# Fiscal Consequences of Corporate Tax Avoidance

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**Abstract**

Multinational corporations (MNCs) 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 analyze the consequences of tax avoidance for the structure of government tax revenues. First, we show that, at the country level, there is a strong negative correlation between the proportion of tax revenues coming from corporations and the size of profit shifting that multinationals do. At the same time countries that lose a large proportion of their revenues due to profit shifting raise a larger share from personal and indirect taxes. 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, there is a significant decline in the share of municipal tax revenue derived from that tax, but only for municipalities with a large presence of aggressive multinational firms.

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

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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 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, we find that countries that are switching from direct to indirect taxation, are the ones losing more revenues due to profit shifting.

We follow the country-level analysis, with municipal level estimates using Germany as a case study. German municipalities set their own 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 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 rely on the comparisons between municipalities with more aggressive MNCs as a share of all firms in the municipality and those with lower such share.

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, 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.

In this paper, we build 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). 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.

We also 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. Here, we are interested in a more specific question of what happens to tax revenues when firms shift profits away from a country or municipality that imposes taxes. Therefore, we consider the consequences of changes in tax rates on tax revenues structures in the presence of profit shifting.

# 2 County-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. We then look at the evolution of those tax revenues shares across years and link it with the extent of profits being shifted out of the countries in our sample.

## 2.1 Data and methodology

The main data source for the country-level tax structure is the UNU-WIDER Government Revenue Dataset,[1] which we complement with the IMF Government Finance Statistics,[2] and the UNCTAD statistical data.[3] We obtain tax rates from the KPMG Tax rates online data.[4] The combined dataset includes information on the tax revenue structure of governments, GDP, 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

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

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

[3]UNCTAD 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)

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

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 A. 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 A1), 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:

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

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 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, $\psi_t$ are year fixed effects, and $\epsilon_{it}$ is an error term. As country controls, we use logarithm of GDP per capital, 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).

## 2.2 Baseline correlations

In Figure 1 we visualise the correlations between profit shifting and tax revenue structure. Each panel corresponds to a share of tax revenues derived from a different source: panel (a) corporate tax revenues, panel (b) individual tax revenues, panel (c) sales and goods tax revenues, and panel (d) VAT revenues. On the horizontal axis, we have profits shifted, as a percent of GDP. 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, 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.

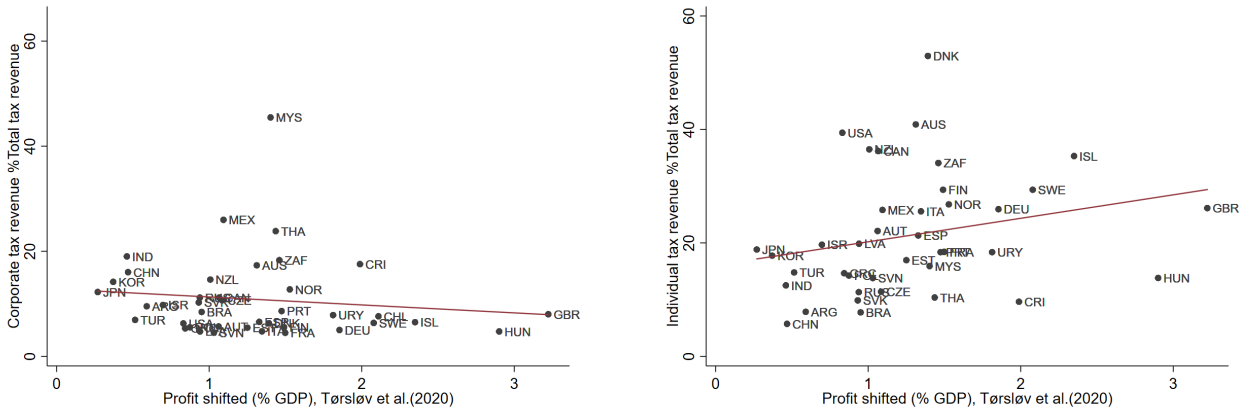
In Table 1, we quantify these results using a simple regression framework. In Panel A, we provide baseline estimates without controls, in Panel B, we include a host of country level business cycle, size, and tax system controls. In Table A1, we include additional tax system controls. In Column (1), we 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.

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 a positive association between other types of tax revenues and profit shifting. Hence, we find some evidence of countries substituting the lower corporate tax revenue shares with indirect taxes.

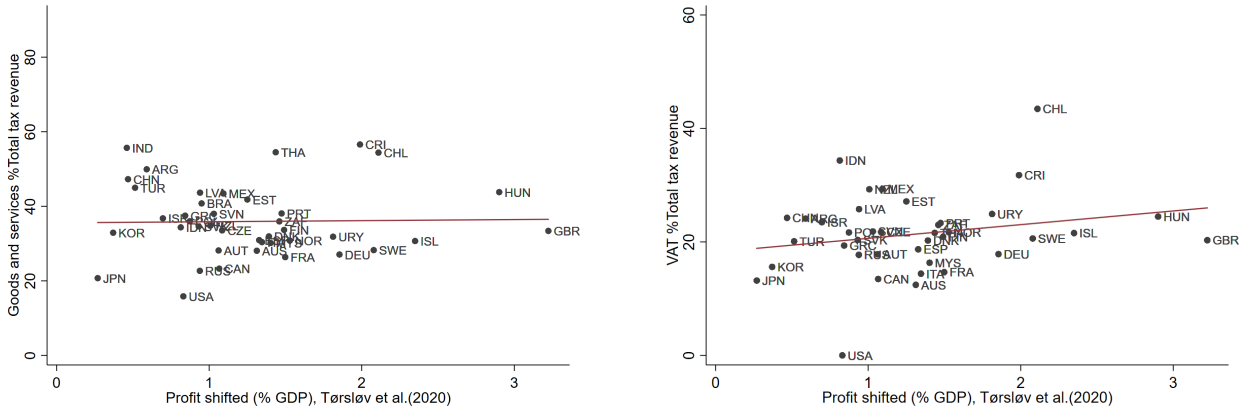
## 2.3 The evolution of tax revenue structure

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 2 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 substan-

Figure 1: Impact of tax avoidance on corporate, individual, goods and services, and VAT tax revenues.




(a) (b)




(c) (d)

Note: Data from UNU-WIDER, IMF, Tørsløv et al. (2020). On the vertical axis is the average tax revenue share during 2015-2018 period in total tax revenue: on the graph (a) revenue share of income, profits, and capital gains taxes on corporations; on the graph (b) revenue share of income, profits, and capital gains taxes on individuals; on the graph (c) revenue share of taxes on goods and services; on the graph (d) revenue share from VAT. 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). On the graphs we exclude tax havens defined by Tørsløv et al. (2020).

Table 1: Summary of Country-level Results.

**Panel A: Baseline Correlations**

| | (1) corp.share | (2) indiv.share | (3) gs.share | (4) vat.share | (5) 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) |
| Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| # Countries | 146 | 146 | 151 | 145 | 137 |

**Panel B: Panel Analysis**

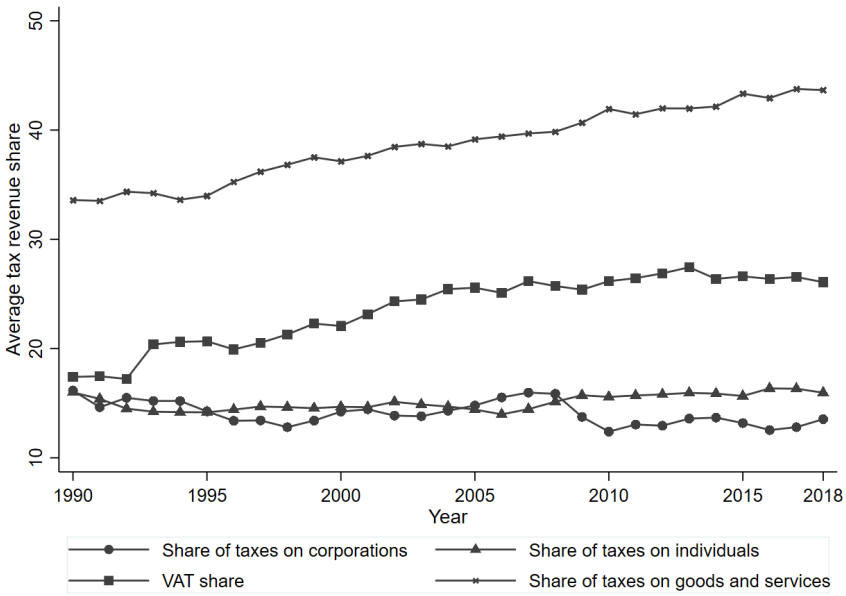
| | (1) corp.share | (2) indiv.share | (3) gs.share | (4) vat.share | (5) rest.share |
|---|---|---|---|---|---|
| Profit shifted % GDP | -2.019** | 2.364* | 0.424 | 1.447 | 0.404 |
| | (0.659) | (1.008) | (1.159) | (0.746) | (1.199) |
| Employer soc. sec tax rates | 0.031 | -0.262*** | -0.026 | -0.031 | 0.425*** |
| | (0.039) | (0.059) | (0.067) | (0.043) | (0.083) |
| Employee soc. sec tax rates | -0.412*** | -0.373** | -0.026 | -0.103 | 1.018*** |
| | (0.075) | (0.115) | (0.131) | (0.083) | (0.156) |
| Logarithm of GDP per capita | 0.688 | 3.309*** | -4.012*** | -1.656* | 3.566** |
| | (0.539) | (0.826) | (0.971) | (0.635) | (1.081) |
| Logarithm of population | 0.984 | 0.833 | -0.655 | -1.440* | -2.232 |
| | (0.632) | (0.967) | (1.131) | (0.723) | (1.131) |
| FDI % GDP | -0.015 | 0.037* | -0.055** | -0.073*** | 0.039* |
| | (0.010) | (0.016) | (0.019) | (0.012) | (0.018) |
| Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| # Countries | 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 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 (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 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.

tially (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 2 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 2: The evolution of tax revenue shares




Note: Data from UNU-WIDER. The vertical axis on the graph (a) represents the average tax revenue shares among countries excluding tax havens (taxes on income, profits, and capital gains from corporations and individuals; VAT; taxes on goods and services) in total tax revenue. The vertical axis on the graph (b) represents the average tax rates among countries excluding tax havens (corporate tax rates, individual tax rates, indirect tax rates, employer and employee social security tax rates). The horizontal axis represents the time evolution on both graphs. The list of tax havens defined by Tørsløv et al. (2020) and Garcia-Bernardo and Janský (2021).

**Summary** The country-level results provide suggestive evidence that countries that lose more tax revenues due to profit shifting rely less on corporate tax revenues and more on indirect tax revenues to supplement their overall tax revenue. However, we cannot draw any causal conclusions from these results, which is why we turn to municipal-level data next.

Table 2: Summary of the Dynamic Country-level Results.

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

# 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, tax revenues, and multinational presence.

## 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% of VAT is redistributed across states.[5] Municipalities collect trade tax and property tax.[6] Germany's total tax revenue was 740 billion euro in 2020.[7] Out of that total, the tax revenue collected at the municipal level was 108 billion euro (15%), at the state level (Länder) it was 316 billion euro (43%), at the federal level it was 283 billion euro (39%) and EU contributions totalled 33 billion euro (4%). 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% of their revenues comes from trade tax and 14% comes from property tax. These taxes are the exclusive tax revenues of municipalities. The rest comes from federal and state tax apportionment.[8] 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 euro, 8%). 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 euro our of total 41 billion trade tax revenue.

Trade tax (Gewerbesteuer) is a tax on companies' profits and the tax rate is a combina-

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

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

[7]According 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

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

tion of a base rate of 3.5%, uniform across Germany, and a municipal tax rate (Hebesatz), determined by each municipality, applicable according to where the companies' permanent establishments are located. In January 2022, municipalities with at least 80,000 inhabitants currently levy trade tax at a rate of between 8.75% (Hebesatz of 250%) and 20.3% (Hebesatz of 580%). 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% (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 as 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.

## 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. 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 in total tax revenue as well as logarithm of both trade and property tax. We have data at the municipal level available between 2008 and 2019.

**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% 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.[9] 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

[9]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)

more than 50%. Our sample includes over 4,000 foreign MNCs and 16,000 domestic MNCs, which are 4.8 % and 19.8% of all German firms with known parents, correspondingly.[10] 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).[11] 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 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 B, we discuss the limitations of this financial data and why we prefer to use firm counts over size of their business operations.

**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.[12] 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. We break it down by the share of domestic and share of foreign multinationals. 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%, with a large variation ranging from municipalities that have no MNC presence to those that have over 3.5% of their firms being multinationals.

## 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 multinational firms in each municipality. First, we take advantage of cross-sectional differences in tax rates and multinational presence to estimate the following model:

[10] 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.

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

[12] For maps outlining municipality coverage in our data, see Appendix E.

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

where $Taxrev_{it}$ is a share of tax revenues coming from trade tax or the log of tax revenues coming from each of the trade tax or property tax source. $MNCsh_i$ is a continuous variable that describes the share of 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, population, and local GDP. $\eta_i$ are municipality fixed effects and $\delta_t$ 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 multinational and domestic firms contributing to their revenues, controlling for municipal tax rates. We present results in Table 3. In Panel A, 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. Correspondingly, in columns (2) and (3), we find that they have lower trade tax revenue more generally, and that presence of aggressive MNCs does not affect their property tax revenues. Consequently, in column (4) we also show that these municipalities have overall lower total tax revenues.

In Panel B, we use a share of all MNCs in all firms. We find that municipalities with simply more multinationals do not derive lower revenues from trade taxes. 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.

## 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 the tax rate increase on tax revenue structure for municipalities

Table 3: Summary of Cross-sectional Results.

**Panel A: Aggressive MNCs**

| | (1) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) ln(tot tax rev) |
|---|---|---|---|---|
| tax rate × agg MNC share | -0.087** | -0.209*** | 0.006 | -0.206** |
| | (0.039) | (0.063) | (0.017) | (0.093) |
| Year FE | ✓ | ✓ | ✓ | ✓ |
| Municipality FEs | ✓ | ✓ | ✓ | ✓ |
| Firm controls | ✓ | ✓ | ✓ | ✓ |
| Observations | 36362 | 80939 | 82203 | 36419 |
| # Municipalities | 14291 | 9507 | 9277 | 14409 |
| Mean | 0.299 | 5.945 | 2.902 | 7.470 |

**Panel B: All MNCs**

| | (1) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) ln(tot tax rev) |
|---|---|---|---|---|
| tax rate × MNC share | -0.002 | -0.010 | 0.006 | -0.024 |
| | (0.027) | (0.054) | (0.011) | (0.062) |
| Year FE | ✓ | ✓ | ✓ | ✓ |
| Municipality FEs | ✓ | ✓ | ✓ | ✓ |
| Firm controls | ✓ | ✓ | ✓ | ✓ |
| Observations | 36362 | 80939 | 82203 | 36419 |
| # Municipalities | 14403 | 9479 | 9274 | 14278 |
| 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 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 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 column 2 and 4, we have data for trade and property tax revenues for years 2011 - 2019.

with different exposures to MNCs.[13] 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 such 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. 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 to provide a dynamic evolution of the effects, we estimate the following event study model:

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

where $Taxrev_{it}$ is a share of tax revenues coming from corporations or the log of tax revenues coming from each source. $\sum_{\kappa=-4}^{4} \mathbb{1}[t=\kappa]$ is a series of year dummies that equal one when the tax reform was $\kappa$ 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 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, population, and local GDP. $\eta_i$ are municipality fixed effects and $\delta_t$ are year fixed effects. We cluster standard errors at the municipal level in each estimations.

The coefficients of interest are the $\beta_t$: they estimate the difference in the share of trade tax revenues between municipalities with a high and low share of MNCs, $\kappa$ 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 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.[14]

We start by pooling all of the post reform coefficients for periods t=1 up to t=+3 as a post

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

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

dummy equal to 1 and all coefficients before as post dummy equal to zero. We summarise these results in Table 4 including the share of all MNCs in Panel A and a share of aggressive ones in Panel B. In columns 1-4, we use a continuous share variable, while in columns 5 - 8, 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 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, but not much compensation from property tax revenues. Note that the results with continuous shares in Panel B are not significant, but the dummy ones are.

We then plot the event study coefficients in Figure 3 to show the evolution of tax revenue structure around the tax rate increase. Panel a shows the evolution of the share of trade 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. 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. Further, we find no evidence of a differential evolution in tax revenue structure between municipalities with a larger share of more aggressive MNCs before the reform.[15]

# 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 absence of corporate tax revenues from MNCs. We explore possible alternative sources of revenues for countries that are most affected by profit shifting. This allows us to understand which groups of firms or individuals bear the burden of tax not paid by MNCs. This is important, especially for developing countries, which have the much lower fiscal capacity, and as a consequence, lower ability to raise tax revenues.

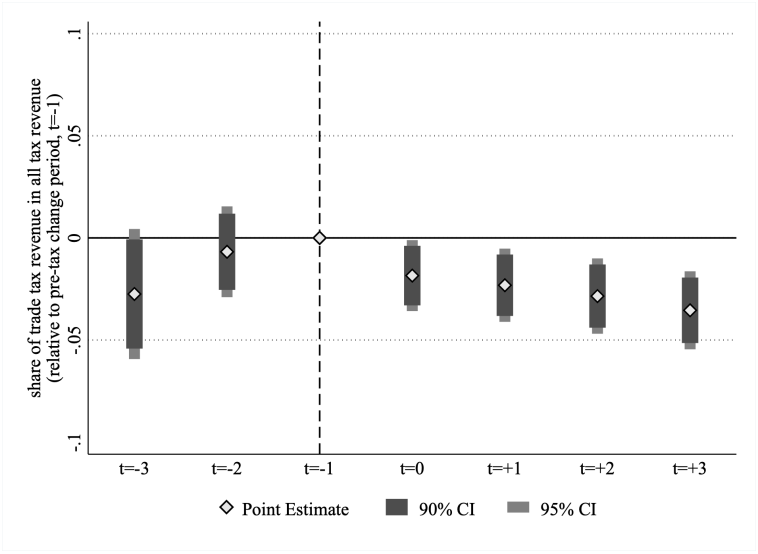
[15]In Appendix B, instead of firm counts, we use the share of assets, employment, turnover, and profits that firms have in each municipality to understand the intensity of the MNC presence. The caveat is that Orbis data has poor coverage of financial information, especially for domestic firms, which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

Table 4: Difference in difference results: pre and post tax rate increase.

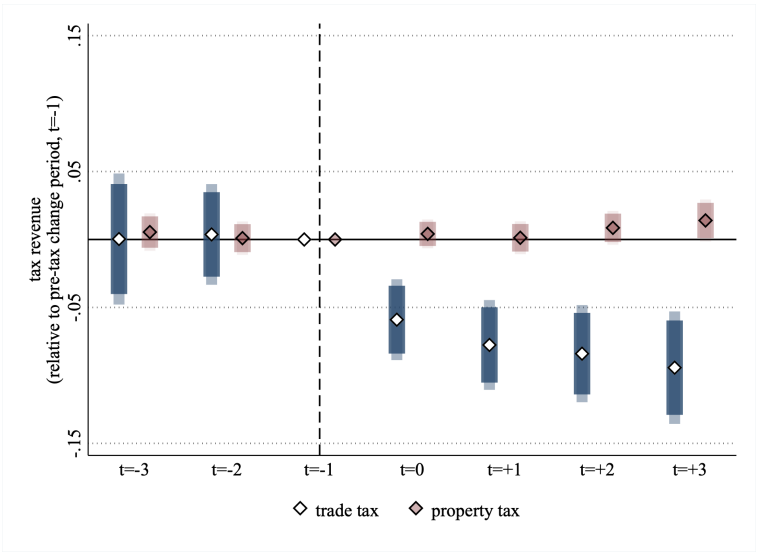
| | (1) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) ln(tot tax rev) | (5) trade tax share | (6) ln(trade ln(trade | (7) ln(prop tax rev) | (8) ln(tot tax rev) |
|---|---|---|---|---|---|---|---|---|
| **Panel A: All MNCs** | | | | | | | | |
| MNC share × post==1 | -0.333 | -0.325 | 0.110 | -0.988 | | | | |
| | (0.687) | (1.663) | (0.334) | (1.471) | | | | |
| high share==1=1 × post==1=1 | | | | | -0.012 | -0.054*** | 0.010** | -0.031* |
| | | | | | (0.009) | (0.015) | (0.004) | (0.016) |
| **Panel B: Aggressive MNCs** | | | | | | | | |
| agg MNC share × post==1 | -2.116 | -7.808*** | 0.320 | -3.211 | | | | |
| | (2.190) | (2.527) | (0.688) | (4.564) | | | | |
| high share==1=1 × post==1=1 | | | | | -0.028*** | -0.099*** | 0.005 | -0.056*** |
| | | | | | (0.010) | (0.015) | (0.005) | (0.020) |
| Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Municipality FEs | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Firm controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 19195 | 41884 | 42608 | 19226 | 19195 | 41884 | 42608 | 19226 |
| # Municipalities | 15838 | 12908 | 12749 | 15775 | 15897 | 12910 | 12752 | 15803 |

Note: Data from Orbis and German Statistical Office. The dependent variable in columns 1 and 5 is the share of trade tax in all tax revenue, in columns 2 and 6 the logarithm of trade tax revenue, in columns 3 and 7 the logarithm of property tax revenue, in columns 4 and 8 the logarithm of total tax revenue. Columns 1 -4 use the continuous share of MNC presence and columns 5-8 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 beforehand. In Panel A, MNCs share is a share of MNCs in all firms in that municipality. In Panel B 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, 4, 5, and 8, we only have data for total tax revenue at the municipality level for the period 2016 - 2019, which reduced the number of observations. In column 2, 4, 6 and 7, we have data for trade and property tax revenues for the years 2011 - 2019.

Figure 3: 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 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 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. 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.

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. 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 have an opposite effect and reduces these revenues.

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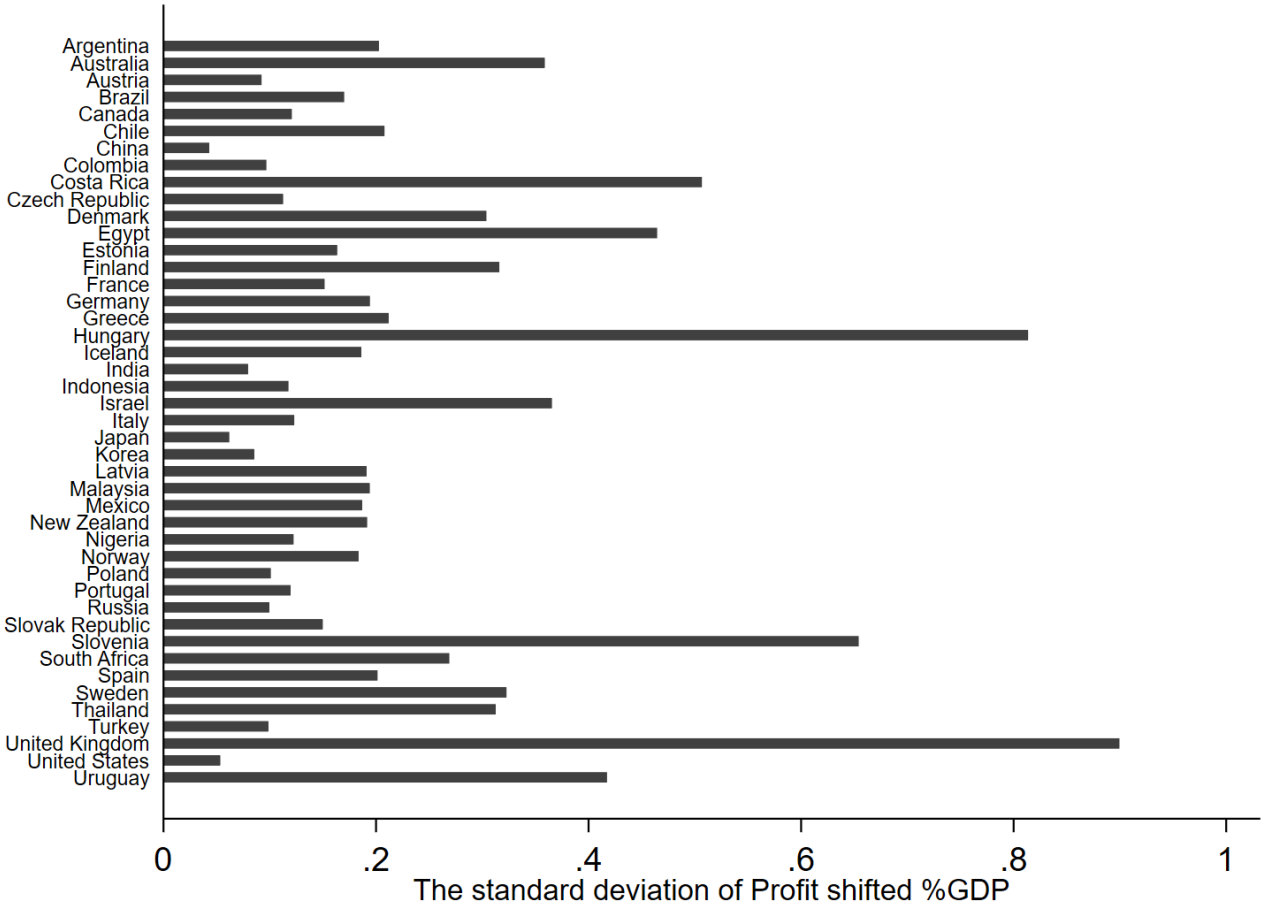
# Appendices

## A Additional country-level estimates

Figure A1: 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 A1: Summary of Country-level Results: additional controls.

| | (1) corp.share | (2) indiv.share | (3) gs.share | (4) vat.share | (5) rest.share |
|---|---|---|---|---|---|
| Profit shifted % GDP | -0.085 | 2.650* | 0.469 | 1.123 | -0.773 |
| | (0.637) | (1.094) | (1.336) | (0.863) | (1.318) |
| Individual tax rates | -0.024 | 0.249*** | -0.169* | -0.130* | 0.157 |
| | (0.040) | (0.069) | (0.085) | (0.059) | (0.085) |
| Corporate tax rates | 0.118 | 0.112 | 0.157 | 0.102 | -0.485** |
| | (0.079) | (0.136) | (0.170) | (0.121) | (0.161) |
| Employer soc. sec. tax rates | 0.099* | -0.209** | -0.081 | -0.081 | 0.461*** |
| | (0.040) | (0.068) | (0.083) | (0.054) | (0.095) |
| Employee soc. sec. tax rates | -0.336*** | -0.517*** | 0.031 | -0.063 | 1.013*** |
| | (0.066) | (0.114) | (0.139) | (0.089) | (0.151) |
| Indirect tax rates | -0.561*** | 0.136 | 0.040 | 0.101 | 0.081 |
| | (0.102) | (0.175) | (0.218) | (0.145) | (0.209) |
| Logarithm of GDP per capita | 0.771 | 1.112 | -2.911* | -0.659 | 2.982* |
| | (0.554) | (0.952) | (1.177) | (0.799) | (1.261) |
| Logarithm of population | 0.376 | 0.734 | -0.746 | -1.445 | -1.612 |
| | (0.538) | (0.924) | (1.140) | (0.732) | (1.090) |
| FDI % GDP | -0.058*** | 0.049** | -0.064** | -0.075*** | 0.071** |
| | (0.011) | (0.018) | (0.023) | (0.014) | (0.021) |
| Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| # Countries | 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 A2: Summary of the Dynamic Country-level Results.

**Panel A: Baseline Correlations**

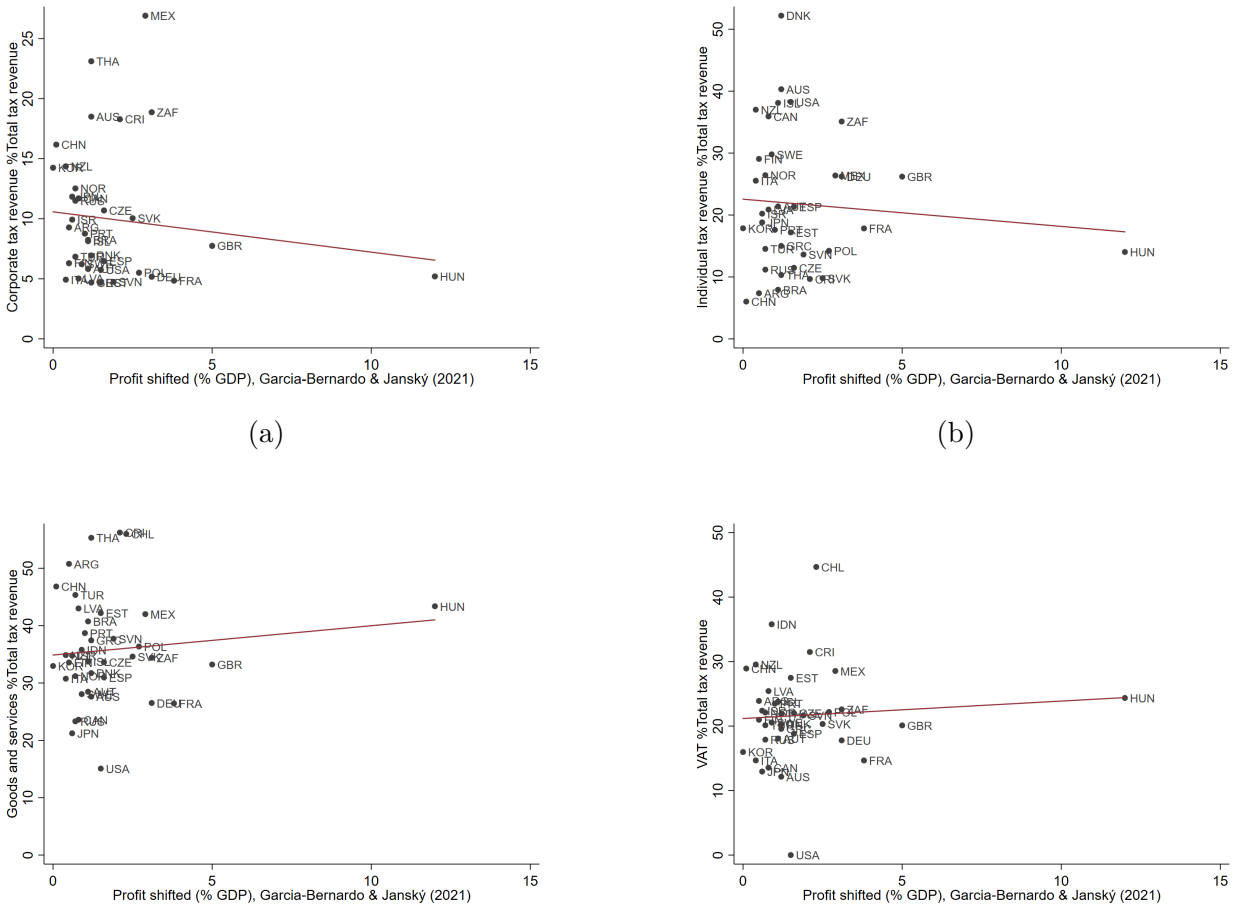
| | (1) corp.sh00 | (2) corp.sh10 | (3) indiv.sh00 | (4) indiv.sh10 | (5) gs.sh00 | (6) gs.sh10 | (7) vat.sh00 | (8) vat.sh10 | (9) rest.sh00 | (10) rest.sh10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Profit shifted % GDP | -0.036 | 0.039 | -0.273 | -0.122* | -0.006 | 0.029 | -0.026 | 0.012 | -0.027 | -0.043 |
| | (0.104) | (0.084) | (0.353) | (0.053) | (0.033) | (0.020) | (0.055) | (0.028) | (0.043) | (0.031) |
| # Countries | 34 | 37 | 34 | 37 | 37 | 37 | 34 | 34 | 33 | 34 |

**Panel B: Panel Analysis**

| | (1) corp.sh00 | (2) corp.sh10 | (3) indiv.sh00 | (4) indiv.sh10 | (5) gs.sh00 | (6) gs.sh10 | (7) vat.sh00 | (8) vat.sh10 | (9) rest.sh00 | (10) rest.sh10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Profit shifted % GDP | -0.158 | -0.038 | -0.243 | -0.120 | -0.025 | 0.023 | 0.004 | -0.004 | 0.031 | -0.060 |
| | (0.122) | (0.088) | (0.419) | (0.060) | (0.034) | (0.024) | (0.065) | (0.033) | (0.053) | (0.040) |
| Logarithm of GDP per capita | 0.362 | 0.343 | 0.579 | 0.126 | -0.058 | -0.045 | -0.066 | 0.012 | -0.088 | 0.041 |
| | (0.239) | (0.183) | (0.823) | (0.125) | (0.068) | (0.050) | (0.128) | (0.068) | (0.105) | (0.081) |
| Logarithm of population | -0.239* | -0.222** | -0.213 | -0.002 | 0.059* | 0.007 | 0.005 | -0.034 | -0.000 | 0.021 |
| | (0.097) | (0.077) | (0.334) | (0.052) | (0.028) | (0.021) | (0.053) | (0.028) | (0.042) | (0.033) |
| Individual tax rates | 0.003 | 0.001 | -0.042 | -0.003 | 0.001 | 0.000 | 0.004 | 0.002 | 0.001 | -0.002 |
| | (0.006) | (0.005) | (0.022) | (0.003) | (0.002) | (0.001) | (0.003) | (0.002) | (0.003) | (0.002) |
| Corporate tax rates | -0.026 | -0.015 | 0.121* | 0.016 | -0.010* | 0.001 | -0.010 | -0.003 | 0.000 | 0.000 |
| | (0.016) | (0.012) | (0.054) | (0.008) | (0.004) | (0.003) | (0.009) | (0.005) | (0.007) | (0.005) |
| Indirect tax rates | -0.003 | 0.006 | 0.082 | 0.012 | -0.004 | 0.001 | -0.019* | -0.000 | -0.009 | 0.004 |
| | (0.013) | (0.011) | (0.045) | (0.007) | (0.004) | (0.003) | (0.008) | (0.004) | (0.006) | (0.005) |
| # Countries | 33 | 36 | 33 | 36 | 36 | 36 | 33 | 33 | 32 | 33 |

Note: Data from UNU-WIDER, IMF, Garcia-Bernardo and Janský (2021). The dependent variable in columns 1 and 2 is the average growth of tax revenue share from income, profits, and capital gains taxes on corporations in total tax revenue between 2000 and 2018, 2010 and 2018 respectively; in columns 3 and 4 is the average growth of tax revenue share from income, profits, and capital gains taxes on individuals in total tax revenue between 2000 and 2018, 2010 and 2018 respectively; in columns 5 and 6 is the average growth of tax revenue share from taxes on goods and services in total tax revenue between 2000 and 2018, 2010 and 2018 respectively; in columns 7 and 8 is the average growth of tax revenue share from VAT in total tax revenue between 2000 and 2018, 2010 and 2018 respectively; in columns 9 and 10 is the average growth of tax revenue share from social contributions, payroll and workforce, property, and other taxes in total tax revenue between 2000 and 2018, 2010 and 2018 respectively. The independent variable is the average profit shifted as a percentage of GDP from Garcia-Bernardo and Janský (2021) during the 2015-2018 period. All the data in the table exclude tax havens which are defined by Garcia-Bernardo and Janský (2021). Controls in Panel B include the logarithm of GDP per capita, the logarithm of population, individual, corporate, and indirect tax rates.

Figure A2: Impact of tax avoidance on corporate, individual, goods and services, and other tax revenues.




(a) (b)

(c) (d)

Note: Data from UNU-WIDER, IMF, Garcia-Bernardo and Janský (2021). On the vertical axis is the tax revenue share in 2017 in total tax revenue: on the graph (a) revenue share from income, profits, and capital gains taxes on corporations; on the graph (b) revenue share from income, profits, and capital gains taxes on individuals; on the graph (c) revenue share from taxes on goods and services; on the graph (d) revenue share from VAT. On the horizontal axis of all graphs is the profit shifted as a percentage of GDP in 2017 from Garcia-Bernardo and Janský (2021). On the graphs we exclude tax havens defined by Tørsløv et al. (2020) and Garcia-Bernardo and Janský (2021).

Table A3: Summary of Country-level Results with an alternative measure of profit shifting.

| **Panel A: Baseline Correlations** | | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | corp_share | indiv_share | gs_share | vat_share | rest_share |
| Profit shifted % GDP | -0.211 | -0.032 | 0.338 | -0.142 | -0.327 |
| | (0.160) | (0.173) | (0.221) | (0.198) | (0.293) |
| # Countries | 113 | 113 | 142 | 119 | 99 |
| **Panel B: Panel Analysis** | | | | | |
| | (1) | (2) | (3) | (4) | (5) |
| | corp_share | indiv_share | gs_share | vat_share | rest_share |
| Profit shifted % GDP | -0.079 | -0.020 | 0.298 | 0.139 | -0.018 |
| | (0.193) | (0.244) | (0.306) | (0.265) | (0.356) |
| Employer soc. sec tax rates | -0.107 | -0.122 | -0.148 | -0.122 | 0.607*** |
| | (0.072) | (0.091) | (0.110) | (0.094) | (0.154) |
| Employee soc. sec. tax rates | -0.307* | -0.348* | 0.058 | 0.121 | 0.777** |
| | (0.121) | (0.154) | (0.187) | (0.160) | (0.245) |
| Logarithm of GDP per capita | 0.479 | 0.803 | -2.374* | 0.685 | 0.530 |
| | (0.772) | (0.977) | (1.177) | (1.018) | (1.431) |
| Logarithm of population | 0.862 | 1.703 | -1.955 | -1.766 | 0.873 |
| | (0.881) | (1.115) | (1.393) | (1.207) | (1.665) |
| FDI % GDP | -0.009 | 0.072* | -0.107** | -0.104** | 0.103* |
| | (0.024) | (0.031) | (0.039) | (0.033) | (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.

# B 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 A4 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 A5 we replicate results from column 2 in Table 3 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 A4: 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 A5: Summary of Cross-sectional Results: real business operations weighted.

| **Panel A: Aggressive MNCs** | | | | |
|---|---|---|---|---|
| Dep.var.: ln(trade tax rev) | (1)<br>share assets | (2)<br>share empl | (3)<br>share turnover | (4)<br>share profits |
| tax rate × agg MNC share | -0.011***<br>(0.004) | -0.023***<br>(0.008) | -0.016**<br>(0.006) | -0.003<br>(0.002) |
| **Panel B: All MNCs** | | | | |
| Dep.var.: ln(trade tax rev) | (1)<br>share assets | (2)<br>share empl | (3)<br>share turnover | (4)<br>share profits |
| tax rate × MNC share | -0.005***<br>(0.002) | -0.009***<br>(0.002) | -0.006***<br>(0.002) | -0.003***<br>(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 A, 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.

# C 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 3 into domestic and foreign MNCs. In Table A6 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 A7 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 A6: Summary of Cross-sectional Results. Foreign vs Domestic MNC heterogeneity.

**Panel A: Foreign MNCs**

| | (1) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) ln(tot tax rev) |
|---|---|---|---|---|
| tax rate × sharefmnc | -0.045 | -0.426** | 0.025 | -0.129 |
| | (0.085) | (0.168) | (0.053) | (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) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) ln(tot tax rev) |
|---|---|---|---|---|
| tax rate × sharedmnc | 0.003 | 0.004 | 0.000 | -0.020 |
| | (0.030) | (0.058) | (0.010) | (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.

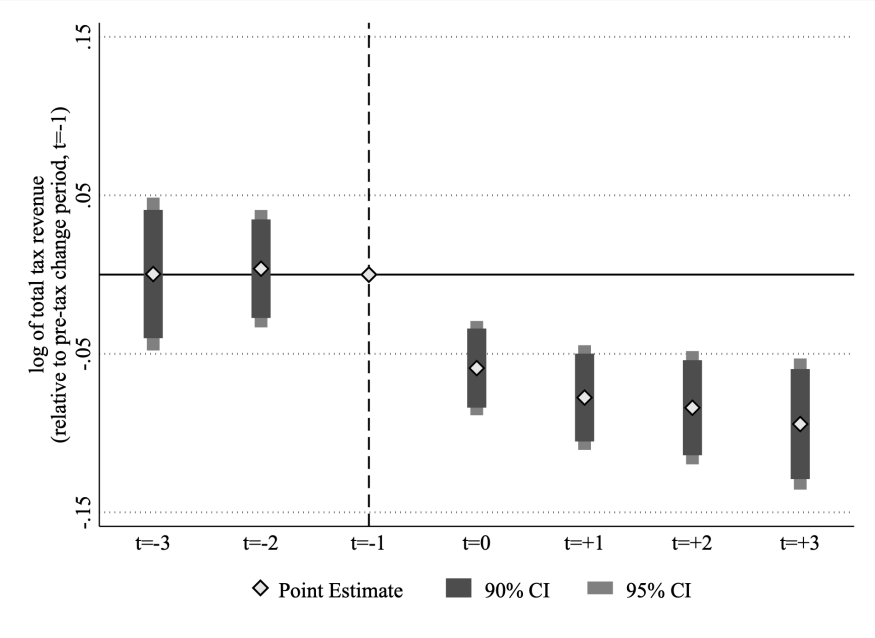
Table A7: Summary of Cross-sectional Results. Foreign vs Domestic aggressive MNC heterogeneity.

| **Panel A: Foreign aggressive MNCs** | | | | |
|---|---|---|---|---|
| | (1) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) ln(tot tax rev) |
| tax rate × 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) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) ln(tot tax rev) |
| tax rate × 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 sharemncchf is the share of aggressive foreign MNCs in all firms in that municipality. In Panel B, sharemncchd 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.

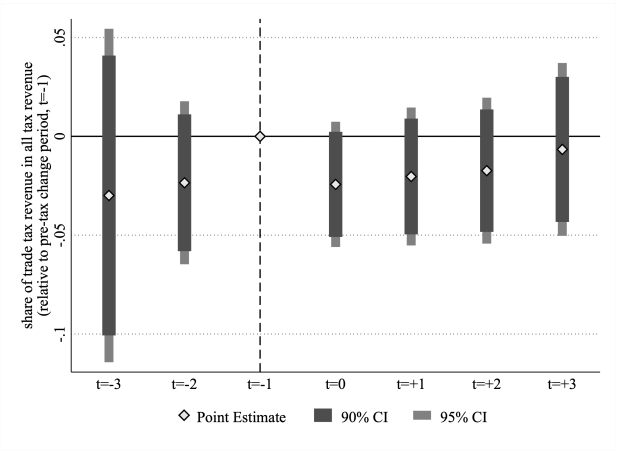
# D Additional municipal results

Figure A3: Dynamic effects of the tax rate increase on municipal revenue structure.

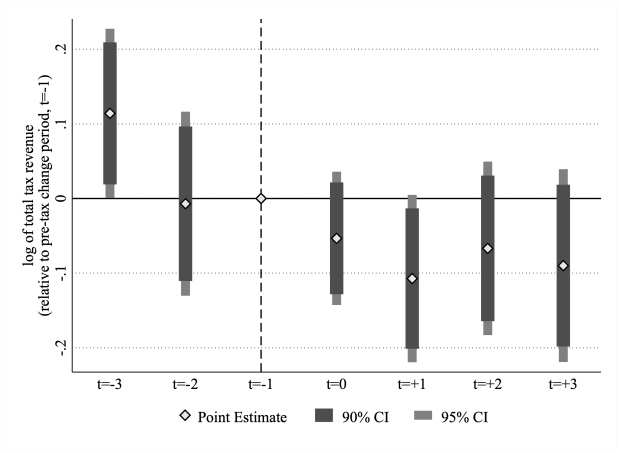



Note: This figure reports the dynamic effects of the tax rate increase on the logarithm of the total tax. We include the event study coefficient plots for municipalities with a high share of aggressive MNCs relative to those with a low share and relative to the control group from 3 years before the tax rate increase to 3 or more years after the tax rate increase. 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 the above median. 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. Here, we only include the period 2016 - 2019, as we only have data for total tax revenue at the municipality level for that period.

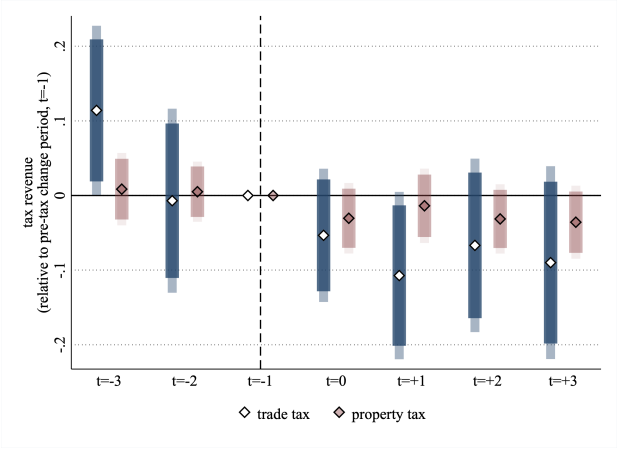
Figure A4: Dynamic effects of the tax rate increase on municipal revenue structure: placebo




(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 A8: Summary of Cross-sectional Results: static average across years.

**Panel A: Aggressive MNCs**

| | (1) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) ln(tot tax rev) |
|---|---|---|---|---|
| tax rate | 0.000*** | 0.004*** | -0.003*** | 0.002*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| tax rate × agg MNC share | -0.024 | -0.380*** | 0.303** | -0.210** |
| | (0.019) | (0.137) | (0.138) | (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) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) ln(tot tax rev) |
|---|---|---|---|---|
| tax rate | 0.000*** | 0.005*** | -0.003*** | 0.003*** |
| | (0.000) | (0.001) | (0.000) | (0.000) |
| tax rate × MNC share | -0.016* | -0.259*** | 0.082 | -0.164*** |
| | (0.009) | (0.066) | (0.057) | (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.

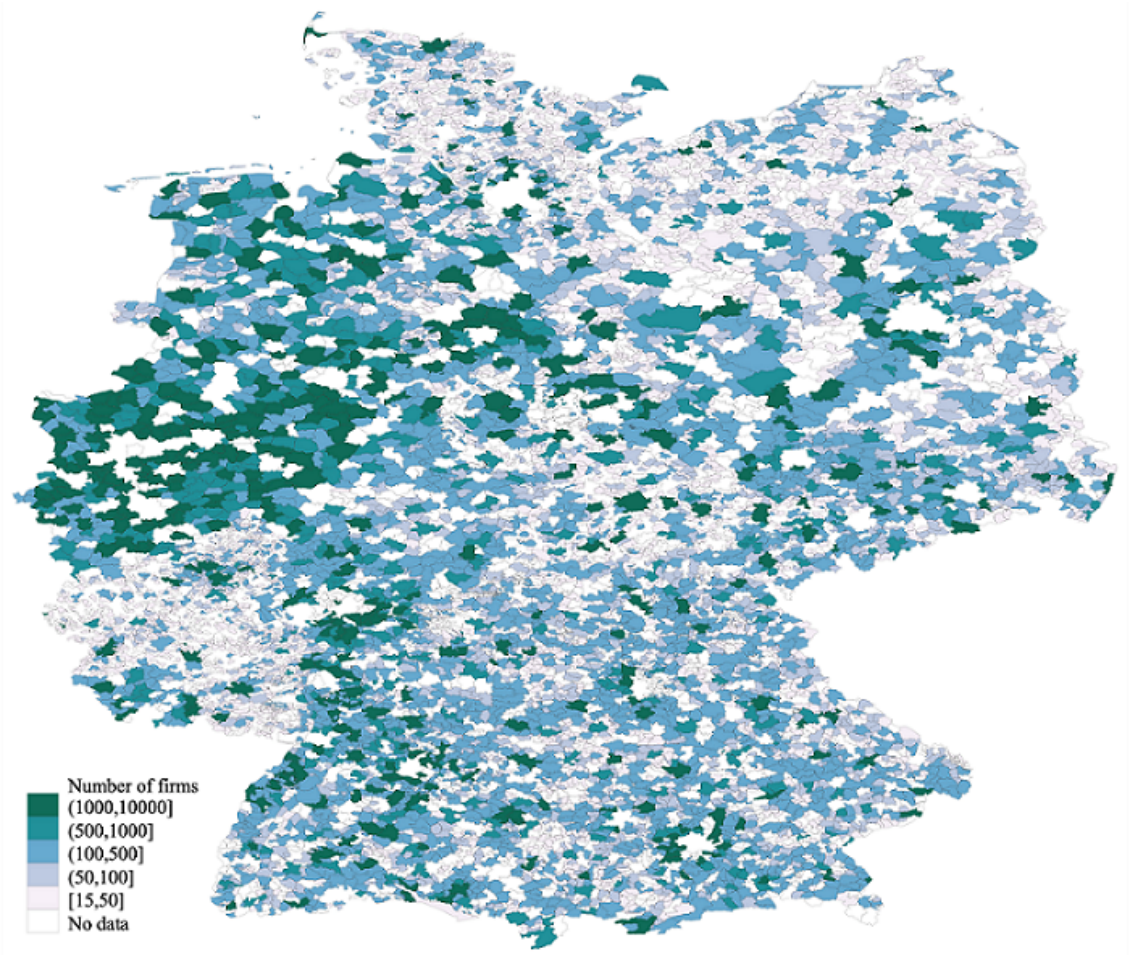
Table A9: Robustness of cross-sectional results: share of aggressive MNCs in all MNCs.

| | (1) trade tax share | (2) ln(trade tax rev) | (3) ln(prop tax rev) | (4) 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 |

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.

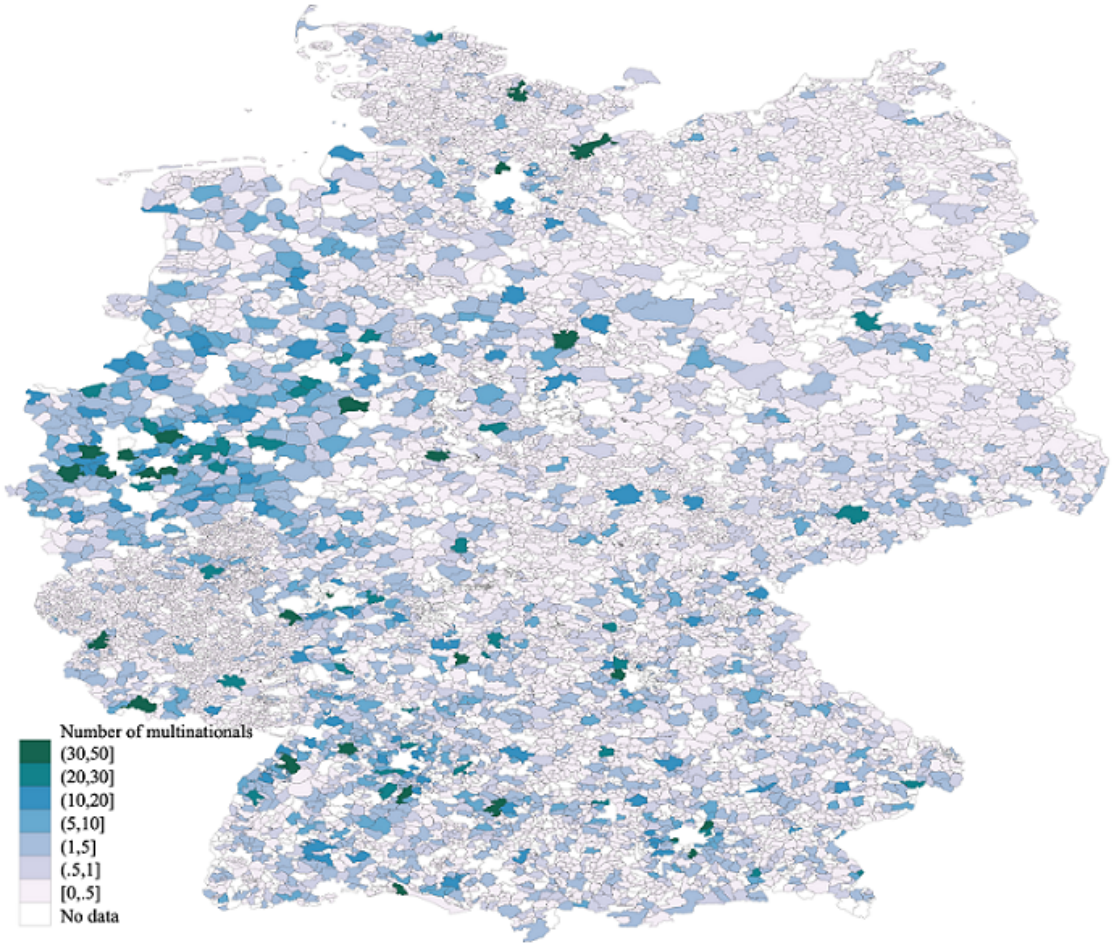
# E Maps

Figure A5: Number of firms across municipalities.



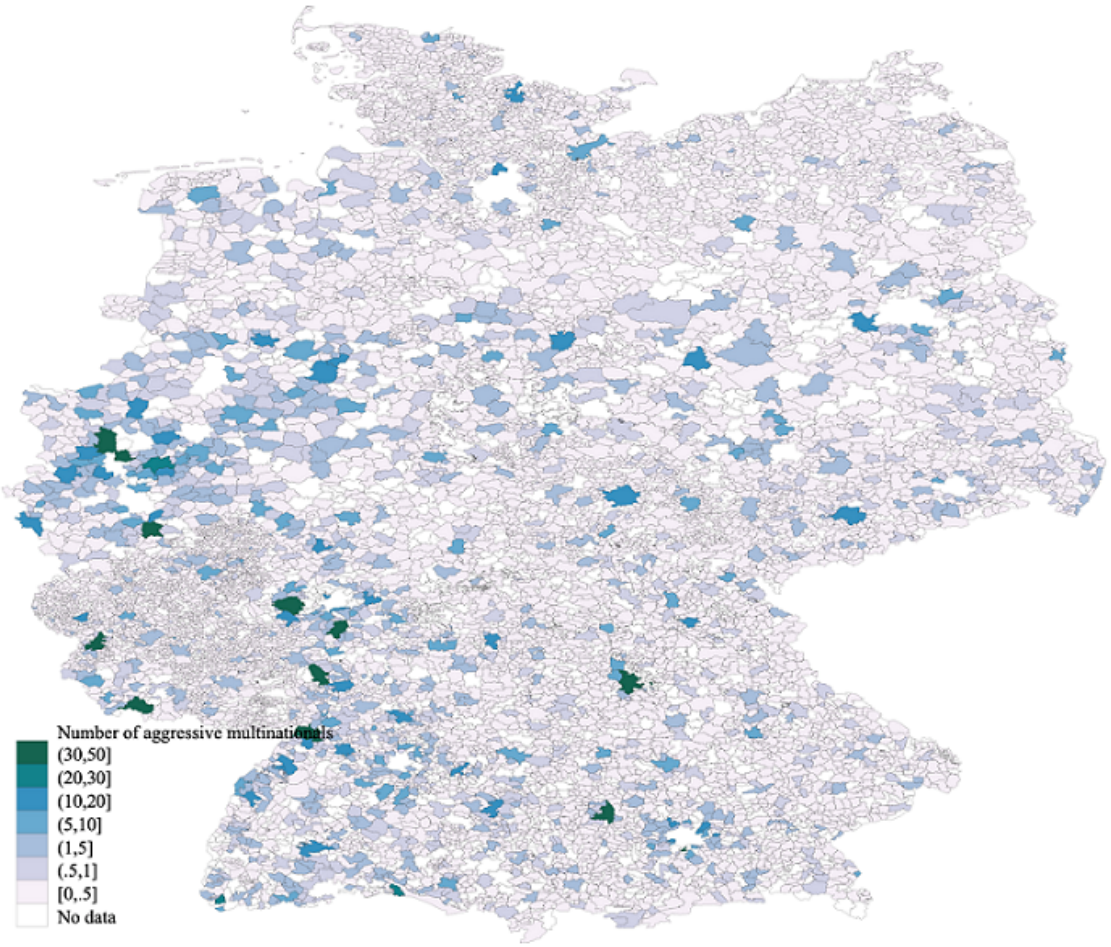

Note: Data from Orbis and German Statistical Office. This maps outlines all German municipalities and the number of firms in each from Orbis.

Figure A6: Number of multinationals across municipalities.



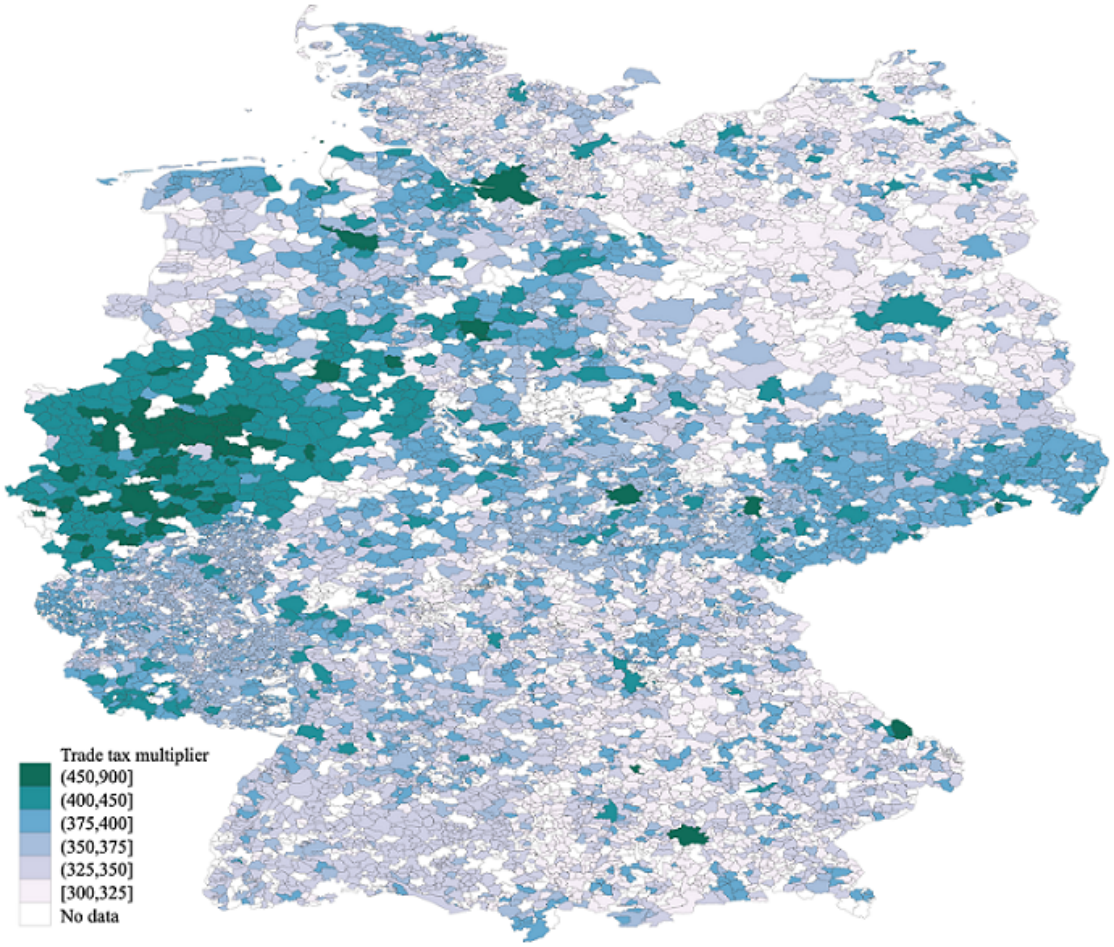

Note: Data from Orbis and German Statistical Office. This maps outlines all German municipalities and the number of multinationals in each from Orbis.

Figure A7: Number of aggressive multinationals across municipalities.



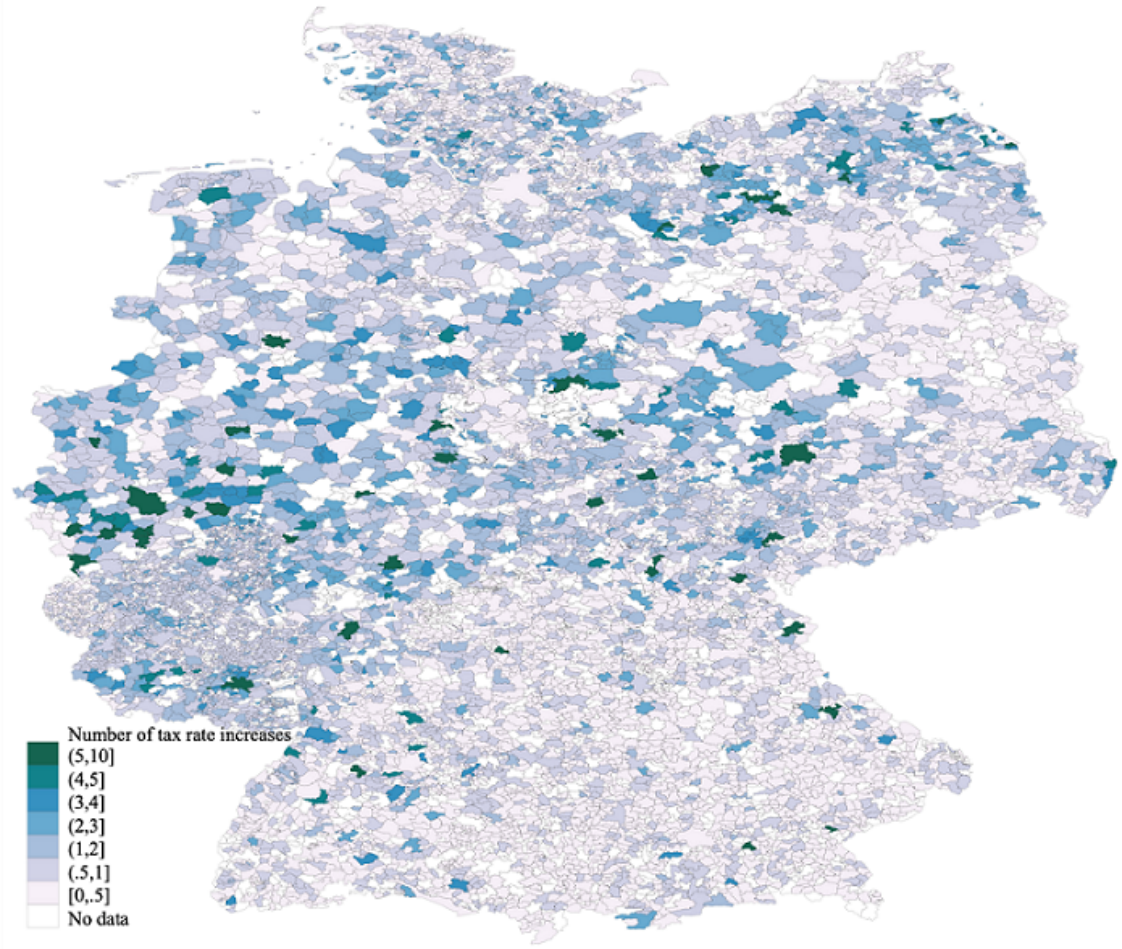

Note: Data from Orbis and German Statistical Office. This maps outlines all German municipalities and the number of aggressive multinationals in each from Orbis. Aggressive multinational subsidiary is defined as a subsidiary belonging to a firm that own a tax haven subsidiary as well.

Figure A8: Trade tax multipliers.




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

Figure A9: Number of trade tax rate increases.




Note: Data from German Statistical Office. This maps outlines all German municipalities and the number of times trade tax multipliers were increased across municipalities.