group (black squares). The results remain virtually unchanged across all outcome variables. Second, we weigh the results using population (black triangles). A potential concern could be that our results are picking up effects coming from small municipalities, while multinational presence may be larger and more important in more populated municipalities. We attenuate this concern by showing that the results weighted by population are very similar in magnitude to the baseline across our main outcome variables of interest.

Third, we include as control variables the average of the five neighbouring trade and property tax rates. One may be concerned that municipalities compete over firm presence and tax revenues using tax rates and this may affect smaller municipalities, in particular, Buettner (2003). If this was driving our results, we would expect that controlling for the neighbouring tax rates would reduce the magnitude of the coefficient on the main interaction effect of interest. Instead, we find coefficient magnitudes that are quite similar (coefficients marked by crosses), though with higher standard errors that may suggest some heterogeneity across municipalities.[20] Additionally, in columns 5 and 6 in Table A3 in the Appendix, we look directly at the average of the neighbouring trade and property tax rates as outcome variables following a trade tax rate increase in a given municipality. We find a reduction in the average tax rate of neighbouring municipalities following a tax rate increase in municipalities with *both* low and high exposure to aggressive MNCs. In sum, these results suggest that tax competition may occur locally, but does not affect the magnitude of our baseline estimates since we rely on the variation between municipalities with high and low exposure to aggressive MNCs.

Fourth, we consider the effect that apportionment can have on our baseline estimates. Specifically, we subtract apportionment from trade tax revenues in Panel a.[21] Because federal

[20]Note that the sample size here is smaller since we compute the average of 5 neighbouring municipalities and those without 5 neighbours drop out of the sample. We test the robustness of this using the average trade and property tax rates of 3 and 4 neighbouring municipalities and the results remain unchanged. We do not report these coefficients.

[21]We do that only for panel a, as there is no apportionment for property tax revenue and the one for

and state governments may apportion some of their revenues to municipalities that see a reduction in their own tax revenues, including apportionment may reduce the magnitude of the trade tax revenue estimates. However, since municipalities also apportion some of their revenues back to state and federal governments, this may attenuate the effect. We show that excluding apportionment from trade tax revenues does not change the magnitude of the estimate relative to the baseline (marked by a plus in panel a). Hence, apportionment does not play a large role in our setting.

Fifth, we consider the presence of subsidiaries that belong to domestic and foreign MNCs separately, in a spirit similar to Becker et al. (2012). Red diamonds correspond to results for the share of subsidiaries that belong to foreign MNCs, while blue diamonds correspond to those belonging to domestic MNCs. We find no significant effect of the trade tax rate increase on the trade tax revenues of municipalities with a larger share of subsidiaries that belong to domestic or foreign MNCs. Consistent with the results from the placebo test in Table 3, the magnitude of the estimated effect is very small relative to the baseline estimate and not statistically significant. Unlike Becker et al. (2012), we do not find a differential effect of the trade tax rate increases between municipalities differentially exposed to domestic and foreign MNCs.[22]

Finally, instead of looking at the share of subsidiaries that belong to more aggressive MNCs and the share of subsidiaries of MNCs separately, we combine the two to consider the share of subsidiaries that belong to aggressive MNCs in all MNCs' subsidiaries in each municipality. This is a continuous variable and we denote the coefficient estimate by a black circle. Similar to baseline results, the larger the share of aggressive MNCs in all MNCs in each municipality, the lower the potential trade tax revenue, the share of tax revenue coming from trade taxes, and the overall municipal tax revenue.

5.6 The staggered nature of the tax rate cuts

In section 5.5, we demonstrate that our estimates are robust to including in our sample all municipalities, rather than just those with one tax rate increase. In this subsection, we continue using that extended sample, to show that our results are robust to the new two-way fixed effects literature using the proposed corrections. First, we decompose the overall

overall tax revenue is not reported in the data we have.

[22]There are at least two potential explanations for this difference. First, Becker et al. (2012) use a sample that covers a much earlier period 2001 - 2005, before the large corporate tax rate cuts that were enacted in Germany in 2008. Second, their estimates include a host of control variables that we do not include in our baseline estimates.

effect we obtain from our regressions into its sources of variation following Goodman-Bacon (2021). In Table A4 we show that our estimates rely almost exclusively on the comparison of "treated" with "never-treated" groups. Hence, the staggered implementation of the reform should not substantially bias our baseline estimates.

What remains, is the concern about the heterogeneous size of the tax rate increases across municipalities. To attenuate concerns about the potential bias this could introduce into our baseline estimates, in Figure A2 we present estimates using corrections for the staggered heterogeneous difference-in-differences estimators, as suggested by Roth et al. (2022). In panel a, we show results using the logarithm of trade tax revenues as an outcome variable, while in panel b, we show results using the logarithm of property tax revenues. Generally, the magnitude of our baseline OLS estimates, which are also plotted alongside the corrections, is similar to that using Sun and Abraham (2021), De Chaisemartin and d'Haultfoeuille (2020), and Callaway and Sant'Anna (2021) corrections. The Callaway and Sant'Anna (2021) estimator has larger standard errors, but generates a similar magnitude of the estimated differences between municipalities with high and low exposure to aggressive MNCs. We continue to find a negative effect of the tax rate increase on trade tax revenues, with no effect on property tax revenues.

5.7 Expenditures and debt

Does the reduction in tax revenues that we demonstrate in our analysis affect municipal expenditures and consequently their GDP and debt? We investigate this using information on municipal expenditures, debt, and GDP. We summarise the results in Table A5 in which we consider the differential reaction of GDP, expenditures, and debt between municipalities that were more or less exposed to aggressive MNCs. In columns 1-3 we use the dummy variable equal to 1 if the share of subsidiaries belonging to more aggressive MNCs is larger than the median. In columns 4-6, we use the continuous variable which is the number of subsidiaries that belong to aggressive MNCs. We find that following a trade tax rate increase, there is a significant reduction in municipal expenditures and an increase in municipal debt in municipalities more exposed to aggressive MNCs relative to those less exposed. We find no significant change in municipal GDP. These results suggest that to keep the municipal GDP constant following the drop in the overall tax revenues, the municipality that is more exposed to aggressive MNCs has to decrease its expenditures and increase debt relative to a municipality that is not exposed to those aggressive MNCs.

There are two caveats that come with this analysis. First, the GDP and debt data

available to us do not cover the full set of municipalities. Second, the apportionment of tax revenues from state and federal governments to municipalities and vice versa could affect these estimates. While we show that the apportionment does not affect the responsiveness of trade tax revenues to changes in trade tax rates, this may not be the case for local expenditures. Given the two caveats, these results should be treated with caution. This is also why we do not interpret the magnitudes of the effects that trade tax rate increases have on debt and GDP, especially in relation to changes in tax revenues.

Summary The municipal-level results suggest that firms with opportunities to avoid taxes move profits out of municipalities that increase trade tax rates. This, in turn, affects the ability of these municipalities to collect trade tax revenues from those more aggressive firms. Consequently, we show that profit-shifting practices causally affect tax revenue structure at the municipal level, especially as municipalities are unable to fully compensate and raise additional revenues through property taxes.

6 Discussion

This paper provides novel estimates of how tax revenue structures are affected by the profit-shifting practices of MNCs. In particular, we present evidence on sources of tax revenues in countries where governments may be unable to raise revenues from MNCs. From a policy perspective, it is important to understand how governments raise revenues in the presence of profit shifting by MNCs. Our analysis allows us to understand which groups of firms or individuals may bear the burden of taxes that are not paid by MNCs, particularly in developed countries included in the Tørsløv et al. (2022) sample. This is important, especially for developing countries, which have much lower fiscal capacity, and, as a consequence, lower ability to raise tax revenues.

At the municipal level, we provide causal evidence that the exposure to more aggressive MNCs reduces the local capacity to collect tax revenues from those firms and, consequently, affects the tax revenue structure. As such, profit shifting appears to be causally linked with tax revenue structure. These municipal-level estimates lend credibility to the country-level correlations. Further, our findings have implications for local governments that are trying to increase their revenues from MNCs. We find that increasing tax rates in municipalities that have a large presence of aggressive firms has the opposite of the expected effect and reduces these revenues. We rule out that the observed revenue changes are driven by the reallocation of real operations.

Do our results suggest that profit shifting affects income inequality through changes in tax revenues and tax revenue structure? Our findings suggest that higher profit shifting is correlated with lower corporate tax revenues, but higher individual, VAT, and other indirect tax revenues and rates. We can infer the direct effect of profit shifting on inequality using the literature on corporate tax incidence. Corporate income taxes are mostly borne by capital and labour — MNCs' shareholders, employees, and customers (Clausing; 2013; Fuest et al.; 2018; Gravelle; 2013; Suárez Serrato and Zidar; 2016). A share of those individuals is likely to be located in foreign countries thus not directly affecting the within-country inequality. A share of those individuals who live in the affected country, is likely to be relatively high-income ones — high-income individuals are more likely to own, be employed by, or buy products from most MNCs. As such, corporate tax is likely to reduce inequality, while not paying that tax will directly increase inequality. We can infer the indirect effect of profit shifting on inequality by using the data from Commitment to Equity (CEQ) Institute (Commitment to Equity Institute; 2022; Lustig; 2018) on the incidence of various taxes. Individual direct taxes tend to be progressive, whereas indirect and VAT taxes are regressive in almost all cases. As a consequence, the overall effect is likely to differ between individual countries and is hard to determine without further research. This goes beyond the scope of this paper and will likely depend on the country-specific characteristics of profit shifting and tax systems, such as tax rates and their progressivity.

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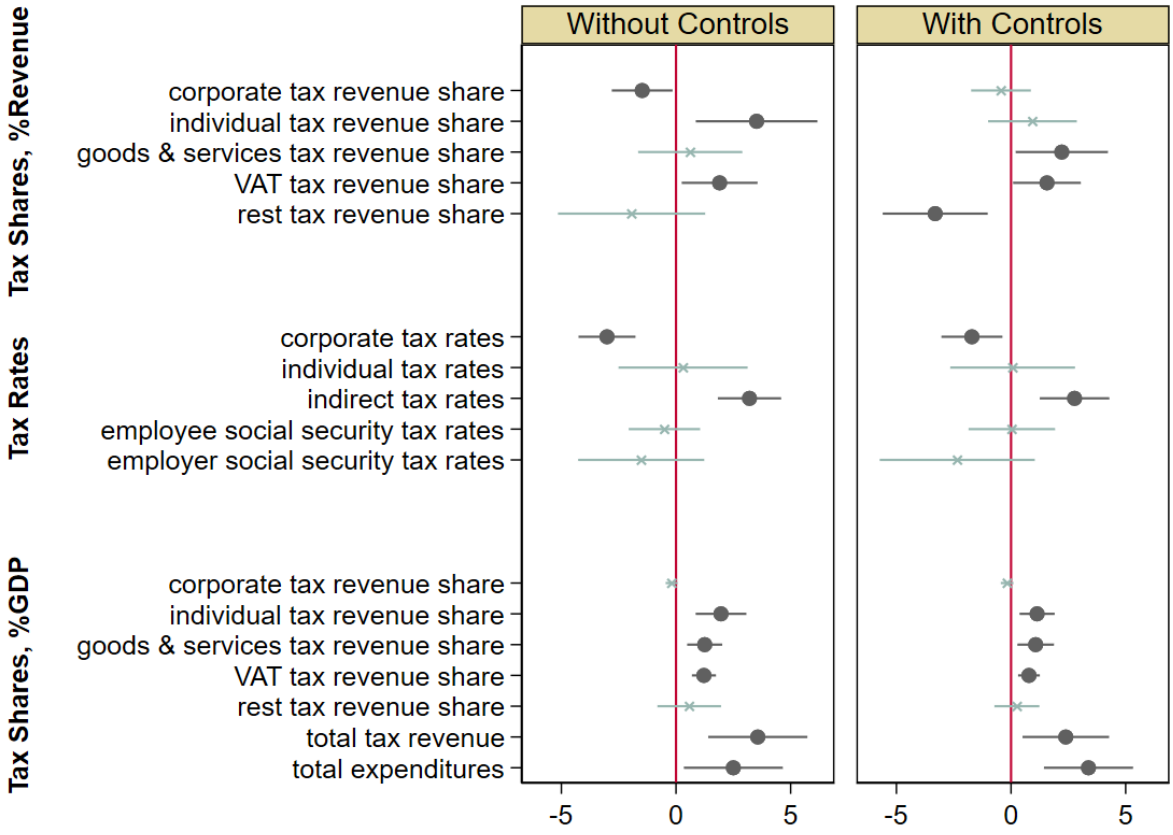
Tables and figures

Figure 1: Summary of Country-Level Results



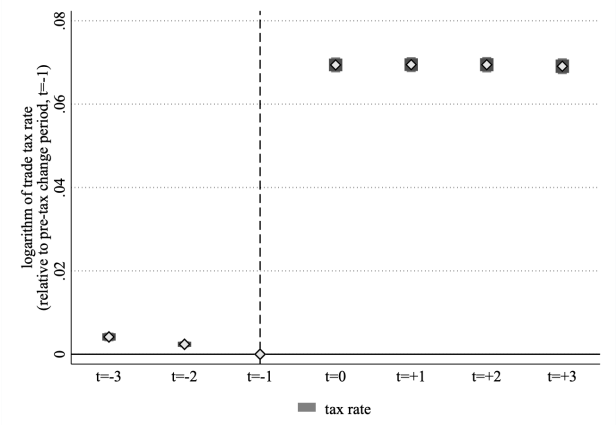
Note: Data from UNU-WIDER Government Revenue Dataset (2021), IMF Government Finance Statistics (2021), Tørsløv et al. (2022), KPMG Tax rates online data (2021), UNCTAD statistical data (2021). Each dot represents the correlation between tax revenues or rates and profit shifting as a share of GDP from Tørsløv et al. (2022). The horizontal lines are 95% confidence intervals. The dark grey colour markers indicate statistically significant coefficients (at the 10% level) and the crossed light green colour markers indicate coefficients that are not statistically significant. The dependent variables in the "Tax Shares, %Revenue" section are all scaled by total tax revenues. The dependent variables in the "Tax Rates" section refer to different types of tax rates. The dependent variables in the "Tax Shares, %GDP" section are all scaled by total GDP. In all specifications we include year fixed effects. In the left panel, we present estimates from regressions without additional controls, while the right hand side panel includes estimates from regressions in which we control for the employer and employee social security tax rates, the logarithm of GDP per capita, the logarithm of population, foreign direct investment inward stock as a percentage of GDP for sections "Tax Shares" and "Tax Shares, %GDP". Controls for the section "Tax Rates" include the logarithm of GDP per capita, the logarithm of population, foreign direct investment inward stock as a percentage of GDP. Table D1 in the Appendix presents corresponding coefficients.

Table 1: Difference-in-Differences Results: pre and post Trade Tax Rate Increase

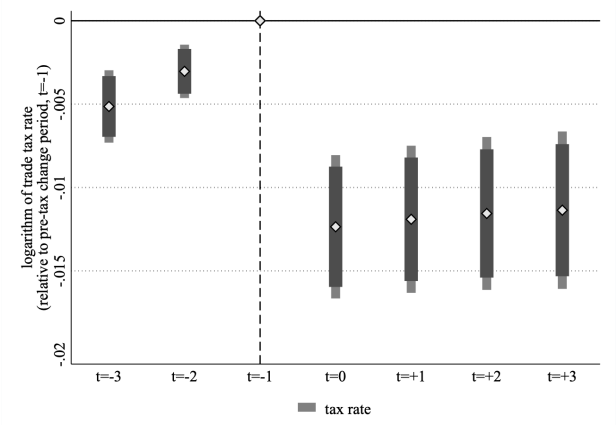
	(1) log(trade tax rate)	(2) log(property tax rate)	(3) ln(trade tax rev)	(4) trade tax share	(5) ln(tot tax rev)	(6) ln(prop tax rev)	(7) property tax share
Panel A: Shares							
post=1	0.073***	0.065***	0.007	0.001	0.006	0.001	0.000
	(0.001)	(0.002)	(0.024)	(0.008)	(0.019)	(0.005)	(0.001)
high agg share=1	-0.008***	0.002	-0.085***	-0.027***	-0.060***	-0.004	0.002***
× post	(0.002)	(0.006)	(0.021)	(0.009)	(0.016)	(0.007)	(0.000)
Panel B: counts							
post=1	0.072***	0.065***	-0.004	-0.003	-0.002	0.003	0.001
	(0.001)	(0.002)	(0.023)	(0.008)	(0.018)	(0.005)	(0.001)
nb agg subs	-0.001**	-0.000	-0.005**	-0.002**	-0.006***	-0.005***	0.000
× post=1	(0.000)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.000)
Year FE	✓	✓	✓	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓	✓	✓	✓
Municipality controls	✓	✓	✓	✓	✓	✓	✓
Observations	27602	31010	26978	12485	12509	27456	12518
Mean	2.517	2.385	5.542	0.282	7.111	2.591	0.021

Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the logarithm of the trade tax rate, in column 2, the logarithm of the property tax rate, in column 3, the logarithm of trade tax revenue, in column 4, the share of trade tax revenue in all tax revenue, in column 5, the logarithm of total tax revenue, in column 6, the logarithm of property tax revenue, and in column 7, the share of property tax revenue in all tax revenue. In Panel A, high agg share is a dummy equal to 1 if the share of subsidiaries of aggressive MNCs is larger than a median across all municipalities, in Panel B, nb agg subs is the number of subsidiaries that belong to aggressive MNCs. Post is equal to 1 after the tax rate increase and 0 beforehand. It is also zero for all control group municipalities. In each specification, we include year and municipality fixed effects. Controls include municipal population, and the number of firms in each municipality across all specifications, and in columns 3-7 they further include trade tax and property tax rates. Standard errors are clustered at the municipality level.

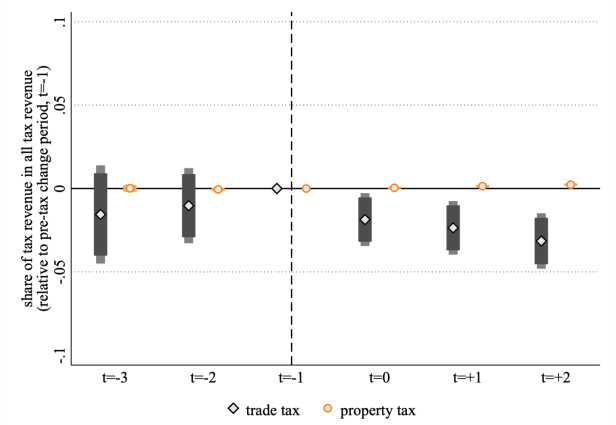
Figure 2: Dynamic Effects of the Tax Rate Increase on Municipal Revenue Structure



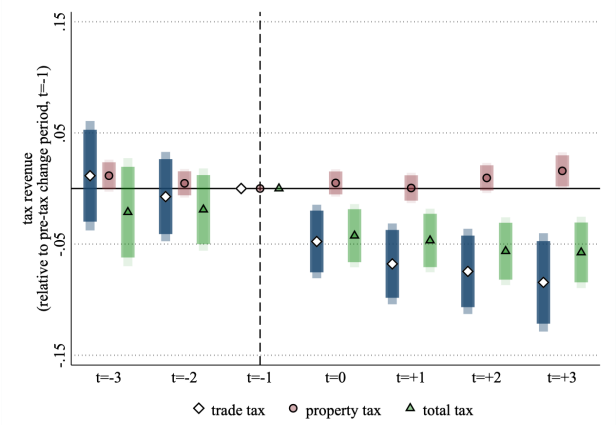
(a) Logarithm of trade tax rate: difference-in-differences



(b) Logarithm of trade tax rate: high agg share interaction



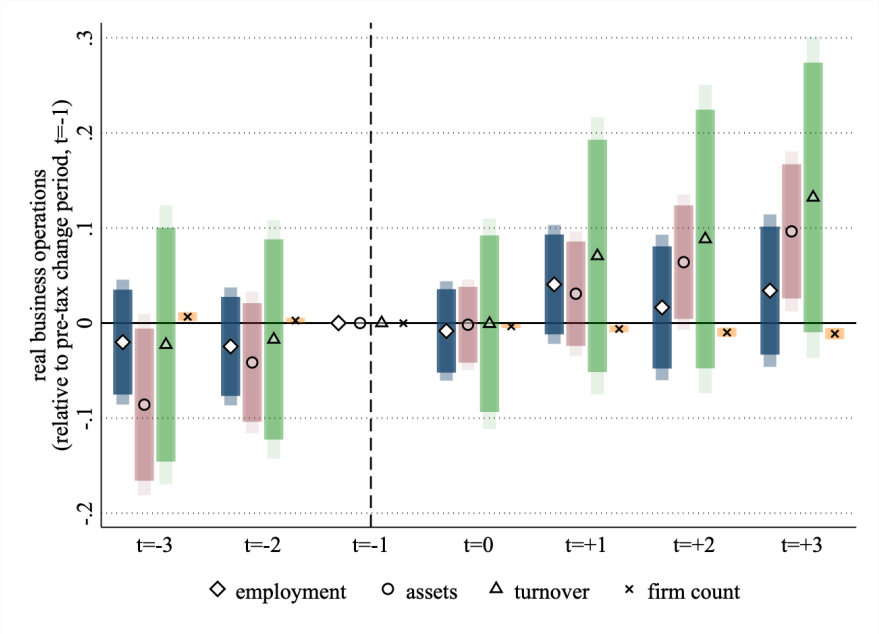
(c) Share of trade tax in total tax



(d) Trade tax vs property tax

Note: Panel (a) of this figure reports the percent change in the trade tax rate for municipalities with a low share of subsidiaries that belong to aggressive MNCs relative to the control group. Panel (b) reports the percent change in the trade tax rate for municipalities with a high share of subsidiaries that belong to aggressive MNCs relative to those with a low share. Panels (c) and (d) report the dynamic effects of the tax rate increase on the share of trade tax and property tax in total tax (panel c) and the logarithm of trade tax, property tax, and total tax revenue (panel d). Panels c and d include the event study coefficient plots for municipalities with high exposure to aggressive MNCs relative to those with low exposure and relative to the control group from 3 years before the tax rate increase to 2 or more years after the tax rate increase. The high exposure to aggressive MNCs is defined as above median. Each dot represents the coefficient estimate using the difference-in-differences methodology, the darker shaded box represents the 95% confidence interval, while the lighter shaded box, the 90% confidence interval. In each specification, we include year and municipality fixed effects. Controls in Panels (a) and (b) include property tax rate, municipal population, and the number of firms in each municipality. Additionally, controls in panels (c) and (d) include trade tax rates. Standard errors are clustered at the municipality level.

Figure 3: Dynamic Effects of Tax Rate Hikes on Real Firm Presence.



Note: This figure reports the dynamic effects of the trade tax rate increase on municipal aggregates of firm employment, total assets, turnover, and firm numbers. The figure plots the event study coefficients for municipalities with high exposure to aggressive MNCs relative to those with low exposure and relative to the control group from 3 years before the tax rate increase to 2 or more years after the tax rate increase. The high exposure to aggressive MNCs is defined as above median. Each dot represents the coefficient estimate using the difference-in-differences methodology, the darker shaded box represents the 95% confidence interval, while the lighter shaded box, the 90% confidence interval. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, municipal population, and the number of firms in each municipality (with the exception of regressions with firm counts as the outcome variable, where we do not control for that). Standard errors are clustered at the municipality level. The sample time period includes years 2012—2019 for which we have observations of firm financial data.

Table 2: Difference-in-Differences Results: using real business operation weights

	(1) share assets	(2) share empl	(3) share turnover	(4) share profits
Panel A: Logarithm of trade tax revenue				
post=1	0.041***	0.027*	0.027*	0.049***
	(0.016)	(0.015)	(0.015)	(0.017)
post=1	-0.279**	-0.525*	-0.370*	-0.098
× agg MNC share	(0.120)	(0.308)	(0.213)	(0.074)
Panel B: Share of trade tax revenue				
post=1	0.010	0.007	0.007	0.013
	(0.008)	(0.007)	(0.007)	(0.011)
post=1	-0.106**	-0.159	-0.149*	-0.028
× agg MNC share	(0.048)	(0.115)	(0.077)	(0.034)
Panel C: Logarithm of total tax revenue				
post=1	0.012	0.010	0.011	0.023
	(0.014)	(0.013)	(0.013)	(0.019)
post=1	-0.184***	-0.291**	-0.261***	-0.063
× agg MNC share	(0.054)	(0.130)	(0.084)	(0.050)
Year FE	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓
Municipality controls	✓	✓	✓	✓
Observations	13880	15671	15707	9281

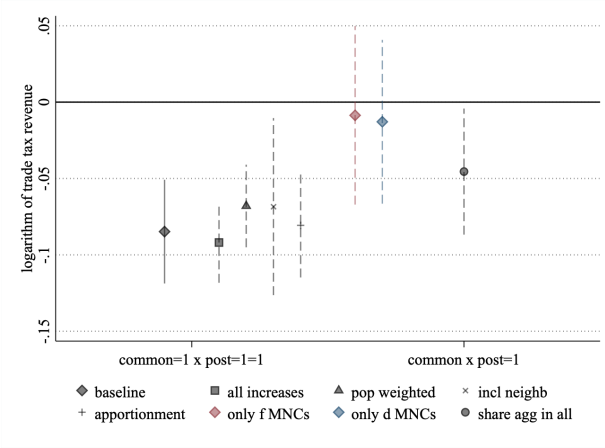
Note: Data from Orbis and German Statistical Office. The dependent variable in all columns in Panel A is the logarithm of trade tax revenue, in Panel B the share of trade tax revenues in all municipal revenues, and in Panel C, the logarithm of total municipal tax revenue. Post is equal to 1 after the tax rate increase and 0 beforehand. It is also zero for all control group municipalities. Agg MNC share is the share of assets, employment, turnover, and profits that subsidiaries of aggressive MNCs hold in each municipality relative to assets, employment, turnover, and profits reported by all firms in that municipality. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, municipal population, and the number of firms in each municipality. Standard errors are clustered at the municipality level.

Table 3: Difference-in-Differences Results: pre and post Tax Rate Increase, placebo

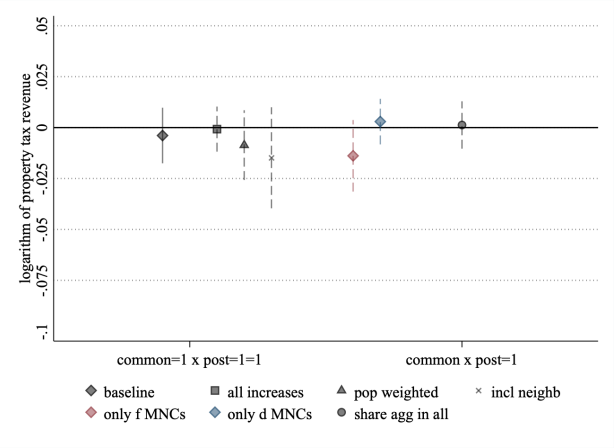
	(1) ln(trade tax rev)	(2) trade tax share	(3) ln(tot tax rev)	(4) ln(prop tax rev)	(5) property tax share
Panel A: Shares					
post=1	-0.003	-0.003	0.004	-0.001	0.000
	(0.025)	(0.009)	(0.020)	(0.005)	(0.001)
high share=1	-0.013	-0.004	-0.025	0.005	0.002***
× post	(0.020)	(0.008)	(0.015)	(0.005)	(0.001)
Panel B: counts					
post=1	-0.004	-0.004	-0.003	0.004	0.001
	(0.023)	(0.008)	(0.018)	(0.005)	(0.001)
nb subs	-0.001	-0.000	-0.001*	-0.003***	0.000
× post	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Year FE	✓	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓	✓
Municipality controls	✓	✓	✓	✓	✓
Observations	26978	12485	12509	27456	12518
Mean	5.542	0.282	7.111	2.591	0.021

Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the logarithm of trade tax revenue, in column 2, the share of trade tax revenue in all tax revenue, in column 3, the logarithm of total tax revenue, in column 4, the logarithm of property tax revenue, and in column 5, the share of property tax revenue in all tax revenue. In Panel A, high share is a dummy equal to 1 if the share of subsidiaries that belong to MNCs is larger than a median across all municipalities, in Panel B, nb subs is the number of subsidiaries that belong to MNC. Post is equal to 1 after the tax rate increase and 0 beforehand. It is also zero for all control group municipalities. In each specification, we include year and municipality fixed effects. Controls include municipal population, the number of firms in each municipality, and trade tax and property tax rates. Standard errors are clustered at the municipality level.

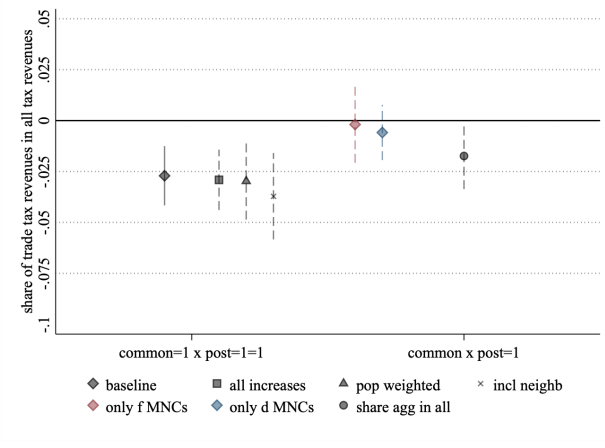
Figure 4: Difference-in-difference: robustness tests



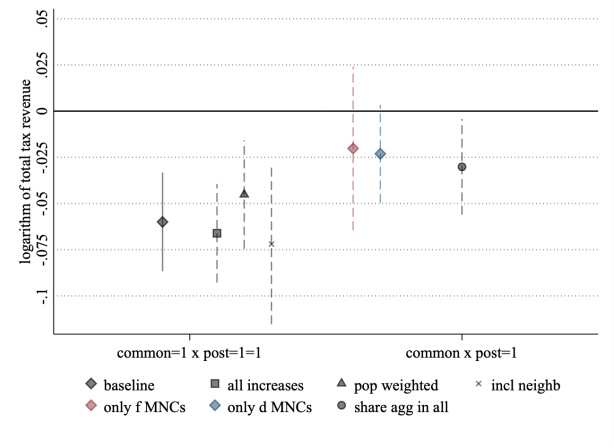
(a) Logarithm of trade tax revenues



(b) Logarithm of property tax revenues



(c) Share of trade tax revenues in total tax



(d) Logarithm of total tax revenues

Note: This figure tests the robustness of the difference-in-differences coefficients in Table 1. In each case, we plot the interaction term between the high share of subsidiaries that belong to aggressive MNCs and post dummy. Panel A uses as a dependent variable the logarithm of trade tax revenues, panel B uses the logarithm of property tax revenue, panel C uses the share of trade tax revenue in total tax revenue, and panel D uses the logarithm of total tax revenue. The high share of subsidiaries that belong to aggressive MNCs is defined as above median. Each dot represents the coefficient estimate using the difference-in-differences methodology and each shape corresponds to a different robustness test. The lines represent the 90% confidence intervals. Solid diamonds replicate directly coefficients from Table 1, squares show the results when we include all tax rate increases, triangles show the results when we weight the regression by municipal population, crosses show the results when we control for neighbouring tax rates, pluses show the results when we replace trade tax revenues with trade tax revenues minus apportionment (only in Panel a), red diamonds show results for baseline case, but for a high share of foreign MNCs in each municipality, blue diamonds show results for baseline case, but for a high share of domestic MNCs in each municipality, circles show baseline results in which instead of using a high share of subsidiaries that belong to aggressive MNCs in each municipality, we calculate the share of subsidiaries that belong to aggressive MNCs in all MNCs in each municipality and present the coefficient on the interaction between that and post=1 dummy. In each specification, we include year and municipality fixed effects and control for trade tax rate, property tax rate, municipal population, and the number of firms in each municipality. Standard errors are clustered at the municipality level.

ONLINE APPENDIX—NOT FOR PUBLICATION, May 4, 2023
"Fiscal Consequences of Corporate Tax Avoidance" by Bilicka, Dubinina and Janský

Appendices

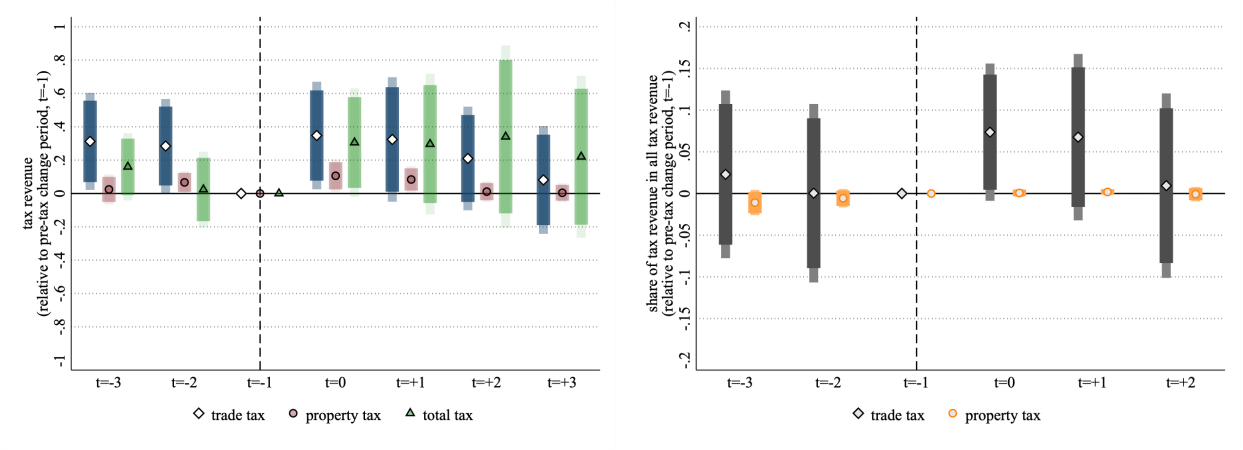
A Additional Municipal-level estimates

Table A1: Descriptive Statistics: Municipalities

	(1) high agg share	(2) low agg share	(3) diff	t-stat
number of firms	2411.673	107.741	-2303.931***	-29.593
employment: Orbis	15526.447	475.229	-15051.218***	-29.550
total assets: Orbis	7698263.398	56447.687	-7641815.711***	-15.067
turnover: Orbis	5604863.125	105245.611	-5499617.513***	-23.988
profits: Orbis	65605.337	1277.258	-64328.080***	-20.146
avg trade tax rate	13.036	12.353	-0.683***	-46.008
avg property tax rate	11.193	11.265	0.072***	3.389
avg of neighbouring trade tax rate	12.938	12.396	-0.542***	-27.653
avg of neighbouring property tax rate	11.114	11.224	0.111***	4.261
population	72848.446	3334.138	-69514.308***	-29.363
share of trade tax in all tax	0.424	0.275	-0.149***	-71.053
log(trade tax revenue)	8.609	5.297	-3.312***	-199.410
log(property tax revenue)	3.889	2.684	-1.206***	-98.300
log(total tax revenue)	9.741	7.028	-2.713***	-112.232
log(income share trade tax revenue)	8.418	5.111	-3.306***	-199.021
log(apportioned trade tax revenue)	6.833	3.599	-3.234***	-195.971
log(gross expenditures)	9.985	7.569	-2.416***	-111.100
log(GDP)	15.840	14.907	-0.933***	-23.091
log(debt)	12.466	11.915	-0.551***	-8.373

Note: Data from Orbis and German Statistical Office. We compare characteristics of municipalities across 2008—2019. Column 1 shows the means for municipalities with a higher share of subsidiaries that belong to aggressive MNCs and column 2 shows the means for municipalities with a lower share of subsidiaries that belong to aggressive MNCs. The high share of subsidiaries that belong to aggressive MNCs is defined as above the median across all municipalities in the sample.

Figure A1: Dynamic Effects of the Tax Rate Increase on Municipal Revenue Structure: tax decreases



(a) Tax revenues (logs)

(b) Shares in total tax revenue.

Note: This figure reports the dynamic effects of the tax rate *decrease* on the logarithm of trade tax, property tax, and total tax revenue (panel a) and the share of trade tax and property tax revenue in total tax revenue (panel b). All panels include the event study coefficient plots for municipalities with a high share of subsidiaries that belong to aggressive MNCs relative to those with a low share and relative to the control group from 3 years before the tax rate decrease to 2 or more years after the tax rate decrease. Each dot represents the coefficient estimate using the difference-in-differences methodology, the darker shaded box represents the 95% confidence interval, while the lighter shaded box 90% confidence interval. The high share of subsidiaries that belong to aggressive MNCs is defined as above the median. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, municipal population, and the number of firms in each municipality. Standard errors are clustered at the municipality level.

Table A2: Orbis Data Coverage: Counts and Financials

Stats	total assets (1)	employment (2)	turnover (3)	profits (4)	firm count (5)	MNC count (6)
Panel A: firm coverage						
Mean	0.066	0.131	0.134	0.020	37156	197
Median	0.062	0.124	0.127	0.019	2823	13
Standard Deviation	0.023	0.045	0.045	0.010	70313.274	369.302
Panel B: MNC coverage						
Mean	0.309	0.429	0.437	0.203		
Median	0.286	0.406	0.417	0.172		
Standard Deviation	0.213	0.227	0.228	0.184		

Note: Data from Orbis. This table summarises the data coverage in Orbis. Columns 1-4 show the fraction of firms that have financial data coverage for total assets, employment, turnover, and profits, respectively. Column 5 shows the average number of firms and column 6 the average number of multinational subsidiaries across municipalities. Panel A shows these statistics for overall firm coverage and Panel B for multinational firms only.

Table A3: The Effect of Tax Rate Hikes on Real Firm Presence and tax competition.

	(1)	(2)	(3)	(4)	(5)	(6)
	Real firm operations				*Tax competition*	
	employment	total assets	turnover	number of firms	ln(avg nghb trade tax rate)	ln(avg nghb prop tax rate)
post=1	-0.010	-0.101***	-0.005	0.010**	-0.006**	-0.006*
	(0.037)	(0.038)	(0.094)	(0.004)	(0.002)	(0.004)
high agg share=1	0.073**	0.124***	0.139*	-0.016***	0.000	0.001
× post=1	(0.033)	(0.037)	(0.074)	(0.003)	(0.003)	(0.005)
Year FE	✓	✓	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓
Observations	11,179	13,644	8,012	14,570	10746	10746
# Municipalities	1,765	1,818	1,461	1,831	1,365	1,365
Mean	0.363	0.360	0.402	0.356	2.523	2.399

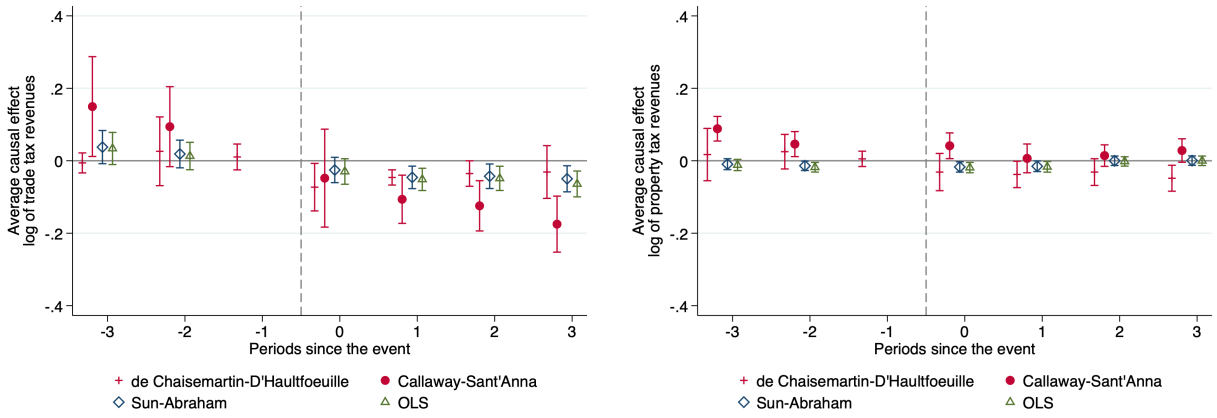
Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the logarithm of the number of employees, in column 2 the logarithm of total assets, in column 3, the logarithm of turnover, in column 4 the logarithm of the number of firms, in column 5 is the logarithm of the average trade tax rate of nearest 5 municipalities, in column 6 is the logarithm of the average property tax rate of nearest 5 municipalities. High agg share is a dummy equal to 1 if the share of subsidiaries of aggressive MNCs is larger than a median across all municipalities. Post is equal to 1 after the tax rate increase and 0 beforehand. It is also zero for all control group municipalities. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, municipal population, and the number of firms (except in column 4) in each municipality across all specifications. Standard errors are clustered at the municipality level.

Table A4: The Goodman-Bacon decomposition

Dep Var.		Timing groups	Always vs timing	Never vs timing	Overall coefficient
Ln(trade tax revenues)	Coefficient	0.037	0	-0.081	-.076***
	Weights	0.035	0	0.965	
Ln(property tax revenues)	Coefficient	0.051	0.293	0.034	0.034***
	Weights	0.035	0.000	0.965	
Ln(total tax revenue)	Coefficient	0.002	-0.030	-0.050	-.047***
	Weights	0.000	0.123	0.877	
trade tax share	Coefficient	-0.011	0.007	-0.0113	-0.009
	Weights	0.000	0.123	0.877	
property tax share	Coefficient	0.000	0.000	0.003	0.003***
	Weights	0.000	0.123	0.877	

Note: Data from Orbis and German Statistical Office. This table decomposes the overall effect of the trade tax increases using the Goodman-Bacon decomposition, based on balanced data during 2011-2019. This limits the number of observations, relative to the benchmark results, which is necessary to perform the decomposition. We report the estimated effects of the reform for the municipalities with a high share of subsidiaries that belong to aggressive MNCs on the logarithms of trade tax revenues, property tax revenues, total tax revenues and then on the shares of trade tax and property tax revenues relative to total tax revenues. Post is equal to 1 after the tax rate increase and 0 beforehand. It is also zero for all control group municipalities. In the decomposition, we include year and municipality fixed effects, but no controls. Standard errors are clustered at the municipality level.

Figure A2: Dynamic Effects of the Tax Rate Increase on Municipal Revenue Structure: staggered difference-in-differences corrections



(a) Log of trade tax revenues

(b) Log of property tax revenues

Note: This figure reports the dynamic effects of the tax rate increase on the logarithm of trade tax and property tax revenue (panels a and b respectively). Both panels include the event study coefficient plots for municipalities with a high share of subsidiaries that belong to aggressive MNCs relative to those with a low share and relative to the control group from 3 years before the tax rate decrease to 2 or more years after the tax rate decrease. Each dot represents the coefficient estimate using different correction methodologies, while each vertical line represents the associated 95% confidence intervals. The high share of subsidiaries that belong to aggressive MNCs is defined as above the median. In each specification, we include year and municipality fixed effects. Standard errors are clustered at the municipality level.

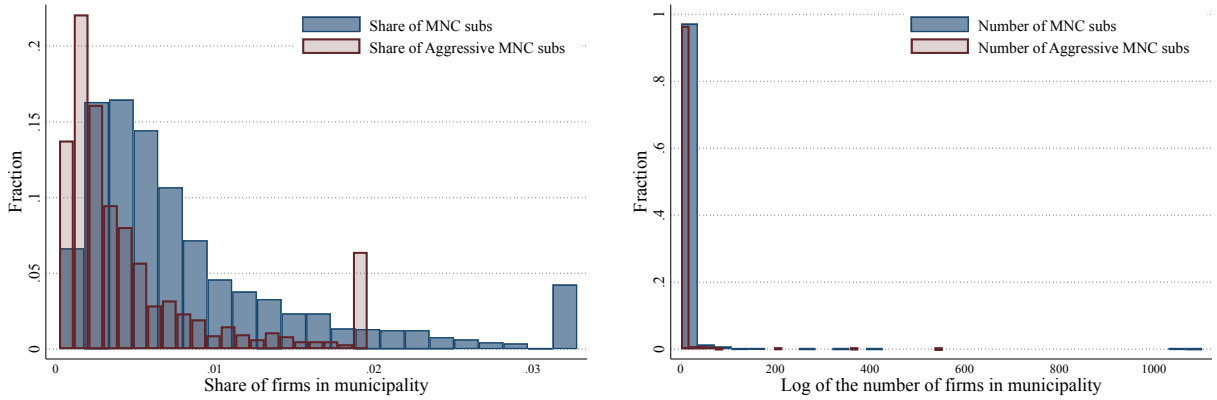
Table A5: Expenditures, Debt, and GDP.

	(1) log(gross exp)	(2) log(GDP)	(3) log(debt)	4 log(gross exp)	5 log(GDP)	6 log(debt)
post=1	-0.017	-0.024	-0.193***	-0.012	0.013	-0.089***
	(0.016)	(0.020)	(0.069)	(0.008)	(0.009)	(0.025)
high agg share=1	-0.032**	0.016	0.149**			
× post=1	(0.015)	(0.016)	(0.066)			
nb agg subs				-0.002***	-0.000	0.002***
× post=1				(0.000)	(0.000)	(0.000)
Year FE	✓	✓	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓	✓	✓
Municipality controls	✓	✓	✓	✓	✓	✓
Observations	19581	1527	1148	19581	1527	1148
Mean	7.738	15.682	12.354	7.738	15.682	12.354

Note: Data from Orbis and German Statistical Office. The dependent variable in columns 1 and 4 is the logarithm of gross expenditures, in columns 2 and 5 the logarithm of GDP, in columns 3 and 6 the logarithm of debt. High agg share is a dummy equal to 1 if the share of subsidiaries of aggressive MNCs is larger than a median across all municipalities, nb agg subs is the number of subsidiaries that belong to aggressive MNC. Post is equal to 1 after the tax rate increase and 0 beforehand. It is also zero for all control group municipalities. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, municipal population, and the number of firms in each municipality across all specifications. Standard errors are clustered at the municipality level.

B Variation in trade tax rates and share of subsidiaries belonging to aggressive MNCs.

Figure B1: Distribution of the number of MNCs and shares of MNCs across municipalities.

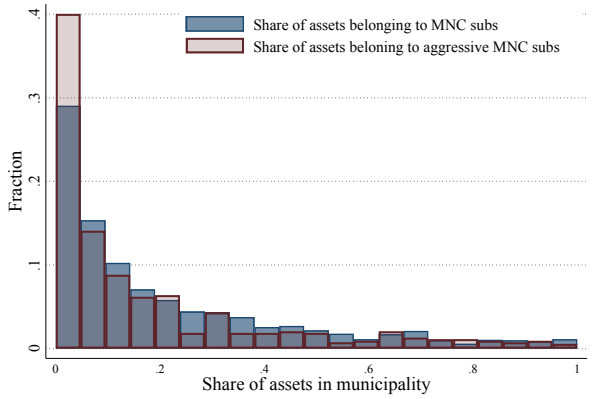


(a) Shares of MNC subsidiaries

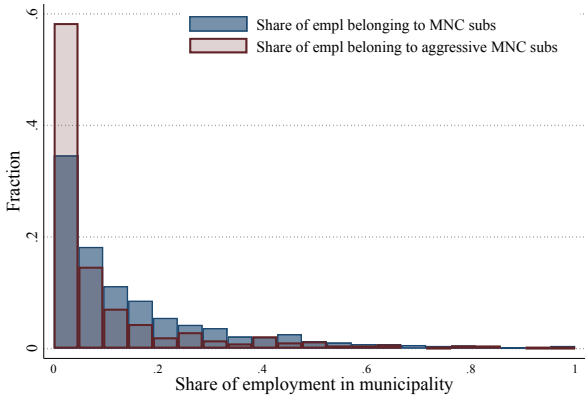
(b) Numbers of MNC subsidiaries

Note: This figure plots the distribution of the shares of MNC subsidiaries and the number of MNC subsidiaries across municipalities. In panel A, in blue, we plot the shares of subsidiaries belonging to MNCs across municipalities, and in red, the shares of subsidiaries belonging to aggressive MNCs across municipalities. In panel B, we plot the corresponding numbers of subsidiaries that belong to MNCs (in blue) and those that belong to aggressive MNCs (in red). In both panels, we omit zero shares and zero numbers municipalities for clarity of exposition. 71.7% of municipalities have no subsidiaries that belong to MNCs, and 83.6% of municipalities have no subsidiaries that belong to aggressive MNCs.

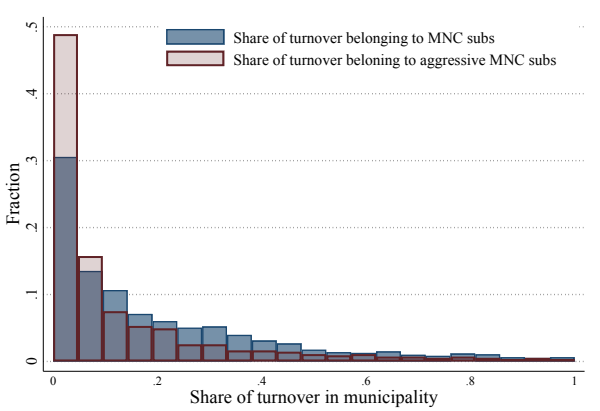
Figure B2: Distribution of the share of assets, employment and turnover of subsidiaries that belong to aggressive MNCs across municipalities.



(a) Share of total assets



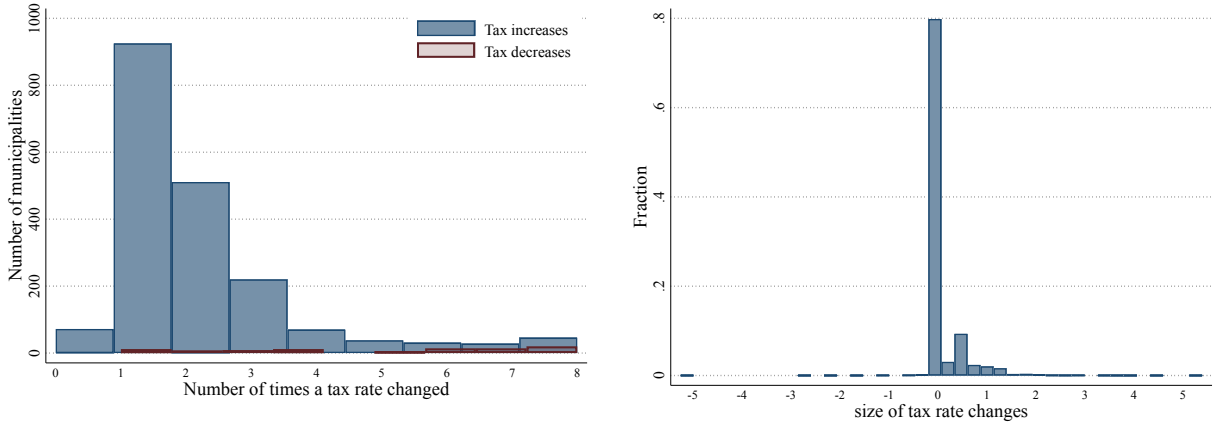
(b) Share of employment



(c) Share of turnover

Note: This figure plots the distribution of the shares of total assets, employment, and turnover that subsidiaries of MNCs own across municipalities in Panels a, b, and c, respectively. In each panel, in blue, we plot the shares belonging to MNCs, and in red, the shares belonging to aggressive MNCs. In both panels, we omit zero shares for clarity of exposition. 80% of municipalities have no assets that belong to subsidiaries of MNCs, and 93.5% of municipalities have no assets that belong to subsidiaries of aggressive MNCs.

Figure B3: Distribution of tax rate changes: numbers and sizes.

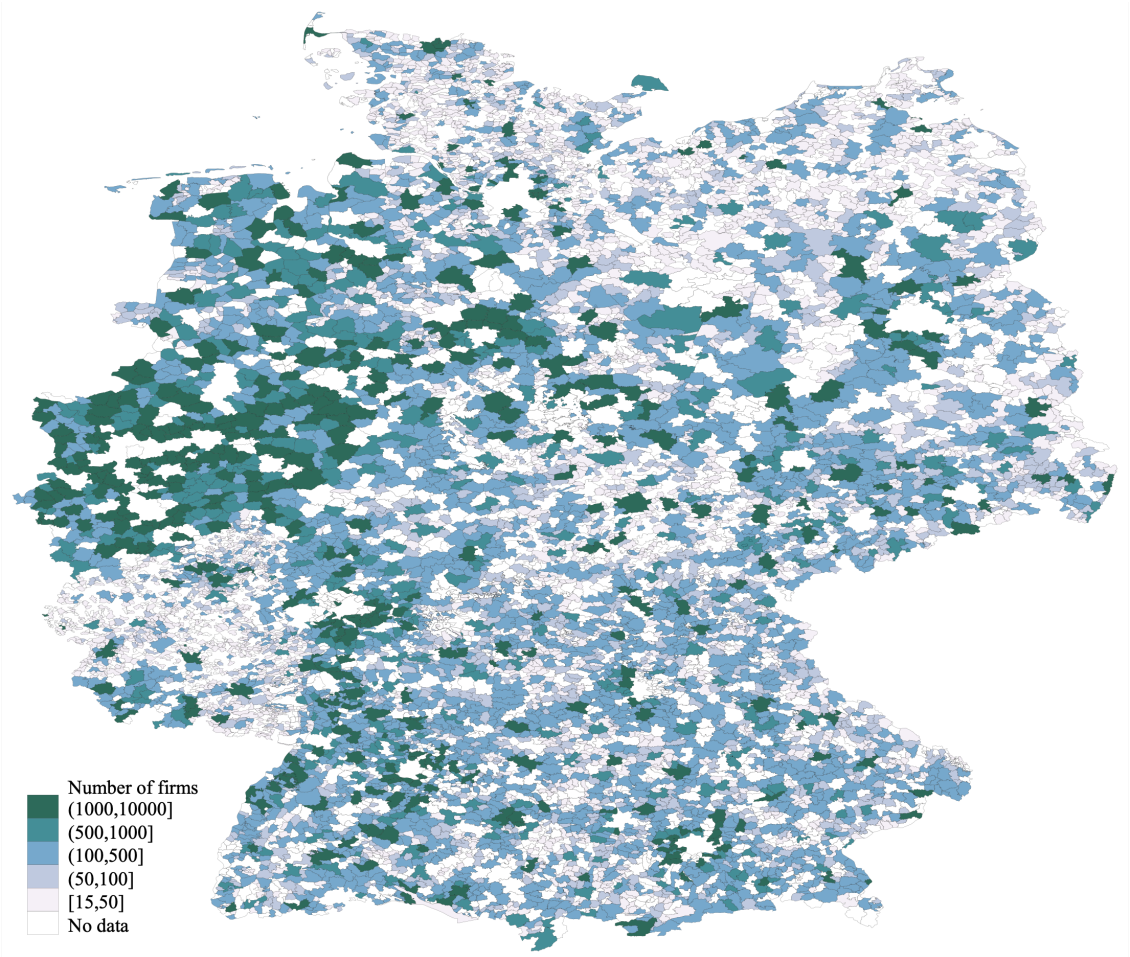


(a) Number of tax rate changes

(b) Size of tax rate changes.

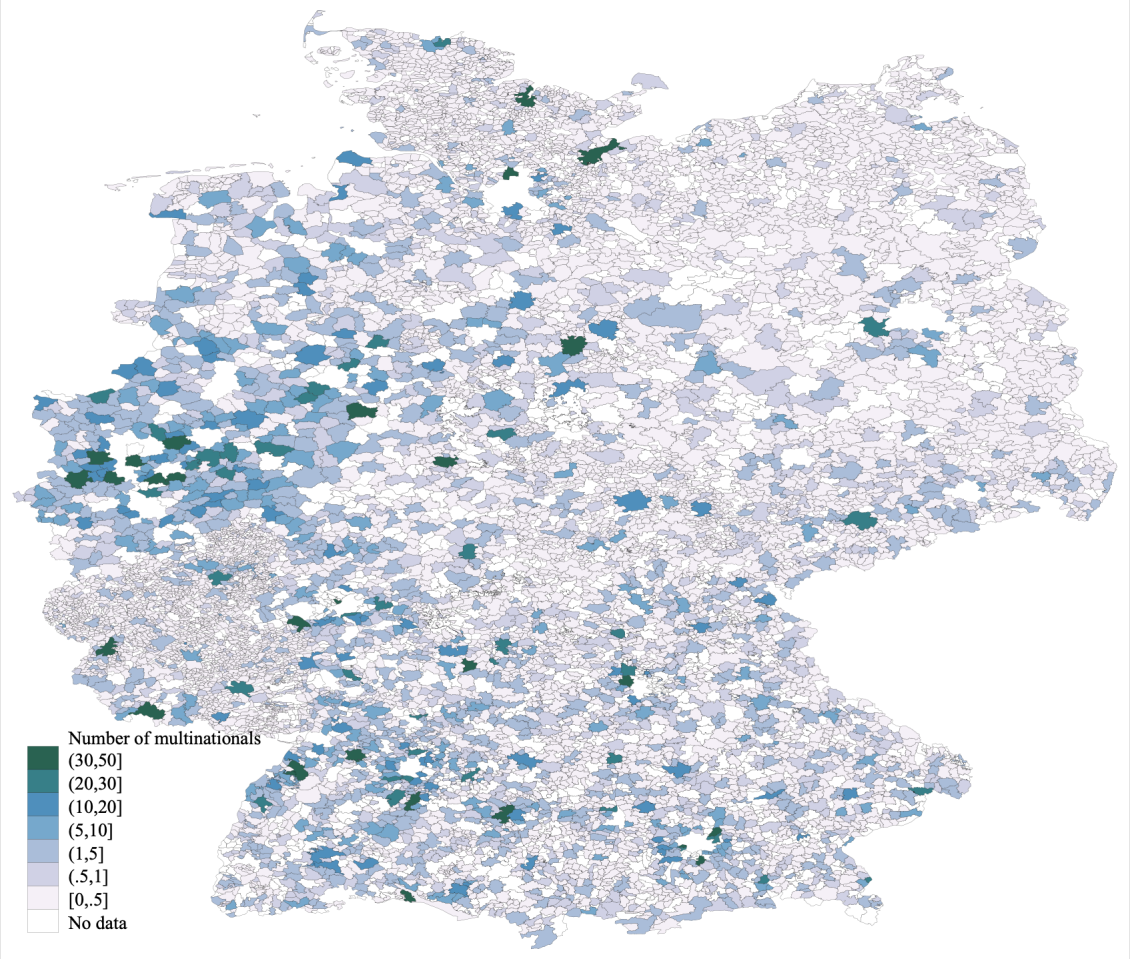
Note: In panel a, we plot the number of times a tax rate changed in each municipality across the sample period: 2008 - 2019. In blue, we have the tax rate increases, and in red, the tax rate decreases. We exclude cases when the tax rate did not change at all. In Panel B, we plot the distribution of the sizes of these tax rate changes.

Figure B4: Number of Subsidiaries Across Municipalities



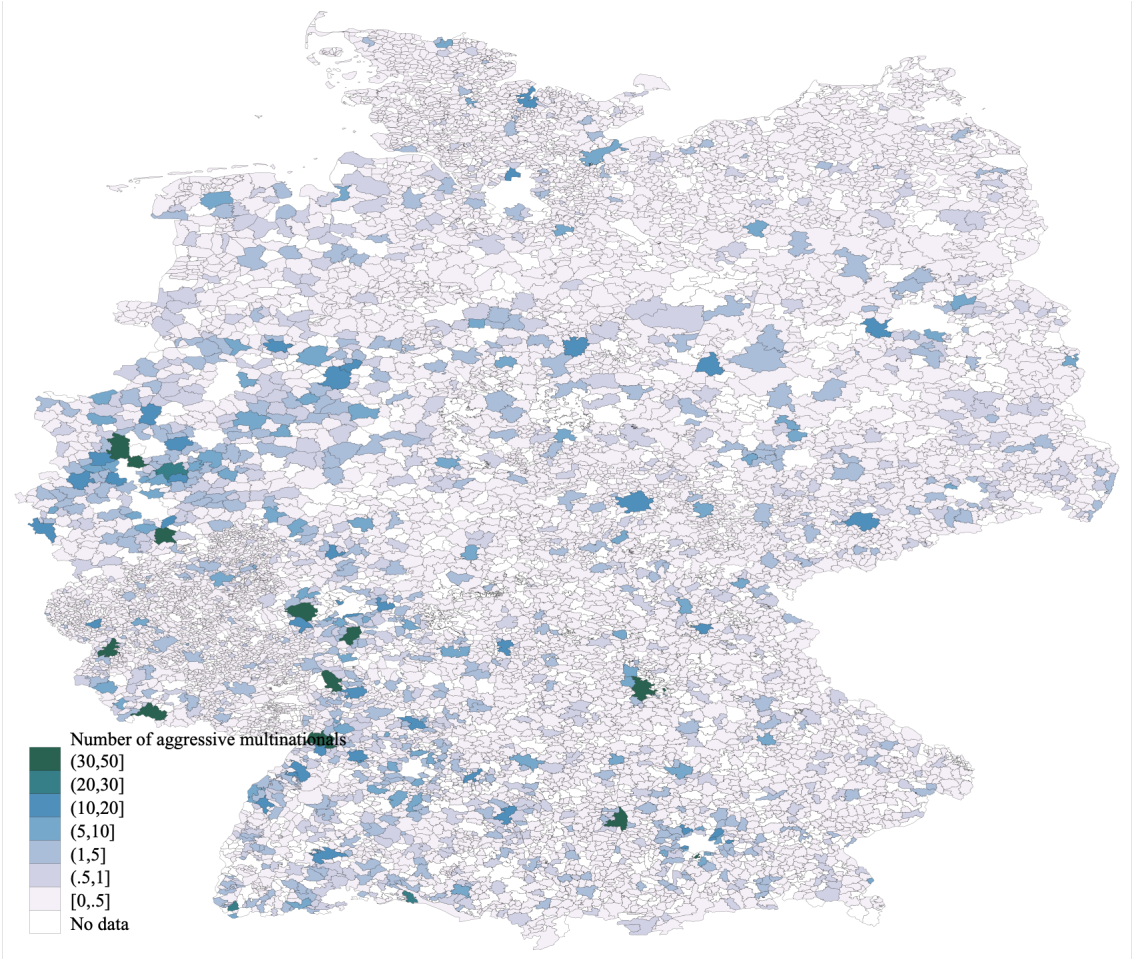
Note: Data from Orbis and German Statistical Office. This maps outlines all German municipalities and the number of firms in each.

Figure B5: Number of Subsidiaries that belong to Multinationals across Municipalities



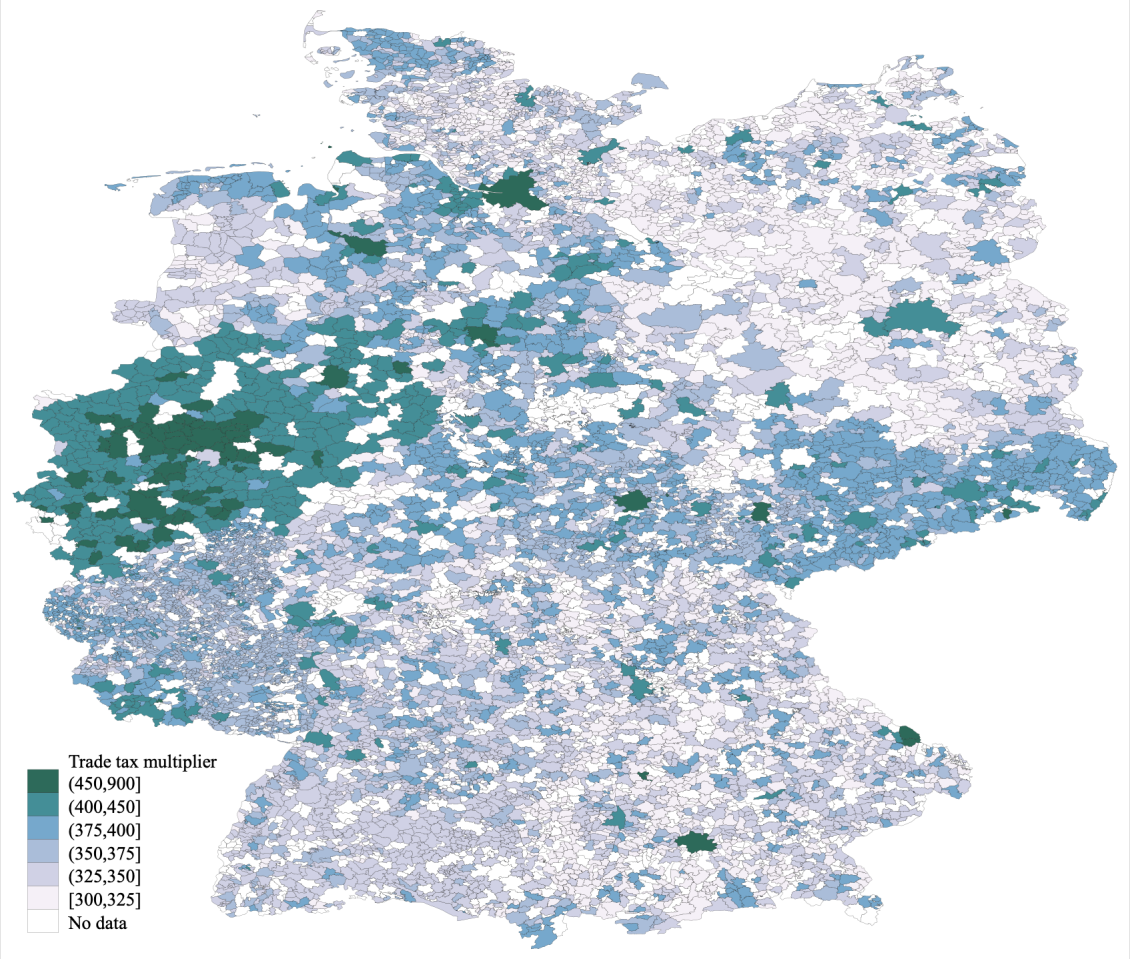
Note: Data from Orbis and German Statistical Office. This maps outlines all German municipalities and the number of subsidiaries of multinational firms in each.

Figure B6: Number of Subsidiaries that belong to Aggressive Multinationals Across Municipalities



Note: Data from Orbis and German Statistical Office. This maps outlines all German municipalities and the number of subsidiaries that belong to aggressive multinationals in each. Aggressive multinational subsidiary is defined as a subsidiary belonging to a firm that owns a tax haven subsidiary as well.

Figure B7: Trade tax multipliers.



Note: Data from German Statistical Office. This maps outlines all German municipalities and the trade tax multipliers variation across municipalities in 2014.

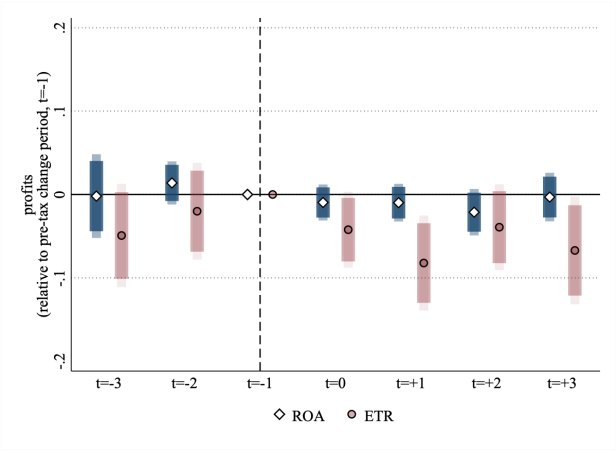
C Firm level results.

Table C1: Profitability and real operations: firm-level results.

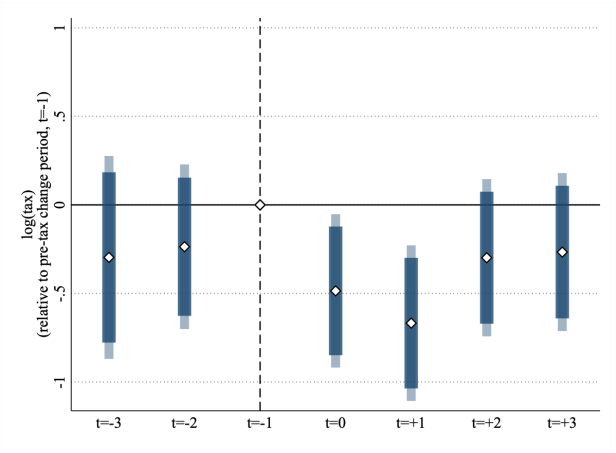
	Profits			***Real operations***			
	Panel A: Firm-level clustering						
	(1) ROA	(2) ETR	(3) log(tax)	(4) log(assets)	(5) log(fxa)	(6) log(empl)	(7) log(turnover)
post=1	0.003	0.001	-0.002	-0.010*	-0.032***	-0.005	-0.014
	(0.002)	(0.004)	(0.033)	(0.005)	(0.007)	(0.005)	(0.009)
MNC × post=1	0.008	0.029**	0.292***	0.108***	0.187***	0.057***	0.039
	(0.007)	(0.012)	(0.096)	(0.019)	(0.026)	(0.014)	(0.037)
MNC × post=1	-0.020*	-0.057***	-0.332*	-0.031	-0.074	-0.019	-0.041
× agg	(0.012)	(0.021)	(0.192)	(0.040)	(0.066)	(0.038)	(0.065)
	Panel B: Municipal- and year-level clustering						
post=1	0.003	0.001	-0.002	-0.010	-0.032***	-0.005	-0.014
	(0.003)	(0.004)	(0.054)	(0.007)	(0.009)	(0.006)	(0.013)
MNC × post=1	0.008**	0.029	0.292**	0.108***	0.187***	0.057***	0.039
	(0.004)	(0.017)	(0.104)	(0.030)	(0.034)	(0.016)	(0.047)
MNC × post=1	-0.020**	-0.057**	-0.332***	-0.031	-0.074	-0.019	-0.041
× agg	(0.009)	(0.020)	(0.100)	(0.046)	(0.059)	(0.025)	(0.072)
Year FE	✓	✓	✓	✓	✓	✓	✓
Firm FEs	✓	✓	✓	✓	✓	✓	✓
Observations	156761	131003	132575	294854	276316	173983	103193
# firms	35,581	30,804	30,876	49,005	46,316	40,670	26,340
Mean	0.496	0.492	0.492	0.484	0.482	0.481	0.506

Note: Data from Orbis and German Statistical Office. This table reports the results from estimating the effects of municipal trade tax rate increases on subsidiary-level profits and real operations. In columns 1- 3, we consider effects on firm profits; the dependent variable in column 1 is the returns on assets, which is the ratio of profits and loss before tax to total assets, in column 2 the effective tax rate, which is the ratio of tax paid to profit and loss before taxes, in column 3 the logarithm of tax paid. In columns 4-7, we consider the effects on the firm's real operations; the dependent variable in column 4 is the logarithm of total assets, in column 5 is the logarithm of fixed assets, in column 6 is the logarithm of the number of employees, and in column 7 is the logarithm of turnover. Post is equal to 1 after the tax rate increase and 0 beforehand. It is also zero for all control group municipalities. Agg is a dummy equal to 1 when the MNC that owns that particular subsidiary has a tax haven subsidiary. In each specification, we include year and firm fixed effects. Standard errors are clustered at the firm level in panel A and the municipal-year level in Panel B.

Figure C1: Profitability and real-effects: firm-level event studies.



(a) ROA and ETR



(b) Log of tax paid.

(c) Real operations.

Note: Data from Orbis and German Statistical Office. This figure reports the dynamic effects of municipal trade tax rate increases on subsidiary-level profits and real operations. In Panel a, we consider the effects on returns on assets, which is the ratio of profits and loss before tax to total assets, and on the effective tax rate, which is the ratio of tax paid to profit and loss before taxes. In Panel b, we look at the logarithm of tax paid. In Panel c, we look across real operations, which we proxy by logarithms of total assets, fixed assets, number of employees, and turnover. All panels include the event study coefficient plots for subsidiaries that belong to aggressive MNCs relative to those that belong to non-aggressive MNCs and relative to the control group of domestic firms from 3 years before the tax rate increase to 2 or more years after the tax rate increase. An aggressive MNC is defined as one that has a tax haven in its ownership structure. Each dot represents the coefficient estimate using the difference-in-differences methodology, the darker shaded box represents the 95% confidence interval, while the lighter shaded box 90% confidence interval. In each specification, we include firm and year fixed effects. Standard errors are clustered at the firm level.

D Additional country-level estimates

Table D1: Summary of Country-Level Results

	(1) corp.share	(2) indiv.share	(3) gs.share	(4) vat.share	(5) rest.share
Panel A: Baseline Correlations for Tax Shares					
Profit shifted % GDP	-1.475*	3.516**	0.620	1.903*	-1.938
	(0.670)	(1.342)	(1.150)	(0.836)	(1.623)
Year FE	✓	✓	✓	✓	✓
# Observations	146	146	151	145	137
Panel B: Tax Shares: including controls					
Profit shifted % GDP	-0.438	0.935	2.215*	1.568*	-3.308**
	(0.657)	(0.977)	(1.017)	(0.746)	(1.156)
Controls	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
# Observations	131	131	136	130	122
	(1) corp	(2) indiv	(3) indir	(4) socsecemployee	(5) socsecemployer
Panel C: Baseline Correlations for Tax Rates					
Profit shifted % GDP	-3.010***	0.308	3.206***	-0.507	-1.519
	(0.630)	(1.426)	(0.699)	(0.788)	(1.392)
Year FE	✓	✓	✓	✓	✓
# of Observations	165	165	165	158	152
Panel D: Tax Rates: including controls					
Profit shifted % GDP	-1.706*	0.071	2.772***	0.034	-2.346
	(0.674)	(1.378)	(0.768)	(0.956)	(1.712)
Controls	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
# Observations	165	165	165	158	152

Note: Data from UNU-WIDER Government Revenue Dataset (2021), IMF Government Finance Statistics (2021), Tørsløv et al. (2022), KPMG Tax rates online data (2021), UNCTAD statistical data (2021). The dependent variables in Panel A and B are the shares of tax revenue from income, profits, and capital gains taxes on corporations in column 1; income, profits, and capital gains taxes on individuals in column 2; goods and services taxes in column 3; VAT in column 4; and social contributions, payroll and workforce, property, and other taxes in column 5. The dependent variables in Panel C and D are tax rates: corporate in column 1; individual in column 2; indirect in column 3; employee social security in column 4; and employer social security in column 5. The independent variable in all panels is the profit shifted as a percentage of GDP from Tørsløv et al. (2022). In all specifications, we include year fixed effects. Controls in Panel B include employer and employee social security tax rates, the logarithm of GDP per capita, the logarithm of population, and foreign direct investment inward stock as a percentage of GDP. Controls in Panel D include the logarithm of GDP per capita, the logarithm of population, foreign direct investment inward stock as a percentage of GDP.

Table D2: Summary of Country-Level Results: Robustness, Scaling by GDP

Panel A: Baseline Correlations for Total Tax Revenue, Expenditures, Tax Shares

	(1) tax.tot	(2) exp	(3) tax.corp	(4) tax.indiv	(5) tax.gs	(6) tax.vat	(7) tax.rest
Profit shifted % GDP	3.567**	2.501*	-0.192	1.963***	1.251**	1.217***	0.578
	(1.095)	(1.091)	(0.131)	(0.559)	(0.387)	(0.266)	(0.702)
Year FE	✓	✓	✓	✓	✓	✓	✓
# Observations	160	139	152	149	156	148	137

Panel B: Total Tax Revenue, Expenditures, Tax Shares: including controls

	(1) tax.tot	(2) exp	(3) tax.corp	(4) tax.indiv	(5) tax.gs	(6) tax.vat	(7) tax.rest
Profit shifted % GDP	2.390*	3.380***	-0.171	1.138**	1.075**	0.782**	0.257
	(0.954)	(0.982)	(0.139)	(0.387)	(0.404)	(0.239)	(0.495)
Employer soc. sec. tax rates	0.166***	0.251***	-0.011	-0.064**	0.049*	0.029*	0.208***
	(0.045)	(0.052)	(0.007)	(0.020)	(0.019)	(0.011)	(0.031)
Employee soc. sec. tax rates	0.188*	0.060	-0.061***	-0.170***	0.132***	0.046*	0.339***
	(0.087)	(0.093)	(0.013)	(0.036)	(0.036)	(0.021)	(0.057)
Logarithm of GDP per capita	6.532***	4.801***	-0.054	3.322***	-0.009	0.022	3.709***
	(0.735)	(0.831)	(0.104)	(0.298)	(0.294)	(0.195)	(0.412)
Logarithm of population	-1.314***	-1.481***	0.072	-0.220	-0.988***	-0.779***	0.044
	(0.383)	(0.390)	(0.056)	(0.157)	(0.160)	(0.095)	(0.203)
FDI % GDP	-0.137***	-0.169***	-0.001	-0.046**	-0.036*	-0.010	-0.002
	(0.035)	(0.036)	(0.006)	(0.016)	(0.015)	(0.009)	(0.022)
Year FE	✓	✓	✓	✓	✓	✓	✓
# Observations	144	126	135	134	140	131	122

Note: Data from UNU-WIDER Government Revenue Dataset (2021), IMF Government Finance Statistics (2021), Tørsløv et al. (2022), KPMG Tax rates online data (2021), UNCTAD statistical data (2021). The dependent variables are all expressed as percentages of GDP: in column 1 the total tax revenue; in column 2 the total expenditures; in column 3 the revenue from income, profits, and capital gains taxes on corporations; in column 4 the revenue from income, profits, and capital gains taxes on individuals; in column 5 the revenue from goods and services taxes; in column 6 the revenue from VAT, and in column 8 the revenue from social contributions, payroll and workforce, property, and other taxes. The independent variable is the profit shifted as a percentage of GDP from Tørsløv et al. (2022). In each specification, we include year fixed effects. Controls in Panel B include employer and employee social security tax rates, the logarithm of GDP per capita, the logarithm of population, and foreign direct investment inward stock as a percentage of GDP.

Table D3: Summary of Country-Level Results: Averages, Robustness

Panel A: Baseline Correlations for Tax Shares (% Total Tax Revenue)

	(1) corp.share	(2) indiv.share	(3) gs.share	(4) vat.share	(5) rest.share
Profit shifted % GDP	-1.514	2.871	0.292	2.412	-1.192
	(1.955)	(2.762)	(2.400)	(1.754)	(3.416)
# Observations	40	40	41	39	36

Panel B: Baseline Correlations for Tax Shares (% GDP)

	(1) tax.corp	(2) tax.indiv	(3) tax.gs	(4) tax.vat	(5) tax.rest
Profit shifted % GDP	-0.213	1.743	1.314	1.340*	0.841
	(0.291)	(1.162)	(0.860)	(0.569)	(1.437)
# Observations	42	41	43	40	36

Panel C: Baseline Correlations for Tax Rates

	(1) corp	(2) indiv	(3) indir	(4) socsecemployee	(5) socsecemployer
Profit shifted % GDP	-3.281*	0.267	3.445*	-0.533	-1.509
	(1.248)	(2.913)	(1.501)	(1.608)	(2.806)
# Observations	43	43	43	43	41

Note: Data from UNU-WIDER Government Revenue Dataset (2021), IMF Government Finance Statistics (2021), Tørsløv et al. (2022), KPMG Tax rates online data (2021), UNCTAD statistical data (2021). The dependent variables in Panel A are the average shares over the 2015-2018 period of tax revenue from income, profits, and capital gains taxes on corporations in column 1; income, profits, and capital gains taxes on individuals in column 2; goods and services taxes in column 3; VAT in column 4; and social contributions, payroll and workforce, property, and other taxes in column 5. The dependent variables in Panel B are the average percentages of GDP over the 2015-2018 period: in column 1 the revenue from income, profits, and capital gains taxes on corporations; in column 2 the revenue from income, profits, and capital gains taxes on individuals; in column 3 the revenue from goods and services taxes; in column 4 the revenue from VAT, and in column 5 the revenue from social contributions, payroll and workforce, property, and other taxes. The dependent variables in Panel C are average tax rates over the 2015-2018 period: corporate in column 1; individual in column 2; indirect in column 3; employee social security in column 4; and employer social security in column 5. The independent variable in all panels is the average profit shifted as a percentage of GDP over the 2015-2018 period from Tørsløv et al. (2022).

D.1 Alternative profit shifting estimates

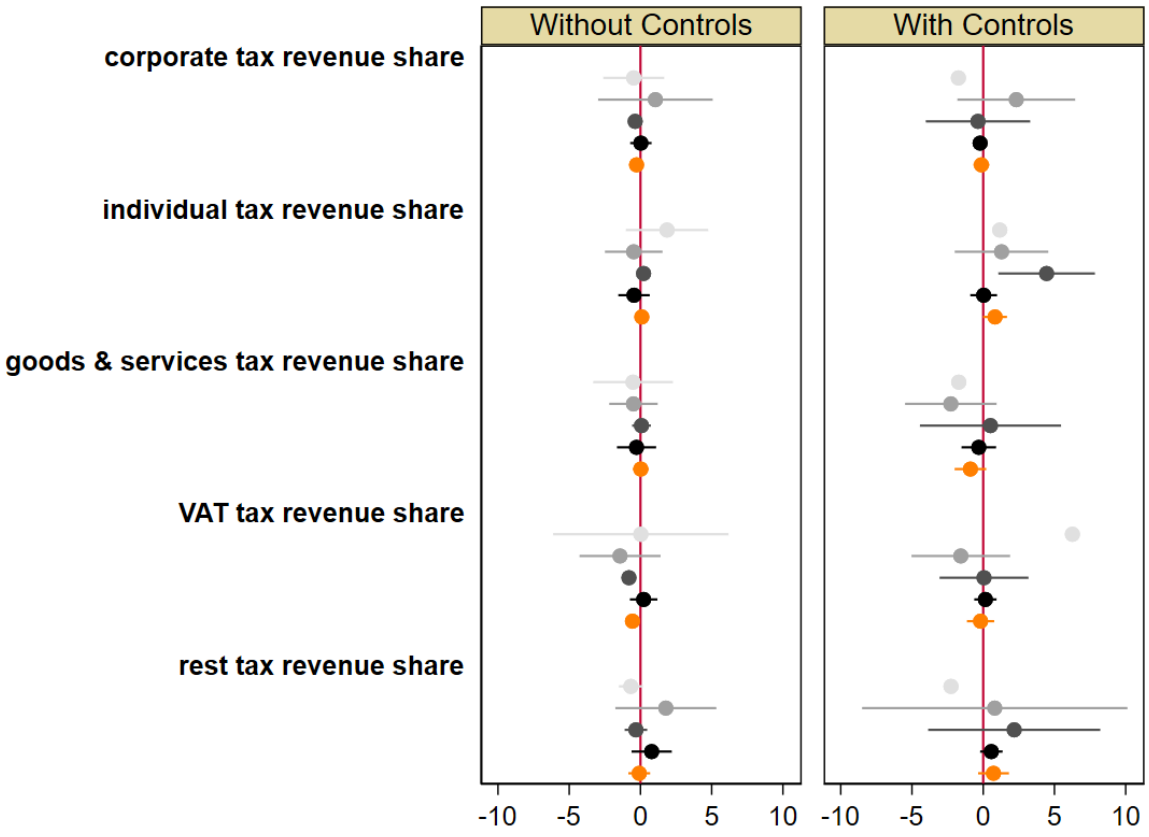
We test the robustness of our findings using an alternative set of profit-shifting estimates from Garcia-Bernardo and Janský (2021). They use country-by-country reporting data to show that MNCs report substantially more profits in many low-tax countries than their corresponding economic activity. Based on their misalignment model, they provide estimates for up to 190 countries, but only for one year, 2017. As such, Tørsløv et al. (2022) estimates are more established and cover panel data, while Garcia-Bernardo and Janský (2021) estimates cover a broader range of countries, but for one year only. In Table D4 we show the baseline correlations between tax revenue shares and profit-shifting measures. In Figure D1 we present heterogeneous estimates across countries with different income levels.

Table D4: Summary of Country-Level Results with an Alternative Measure of Profit Shifting

	(1) corp.share	(2) indiv.share	(3) gs.share	(4) vat.share	(5) rest.share
Profit shifted % GDP	-0.128	0.830	-0.897	-0.183	0.725
	(0.280)	(0.422)	(0.558)	(0.481)	(0.541)
Employer soc. sec tax rates	-0.089	-0.230*	-0.059	-0.052	0.557***
	(0.058)	(0.088)	(0.113)	(0.095)	(0.126)
Employee soc. sec. tax rates	-0.201*	-0.344*	0.149	0.216	0.522*
	(0.088)	(0.133)	(0.175)	(0.148)	(0.201)
Logarithm of GDP per capita	-2.211***	3.227***	-4.211***	-2.780**	7.180***
	(0.528)	(0.795)	(0.994)	(0.887)	(1.064)
Logarithm of population	1.648***	1.186	-2.412**	-1.786*	1.319
	(0.430)	(0.647)	(0.831)	(0.720)	(0.837)
FDI % GDP	0.049***	-0.012	-0.014	-0.032*	-0.024
	(0.008)	(0.013)	(0.016)	(0.016)	(0.015)
# Countries	78	78	90	81	68

Note: Data from UNU-WIDER Government Revenue Dataset (2021), IMF Government Finance Statistics (2021), Garcia-Bernardo and Janský (2021), KPMG Tax rates online data (2021), UNCTAD statistical data (2021). The dependent variables are the shares of tax revenue from income, profits, and capital gains taxes on corporations in column 1, from income, profits, and capital gains taxes on individuals in column 2, from goods and services taxes in column 3, VAT tax in column 4, and from social contributions, payroll and workforce, property, and other taxes in column 5. The independent variable is the profit shifted as a percentage of GDP from Garcia-Bernardo and Janský (2021). In each specification, we include year fixed effects. Controls include employer and employee social security tax rates, the logarithm of GDP per capita, the logarithm of population, and foreign direct investment inward stock as a percentage of GDP.

Figure D1: Summary of Country-Level Results with an Alternative Measure of Profit Shifting by Countries' Income Levels



Note: Data from UNU-WIDER Government Revenue Dataset (2021), IMF Government Finance Statistics (2021), Garcia-Bernardo and Janský (2021), KPMG Tax rates online data (2021), UNCTAD statistical data (2021). In orange, we show the overall coefficient. The darker colour markers indicate a higher level of income, classified by World Bank (high, upper-middle, lower-middle, and low, respectively). The dependent variables are all scaled by total tax revenues. The independent variable is the profit shifted as a percentage of GDP from Garcia-Bernardo and Janský (2021). In each specification, we include year fixed effects. Controls in the right hand side panel include employer and employee social security tax rates, the logarithm of GDP per capita, the logarithm of population, and foreign direct investment inward stock as a percentage of GDP.