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Katarzyna Bilicka, Evgeniya Dubinina and Petr Janský

Fiscal Consequences of Corporate Tax Avoidance

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CROATIAN NATIONAL BANK

Fiscal Consequences of Corporate Tax Avoidance

Katarzyna BILICKA*

Evgeniya DUBININA[†]

Petr JANSKÝ[‡]

Abstract

Multinational corporations shift a large share of their foreign profits to tax havens and, due to this corporate tax avoidance, governments worldwide lose a portion of their tax revenue. In this paper, we study the consequences of multinational tax avoidance for the structure of government tax revenues. First, we show that, at the country level, countries with large revenue losses due to profit shifting have lower corporate tax revenues and rates. At the same time, they raise a larger share of tax revenues from personal and indirect taxes and have higher indirect tax rates. Second, to establish causality, we use German municipal data and analyse the effects of changes in municipal tax rates levied on corporate profits on local tax revenue structure. We show that following a tax rate increase, municipalities with a large presence of aggressive multinational corporations experience a significant decline in that tax revenue share.¹

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

JEL: E62, H26, H71

*kat.bilicka@usu.edu, Utah State University, NBER, CEPR & Oxford Centre for Business Taxation; Jon M Huntsman School of Business, 3500 Old Main Hill, Logan, 84322, UT.

[†]evgeniya.dubinina@fsv.cuni.cz, Institute of Economic Studies, Faculty of Social Sciences, Charles University, Opletalova 26, 110 00, Prague, Czech Republic.

[‡]petr.jansky@fsv.cuni.cz, Institute of Economic Studies, Faculty of Social Sciences, Charles University, Opletalova 26, 110 00, Prague, Czech Republic.

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1 Introduction

The revelations from Panama and Paradise papers in 2015 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.; 2020; Garcia-Bernardo and Janský; 2021). The estimates from the literature suggest these tax revenue losses are large. However, what are the consequences of these tax avoidance practices for where governments derive their tax revenues from? In this paper, we analyse the relationship between corporate tax avoidance and the structure of tax revenues, both at the country and at the local government level, to answer this question.

First, 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. We take advantage of the new country-level estimates of profit shifting from Tørsløv et al. (2020). 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 will be strongly affected and taxing domestic firms may not compensate for that. Second, when corporate tax revenues decline, governments 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 higher share of shifted profits also have lower corporate tax rates and higher indirect tax rates.

We follow the country-level analysis, with municipal level estimates using Germany as a case study. German municipalities set their own multipliers on trade tax and property tax rates. Trade tax is a municipal tax on corporate profits, while property tax is levied on the value of property. This local tax rate flexibility allows us to identify the relationship between tax revenue structure and profit shifting at the local level causally. We take advantage of a large variation in municipal tax rates across over 11,000 municipalities in Germany combined with firm-level data on the geographical presence of multinational subsidiaries. In particular, we focus on a comparison between municipalities that are more exposed to aggressive MNCs and those that are not. We define aggressive MNCs as those having at least one tax haven in their ownership structure, following the large literature (Bilicka and Scur; 2021; Gumpert et al.; 2016; Hines and Rice; 1994). We use two identification strategies to understand the

relationship between profit shifting and tax revenue structure. First, we consider cross-sectional variation in tax rates and aggressive MNC presence across municipalities. Second, we consider the effects of changes in tax rates at the municipal level on the evolution of tax revenue structures following such changes (Fuest et al.; 2018).

We have two sets of main results using the municipal data. First, we find that municipalities with higher shares of more aggressive MNCs derive a lower share of tax revenues from trade taxes, controlling for trade tax and property tax rates and municipal characteristics. They do not compensate for this with higher property tax revenues or rates. Consequently, they also have lower trade tax and total tax revenues. We do not find similar effects for municipalities with a larger share of all MNCs, which we use as placebo tests. Second, we find that following a tax rate increase at the municipal level, the share of trade tax revenues in municipalities with more aggressive MNCs falls. Again, this is driven by the fall in trade tax revenues, with no change in property tax revenues.

Taken together, our country- and municipal-level estimates suggest that the ability of firms to shift profits is strongly related to tax revenues structure. 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 policy perspective, as it suggests that countries that are more exposed to profit shifting multinationals, 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 loose more tax revenue due to profit shifting. We return to this discussion in the conclusion.

The paper closest to ours is Becker et al. (2012) who show that German municipalities use local tax rates to attract foreign MNCs as a source of skilled labor, physical capital, and local business tax income. In their context higher tax rates negatively impact the number of foreign MNCs, their employment, and fixed assets. If MNCs respond to increases in tax rates by lowering their presence in municipalities, this will mechanically lower the tax revenues in that jurisdiction. However, we find no significant effect on tax revenues in municipalities with larger MNC presence nor with larger *foreign* MNC presence. Instead, our result *only* hold for municipalities that have larger share of more tax aggressive MNCs. Competition amongst municipalities for those more aggressive firms, is unlikely to yield much local business tax revenue, due to potential profit shifting activities of those firms. Given this, we do not think that tax competition, and consequently, reverse causality is a potential threat to our specific identification strategy.

We further contribute to the literature analysing the effects of tax rates 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 imposes a particular tax rate.

More broadly, this paper builds on the existing studies that analyse the magnitude and consequences of profit shifting for other margins. First, recent work has estimated the effects of profit shifting on tax revenues lost in developed and developing countries ([Garcia-Bernardo and Janský; 2021](#); [Tørsløv et al.; 2020](#)), including the costs of personal and capital gains tax losses ([Garcia-Bernardo et al.; 2021](#)). Further, [Bilicka \(2019\)](#) examines the extent of disparity between profits reported by MNCs and domestic firms. Second, growing empirical work has been focusing on examining consequences of profit shifting on real firm operations ([Becker and Riedel; 2012](#); [Bilicka et al.; 2021](#); [Egger and Wamser; 2015](#); [Grubert and Slemrod; 1998](#); [Mintz and Smart; 2004](#); [Suárez Serrato; 2018](#)). None of these studies discuss the consequences of profit shifting on tax revenue structure. Third, the incidence of corporate income taxes, especially those of MNCs has been difficult to estimate ([Clausing; 2011](#)). The notable exception includes [Fuest et al. \(2018\)](#) who analyse the incidence of corporate taxes on wages in Germany and show that MNCs do not pass the cost of tax increases to workers, because they can shift profits abroad.

2 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.² We then present results using tax rates for corporations, individuals, indirect taxes, and social security contribution rates.

²We show results using shares of each component of tax revenues in GDP in the Appendix B.

2.1 Data and methodology

The main data source for the country-level tax structure is the UNU-WIDER Government Revenue Dataset,³ which we complement with the IMF Government Finance Statistics,⁴ and the UNCTAD statistical data.⁵ We obtain tax rates from the KPMG Tax rates online data.⁶ The combined dataset includes information on the tax revenue structure of governments, GDP per capita, population, foreign direct investment (FDI) inward stock of the countries, top corporate, individual, sales tax rates, employer and employee social security tax rates at the country level.

We combine this data with country-level profit shifting estimates, relying on the leading set of estimates from Tørsløv et al. (2020). They use 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, but include only around 40 countries. We test the robustness of these findings using an alternative set of profit shifting estimates from Garcia-Bernardo and Janský (2021) in Appendix B. They use country-by-country reporting data to show that MNCs report substantially more profits in a number of low-tax countries than their corresponding economic activity. On the basis of their misalignment model, they provide estimates for up to 190 countries, but only for one year, 2017. As such, Tørsløv et al. (2020) estimates are more established and cover a panel data, while Garcia-Bernardo and Janský (2021) estimates cover a broader range of countries, but for one year only.

Given the volatility of Tørsløv et al. (2020) estimates across years (Figure B1), we do not rely on the time series variation but rather pool these across years. We estimate the following equation as a baseline for our analysis:

$$Y_{it} = \beta_0 + \beta_1 T_i + \beta_n X_{it} + \psi_t + \epsilon_{it} \quad (1)$$

where Y_{it} is a specific tax structure measure, such as, percent of corporate tax revenues in total tax revenues, percent of individual tax revenues in total tax revenues, percent of

³UNU-WIDER Government Revenue Dataset (GRD) <https://www.wider.unu.edu/project/government-revenue-dataset> (accessed September 20, 2021)

⁴IMF Finance Statistics (GFS) <https://data.imf.org/?sk=a0867067-d23c-4ebc-ad23-d3b015045405> (accessed August 17, 2021)

⁵UNCTAD STAT Foreign Direct Investment: Inward and Outward flows and stock, annual. <https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=96740> (accessed January 21, 2022)

⁶KPMG Tax Rates Online. <https://home.kpmg/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online.html> (accessed January 20, 2022)

indirect tax revenues in total tax revenues, and other tax revenue contributions; T_i is a tax avoidance measure; X_{it} are country control variables, ψ_t are year fixed effects, and ϵ_{it} is an error term. As country controls, we use logarithm of GDP per capita, the stock of foreign direct investment as percent of GDP, logarithm of population, employer and employee social security rates. Further, we control for corporate, individual and indirect tax rates in all specifications to account for strong correlation between the tax revenues, tax rates and tax bases (Kawano and Slemrod; 2016). Then, we examine the correlations between tax rates and profit shifting estimates directly, using tax rates as Y_{it} in equation (1).

2.2 Baseline correlations

In Figure 1 we visualise the correlations between profit shifting and tax revenue structure. The first four panels correspond to correlations with tax revenue shares from various sources: panel (a) corporate tax revenues, panel (b) individual tax revenues, panel (c) sales and goods tax revenues, and panel (d) VAT revenues. The last two panels correspond to correlations with tax rates: panel (e) corporate tax rates, and panel (f) indirect tax rates. On the horizontal axis, we use profits shifted, as a percent of GDP in all figures. First, we find that countries that lose more revenues to profit shifting have lower share of corporate tax revenues in all revenues. 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 correlation between personal tax revenue shares and profit shifting. Countries with larger share of profits shifted, likely have a larger multinational presence and these firms employ a large share of population. With MNC wages being higher than domestic firm ones (Alstadsæter et al.; 2022), it is possible that this generates larger shares of individual tax revenues in these countries. Third, we find a positive correlation between sales tax revenues and profit shifting, especially for VAT. This suggests that countries that lose tax revenues due to profit shifting may choose to rely more on indirect taxes, especially VAT.

Further, we show a strong negative correlation between corporate tax rates and share of profits shifted. This suggests that countries that potentially lose a large share of their revenues due to profit shifting attempt to keep the multinationals in their countries by having lower tax rates. These lower tax rates, of course, reduce the share of corporate tax revenues in those countries. At the same time, we show that large share of shifted profits is correlated with higher indirect tax rates. This again is consistent with a larger share of indirect taxes that these countries have.

In Table 1, we quantify these results using a simple regression framework. In Panel A, we provide baseline estimates for the correlation between tax revenue shares and profit shifting without controls, in Panel B, we include a host of country level business cycle, size, and tax system controls. In Column (1), we find a strong negative significant 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 does not change this estimate much.⁷

In Column (2), we show a positive significant relationship between profits shifted and 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. Column (3) and (4) coefficients suggest a positive relationship between profit shifting and sales and goods tax share, especially in countries that use VAT. Finally, column (5) results suggest that 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 Panels C and D in Table 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 where multinationals shift large portion of tax revenues 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.⁸

In Table B2 in the Appendix B we provide additional estimates with revenue shares of tax components as a percentage of GDP, gross operating surplus, which we use as a proxy for the overall tax base, and expenditures as a percentage of GDP as dependent variables. 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

⁷In Table B1, we include additional tax system controls.

⁸In Appendix A, we show that using changes in tax revenues and rates, we get results that are qualitatively similar to the baseline, but not statistically significant. Further, using the alternative set of profit shifting estimates from Garcia-Bernardo and Janský (2021), we find qualitatively similar results that we report in Table B3.

other types of tax revenues. Further, even though profit shifting is negatively correlated with our proxy for the tax base, this correlation is not significant. Hence, the concern is not about the effect of profit shifting on overall tax revenues, but about the distributional consequences profit shifting may potentially have as countries switch from taxing individuals indirectly through corporate taxes to taxing individuals directly through individual taxes and indirectly through VAT.

Summary The country-level results provide suggestive evidence that a larger share of shifted profits is related to lower corporate tax revenue shares, that likely come from lower tax rates, and higher indirect tax revenue shares, that likely come from higher indirect tax rates. Depending on tax incidence of corporate tax rates and progressivity of the indirect and individual tax rates, these results point towards 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 next.

3 Municipal-level estimates

To establish the causal relationship between profit shifting and tax 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 tax rates and the presence of aggressive multinationals.

3.1 Institutional context

Germany tax revenue is collected at the federal, state, and municipal level. Germany has over 11,000 municipalities and 16 states. Each governmental unit has control over different types of taxes: the federal government has exclusive power over customs duties and fiscal monopolies; income tax revenue (excluding shares of municipalities) and corporation tax are shared by states and federal government; 75 per cent of VAT is redistributed across states.⁹ Municipalities collect trade tax and property tax.¹⁰ Germany's total tax revenue was €740

⁹European Committee of the Regions. Germany - Fiscal Powers. <https://portal.cor.europa.eu/divisionpowers/Pages/Germany-Fiscal-Powers.aspx> (accessed February 12, 2022)

¹⁰International Core of Excellence 2018 essentials. Deloitte. <https://www2.deloitte.com/us/en/pages/tax/articles/us-ICE-country-guide.html> (accessed February 13, 2022)

billion in 2020.¹¹ Out of that total, the tax revenue collected at the municipal level was €108 billion (15 per cent), at the state level (Länder) it was €316 billion (43 per cent), at the federal level it was €283 billion (39 per cent) and EU contributions totalled €33 billion (4 per cent). In this paper, we focus on municipal tax rate changes. Hence, below we describe how the tax revenue collection at the municipal level is organised in detail.

Municipalities derive their tax revenues mostly from two sources: trade tax and property tax. 38 per cent of their revenues comes from trade tax and 14 per cent comes from property tax. These taxes are the exclusive tax revenues of municipalities. The rest comes from federal and state tax apportionment.¹² Specifically, municipalities get a share of wage and assessed income tax and final withholding tax (41 billion, 38 per cent) and a share of value added tax (€9 billion, 8 per cent). In return, municipalities have to apportion a share of their trade tax revenue to state and federal government; in 2020 this apportionment amounted to €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 per cent, uniform across Germany, and a municipal tax rate (Hebesatz), determined by each municipality, applicable according to where the companies' permanent establishments are located. The tax rate is determined with the multiplier (m_i) in the following way: $t_i = m_i \times f / [100 + (m_i * f)]$, where f is a fixed tax rate which is uniform for all municipalities. In January 2022, municipalities with at least 80,000 inhabitants currently levy trade tax at a rate of between 8.75 per cent (Hebesatz of 250 per cent) and 20.3 per cent (Hebesatz of 580 per cent). Trade tax is levied not only on corporations, but also on sole proprietorships and partnerships. In addition to trade tax collected by municipalities, corporate profits are taxed by the federal government at a uniform rate of 15.825 per cent (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 the local tax rate or multiplier, determined by each municipality. In 2019, there was a property tax reform, which gave more flexibility to states in designing the tax from 2022 and therefore it does not influence the period covered by our analysis.

¹¹According to the Federal Statistical Office of Germany: <https://www.destatis.de/EN/Themes/Government/Taxes/Tax-Revenue/Tables/cash-tax-revenue-after-tax-redistribution.html;jsessionid=A587683A7079B69E85EA2830E0938C82.live731>

¹²Other municipal taxes such as tax on dog ownership are negligible (€1 billion, 1 per cent).

3.2 Data and methodology

Municipal-level data We choose Germany for our case study 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 in Germany 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 logarithm of both trade and property tax. 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 cannot consider trade tax rates as an outcome variable. We have data at the municipal level available between 2008 and 2019.¹³

Firm-level data The firm-level data comes from 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 per cent 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.¹⁴ 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 per cent. Our sample includes over 4,000 foreign MNCs and 16,000 domestic MNCs, which are 4.8 per cent and 19.8 per cent of all German firms with known parents, correspondingly.¹⁵ 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).¹⁶ We identify over 8,000

¹³In the main analysis, we use the total trade tax revenue that includes the apportionment component. We explore the apportionment component separately in Appendix F and find no changes in that component. We also provide a robustness check with trade tax revenues less apportionment in that Appendix and the results are consistent with the baseline.

¹⁴Note 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)

¹⁵Note 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.

¹⁶As Tørsløv et al. (2020) 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

affiliates that belong to more aggressive MNCs of which 835 belong to foreign MNCs and the remainder to domestic MNCs.

We then collect balance sheet information for each of those affiliates in Germany, which allows us to have total assets, fixed assets, employment, profits, and other variables. In Appendix C, we discuss the limitations of this financial data and why we use firm counts over size of their business operations in our preferred identification strategy.

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 variation we explore in this paper is the presence of multinational affiliates, especially those that are more tax aggressive, in each municipality. For that purpose, we calculate the share of multinational affiliates in all firms in each municipality.¹⁷ Further, we calculate the share of aggressive multinationals based on the number of multinationals that have a tax haven presence in their ownership tree. On average, a municipality has 486 firms with 2 domestic MNC affiliates and 0.5 foreign affiliate. 1 of those 2.5 average affiliates is aggressive. As such, the share of MNCs in each municipality firm count is, on average, 0.2 per cent, with a large variation ranging from municipalities that have no MNC presence to those that have over 3.5 per cent of their firms being multinationals.¹⁸

3.3 Cross-sectional variation

To understand the role of tax avoidance, we use two identification strategies, both relying on the rich variation in the municipal tax rates and the presence of aggressive MNCs in each municipality. First, we take advantage of cross-sectional differences in tax rates and aggressive multinational presence to estimate the following model:

$$Taxrev_{it} = \alpha + \beta_1 MNCsh_i + \beta_2 taxr_{it} + \beta_3 MNCsh_i \times taxr_{it} + \gamma_1 X_{it} + \eta_i + \delta_t + \varepsilon_{it} \quad (2)$$

Scur (2021) use this same nomenclature to define more plausibly tax-aggressive firms.

¹⁷We break it down by the share of domestic and share of foreign multinationals and show the results in the Appendix E. Our results are consistent with prior literature that shows that foreign MNCs are largely drivers of more aggressive tax avoidance, see for example Bilicka (2019).

¹⁸We provide descriptive statistics on these municipalities in Table G1 and maps outlining the municipal variation in Appendix H.

where $Taxrev_{it}$ is a share of tax revenues coming from trade tax or property tax, the log of tax revenues coming from each of the trade tax or property tax source, or property tax rate. $MNCsh_i$ is a continuous variable that describes the share of aggressive multinationals in all firms in a given municipality. $taxr_{it}$ is a municipal trade tax multiplier that varies across municipalities and years, X_{it} includes property tax rates, number of firms in each municipality, and population¹⁹. η_i are municipality fixed effects and δ_t are year fixed effects. We cluster standard errors at the municipal level in each estimations.

Here, we estimate the differences in tax revenue structures between municipalities that have a different composition of aggressive multinationals, multinationals and domestic firms contributing to their revenues, controlling for municipal tax rates. We present results in Table 2. In Panel A, we present baseline results in which we use a share of aggressive MNCs in all firms in the municipality as interaction with tax rates. Column (1) presents the results using the share of tax revenues coming from trade taxes. We find that municipalities with a higher share of aggressive MNCs, derive a lower share of their revenues from trade taxes. In column (2), we show that these same municipalities derive higher share of their tax revenues from property taxes. In columns (3) and (4), we find that the municipalities that have a higher share of aggressive MNCs, have lower trade tax revenue more generally, and that presence of aggressive MNCs does not affect their property tax revenues. Consequently, in column (5) we also show that these municipalities have overall lower total tax revenues, which drives the results using property tax revenue shares. In column (6) we show that municipalities with more aggressive MNCs do levy higher property tax rates, but this does not affect their share of property tax revenues, as shown in column 4. Note that total tax revenue data is not available for years 2011- 2015. As such, we have a smaller sample in columns 1, 2, and 5.

In Panel B, we use the share of all MNCs in all firms as a placebo test. We find that municipalities with simply more multinationals do not derive lower revenues from trade taxes, but they do have higher property tax rates. Hence, it is not a simple presence of MNCs that affects the tax revenue collection, but the presence of aggressive MNCs. These results suggest that firms that are more likely to be able to shift profits out of Germany towards lower tax rate countries affect the trade tax revenue collection at the municipal level. Specifically, it may be that profit shifting affects tax revenue structure at the municipal level.

¹⁹The GDP data is not collected for all municipalities, hence we do not use it as a control in our specifications. We look at it directly as an outcome variable in Appendix D

3.4 Event study evidence

As a second step, we identify municipalities that increased their 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.²⁰ In that, we use the event study framework that follows [Fuest et al. \(2018\)](#), who look at municipal tax rate changes and their effect on wages. In our data we identify 9,606 events when the municipality increased the tax rate. We stack each of these events to occur in time $t=0$. The identification relies on the comparison across municipalities that increased their tax rates and between municipalities with higher share of more aggressive MNCs. We convert the continuous MNC share to a binary variable that splits the share according to a median share of aggressive MNCs across municipalities to differentiate between those more exposed to more aggressive firms.²¹ The identifying assumption is that the treated municipalities did not evolve differentially before the reform from the control group. To test this assumption and to provide a dynamic evolution of the effects, we estimate the following event study model:

$$Taxrev_{it} = \alpha + \sum_{\kappa=-4}^4 \delta_t \mathbb{1}[t = \kappa] + \sum_{\kappa=-4}^4 \beta_t (\mathbb{1}[t = \kappa] \times hMNCsh_i) + \sigma_1 X'_{it} + \eta_i + \delta_t + \epsilon_{it} \quad (3)$$

where $Taxrev_{it}$ 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 dummies that equal one when the tax reform was κ years away, with the dummy variable corresponding to $\kappa = -1$ as the omitted category. $hMNCsh_i$ is a dummy equal to 1 when the share of aggressive MNCs in a given municipality is larger than a median. X_{it} includes municipal and property tax rates, the number of firms in each municipality, and population. η_i are municipality fixed effects and δ_t are year fixed effects. We cluster standard errors at the municipal level in each estimations.

The coefficients of interest are the β_t : they estimate the difference in the share of trade tax revenues between municipalities with a high and low share of aggressive MNCs, κ years before or after the reform, relative to the control group of municipalities that did not change their tax rate at all. 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

²⁰The majority of municipal rate changes are tax rate increases. In fact, only 6 per cent of tax rate changes in our sample are tax decreases.

²¹The results with continuous exposure are consisted and we provide these in Table G4 in the Appendix G.

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.²²

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. We summarise these results in Table D1 including the share of aggressive MNCs in Panel A and a share of all MNCs in Panel B. We use a dummy equal to 1 when the share of firms is above the median across all municipalities. We find that municipalities that have a larger share of more aggressive MNCs, reduce the share of tax revenue they derive from trade taxes, following a tax rate increase. This is not the case for municipalities that simply have a larger share of MNCs, more generally. There is also a reduction in trade tax revenue and overall tax revenue for those municipalities with more aggressive MNCs, but not much compensation from property tax revenues. In turn, in our placebo experiment in Panel B, we find that property tax rates increase and so do property tax revenues.

We then plot the event study coefficients in Figure 2 to show the evolution of tax revenue structure around the tax rate increase. Panel (a) shows the evolution of the share of trade tax and property tax in total tax revenue across years in our sample for municipalities that have a higher share of aggressive MNCs relative to those with a lower share. We find that following a tax rate increase there is a steady decline in the share of trade tax revenues in the affected municipalities, but no significant change in the share of property tax revenues. Before the tax rate increase there is no difference between the two types of municipalities in any of the time periods. In Panel (b), 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 tax rate increase. Further, we find no evidence of a differential evolution in tax revenue structure components between municipalities with a larger share of more aggressive MNCs before the reform.²³

Does the reduction in tax revenues affect municipal expenditures and consequently their GDP and debt? There are two caveats that come with this analysis. First, the GDP and expenditures data available to us does not cover the full set of municipalities. Second, the

²²The binning at the end-points of the window is the reason we do not plot the endpoint estimates in the event study graphs.

²³In Appendix C, instead of firm counts, we use the share of assets, employment, turnover, and profits that firms have in each municipality to understand the intensity of the MNC presence. The caveat is that Orbis data has poor coverage of financial information, especially for domestic firms, which means that these results are heavily skewed towards reporting larger shares of multinational real business operations. Nevertheless, the results confirm our baseline story.

apportionment of tax revenues from state and federal governments to municipalities and vice versa could affect these estimates. Specifically, because federal and state governments may apportion some of their revenues to municipalities that see a reduction in their own tax revenues, 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. In Appendix D, we find no effects of tax rate increases on municipal expenditures, GDP, or debt and in Appendix F, no significant effects directly on apportionment. Hence, apportionment does not play a large role in our estimates. However, given the two caveats, the results for expenditures and GDP should be treated with caution.

Summary The municipal-level results show a strong causal relationship between changes in tax rates in municipalities with larger share of more aggressive MNCs and tax revenue structure. As such, these results suggest that firms with opportunities to avoid taxes will move profits out of municipalities that increase tax rates. This, in turn, will affect the ability of these municipalities to collect tax revenues from those more aggressive firms. Consequently, we show that profit shifting practices causally affect tax revenue structure at the municipal level.

4 Discussion

This paper provides novel estimates of how tax revenue structures are affected by profit shifting practices of MNCs. From a policy perspective, it is important to understand how governments raise revenues in the presence of profit shifting by MNCs. In particular, we provide the first evidence on sources of tax revenues in countries where governments may be unable to raise revenues from MNCs. More broadly, our analysis allows us to understand which groups of firms or individuals may bear the burden of taxes which are not paid by MNCs. 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 municipality level, we provide casual evidence that the presence of more aggressive MNCs reduces local capacity to collect tax revenues from those firms and consequently affects tax revenue structure. As such, profit shifting appears to be causally linked with tax revenues 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 an opposite effect and reduces these revenues.

Do our results mean that profit shifting affects income inequality through changes in tax revenues and tax rates 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 are 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, are likely to be relatively high income ones — high-income individuals are more likely to own, be employed by or buy products of 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 hard to determine without a further research, which 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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Table 1: Summary of Country-Level Results

Panel A: Baseline Correlations for Tax Shares					
	(1)	(2)	(3)	(4)	(5)
	corp.share	indiv.share	gs.share	vat.share	rest.share
Profit shifted % GDP	-1.475*	3.516**	0.620	1.903*	-1.938
	(0.670)	(1.342)	(1.150)	(0.836)	(1.623)
# Observations	146	146	151	145	137
Panel B: Tax Shares: including controls					
	(1)	(2)	(3)	(4)	(5)
	corp.share	indiv.share	gs.share	vat.share	rest.share
Profit shifted % GDP	-2.019**	2.364*	0.424	1.447	0.404
	(0.659)	(1.008)	(1.159)	(0.746)	(1.199)
Controls	✓	✓	✓	✓	✓
# Observations	131	131	136	130	122
Panel C: Baseline Correlations for Tax Rates					
	(1)	(2)	(3)	(4)	(5)
	corp	indiv	indir	socsecemployee	socsecemployer
Profit shifted % GDP	-3.010***	0.308	3.206***	-0.507	-1.519
	(0.630)	(1.426)	(0.699)	(0.788)	(1.392)
# of Observations	165	165	165	158	152
Panel D: Tax Rates: including controls					
	(1)	(2)	(3)	(4)	(5)
	corp	indiv	indir	socsecemployee	socsecemployer
Profit shifted % GDP	-2.870***	0.111	2.907***	-0.800	-1.436
	(0.581)	(1.283)	(0.619)	(0.746)	(1.394)
Controls	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
# Observations	165	165	165	158	152

Note: Data from UNU-WIDER, IMF, Tørsløv et al. (2020), KPMG, UNCTAD. The dependent variable in Panel A and B in column 1 is the share of tax revenue from income, profits, and capital gains taxes on corporations, in column 2 is the share of tax revenue from income, profits, and capital gains taxes on individuals, in column 3 is the share of tax revenue from goods and services taxes, in column 4 is the share of tax revenue from VAT, and in column 5 is the share of tax revenue from social contributions, payroll and workforce, property, and other taxes. The dependent variable in Panel C and D in column 1 is the corporate tax rate, in column 2 is the individual tax rate, in column 3 is the indirect tax rate, in column 4 is the employee social security tax rate, and in column 5 is the employer social security tax rate. The independent variable in all panels is the profit shifted as a percentage of GDP from Tørsløv et al. (2020). We exclude tax havens which are defined by Tørsløv et al. (2020). 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, 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 2: Summary of Cross-Sectional Results

Panel A: Aggressive MNCs						
	(1)	(2)	(3)	(4)	(5)	(6)
	trade tax share	property tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)	property tax rate
tax rate	-0.072*	0.005***	-0.172***	0.007	-0.199*	0.193***
× agg MNC share	(0.043)	(0.001)	(0.064)	(0.018)	(0.107)	(0.020)
Panel B: All MNCs						
	(1)	(2)	(3)	(4)	(5)	(6)
	trade tax share	property tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)	property tax rate
tax rate	0.002	0.001	0.004	0.007	-0.014	0.136***
× MNC share	(0.029)	(0.001)	(0.057)	(0.011)	(0.063)	(0.014)
Year FE	✓	✓	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓
Observations	36362	36447	80939	82203	36419	82485
# firms	9188	14517	9363	9278	14347	9241
Mean	0.299	0.021	5.945	2.902	7.470	5.763

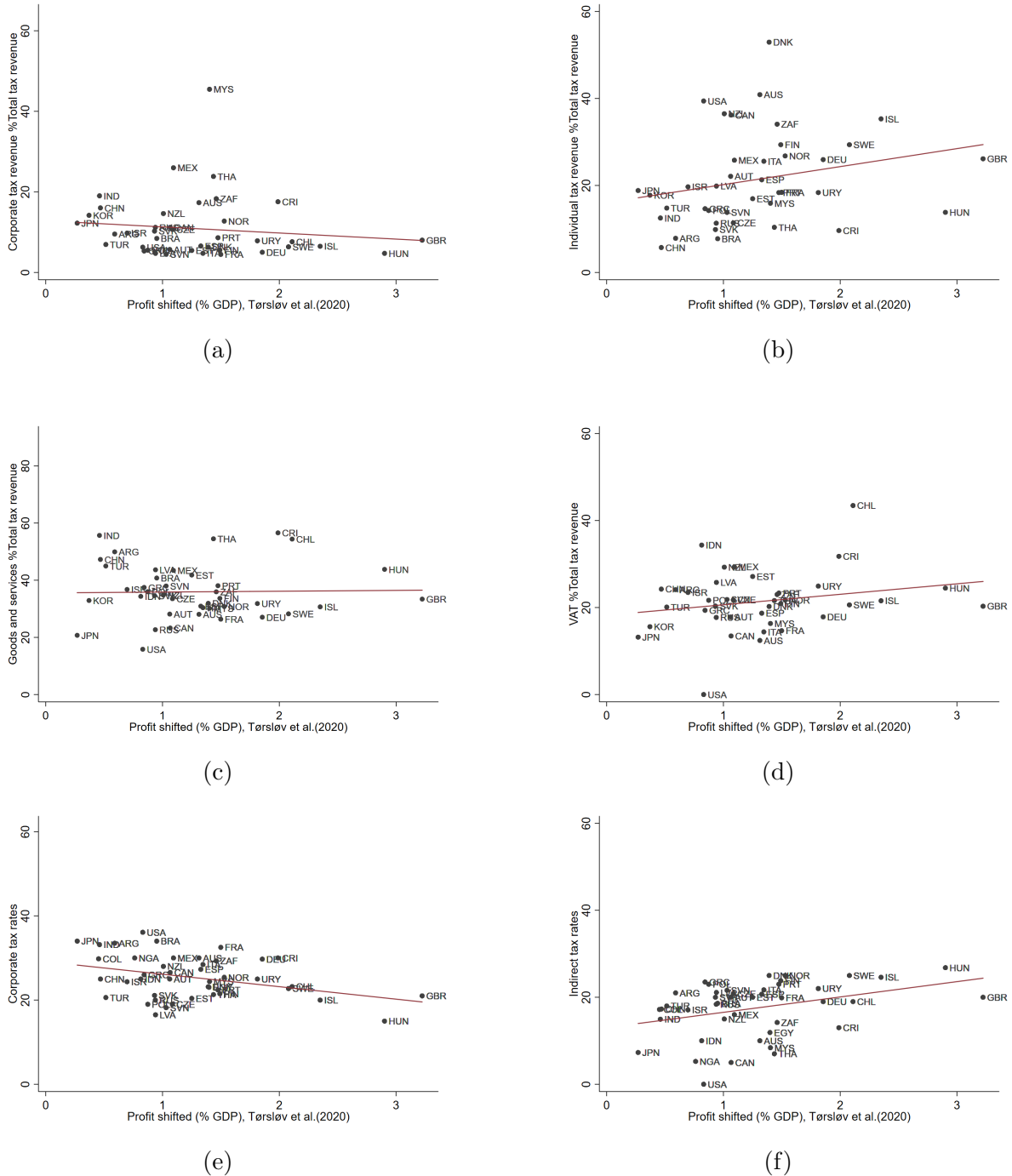
Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the share of trade tax in all tax revenue, in column 2 the share of property tax revenue, in column 3, the logarithm of trade tax revenue, in column 4 the logarithm of property tax revenue, in column 5 the logarithm of total tax revenue, in column 6 the logarithm of property tax rate. The tax rate is the trade tax rate. In Panel A agg MNC share is the share of aggressive MNCs in all firms in that municipality. In Panel B, share MNCs is a share of MNCs in all firms in that municipality. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. In columns 1,2 and 5, we only have data for total tax revenue at the municipality level for the period 2016—2019, which reduces the number of observations. In columns 3 and 4, we have data for trade and property tax revenues for years 2011—2019.

Table 3: Difference in Difference Results: pre and post Tax Rate Increase

Panel A: Aggressive MNCs						
	(1)	(2)	(3)	(4)	(5)	(6)
	trade tax share	property tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)	property tax rate
high share=1 × post=1	-0.024** (0.010)	0.002*** (0.000)	-0.093*** (0.015)	0.005 (0.005)	-0.050** (0.020)	0.006 (0.005)
Panel B: All MNCs						
	(1)	(2)	(3)	(4)	(5)	(6)
	trade tax share	property tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)	property tax rate
high share=1 × post=1	-0.008 (0.009)	0.002*** (0.001)	-0.051*** (0.015)	0.010** (0.004)	-0.026 (0.016)	0.013*** (0.004)
Year FE	✓	✓	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓
Observations	19195	19242	41884	42608	19226	48627
# firms	9320	9736	6765	6641	9737	5870
Mean	0.290	0.022	5.733	2.742	7.260	5.731

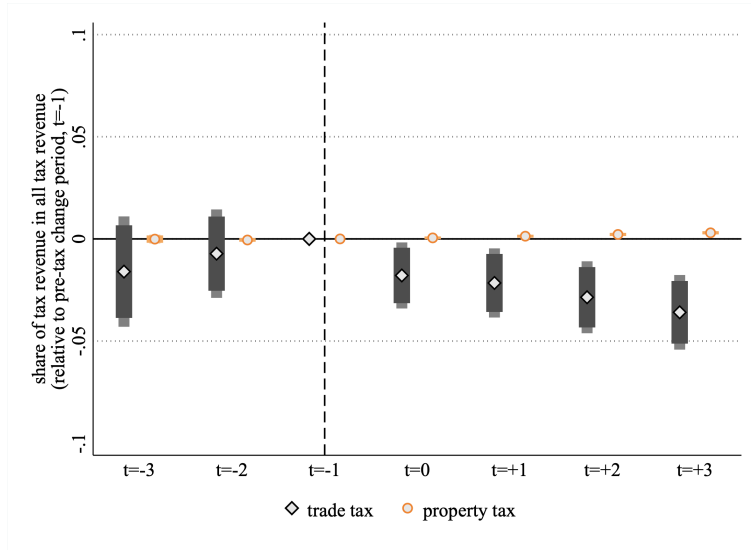
Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the share of trade tax in all tax revenue, in column 2 the share of property tax revenue, in column 3, the logarithm of trade tax revenue, in column 4 the logarithm of property tax revenue, in column 5 the logarithm of total tax revenue, in column 6 the logarithm of property tax rate. In Panel A, high share is a dummy equal to 1 if the share of aggressive MNCs is larger than a median across all municipalities, in Panel B, it is 1 if the share of MNCs is larger than a median across all municipalities. Post is equal to 1 after the tax rate increase and 0 beforehand. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. In columns 1, 2, and 5, we only have data for total tax revenue at the municipality level for the period 2016–2019, which reduces the number of observations. In columns 3, 4, and 6, we have data for trade and property tax revenues for the years 2011–2019.

Figure 1: Impact of Tax Avoidance on Corporate, Individual, Goods and Services, and VAT Tax Revenues

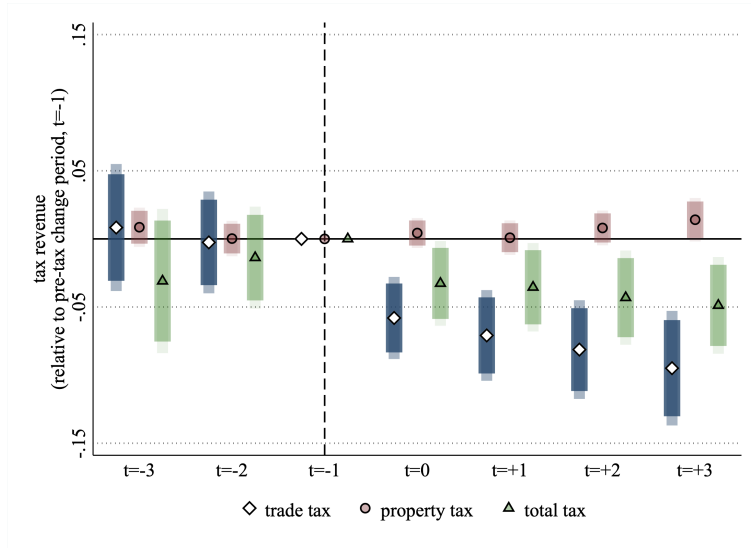


Note: Data from UNU-WIDER, IMF, KPMG, [Tørsløv et al. \(2020\)](#). On the vertical axis is the average tax revenue share during 2015–2018 period as a percentage of total tax revenue: in panel (a) revenue share of income, profits, and capital gains taxes on corporations; in panel (b) revenue share of income, profits, and capital gains taxes on individuals; in panel (c) revenue share of taxes on goods and services; in panel (d) revenue share from VAT. On the vertical axis of the bottom two graphs is the average tax rate during 2015–2018 period: in panel (e) corporate tax rates; in panel (f) indirect tax rates. On the horizontal axis of all graphs is the average profit shifted as a percentage of GDP during the 2015–2018 period from [Tørsløv et al. \(2020\)](#). We exclude tax havens defined by [Tørsløv et al. \(2020\)](#).

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



(a) Share of trade tax in total tax



(b) Trade tax vs property tax

Note: This figure reports the dynamic effects of the tax rate increase on the share of trade tax and property tax in total tax (panel (a)) and the logarithm of trade tax, property tax, and total tax revenue (panel (b)). All panels include the event study coefficient plots for municipalities with a high share of aggressive MNCs relative to those with a low share and relative to the control group from 3 years before the tax rate increase to 3 or more years after the tax rate increase. The high share of aggressive MNCs is defined as the above median. Each dot represents the coefficient estimate using the difference in difference methodology, the darker shaded box represents the 95% confidence interval, while the lighter shaded box 90% confidence interval. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. In panel (a), we only include the period 2016–2019, as we only have data for total tax revenue at the municipality level for that period. In panel (b), we include the full 2011–2019 period for property and trade tax revenue estimates and the limited time period for total tax revenue estimates.

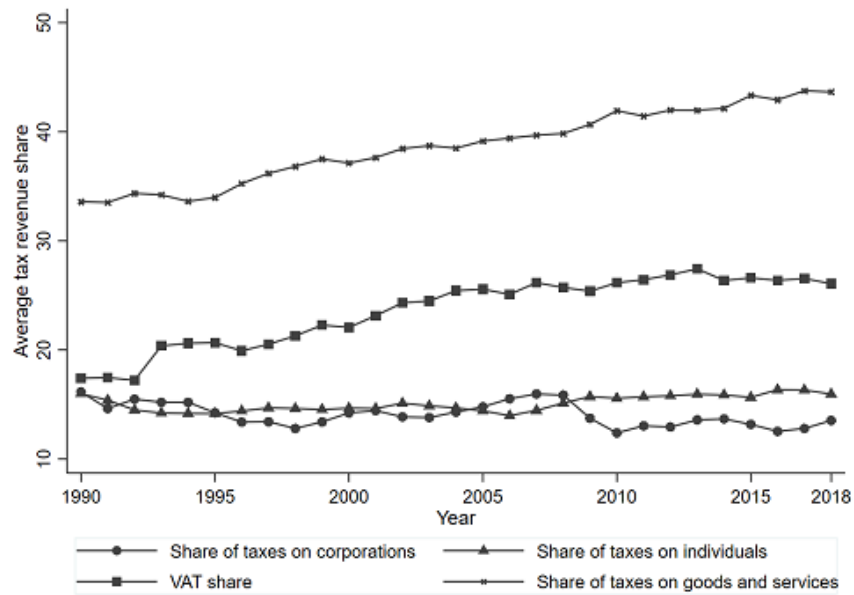
Appendices

A The evolution of tax revenue structure

In the recent decades, the size of profit shifting has increased, despite numerous unilateral and multilateral efforts of governments to reduce the ability of MNCs to shift profits out of high tax-rate countries (Clausing et al.; 2016; OECD; 2017). In Figure A1 we show that over the recent decades the share of corporate tax revenues in total tax revenues has declined accordingly, while the share of tax revenues coming from indirect taxes on goods and service, VAT in particular, has increased. At the same time, corporate and individual tax rates have increased and indirect tax rates and social security contribution rates have increased substantially (Fuest et al.; 2021). It appears that as multinationals are shifting profits extensively, countries are also changing the rates and revenue structures to tax the less mobile capital and employment over more mobile corporate profits.

Since profit shifting and tax revenue structures are a dynamic process, it may well be that countries that are loosing the most of their tax revenues due to profit shifting, may be those that are also more likely to switch to taxing consumption over corporate profits. In Table A1 we look at the correlations between changes in tax revenue structure over the last 25 years and the extent of profit shifting. Consistent with the time trend figures, we find that countries that are facing a lot of tax revenue pressure because multinationals shift a lot of profits out of those countries are also those that reduced a share of tax revenues coming from corporations. Specifically, a 1 percentage point increase in profits shifted out reduces the share of corporate tax revenues over the time period by 0.6 percentage points. We do not find a corresponding increase in the share of indirect tax revenues, or VAT.

Figure A1: The Evolution of Tax Revenue Shares



Note: Data from UNU-WIDER. The vertical axis on the graph represents the average tax revenue shares (taxes on income, profits, and capital gains from corporations and individuals; VAT; taxes on goods and services) among countries (excluding tax havens) as a percentage of total tax revenue. The horizontal axis represents the time evolution. The list of tax havens defined by [Tørsløv et al. \(2020\)](#) and [Garcia-Bernardo and Janský \(2021\)](#).

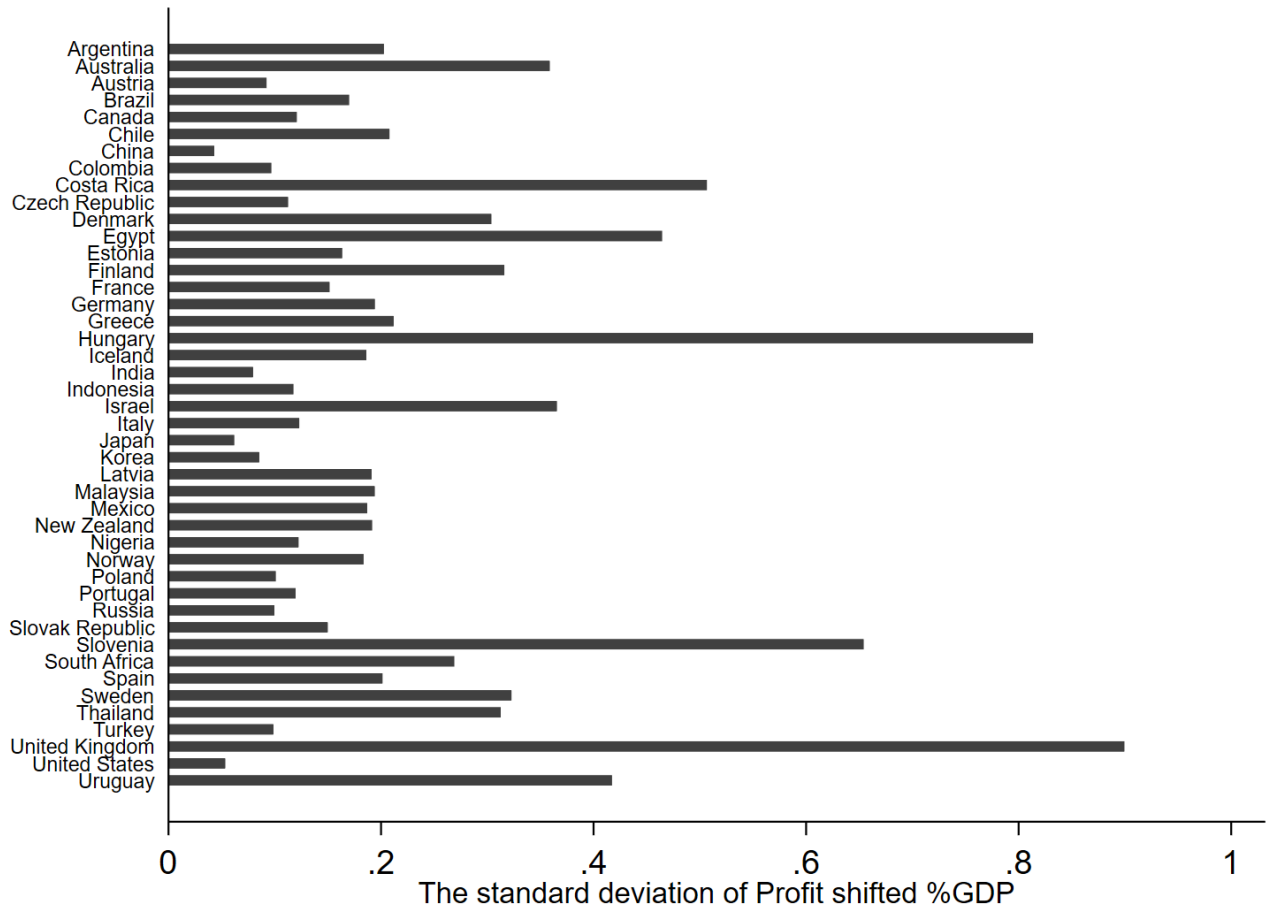
Table A1: Summary of the Dynamic Country-Level Results

Panel A: Baseline Correlations for Tax Shares					
	(1)	(2)	(3)	(4)	(5)
	corp.share90	indiv.share90	gs.share90	vat.share90	rest.share90
Profit shifted % GDP	-0.162 (0.180)	-0.369 (0.385)	0.004 (0.053)	-0.180 (0.146)	-0.115 (0.187)
Number of countries	26	26	27	20	26
Panel B: Tax Shares: including controls					
	(1)	(2)	(3)	(4)	(5)
	corp.share90	indiv.share90	gs.share90	vat.share90	rest.share90
Profit shifted % GDP	-0.616* (0.258)	-0.676 (0.391)	-0.081 (0.069)	-0.067 (0.149)	-0.097 (0.257)
Logarithm of GDP per capita	1.082* (0.493)	1.811* (0.748)	0.067 (0.138)	0.078 (0.294)	0.065 (0.504)
Logarithm of population	-0.066 (0.185)	-0.253 (0.280)	0.090 (0.050)	-0.050 (0.104)	0.037 (0.184)
Individual tax rates	-0.008 (0.016)	-0.096*** (0.024)	-0.008 (0.004)	0.026* (0.011)	0.004 (0.015)
Corporate tax rates	-0.052 (0.033)	0.129* (0.050)	-0.016 (0.009)	0.017 (0.024)	-0.066 (0.032)
Indirect tax rates	0.035 (0.024)	0.143*** (0.036)	-0.002 (0.007)	-0.070* (0.023)	-0.049 (0.024)
Number of countries	25	25	26	19	25

Note: Data from UNU-WIDER, IMF, [Tørsløv et al. \(2020\)](#). The dependent variable in column 1 is the average growth of tax revenue share from income, profits, and capital gains taxes on corporations between 1990 and 2018; in column 2 is the average growth of tax revenue share from income, profits, and capital gains taxes on individuals between 1990 and 2018; in column 3 is the average growth of tax revenue share from taxes on goods and services between 1990 and 2018; in column 4 is the average growth of tax revenue share from VAT between 1990 and 2018; in column 5 is the average growth of tax revenue share from social contributions, payroll and workforce, property, and other taxes between 1990 and 2018. The independent variable is the average profit shifted as a percentage of GDP from [Tørsløv et al. \(2020\)](#) during 2015–2018 period. All the data in the table exclude tax havens which are defined by [Tørsløv et al. \(2020\)](#). Controls in Panel B include the logarithm of GDP per capita, the logarithm of population, individual, corporate, and indirect tax rates.

B Additional country-level estimates

Figure B1: The standard deviation of profit shifted as percentage of GDP.



Note: The graph reports the volatility of profit shifted as a percentage of GDP (Tørsløv et al. (2020)) with standard deviation during 2015-2018 with a breakdown into countries. On the graph we exclude countries defined as tax havens by Tørsløv et al. (2020).

Table B1: Summary of Country-Level Results: Additional Controls

	(1)	(2)	(3)	(4)	(5)
	corp.share	indiv.share	gs.share	vat.share	rest.share
Profit shifted % GDP	-0.085 (0.637)	2.650* (1.094)	0.469 (1.336)	1.123 (0.863)	-0.773 (1.318)
Individual tax rates	-0.024 (0.040)	0.249*** (0.069)	-0.169* (0.085)	-0.130* (0.059)	0.157 (0.085)
Corporate tax rates	0.118 (0.079)	0.112 (0.136)	0.157 (0.170)	0.102 (0.121)	-0.485** (0.161)
Employer soc. sec. tax rates	0.099* (0.040)	-0.209** (0.068)	-0.081 (0.083)	-0.081 (0.054)	0.461*** (0.095)
Employee soc. sec. tax rates	-0.336*** (0.066)	-0.517*** (0.114)	0.031 (0.139)	-0.063 (0.089)	1.013*** (0.151)
Indirect tax rates	-0.561*** (0.102)	0.136 (0.175)	0.040 (0.218)	0.101 (0.145)	0.081 (0.209)
Logarithm of GDP per capita	0.771 (0.554)	1.112 (0.952)	-2.911* (1.177)	-0.659 (0.799)	2.982* (1.261)
Logarithm of population	0.376 (0.538)	0.734 (0.924)	-0.746 (1.140)	-1.445 (0.732)	-1.612 (1.090)
FDI % GDP	-0.058*** (0.011)	0.049** (0.018)	-0.064** (0.023)	-0.075*** (0.014)	0.071** (0.021)
Year FE	✓	✓	✓	✓	✓
# Observations	131	131	136	130	122

Note: Data from UNU-WIDER, IMF, Tørsløv et al. (2020), KPMG, UNCTAD. The dependent variable in column 1 is the share of tax revenue from income, profits, and capital gains taxes on corporations, in column 2 is the share of tax revenue from income, profits, and capital gains taxes on individuals, in column 3 is the share of tax revenue on goods and services, in column 4 is the share of tax revenue from VAT, and in column 5 is the share of tax revenue from social contributions (compulsory and voluntary social insurance contributions from employers, employees, and the self-employed), payroll and workforce, property, and other taxes (tax revenues that are not otherwise classified, or identifies). The independent variable is the profit shifted as a percentage of GDP from Tørsløv et al. (2020). All the data in the table exclude tax havens which are defined by Tørsløv et al. (2020). In each specification, we include year fixed effects. Controls in Panel B include individual tax rates, corporate tax rates, 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.

Table B2: Summary of Country-Level Results: Robustness, Scaling by GDP

Panel A: Baseline Correlations for Total Tax Revenue, Expenditures, Operating Surplus, Tax Shares								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	tax.tot	exp	opersurp	tax.corp	tax.indiv	tax.gs	tax.vat	tax.rest
Profit shifted % GDP	3.567** (1.095)	2.501* (1.091)	-0.105 (1.963)	-0.192 (0.131)	1.963*** (0.559)	1.251** (0.387)	1.217*** (0.266)	0.578 (0.702)
Year FE	✓	✓	✗	✓	✓	✓	✓	✓
# Observations	160	139	165	152	149	156	148	137
Panel B: Total Tax Revenue, Expenditures, Operating Surplus, Tax Shares: including controls								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	tax.tot	exp	opersurp	tax.corp	tax.indiv	tax.gs	tax.vat	tax.rest
Profit shifted % GDP	4.133*** (1.107)	2.902** (0.998)	-1.037 (2.062)	-0.370*** (0.107)	1.502** (0.477)	1.214*** (0.360)	1.056*** (0.200)	1.350** (0.511)
Employer soc. sec. tax rates	0.146* (0.065)	0.256*** (0.064)	-0.325** (0.106)	-0.006 (0.006)	-0.099*** (0.028)	0.026 (0.021)	0.010 (0.012)	0.203*** (0.035)
Employee soc. sec. tax rates	0.487*** (0.129)	0.287* (0.115)	-0.039 (0.190)	-0.066*** (0.012)	-0.056 (0.055)	0.171*** (0.041)	0.080*** (0.022)	0.472*** (0.067)
Logarithm of GDP per capita	3.165*** (0.909)	4.297*** (0.857)	0.289 (1.772)	0.382*** (0.088)	1.635*** (0.391)	0.078 (0.303)	0.256 (0.170)	2.538*** (0.460)
Logarithm of population	-0.513 (1.102)	0.457 (0.958)	-6.171** (2.014)	0.226* (0.102)	0.129 (0.453)	-0.564 (0.350)	-0.568** (0.194)	-0.799 (0.482)
FDI % GDP	-0.028 (0.018)	-0.032* (0.016)	-0.044* (0.017)	-0.007*** (0.002)	-0.001 (0.008)	-0.025*** (0.006)	-0.027*** (0.003)	-0.004 (0.008)
Year FE	✓	✓	✗	✓	✓	✓	✓	✓
# Observations	144	126	165	135	134	140	131	122

Note: Data from UNU-WIDER, IMF, [Tørsløv et al. \(2020\)](#), KPMG, UNCTAD, IMF, United Nations Data Retrieval System. The dependent variable in column 1 is the total tax revenue as a percentage of GDP; in column 2 is the total expenditures as a percentage of GDP; in column 3 is the average gross operational surplus as a percentage of GDP during the 2010-2020 period for each country; in column 4 is the the revenue from income, profits, and capital gains taxes on corporations as a percentage of GDP; in column 5 is the revenue from income, profits, and capital gains taxes on individuals as a percentage of GDP; in column 6 is the revenue from goods and services taxes as a percentage of GDP; in column 7 is the revenue from VAT as a percentage of GDP, and in column 8 is the revenue from social contributions (compulsory and voluntary social insurance contributions from employers, employees, and the self-employed), payroll and workforce, property, and other taxes (tax revenues that are not otherwise classified, or identifies) as a percentage of GDP. The independent variable is the profit shifted as a percentage of GDP from [Tørsløv et al. \(2020\)](#). All the data in the table exclude tax havens which are defined by [Tørsløv et al. \(2020\)](#). In each specification, we include year fixed effects except column 3. Controls in Panel B include 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. In Column 3 of Panel B controls are presented as the average during the 2010-2020 period for each country.

Table B3: Summary of Country-Level Results with an Alternative Measure of Profit Shifting

	(1)	(2)	(3)	(4)	(5)
	corp_share	indiv_share	gs_share	vat_share	rest_share
Profit shifted % GDP	-0.079 (0.193)	-0.020 (0.244)	0.298 (0.306)	0.139 (0.265)	-0.018 (0.356)
Employer soc. sec tax rates	-0.107 (0.072)	-0.122 (0.091)	-0.148 (0.110)	-0.122 (0.094)	0.607*** (0.154)
Employee soc. sec. tax rates	-0.307* (0.121)	-0.348* (0.154)	0.058 (0.187)	0.121 (0.160)	0.777** (0.245)
Logarithm of GDP per capita	0.479 (0.772)	0.803 (0.977)	-2.374* (1.177)	0.685 (1.018)	0.530 (1.431)
Logarithm of population	0.862 (0.881)	1.703 (1.115)	-1.955 (1.393)	-1.766 (1.207)	0.873 (1.665)
FDI % GDP	-0.009 (0.024)	0.072* (0.031)	-0.107** (0.039)	-0.104** (0.033)	0.103* (0.044)
# Countries	82	82	94	85	72

Note: Data from UNU-WIDER, IMF, [Garcia-Bernardo and Janský \(2021\)](#), KPMG, UNCTAD. The dependent variable in column 1 is the the tax revenue share from income, profits, and capital gains taxes on corporations, in column 2 is the tax revenue share from income, profits, and capital gains taxes on individuals, in column 3 is the tax revenue share on goods and services, in column 4 is the VAT tax revenue share, and in column 5 is the tax revenue share from social contributions (compulsory and voluntary social insurance contributions from employers, employees, and the self-employed), payroll and workforce, property, and other taxes (tax revenues that are not otherwise classified, or identifies). The independent variable is the profit shifted as a percentage of GDP from [Garcia-Bernardo and Janský \(2021\)](#). All the data in the table exclude tax havens which are defined by [Garcia-Bernardo and Janský \(2021\)](#). In each specification we include year fixed effects. Controls in Panel B include employer and employee social security tax rates, logarithm of GDP per capita, logarithm of population, foreign direct investment inward stock as a percentage of GDP.

C Municipal-level estimates using real business operation weights

In the main body of the paper, we use the number of subsidiaries that belong to multinationals to calculate the exposure to more aggressive MNCs. In principle, the more assets, profits, turnover or employment these firms have in each municipality, the larger the potential responses to tax rate differences and tax rate changes. Orbis data collects information on these real business operations, but the data has much smaller coverage. In Table C1 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 C2 we replicate results from column 2 in Table 2 using real business operations shares to proxy for municipal exposure to multinationals (Panel A) and more aggressive multinationals (Panel B). The caveat with these results is that we have 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 is lower in municipalities with higher tax rates and a larger share of real business operations done by more aggressive MNCs. The magnitude of this effect is much larger than that for municipalities with a larger share of real business operations done simply by multinationals.

Table C1: 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 number of firms and column 6 number of multinational subsidiaries by municipality. Panel A shows these statistics for overall firm coverage and Panel B for multinational firms only.

Table C2: Summary of Cross-Sectional Results: Real Business Operations Weighted

Panel A: Aggressive MNCs				
Dep.var.: ln(trade tax rev)	(1)	(2)	(3)	(4)
	share assets	share empl	share turnover	share profits
tax rate \times agg MNC share	-0.011*** (0.004)	-0.023*** (0.008)	-0.016** (0.006)	-0.003 (0.002)
Panel B: All MNCs				
Dep.var.: ln(trade tax rev)	(1)	(2)	(3)	(4)
	share assets	share empl	share turnover	share profits
tax rate \times MNC share	-0.005*** (0.002)	-0.009*** (0.002)	-0.006*** (0.002)	-0.003*** (0.001)
Year FE	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓
Observations	64557	71216	71329	44727
# Municipalities	7274	8057	8064	8064
Mean	6.540	6.288	6.285	7.239

Note: Data from Orbis and German Statistical Office. The dependent variable in all columns is the logarithm of trade tax revenue. The tax rate is the trade tax rate. In Panel A agg MNC share is the share of assets, employment, turnover, and profits that aggressive MNCs hold in each municipality relative to assets, employment, turnover, and profits reported by all firms in that municipality. In Panel B, MNC share is the share of assets, employment, turnover and profits that all 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, and municipal population. Standard errors are clustered at the municipality level.

D Expenditures, debt, and local GDP

Municipalities that increase their tax rates see a reduction in trade tax revenues when they are home to more tax aggressive subsidiaries of MNCs. Does the reduction in tax revenues affect municipal expenditures and consequently their GDP and debt? In Figure D1 we plot the event study coefficients to show the evolution of gross municipal expenditures, total debt and municipal GDP around the tax rate increase.²⁴ We find no significant change in municipal expenditures, GDP, or debt.

One of the potential explanations for finding no effects of expenditures, debt, or GDP could be that the German tax system includes the apportionment of wage, income tax, withholding tax, and value added tax from federal and state governments. It is entirely possible that the reduction in tax revenues from trade taxes in municipalities that have more aggressive MNCs, may be compensated by the apportionment from federal and state revenues. Given that the apportionment data that we have includes both the amounts coming from the state and federal and amounts being sent to state and federal government, it is hard to disentangle the two. Evidence from Appendix D shows no effect on apportionment components.

²⁴Note that we do not have GDP data for all municipalities, so these coefficients are estimated using a sub-sample of the German municipalities.

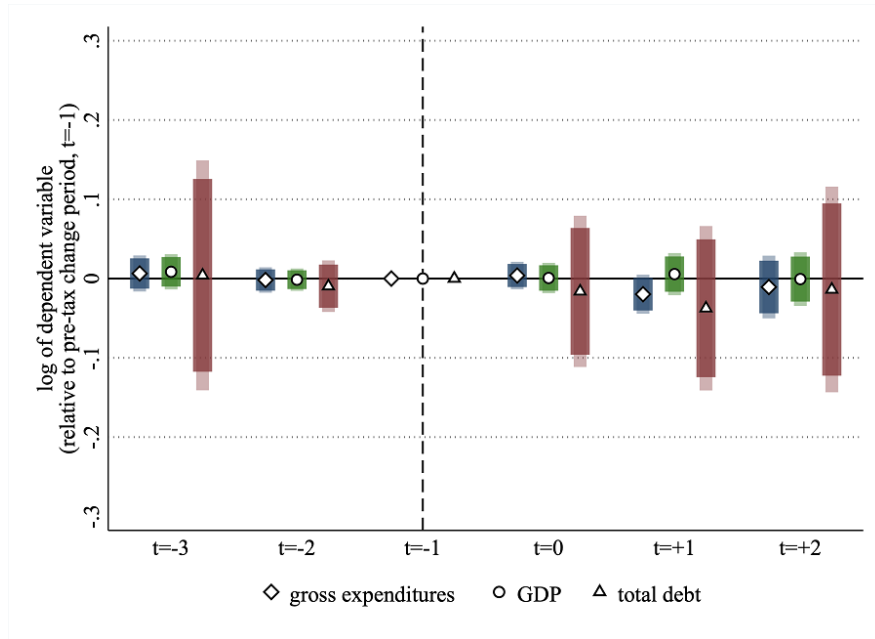
Table D1: Difference in Difference Results: pre and post Tax Rate Increase, Expenditures, Debt and GDP

Panel A: Aggressive MNCs						
	(1)	(2)	(3)	(4)	(5)	(6)
	log(gross exp)	log(GDP)	log(debt)	log(gross exp)	log(GDP)	log(debt)
agg MNC share \times post=1	-3.693*	1.613	-7.469			
	(2.000)	(2.128)	(8.625)			
high share=1=1 \times post=1=1				-0.021	0.005	-0.046
				(0.013)	(0.012)	(0.062)

Panel B: All MNCs						
	(1)	(2)	(3)	(4)	(5)	(6)
	log(gross exp)	log(GDP)	log(debt)	log(gross exp)	log(GDP)	log(debt)
MNC share \times post=1	0.275	2.893**	-0.626			
	(1.250)	(1.283)	(5.963)			
high share=1=1 \times post=1=1				-0.024*	0.006	-0.040
				(0.013)	(0.021)	(0.107)
Year FE	✓	✓	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓
Observations	11758	940	940	11758	940	940
# firms	11666	11617	11617	11664	11618	11618
Mean	7.717	15.678	12.342	7.717	15.678	12.342

Note: Data from Orbis and German Statistical Office. The dependent variable in columns 1 and 4 is the share of logarithm of gross expenditures, in columns 2 and 5 the logarithm of GDP, in columns 3 and 6 the logarithm of debt. Columns 1 -3 use the continuous share of MNC presence and columns 4-6 use a dummy equal to 1 if the share of MNCs is larger than a median across all municipalities. Post is equal to 1 after the tax rate increase and 0 before-hand. MNCs share is a share of MNCs in all firms in that municipality. agg MNC share is the share of aggressive MNCs in all firms in that municipality. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level.

Figure D1: Dynamic Effects of the Tax Rate Increase on Municipal Expenditures, GDP and Debt



Note: This figure reports the dynamic effects of the tax rate increase on municipal expenditures, GDP and debt. The figure plots the event study coefficient for municipalities with a high share of aggressive MNCs relative to those with a low share 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 share of aggressive MNCs is defined as the above median. Each dot represents the coefficient estimate using the different difference in difference methodology, the darker shaded box represents the 95% confidence interval, while the lighter shaded box 90% confidence interval. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. The sample time period includes years 2008—2014.

E Domestic or foreign MNCs?

In the baseline analysis, we do not distinguish between the country of the MNC headquarter. Here, we specifically break down results from Table 2 into domestic and foreign MNCs. In Table E1 we split the sample of all MNCs into foreign and domestic. We show that our baseline estimates for the relationship between tax structure and the presence of aggressive firms hold only for the sample of foreign MNCs, with no effects for domestic MNCs. In Table E2 we split the sample of aggressive MNCs into foreign and domestic. We find that municipalities with a larger share of foreign aggressive firms have lower tax revenues when they have higher tax rates. This relationship is still significant for the share of domestic firms, but much weaker.

Table E1: Summary of Cross-Sectional Results: Foreign vs Domestic MNC Heterogeneity

Panel A: Foreign MNCs				
	(1)	(2)	(3)	(4)
	trade tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)
tax rate \times sharefmnc	-0.045 (0.085)	-0.426** (0.168)	0.025 (0.053)	-0.129 (0.126)
Year FE	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓
Observations	36362	80939	82203	36419
# Municipalities	14400	9489	9268	14325
Mean	0.299	5.945	2.902	7.470
Panel B: Domestic MNCs				
	(1)	(2)	(3)	(4)
	trade tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)
tax rate \times sharedmnc	0.003 (0.030)	0.004 (0.058)	0.000 (0.010)	-0.020 (0.072)
Year FE	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓
Observations	36362	80939	82203	36419
# Municipalities	9188	9368	9269	14386
Mean	0.299	5.945	2.902	7.470

Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the share of trade tax in all tax revenue, in column 2 the logarithm of trade tax revenue, in column 3 the logarithm of property tax revenue, in column 4 the logarithm of total tax revenue. The tax rate is the trade tax rate. In Panel A sharefmnc is the share of foreign MNCs in all firms in that municipality. In Panel B, sharedmnc is a share of domestic MNCs in all firms in that municipality. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. In columns 1 and 4, we only have data for total tax revenue at the municipality level for the period 2016–2019, which reduced the number of observations. In columns 2 and 4, we have data for trade and property tax revenues for years 2011–2019.

Table E2: Summary of Cross-Sectional Results: Foreign vs Domestic Aggressive MNC Heterogeneity

Panel A: Foreign aggressive MNCs				
	(1)	(2)	(3)	(4)
	trade tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)
tax rate \times sharemnchf	-0.051	-2.253**	-0.064	-0.456
	(0.329)	(1.002)	(0.174)	(0.563)
Year FE	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓
Observations	36362	80939	82203	36419
# Municipalities	14341	9487	9280	14402
Mean	0.299	5.945	2.902	7.470
Panel B: Domestic aggressive MNCs				
	(1)	(2)	(3)	(4)
	trade tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)
tax rate \times sharemnchd	-0.183	-1.154***	-0.087	-0.334*
	(0.121)	(0.287)	(0.074)	(0.192)
Year FE	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓
Observations	36362	80939	82203	36419
# Municipalities	14421	9534	9267	14429
Mean	0.299	5.945	2.902	7.470

Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the share of trade tax in all tax revenue, in column 2 the logarithm of trade tax revenue, in column 3 the logarithm of property tax revenue, in column 4 the logarithm of total tax revenue. The tax rate is the trade tax rate. In Panel A sharemnchf is the share of aggressive foreign MNCs in all firms in that municipality. In Panel B, sharemnchd is a share of aggressive domestic MNCs in all firms in that municipality. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. In columns 1 and 4, we only have data for total tax revenue at the municipality level for period 2016–2019, which reduced the number of observations. In columns 2 and 4, we have data for trade and property tax revenues for the years 2011–2019.

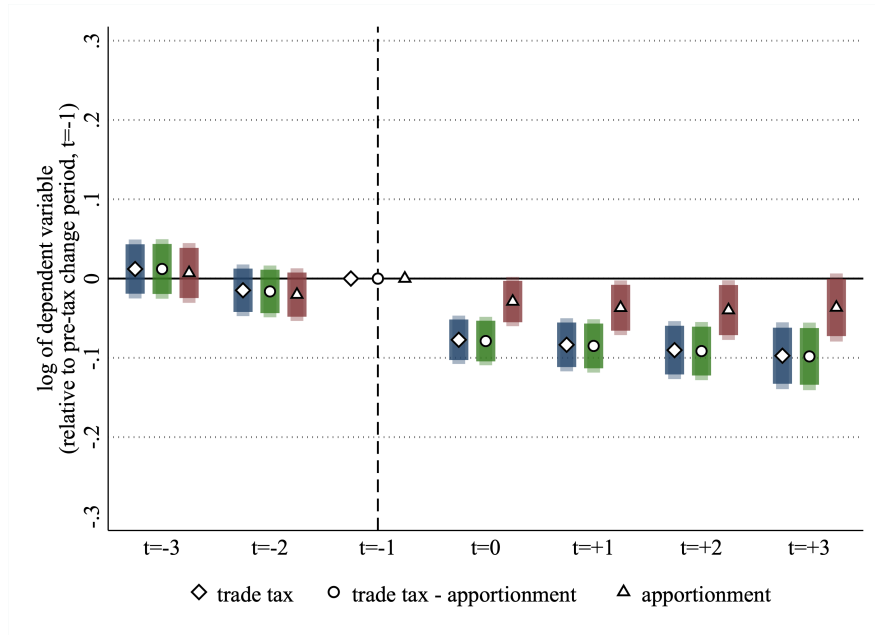
F Municipal apportionment

Table F1: Comparison of Municipal Trade Tax Revenues

	(1)	(2)	(3)	(4)	(5)	(6)
	trade tax	trade tax - appt	appt	trade tax	trade tax - appt	appt
tax rate \times MNC share	0.004 (0.057)	0.008 (0.056)	0.026 (0.059)			
tax rate \times agg MNC share				-0.172*** (0.064)	-0.157** (0.063)	-0.096 (0.064)
Year FE	✓	✓	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓
Observations	80939	80864	79881	80939	80864	79881
# firms	9240	9251	9404	9244	9253	9376
Mean	5.945	2.928	7.510	5.945	7.511	7.510

Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the logarithm of total trade tax revenue, in column 2 the logarithm of trade tax revenue minus apportionment, in column 3 the logarithm of apportionment. The tax rate is the trade tax rate. Agg MNC share is the share of aggressive MNCs in all firms in that municipality, share MNCs is a share of MNCs in all firms in that municipality. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level.

Figure F1: Dynamic Effects of the Tax Rate Increase on Municipal Revenue Structure: Apportionment Effects



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

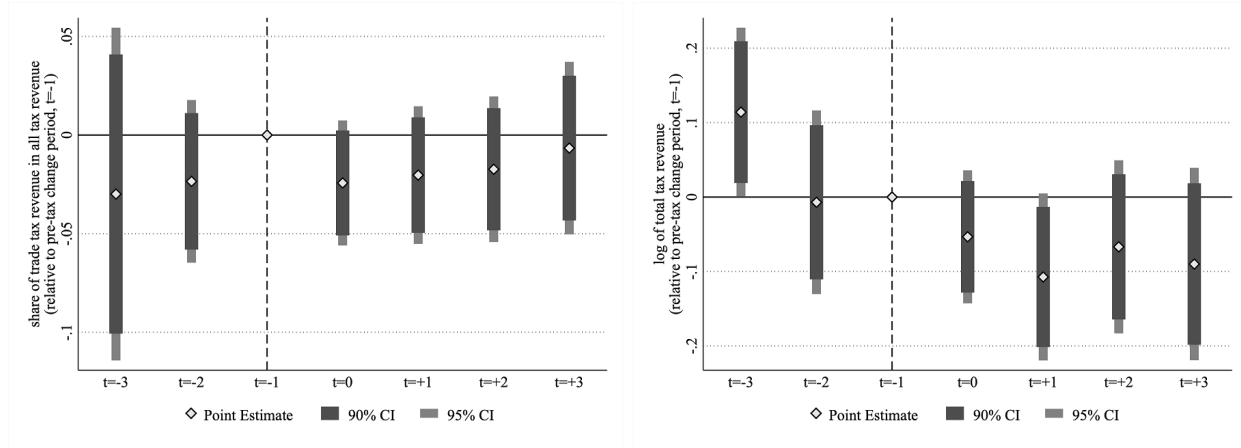
G Additional municipal results

Table G1: Descriptive Statistics: Municipalities

	(1)	(2)	(3)	
	high agg share	low agg share	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
trade tax rate multiplier	372.453	352.932	-19.521***	-46.008
property tax rate multiplier	319.793	321.845	2.052***	3.389
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(apportionmed 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

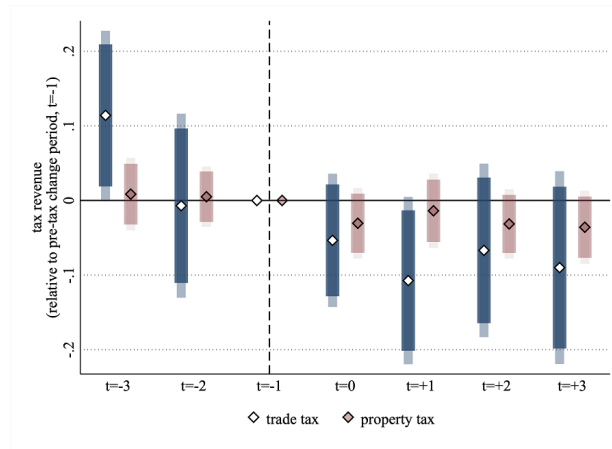
Note: Data from Orbis and German Statistical Office. We compare characteristics of municipalities across 2008—2019. Column 1 shows the means for municipalities with higher share of aggressive MNCs and column 2 shows means for municipalities with lower share of aggressive MNCs. The high share of aggressive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

Figure G1: Dynamic Effects of the Tax Rate Increase on Municipal Revenue Structure: Placebo



(a) Share of trade tax in total tax

(b) Total tax revenue



(c) Trade tax vs property tax

Note: This figure reports the dynamic effects of the tax rate *decrease* on the share of trade tax in total tax (panel a) and the logarithm of trade tax and property tax (panel b). All panels include the event study coefficient plots for municipalities with a high share of aggressive MNCs relative to those with a low share and relative to the control group from 3 years before the tax rate decrease to 3 or more years after the tax rate decrease. Each dot represents the coefficient estimate using the different difference in difference methodology, the darker shaded box represents the 95% confidence interval, while the lighter shaded box 90% confidence interval. The high share of aggressive MNCs is defined as above median. In each specification, we include year and municipality fixed effects. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. In panel a, we only include the period 2016–2019, as we only have data for total tax revenue at the municipality level for that period. In panel b, we include the full 2011–2019 period.

Table G2: Summary of Cross-Sectional Results: Static Average Across Years

Panel A: Aggressive MNCs				
	(1)	(2)	(3)	(4)
	trade tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)
tax rate	0.000*** (0.000)	0.004*** (0.000)	-0.003*** (0.000)	0.002*** (0.000)
tax rate \times agg MNC share	-0.024 (0.019)	-0.380*** (0.137)	0.303** (0.138)	-0.210** (0.102)
Firm controls	✓	✓	✓	✓
Observations	9208	9249	9249	9208
# Municipalities	9249	9249	9249	9249
Mean	0.298	5.774	2.866	7.460
Panel B: All MNCs				
	(1)	(2)	(3)	(4)
	trade tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)
tax rate	0.000*** (0.000)	0.005*** (0.001)	-0.003*** (0.000)	0.003*** (0.000)
tax rate \times MNC share	-0.016* (0.009)	-0.259*** (0.066)	0.082 (0.057)	-0.164*** (0.050)
Firm controls	✓	✓	✓	✓
Observations	9208	9249	9249	9208
# Municipalities	9208	9249	9249	9249
Mean	0.298	5.774	2.866	7.460

Note: Data from Orbis and German Statistical Office. The dataset is collapsed at the municipality level by calculating averages of tax revenues and municipal tax rates. The dependent variable in column 1 is the share of trade tax in all tax revenue, in column 2 the logarithm of trade tax revenue, in column 3 the logarithm of property tax revenue, in column 4 the logarithm of total tax revenue. The tax rate is the trade tax rate. In Panel A agg MNC share is the share of aggressive MNCs in all firms in that municipality. In Panel B, MNC share is a share of MNCs in all firms in that municipality. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. In columns 1 and 4, we only have data for total tax revenue at the municipality level for period 2016—2019, which reduced the number of observations. In columns 2 and 4, we have data for trade and property tax revenues for the years 2011—2019.

Table G3: Robustness of Cross-Sectional Results: Share of Aggressive MNCs in All MNCs

	(1)	(2)	(3)	(4)
	trade tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)
tax rate ×	-0.001**	-0.001**	-0.000**	-0.001*
agg MNC in MNC share	(0.000)	(0.001)	(0.000)	(0.000)
Year FE	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓
Observations	10626	23858	23922	10624
# Municipalities	2669	2685	2680	4201
Mean	0.406	8.172	3.736	9.289

Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the share of trade tax in all tax revenue, in column 2 the logarithm of trade tax revenue, in column 3 the logarithm of property tax revenue, in column 4 the logarithm of total tax revenue. The tax rate is the trade tax rate. agg MNC in MNC share is the share of aggressive MNCs in all MNCs in that municipality. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. In columns 1 and 4, we only have data for total tax revenue at the municipality level for the period 2016—2019, which reduced the number of observations. In columns 2 and 4, we have data for trade and property tax revenues for the years 2011—2019.

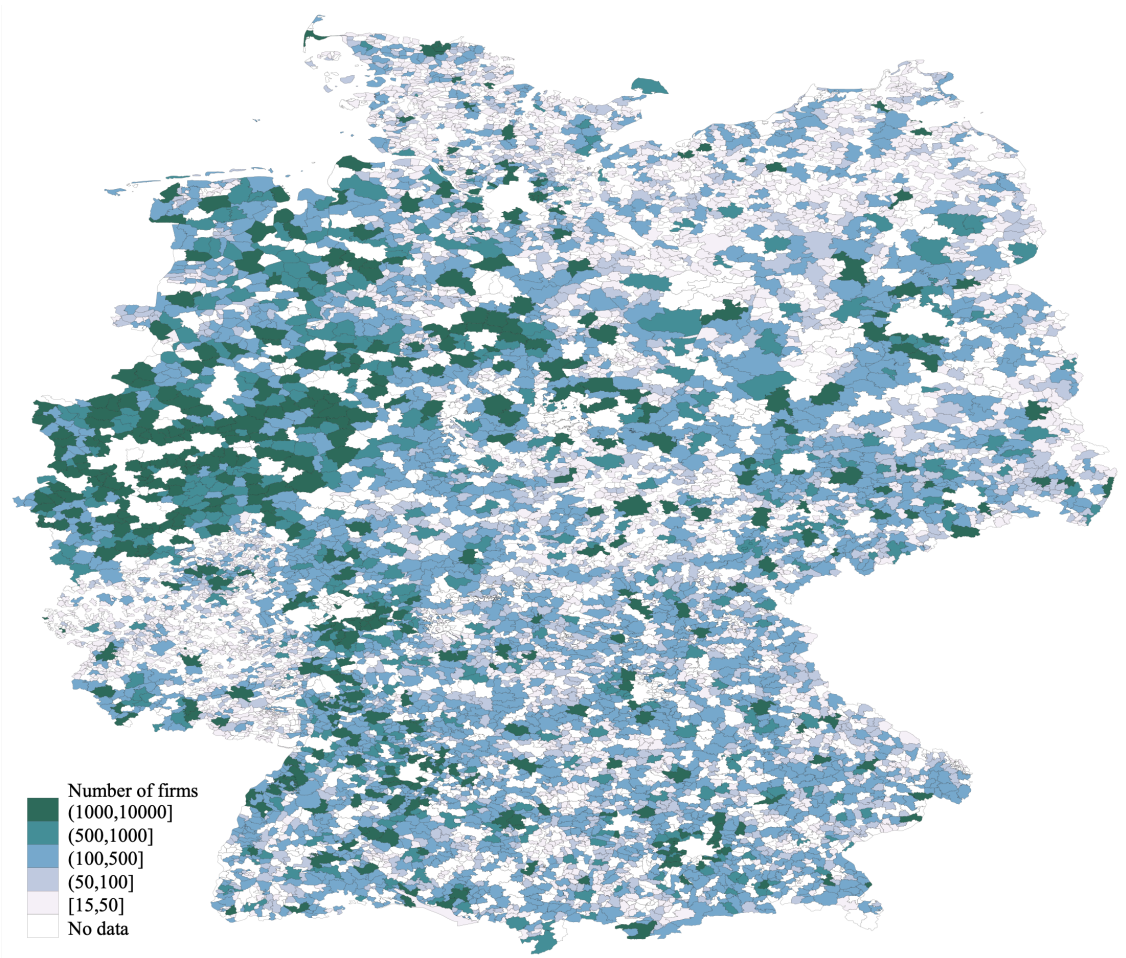
Table G4: Difference in Difference Results: pre and post Tax Rate Increase

Panel A: Aggressive MNCs						
	(1)	(2)	(3)	(4)	(5)	(6)
	trade tax share	property tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)	property tax rate
agg MNC share \times post=1	-0.499 (2.461)	0.122 (0.076)	-7.091*** (2.700)	0.393 (0.734)	0.456 (4.533)	0.728 (0.588)
Panel B: All MNCs						
	(1)	(2)	(3)	(4)	(5)	(6)
	trade tax share	property tax share	ln(trade tax rev)	ln(prop tax rev)	ln(tot tax rev)	property tax rate
MNC share \times post=1	-0.178 (0.653)	0.109*** (0.026)	0.440 (1.826)	0.139 (0.371)	-0.657 (1.298)	0.888*** (0.269)
Year FE	✓	✓	✓	✓	✓	✓
Municipality FEs	✓	✓	✓	✓	✓	✓
Firm controls	✓	✓	✓	✓	✓	✓
Observations	19195	19242	41884	42608	19226	48627
# firms	5674	8896	5965	5888	8897	5870
Mean	0.290	0.022	5.733	2.742	7.260	5.731

Note: Data from Orbis and German Statistical Office. The dependent variable in column 1 is the share of trade tax in all tax revenue, in column 2 the share of property tax revenue, in column 3, the logarithm of trade tax revenue, in column 4 the logarithm of property tax revenue, in column 5 the logarithm of total tax revenue, in column 6 the logarithm of property tax rate. MNCs share is a share of MNCs in all firms in that municipality, agg MNC share is the share of aggressive MNCs in all firms in that municipality. In each specification, we include year and municipality fixed effects. Controls include trade tax rate, property tax rate, and municipal population. Standard errors are clustered at the municipality level. In columns 1, 2, and 5, we only have data for total tax revenue at the municipality level for the period 2016—2019, which reduces the number of observations. In columns 3, 4, and 6, we have data for trade and property tax revenues for the years 2011—2019.

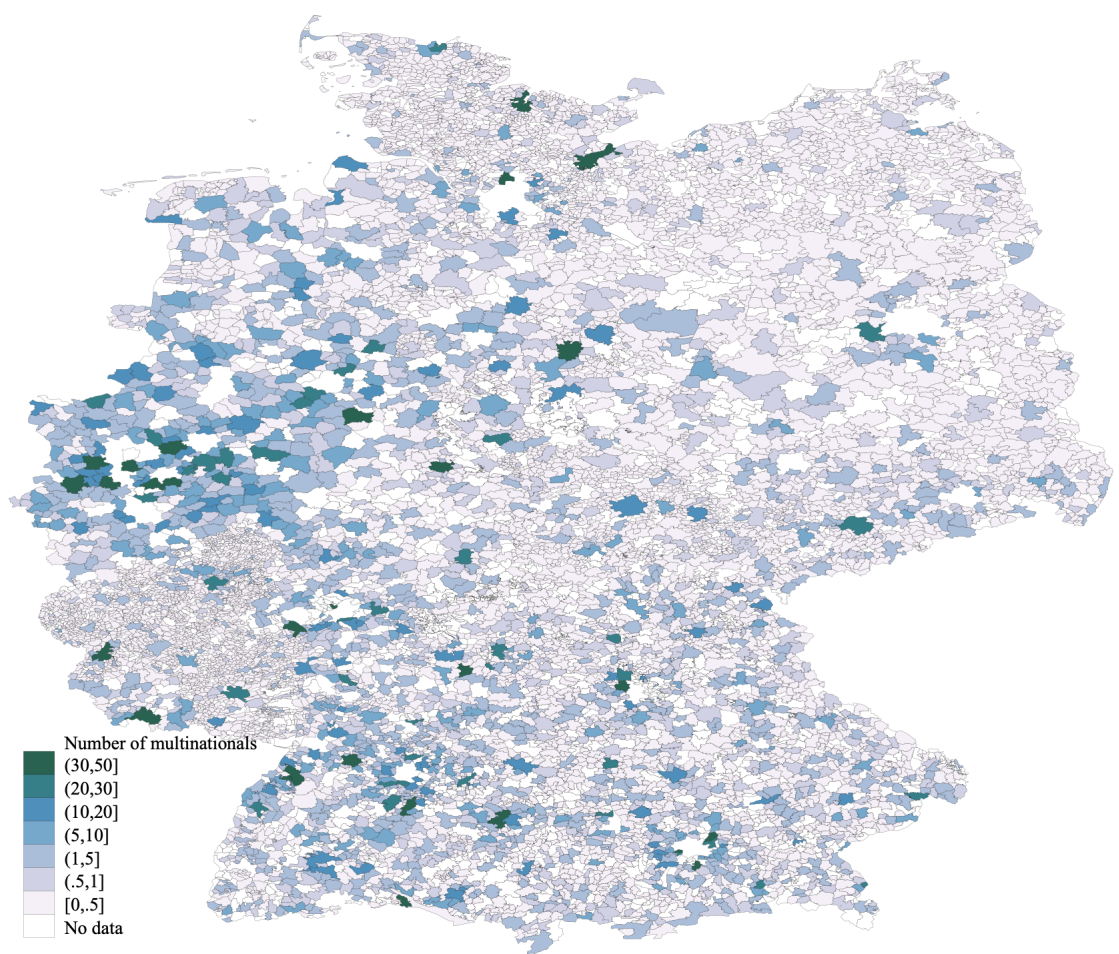
H Maps

Figure H1: Number of Firms Across Municipalities



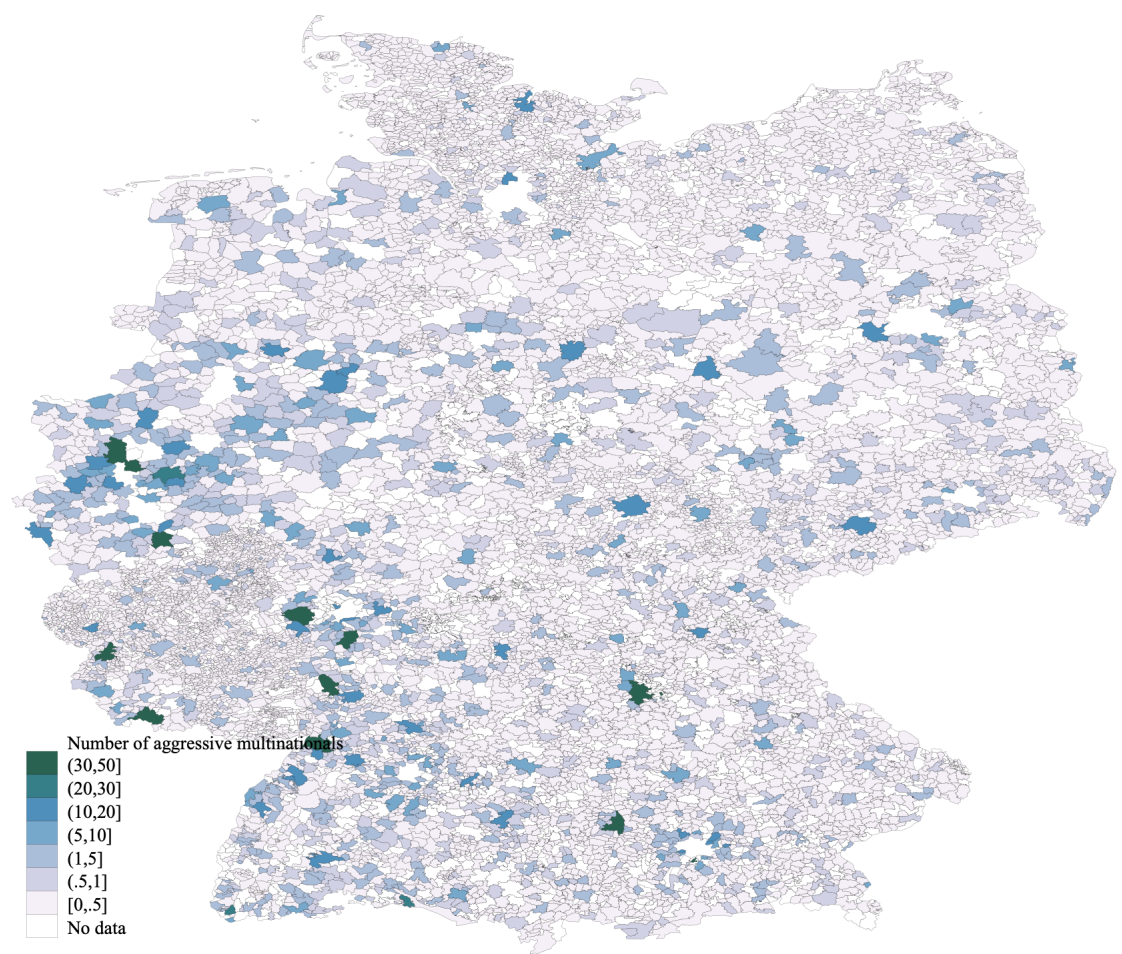
Note: Data from Orbis and German Statistical Office. This maps outlines all German municipalities and the number of firms in each from Orbis.

Figure H2: Number of Multinationals across Municipalities



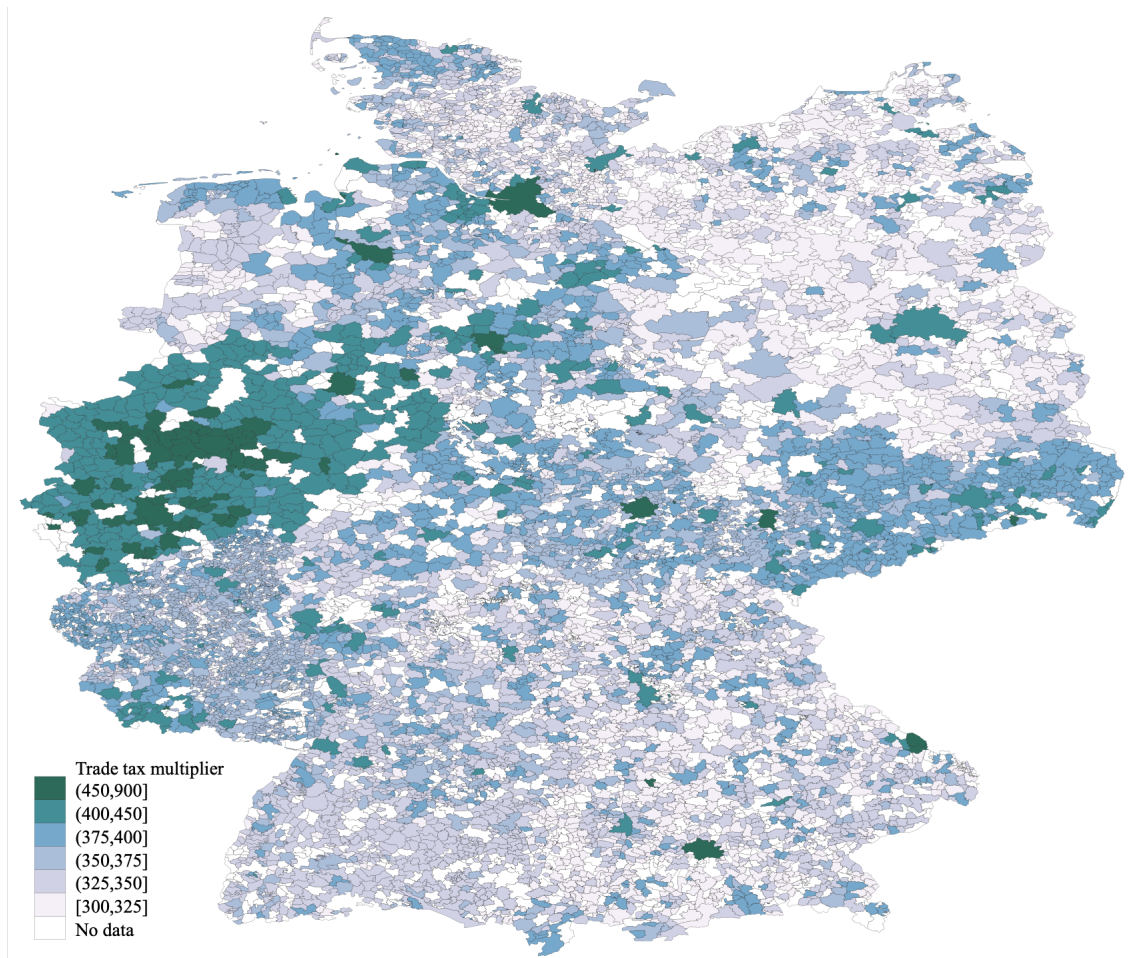
Note: Data from Orbis and German Statistical Office. This maps outlines all German municipalities and the number of multinationals in each from Orbis.

Figure H3: Number of Aggressive Multinationals Across Municipalities



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

Figure H4: Trade tax multipliers.



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