Effective Corporate Income Taxation and Corruption*

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October 29, 2023

Abstract

We show that effective corporate income taxes are lower in EU NUTS 2 regions where citizens perceive corruption to be comparatively more prevalent. We develop a new approach for calculating region-industry-year-specific empirical effective income tax rates (EEITRs) using firm-entity-level income statement data. Controlling for proxies for deductions that could legally be claimed (e.g., depreciation allowances, deduction of interest payments, potential for loss carryforwards, preferential treatment of patent revenues) and additional controls (e.g., regional GDP), as well as country-industry-year fixed effects, our benchmark model suggests that a one standard deviation increase in corruption leads to a statistically significant decrease in EEITRs of approximately 0.4 percentage points. From an economic point of view, this effect is sizeable given that the between-region within-country differences in corruption are significant. Our findings suggest more tax evasion in regions with high corruption via overstated tax-base deductions.

Keywords: Corporate income taxation, empirical effective tax rates, corruption, tax evasion

JEL classification: H25, H32, D73

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*Funding by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – FOR2783 – is gratefully acknowledged. The authors would like to thank Giacomo Brusco, Camila Cisneros, Sean Fahle, Anna Gumpert, Jaqueline Hansen, Michael Knaus, Wilhelm Kohler, Martin Ruf, and Andrea Tulli for helpful comments and suggestions.

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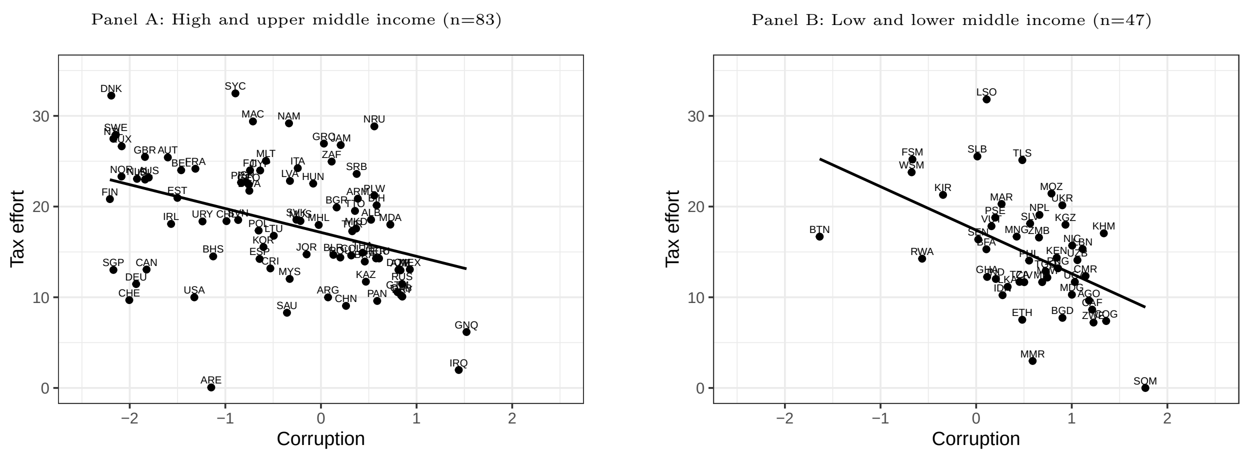
1. Introduction

The adverse effects of corruption on countries' ability to raise domestic revenue, the so-called fiscal capacity (Kaldor, 1963), have been extensively studied and documented in the context of the developing world.[1] Interestingly, however, a negative correlation between what is sometimes called tax effort, i.e., tax revenue as percentage of GDP, and corruption can also be found for developed countries, as can be seen in Figure 1. An important aspect to keep in mind with such correlations is that the interpretation of tax effort is generally ambiguous, as a comparatively low tax effort may be the result of either a generous tax code (including low statutory tax rates) or tax evasion, or a combination of both. Therefore, a meaningful analysis of the relationship between taxation and corruption requires controlling for all relevant aspects of the tax code.

Figure 1: ***TAX EFFORT AND CORRUPTION BY COUNTRY FOR DIFFERENT INCOME LEVELS IN 2018***

The figure depicts scatter plots of the country level variables tax effort (tax revenue as % of GDP) and a corruption measure for different income levels of the World Bank's classification system. The labels above to the dots depict the ISO 3 codes of the respective countries. The data refers to the year 2018, which is the last year for which the corruption measure is available. The line is fit by OLS (models include a constant). The tax revenue (% of GDP) variable is taken from the World Bank's *World Development Indicator Database*. Tax revenue refers to compulsory transfers to the central government for public purposes, excluding penalties, fines, and most social security contributions. The corruption measure is the so-called *Control of Corruption* measure from the World Bank's *Worldwide Governance Indicators* database and measures "the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests" (Kaufmann et al., 2011, p. 223). The corruption variable varies on an interval -2.5 to 2.5. Originally, it is constructed such that a higher value corresponds to less corruption (Kaufmann et al., 2011). The graphs depict the original measure multiplied by -1, such that a higher value indicates more corruption. Note that we exclude Croatia as it exhibits a tax effort of over 150%.



[1]See, e.g., Besley and Persson (2013, 2014), Bird et al. (2008), Ghura (1998).

In this paper, motivated by the findings in Figure 1, we analyze this relationship in the context of developed countries. More precisely, our analysis focuses on member countries of the EU. To manage complexity, we focus solely on corporate income taxation. Our research design exploits the fact that the tax code applies to all firms located in a given country equally, which allows us to base our identification on the variation between different regions of the same country. As a simple aggregation of income statement data shows, the regional variation in firm entities' total-tax-to-profit ratios is strong, even when comparing aggregates corresponding to the same industry and year, see Figure 2.[2] Noteworthy, regional patterns in the figure that hold for all depicted industries are, e.g., that the total-tax-to-profits ratio is substantially higher in the northern part of Italy, compared to its south, or that the ratio is higher in the Madrid region compared to Madrid's surrounding regions.[3]

One particular empirical challenge that we face lies in the fact that large-scale databases that provide financial accounting information, such as Bureau van Dijk's *Orbis*, only provide a single tax liability variable that includes for some countries not only the corporate income tax, but also other taxes (e.g., carbon taxes or property taxes). Therefore, simply analyzing the total-tax-over-profits ratio, which is depicted in Figure 2, would lead to measurement error. Other drawbacks of using standard effective tax rates in the tradition of backward-looking measures (see Sørensen, 2004) are that taxable profits (the tax base) are usually unknown and that they are measures of the average tax burden. However, for our study and the research question we aim to address, a measure of the effective marginal tax burden seems to be more meaningful. We thus propose a novel approach for calculating region-industry-year-specific empirical effective income tax rates (EEITRs) using *Orbis*. Our region-industry-year-specific EEITRs (i) are backward-looking, (ii) capture the marginal tax burden, (iii) and are endogenously determined based on an IV approach.

In a second step, we then examine the new EEITRs. We proxy legal income tax deduc-

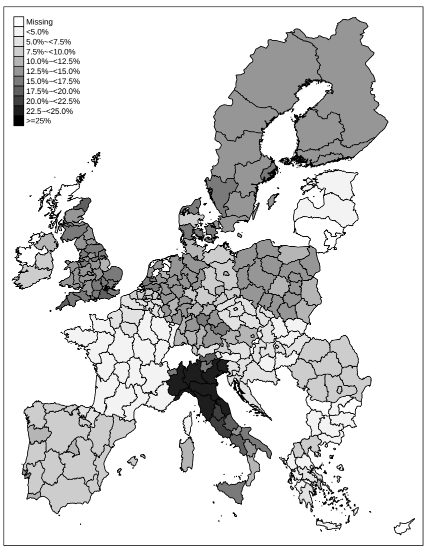
[2]More detailed descriptive statistics on the range of the regional aggregated tax-to-profit ratio are provided in Appendix 1.

[3]Note that the strong regional variation in Germany is mainly due to regional trade taxes that are added to the country-wide statutory tax rate. More detail on this is provided below.

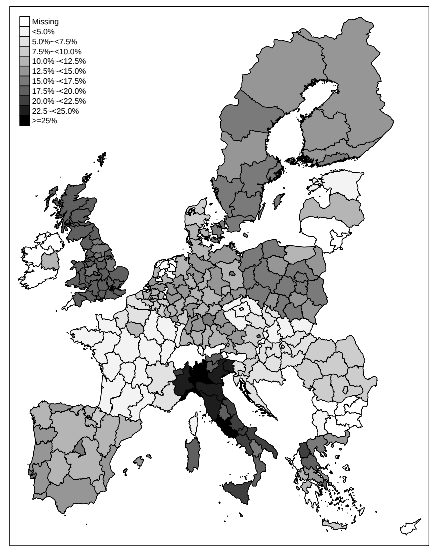
Figure 2: *MEDIAN OF THE RATIO TAX LIABILITY OVER EARNINGS BEFORE INTEREST, TAXES, DEPRECIATION, AND AMORTIZATION IN DIFFERENT NUTS 2 REGIONS IN 2013*

The figure depicts the median of the firm-entity-specific ratio tax liability over Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) for different NUTS 2 regions (version 2016) of the EU 28. The different panels depict the ratios corresponding to firm entities operating in different industries (NACE Rev. 2 sections). All plots correspond to data for the year 2013. Firm entities belonging to MNEs are excluded. Only observations with strictly positive EBITDA are used for the calculation. Observations of the depicted ratio in the top and bottom one percentile were excluded from the sample. A minimum of 25 firm entity observations per region and industry combination was required. The source of the data is *Orbis*. Maps plotted with the *tmap* package for *R* (Tennekes, 2018).

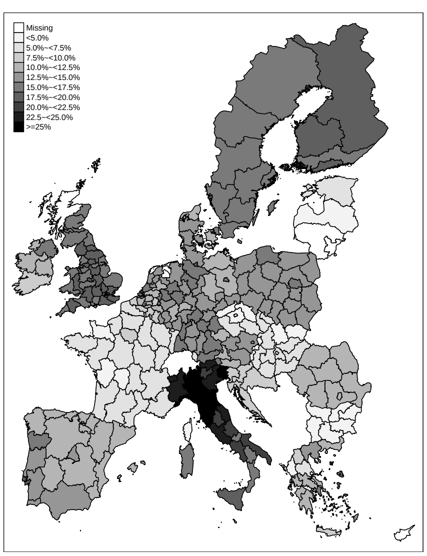
Panel A: Manufacturing



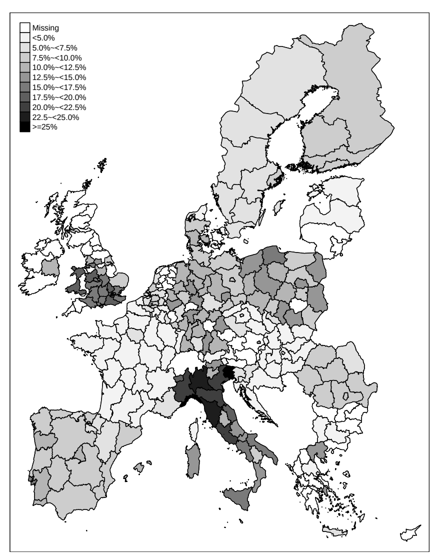
Panel B: Construction



Panel C: Wholesale and retail trade



Panel D: Transportation and storage



tions that firm entities may claim by combining information on firm entities from income statements, balance sheets, and patent records with information from countries' tax codes. Note that this is crucial even when comparing EEITRs within the same jurisdiction, as deductions – despite being calculated on the same legal basis – can vary in magnitude depending on individual firm characteristics such as asset structures, financing compositions, or R&D activities. Furthermore, loss carryforwards and loss carrybacks in combination with regional economic shocks may play a role in explaining regional differences in effective income taxation. Thus, controlling for tax-base determinants, additional controls (e.g., regional GDP), as well as country-industry-year fixed effects, allows us to find out if variation in a regional corruption measure contributes to explaining the variation in the EEITRs. Our results show that EEITRs are substantially lower in NUTS 2 regions where citizens perceive corruption to be more prevalent. More precisely, we find that a one standard deviation increase in corruption is associated with a statistically significant decrease in the EEITR of approximately 0.4 percentage points. This effect is economically substantial, given that several countries in our sample exhibit between regions differences in corruption of more than one standard deviation. Another interesting finding is that EEITRs are slightly higher in regions where survey results suggest that the tax morale is higher.[4]

Conditional on legal ways to decrease the tax base, our results imply that the lower EEITRs in high-corruption regions are likely the result of tax evasion, i.e., the illegal and intentional actions taken by firms to reduce their legally due tax obligations. Our findings particularly suggest that tax evasion is carried out via overstated deductions.

The study most closely related to ours is the one by Alm et al. (2016). This paper uses firm-level survey data from the World Bank to measure the degree of tax evasion as the share of sales reported for tax purposes.[5] Using instrumental variable methods, they

[4]The latter finding is in line with the previous literature that shows that tax morale is a determinant for tax evasion, see, e.g., Richardson (2006), Torgler (2007), or Torgler et al. (2008).

[5]Note that this survey question was not asking the surveyed firm directly about its own sales ratio reported for taxes, but instead asked for an estimate of this ratio for a "typical" firm in the same area of business. See Alm et al. (2019) for a brief discussion of resulting potential issues regarding this surrogate.

find that higher corruption, measured by tax related bribes that are paid, leads to lower reported sales ratios. Using similar data but focusing on a limited number of transition countries, Uslaner (2010) also finds that the decision to pay taxes is negatively affected by corruption.[6] Other studies that use the same survey data from the World Bank are Alm et al. (2019), who show that financial constraints are a determinant of tax evasion, and Beck et al. (2014), who find that there is less tax evasion in countries with better credit information–sharing systems and higher branch penetration. Best et al. (2015) evaluate tax evasion behavior by firms in the context of the Pakistani tax system that – depending on the expected tax liability – taxes either profits or turnover. DeBacker et al. (2015) analyse confidential audit data from the Internal Revenue Service and find that owners from countries with more pronounced corruption norms tend to evade more taxes in the United States. Carrillo et al. (2017) evaluate the effectiveness of combating tax evasion using third-party information to verify tax reports. They evaluate an Ecuadorian policy intervention in which firms were notified about revenue discrepancies and find that most firms do not react and some adjust their reporting to match the discrepancy amount. Doerr and Necker (2021) conduct a field experiment in which they compare offers for home improvement services on online markets for the cases where an invoice is requested or not. They find that particularly in markets that allow to sell anonymously, the willingness to evade taxes is high. In the context of corporate taxation, many studies evaluate the effectiveness of taxpayer audits to combat tax evasion. A recent example is Bergolo et al. (2023). This paper finds that letters announcing audits by the tax authority in Uruguay significantly affec tax compliance by firms regarding the value-added tax. Based on randomized experiments conducted in Chile, Pomeranz (2015)investigates the role that third-party information plays for enforcement of the value-added tax. Another paper that evaluates the effects of audits is Lediga et al. (2020) focusing on spillover effects from tax audits in South Africa. They find that the tax

[6] Theoretical contributions analysing the relationship between corruption and taxation include, e.g., Brueckner (2000), Flatters and MacLeod (1995), and Litina and Palivos (2016).

liability of unaudited firms in the same local network as audited firms increases.[7]

To the best of our knowledge, this is the first paper to investigate the effect of corruption on backward-looking tax rates. We suggest a new approach of calculating an effective marginal tax rate at the region-industry-year level in the European Union. Our results indicate that, conditional on legal tax base determinants, corruption negatively affects effective tax payments. Conditional on legal tax base effects, the finding that EEITRs are affected by corruption can be interpreted as evidence that tax evasion at the firm level is often associated with overstated deductions. Our findings also have policy implications as fighting regional corruption should increase fiscal capacity. An efficient strategy to more efficiently raise tax revenue may therefore be to first invest in institutions. Beyond the revenue perspective, this seems to be favorable for many reasons and it can be done without raising statutory tax rates.

The remainder of this paper is structured as follows. Section 2 presents the institutional setting. Section 3 describes the estimation strategy as well as the data used to carry out the analysis. The results are discussed in Section 4. Finally, Section 5 concludes.

2. Institutional Setting

Suppose firm entity j's Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) in period t amount to π_{jt}. Filing its tax return, j makes use of deductions determining taxable profits (the tax base) π_{jt}^{tax}, which is then taxed at the respective country c's statutory income tax rate τ_{ct} in case $\pi_{jt}^{tax} > 0$; if $\pi_{jt}^{tax} \leq 0$, j's tax burden is equal to zero.

[7]Other papers investigating the effect of tax audits include, e.g., Advani et al. (2021), DeBacker et al. (2018), and Kleven et al. (2011). Furthermore, Xu et al. (2019) investigate how regional political corruption levels impact auditor behavior in the United States.

The income tax liability, $ITAX_{jt}$, is hence given by

$$ITAX_{jt} = \begin{cases} \tau_{ct}\pi_{jt}^{tax} & \text{if } \pi_{jt}^{tax} > 0, \\ 0 & \text{if } \pi_{jt}^{tax} \leq 0. \end{cases} \quad (1)$$

The instruments that a firm entity may use to adjust π_{jt} to the final tax base π_{jt}^{tax} are defined in the respective country's tax code. Generally, countries grant depreciation allowances for certain assets and allow for the deduction of interest payments on debt. Furthermore, some countries grant preferential tax treatment for firm activities associated with R&D or innovation (e.g., "patent boxes"). Other tools to adjust the current year's tax liabilities are loss carryforwards, i.e., applying losses from previous periods to the current period's income, and loss carrybacks, i.e., applying current losses to a previous year's tax return for an immediate refund of previously paid taxes.[8] In the context of MNEs, there may be additional taxes (e.g., withholding taxes) when income is repatriated to foreign parent companies and when the country where the parent company is located seeks to tax worldwide income.

It is important to note that due to reasons of confidentiality, it is generally not possible to observe individual firm entities' income tax returns and the composition of the deductions that are claimed. However, it is possible to combine observable firm entity information with tax code regulations to proxy the deductions that could *legally* be claimed. In this paper, we control for such proxies when analysing regional empirical effective income tax rates (EEITRs), i.e., empirical measures that state the aggregated relationship between the income tax liability and the EBITDA of firm entities located in a given region. In particular, we are interested in whether regional corruption can contribute to explaining variation in EEITRs after controlling for the proxies for legal deductions. Based on results from the previous literature (Alm et al., 2016; Uslaner, 2010), we expect EEITRs to be lower in

[8]Note that in the context of loss carrybacks, the tax liability TAX_{jt} may be negative in case $\pi_{jt}^{tax} \leq 0$ – a special case that is not captured by (1).

regions where corruption is more prevalent, as such environments have the potential to facilitate tax evasion. For instance, entities located in high corruption regions may be more likely to successfully collude with or bribe officials. In our framework, we may think of tax evasion as illegally overstating deductions, which decreases the tax base and therefore the EEITR. It is important to note that we are not able to evaluate if EBITDA, used to calculate the EEITRs, is itself correctly reported. In fact, it is a well-documented tax evasion strategy to underreport sales or profits to the tax authorities (see, e.g., Alm et al., 2016, 2019; Beck et al., 2014; Doerr and Necker, 2021; Uslaner, 2010). The results by Alm et al. (2016) and Uslaner (2010) suggest that tax evasion via underreporting sales figures is more pronounced in high corruption locations, which suggests that our results should be interpreted as lower bounds.

3. Empirical Approach

3.1. Estimation Strategy

To address our main research question – how corruption affects the EEITR – we run OLS regressions at the NUTS 2 region, NACE Rev. 2 section,[9] and year level. The distinction between industries is crucial, as different industries have been shown to use fundamentally different typical financing and asset structures. This is tax-relevant since interest payments on debt are tax-deductible and depreciation allowances differ between asset types (see, e.g., Fabling et al., 2014; Mc Auliffe et al., 2023; Steinmüller et al., 2019). Furthermore, different industries in the same country may be exposed to heterogeneous shocks in a given year. This matters for the magnitude of EEITRs, as consequently the subsequent potential for adjustments of the tax base using loss carryforwards and loss carrybacks differs. Using industry-specific EEITRs as well as tax base determinants that account for industry heterogeneity ensures that the results are not contaminated by differences in industry structures

[9] Note that we shall henceforth use the term "industry" for the sake of simplicity to denote NACE Rev. 2 sections.

between different regions. Formally, the equation that we estimate states as follows:

$$EEITR_{rit} = \beta Corruption_{rt} + \boldsymbol{\psi} \boldsymbol{X_{rit}} + \boldsymbol{\zeta} \boldsymbol{X_{rt}} + c_{cit} + \varepsilon_{rit}. \tag{2}$$

The indices c, r, i, and t denote country, region, industry, and year, respectively. $EEITR_{rit}$ is the region-industry-year-specific EEITR. β is the coefficient on our region-year-specific corruption measure, $Corruption_{rt}$. We further control for a set of region-industry-year-specific variables, contained in $\boldsymbol{X_{rit}}$, as well as for region-year-specific variables, contained in $\boldsymbol{X_{rt}}$. The corresponding parameter estimates are collected in the vectors $\boldsymbol{\psi}$ and $\boldsymbol{\zeta}$, respectively. These sets of controls include different determinants of the tax base and general economic measures. We further include country-industry-year fixed effects, denoted by c_{cit}, to control for level differences that are due to factors that equally impact all regional EEITRs corresponding to the same country, industry, and year.[10] Finally, the error component is denoted by ε_{rit}.

3.2. Data and Sample

To carry out the analysis we use data from a number of different sources. In the following, the data preparation, variable construction, as well as the resulting sample are described. Note that we generally exclude *Orbis* observations corresponding to firm entities that are part of an MNE, as we are not able to accurately observe tax-relevant profit shifting in the data (see discussion above). That is, all results presented are based on stand-alone firms and national groups.[11]

[10] Note that several years of various key variables used in the analysis, including our corruption measure, are imputed using information from observed years (see Section 3.2). Furthermore, the *Orbis* that we use to calculate various variables is highly unbalanced, with the general tendency that more firms are included each year. Therefore, a panel analysis with, e.g., region or region-industry fixed effects that exploits variation across time is not feasible in a sensible way.

[11] Note that we identify MNEs in *Orbis* using the information on the Global Ultimate Owner (GUO). We define an MNE as a corporate group with at least two firm entities that have the same GUO and are located in different countries. In Appendix 4, we provide our results table using data that also includes MNEs. The results including the MNEs are highly similar to the ones where they are excluded. This may be due to the fact that the number of MNEs in our sample is small.

Empirical Effective Income Tax Rate ($EEITR_{rit}$): In the literature, empirical tax rates are often calculated from income statement data as total taxes paid relative to a pre-tax profit measure, as also done in the introduction of this paper.[12] While this ratio holds valuable information, it has to be noted that the total tax liability item from large-scale databases such as *Orbis* is computed using definitions that vary between countries. In Appendix 3, the country-specific definitions of the *Orbis* tax variable that are provided in the official documentation of the data provider (Bureau van Dijk, 2011) are listed for the EU 28 countries. While for some countries, the variable is defined to include corporate income taxes only, for other countries the variable also includes "other taxes" besides income taxes.[13] These "other taxes", which may include, e.g., carbon taxes or property taxes, are, however, not of interest for our analysis, as we do not observe their tax bases (e.g., carbon emissions or property values) and can therefore make no statement about whether the correct amount was paid or not. Instead, we are interested in constructing an EEITR that depicts the relationship between income tax payments and profits only. Using *Orbis*, we propose a new approach for obtaining marginal EEITRs. The way we calculate the EEITRs directly exploits the fact that the for some countries not directly observed income tax payments contained in the total tax liability variable are the only tax payments that directly vary with and depend on profits. To be precise, our approach defines the EEITR as the marginal effect of a one unit increase in the EBITDA on the tax liability TAX for firm entities that report a strictly positive EBITDA in a given year.[14] The estimation of these marginal effects is carried out

[12] A recent and extensive overview of such measures is provided in Janský (2023).

[13] For some EU countries, the official documentation merely provides definitions that do not specify the type(s) of taxes included in the variable, such as "tax" or "taxation". The heterogeneity in definitions in *Orbis* may be due to the fact that Bureau van Dijk works with different data providers depending on the country, see Bureau van Dijk (2011).

[14] Note that both the EBITDA as well as the tax liability numbers from *Orbis* stem from the entities' income statements and must not coincide with the profit reported to the tax authority and the true tax liability that they are obliged to pay, respectively. However, since the EBITDA is based on (billed) real economic transactions, we do not expect a systematic bias. This argument could not be made for, e.g., the EBIT or other profit measures from the income statement that already account for depreciation, since the amounts of depreciation on the income statement and on the tax return may differ due to differences in tax and financial accounting (see, e.g., Graham et al., 2012). Concerning the total tax liability variable form *Orbis*, Arulampalam et al. (2012) argue that it is a good approximation for the true tax obligation, especially when only focusing on national firms, as we do in this paper.

using the following regression, which is separately run for every region, industry, and year combination:

$$\frac{TAX_{jt}}{EMPL_{jt}} = \beta_1 \mathbb{1}(EBITDA_{jt} > 0) \cdot \frac{EBITDA_{jt}}{EMPL_{jt}} + \beta_2 \mathbb{1}(EBITDA_{jt} \leq 0) + \varepsilon_{jt}. \qquad (3)$$

The indices j and t denote firm entity and year, respectively. TAX_{jt}, $EMPL_{jt}$, and $EBITDA_{jt}$ denote the *Orbis* variables tax liablity, number of employees, and EBITDA, respectively. $\mathbb{1}(EBITDA_{jt} > 0)$ is an indicator function equal to one if the EBITDA of j in year t is strictly positive and zero if not. $\mathbb{1}(EBITDA_{jt} \leq 0)$ is equal to one if the EBITDA of j in t is non-positive and zero if not. Note that β_1 and β_2 are the coefficients we are interested in, with β_1 being the EEITR corresponding to the region, industry, and year of the respective estimation sample. Finally, ε_{jt} denotes the error component.

The interaction term $\mathbb{1}(EBITDA_{jt} > 0) \cdot (EBITDA_{jt}/EMPL_{jt})$ in (3) is endogenous due to both simultaneity and correlation with omitted variables. The simultaneity issue arises due to the fact that the precise magnitude of the EBITDA is jointly determined with TAX_{jt}. Potential variables that are omitted that may be correlated with $\mathbb{1}(EBITDA_{jt} > 0) \cdot (EBITDA_{jt}/EMPL_{jt})$ include taxes other than the income tax, such as carbon or property taxes, as well as any tax-relevant deductions, including interest payments, depreciation, or losses from previous periods.

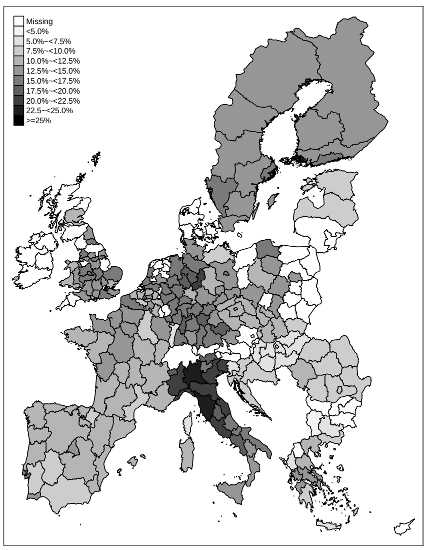
To obtain unbiased estimates of β_1, we construct an instrument for every firm entity observation j in the given year t, which we define as the mean of the ratio EBITDA/EMPL over all firm entities, excluding j itself, that operate in the same 3-digit industry and the same country as j in year t and report a strictly positive EBITDA. We argue that the exclusion restriction, which requires there to be no direct impact of the instrument on $TAX_{jt}/EMPL_{jt}$, is satisfied, as for the determination of j's tax liability only j's own tax base is of relevance.

To mitigate the influence of outliers we drop the top and bottom one percentile of the firm-entity-specific ratios TAX/EMPL, EBITDA/EMPL, as well as TAX/EBITDA. Furthermore,

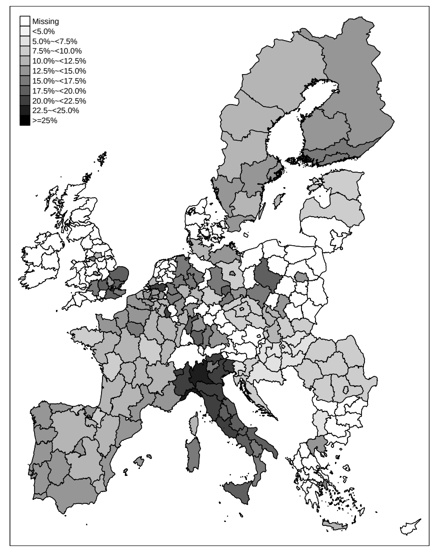
Figure 3: *EMPIRICAL EFFECTIVE INCOME TAX RATES IN DIFFERENT NUTS 2 REGIONS IN 2013*

The figure depicts EEITRs for different NUTS 2 regions (version 2016) of the EU 28. The different panels depict the EEITRs corresponding to firm entities operating in different industries (NACE Rev. 2 sections). All plots correspond to data for the year 2013. Firm entities belonging to MNEs are excluded. The calculation of the EEITRs is detailed in Section 3.2. Maps plotted with the *tmap* package for *R* (Tennekes, 2018).

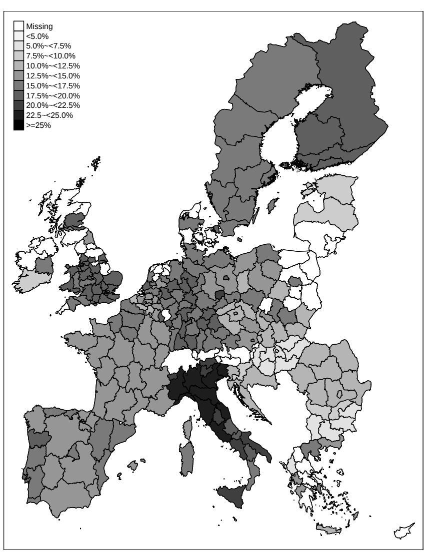
Panel A: Manufacturing



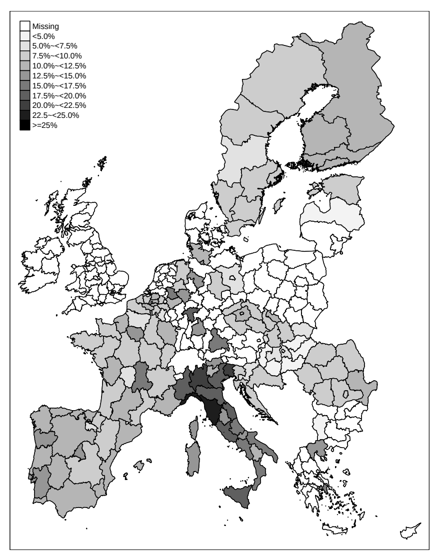
Panel B: Construction



Panel C: Wholesale and retail trade



Panel D: Transportation and storage



to ensure meaningful estimates are obtained, we require a minimum number of 50 firm entity observations per region, industry, and year combination. The time span we use for the estimation is 2009 to 2018, since these are the years of our *Orbis* sample with the most complete coverage. Using 2SLS estimation, we obtain 22,389 EEITRs for 18 industries and 261 NUTS 2 regions that span across 25 EU countries.[15] For 99.97% of the regressions, we find a strong first stage[16] and 99.12% of the EEITRs are in the "plausible range" $(0; \tau_{ct}]$, with τ_{ct} denoting the statutory income tax rate in country c in year t. In Figure 3, we depict the EEITR for the same industries and for the same year for which Figure 2 depicts the median of the total-tax-liability-to-EBITDA ratio. It can be seen that the regional patterns are very similar in the two figures.[17] This observation is supported by the high unconditional correlation of the two measures which amounts to 0.84.

In a last step, we analyse the region-industry-year-specific EEITRs using the analysis of variance (ANOVA) approach. The ANOVA setup allows us to quantify how much of the variance in the EEITRs is attributable to the country level (i.e., the national tax codes) and the industry level.[18] The simple ANOVA model that we use has the form

$$EEITR_{rit} = \alpha + \mu_c + \lambda_i + \theta_t + \eta_{rit}. \tag{4}$$

$EEITR_{rit}$ is the region-r-industry-i-year-t-specific EEITR; α denotes the constant. Country-, industry-, and year-specific sets of dummy variables are contained in μ_c, λ_i, and θ_t, respectively. η_{rit} is the remainder component which is not attributable to either countries, industries, or years. We denote the total variance in $EEITR_{rit}$ as SS_{EEITR} and

[15]The three NACE Rev. 2 sections for which we do not obtain any EEITRs due to data coverage reasons are *O Public administration and defence; compulsory social security*; *T Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use*; as well as *U Activities of extraterritorial organizations and bodies*. The EU countries without any coverage are Cyprus, Lithuania, and Malta.

[16]We consider the first stage of a regression strong, if the coefficient estimate on the instrument is different from zero at a significance level of 10 percent. The tests are based on robust standard errors.

[17]Note that the EEITR exhibits more regions with missing values since the minimum number of observations is set higher for the EEITR calculation compared to the calculation of the median of the ratio total tax liability to EBITDA.

[18]Note that the setup of the ANOVA broadly follows Egger et al. (2009).

the partial sums of squares of the country-, industry-, and year-effects as SS_μ, SS_λ, and SS_θ, respectively. The model's residual sum of squares is SS_η. Note that it holds that $SS_{EEITR} = SS_\mu + SS_\lambda + SS_\theta + SS_\eta$. The results of the ANOVA in Table 1 suggest that the sums of squares of the country effects, SS_μ, contribute to SS_{EEITR} in a major way ($SS_\mu/SS_{EEITR} = 42.57\%$). This finding suggests that national tax codes are the main contributors to the variation in the EEITRs. The industry effects play a smaller – nonetheless sizeable – role with $SS_\lambda/SS_{EEITR} = 21.43\%$. It is important to note that the R^2 of the model, which is given by $(SS_\mu + SS_\lambda + SS_\theta)/SS_{EEITR}$, amounts to 64.8% only. This suggests that idiosyncratic effects at the regional level also play an important role for explaining the variance in our EEITRs, which corroborates our approach of identifying the effect of corruption on EEITRs via within country-, industry-, and year-variation.

Table 1: *ANALYSIS OF VARIANCE OF REGION-INDUSTRY-YEAR-SPECIFIC EEITRs*

The table depicts analysis of variance (ANOVA) results of the region-industry-year-specific Empirical Effectictive Income Tax Rates ($EEITR_{rit}$) that are calculated in Section 3.2. The ANOVA is based on 22,389 observations.

	Partial sum of squares	Degrees of freedom	F-statistic	p-value
Country effects	23.039	24	1103.79	0.000
NACE Rev. 2 section effects	11.596	17	784.35	0.000
Year effects	0.059	9	7.57	0.000
Model	35.700	50	820.99	0.000
Residual	19.427	22,338		
Total	55.127	22,388		
R^2	0.648			

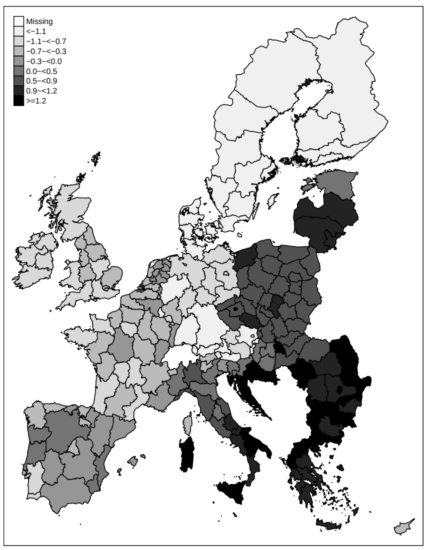
Corruption ($Corruption_{rt}$): The regional corruption measure, which is the variable we are mostly interested in, is taken from the *European Quality of Governance Index* (EQI) database. The corruption measure of the EQI data aims to capture citizens' perceptions and experiences with corruption and is based on a set of survey questions that could be answered using a numeric scale (for details, see Charron et al., 2022). It is important to note that the survey questions, on which the corruption measure is based on, do not specifically ask about tax evasion behavior of firms located in the given region but instead focus on corruption in the context of the local public school system, the public health care system, and the police force (Charron et al., 2022). Therefore, and since the actual tax payments of local firms are generally not public knowledge, we argue that the corruption measure is exogenous in our regression setup. For our purpose, we use all four previous waves of the EQI for the years 2010 (Charron et al., 2014), 2013 (Charron et al., 2015), 2017 (Charron et al., 2019), and 2021 (Charron et al., 2022). The data is provided in a balanced panel spanning across 220 regions of all EU 28 countries.[19] For Belgium, Germany, and the UK ,the corruption measure is provided at the NUTS 1 level. For all other countries the measure is provided at the NUTS 2 level. A graphical illustration of the survey measures is provided in Figure 4. Note that the measure is standardized to have a mean equal to zero and a standard deviation of one across the sample. Further note that we adjust the measure such that a higher value corresponds to a higher perceived corruption level. At first glance, it is very apparent that the southern and eastern EU countries have the highest perceived levels of corruption. The Scandinavian countries as well as Germany and Austria, on the other hand, are among the countries with the lowest corruption levels. The ordering of the countries seems fairly time consistent between the waves, with the exception of the Baltic states that exhibit decreasing levels of corruption over time. Another interesting observation that we exploit in our empirical strategy is the fact that there is a lot of within country and year variation. The country with the most pronounced within-country differences is Italy, with its moderate corruption levels in the north and very high corruption levels in the south. In 2010, the difference between the Italian NUTS 2 regions with the highest corruption value (Apulia) and the lowest corruption value (South Tyrol) amounts to 2.775 standard deviations. Other countries that have within country and year differences of more than one standard deviation in one or more years are Bulgaria, France, Portugal, Romania, and Spain. To be able to carry out our analysis of the EEITRs with more years than the ones in which the surveys were conducted, we linearly interpolate missing years between the

[19]Note that due to Brexit, the UK is not covered in the 2021 wave.

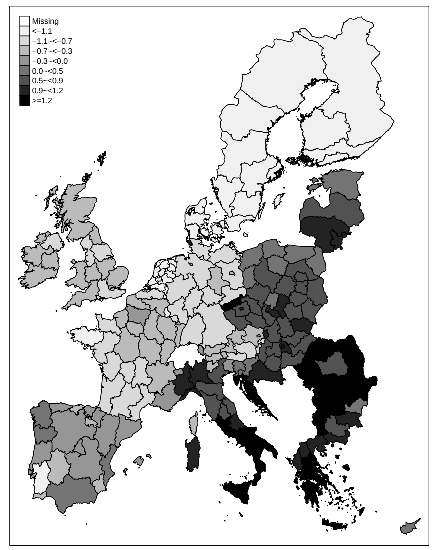
Figure 4: *REGIONAL CORRUPTION SURVEY MEASURE FOR EU COUNTRIES*

The figure depicts the corruption measure of the *European Quality of Governance Index* (EQI). The different panels depict different waves of the survey. For Belgium, Germany, and the UK the measure is depicted at the NUTS 1 level. For all other 25 EU countries the measure is depicted at the NUTS 2 level. There is no data available for the UK in 2021. The measure is standardized to have a mean equal to zero and a standard deviation of one. Further note that the raw measure provided by the EQI database is multiplied by -1, such that a higher value corresponds to a higher perceived corruption level. Maps plotted with the *tmap* package for *R* (Tennekes, 2018).

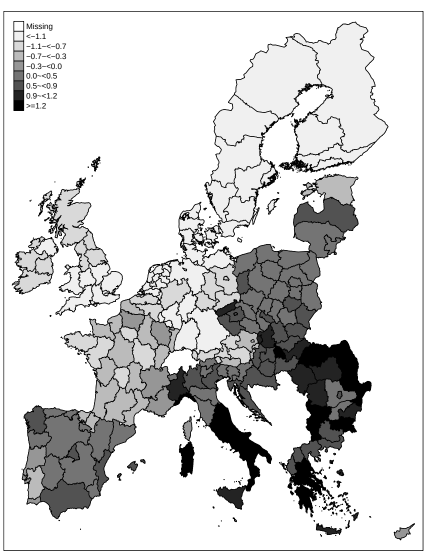
Panel A: 2010



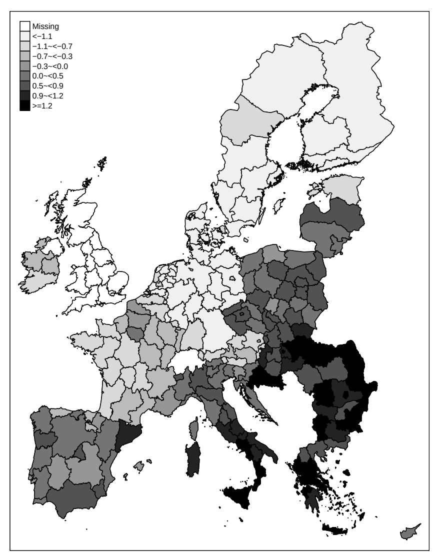
Panel B: 2013



Panel C: 2017



Panel D: 2021



survey years. While we do think that this is a legitimate imputation approach given the moderate variation of individual regions between waves, we do also carry out our analysis using only the observed years.[20]

Statutory income tax rate (τ_{ct} or in the case of Germany τ_{rt}): Since our regression setup controls for country-industry-year fixed effects, country-year-specific variables such as the statutory tax rate, denoted by τ_{ct}, generally drop out. However, in the case of Germany, the statutory income tax rate varies across regions. More precisely, in addition to the country-wide statutory tax rate, each German municipality (*Gemeinde*) sets their trade tax (*Gewerbesteuer*), which is added to the country-wide rate to obtain the final, municipality-specific income tax rate. For our purpose, we aggregate the municipality-specific tax rates to the NUTS 2 level by taking population-weighted averages across all municipalities located in a given NUTS 2 region. We denote the resulting NUTS-2-level statutory tax rates for Germany by τ_{rt}. The data on the region-specific tax rates for Germany is obtained from the Research School of International Taxation's (RSIT) *International Tax Institutions* (ITI) database (Wamser et al., 2023). The municipality-level population data is obtained from the Federal Statistical Office of Germany.

Net present value of depreciation allowances (δ_{rit}): Our EEITRs are based on the EBITDA, i.e., a raw profit measure that does not take asset depreciation and interest deductions into account. As reasoned above, the choice of this profit variable seems to be most adequate for the purpose of this paper, also because depreciation information may differ between the available financial accounting data and the unobserved tax returns due to differences in the respective accounting rules and practices (Graham et al., 2012). We control for the net present value (NPV) of depreciation allowances per unit of investment. This measure accounts for asset depreciation that could legally be claimed and is constructed by combining country-level tax code information with region-industry-specific asset and financing structures. Note that using time-constant rather than time-varying asset and financing structures

[20] We find that the results with and without the imputed years are highly similar (see Section 4).

ensures that the NPVs of depreciation allowances are exogenous, as they do not capture dynamic tax-planning behavior of firm entities (Mc Auliffe et al., 2023). For the construction of the measure, we distinguish two financing modes, financing via retained earnings and debt financing, and seven different asset categories: Buildings, Machinery, Office equipment, Computer equipment, Intangible fixed assets, Vehicles, and Inventory. Formally, the NPVs of depreciation allowances can be stated as follows:

$$\delta_{rit} = ES_{ri} \sum_{a=1}^{7} w_{ari} \cdot A_{act}^{E} + DS_{ri} \sum_{a=1}^{7} w_{ari} \cdot A_{act}^{D}. \tag{5}$$

A_{act}^{E} and A_{act}^{D} denote the NPV of depreciation allowances for an investment in asset type a in country c in year t that is purely financed through retained earnings or debt financing, respectively. They are obtained from the RSIT's *ITI* database (Wamser et al., 2023). It is important to note that these asset- and financing-mode-specific NPVs of depreciation allowances are determined purely by the national tax codes and are therefore identical for all firm entities located in a given country c in year t. The region-industry-specific variation in the δ_{rit}'s stems from the typical asset and financing structures, i.e., from taking into account that firm entities that are located in different regions and operate in different industries, differ in terms of their typical asset and financing compositions. Formally, in (5), this heterogeneity enters the equation via the region-industry-specific shares of the different asset types that the typical asset structure is comprised of, w_{ari}, as well as the via region-industry-specific shares of financing through retained earnings, ES_{ri}, and debt, DS_{ri}.[21] To determine DS_{ri}, we first calculate region-industry-year-specific long-term debt ratios for each year of the sample period (2009 to 2018) using *Orbis*.[22] These year-specific debt ratios are then aggregated to the time-constant DS_{ri}'s by taking unweighted averages over all years, similar to Mc Auliffe et al. (2023). ES_{ri} is then obtained by subtracting DS_{ri} from unity. The calculation of

[21]Note that for each region-industry combination it holds that $\sum_{a=1}^{7} w_{ari} = 1$ and $ES_{ri} + DS_{ri} = 1$.

[22]More precisely, the long-term debt ratio is defined as the ratio of the *Orbis* variables non-current liabilities over total assets.

the region-industry-specific asset structures is undertaken in two steps. First, we obtain region-industry-specific shares for the asset types Inventory, Intangible fixed assets, as well as for the whole tangible fixed asset stock from *Orbis* using a similar aggregation approach as for the financing structures.[23] Since *Orbis* does not provide more detailed information on the composition of the tangible fixed asset stock, we use the country-industry-specific weights proposed by Mc Auliffe et al. (2023) to further divide the tangible fixed asset share into Buildings, Machinery, Office equipment, Computer equipment, and Vehicles.

Forward-looking Effective Marginal Tax Rate ($FL\ EMTR_{rit}$): As an alternative to controlling for the statutory tax rate as well as the NPV of depreciation allowances separately, we also construct forward-looking effective marginal tax rates ($FL\ EMTR_{rit}$) that combine these two measures. Forward-looking EMTRs quantify the income tax burden a firm would face on a hypothetical marginal investment that just breaks even.[24] We calculate the EMTRs using the simple representation proposed by Mc Auliffe et al. (2023):

$$FL\ EMTR_{rit} = \frac{(\tau_{ct} - \tau_{ct}\delta_{rit})}{(1 - \tau_{ct}\delta_{rit})}. \tag{6}$$

In (6), δ_{rit} denotes the region-industry-year-specific NPV of depreciation allowances that is discussed above and τ_{ct} denotes the statutory tax rate. Note that for the calculation of the EMTRs for Germany, we use the NUTS-2 specific statutory tax rates, τ_{rt} (see above).

Patent box regime ($IP\ box_{ct}$): Over the past two decades, more and more countries introduced so-called "patent boxes", i.e., special tax regimes that aim at incentivizing R&D by taxing patent revenues at preferential rates. In our analysis, we use a dummy ($IP\ box_{ct}$) that is equal to unity if country c has a patent box in place in year t and zero if not. We

[23] In more detail, the inventory share, the intangible fixed asset share, and the tangible fixed asset shares are obtained by dividing the *Orbis* variables stocks of current assets (i.e., inventories), intangible fixed assets, and tangible fixed assets by the sum of these three variables, respectively. The approach for obtaining the asset structure from *Orbis* follows Egger et al. (2009), as well as Egger and Loretz (2010).

[24] The concept of the EMTR is formally developed in the seminal contributions by Devereux and Griffith (1998), Hall and Jorgenson (1967), King (1974), King and Fullerton (1984), and OECD (1991). Note that forward-looking tax measures do not aim to proxy the actual income tax burden that an individual firm entity faces, but rather state the incentive of the tax code to invest in a simplified setup where the tax code is applied as intended and where the absence of tax base adjustments outside of depreciation is assumed.

obtain the data on the patent boxes from the RSIT's *ITI* database (Wamser et al., 2023).

Patent density ($Patent\ density_{rit}$): Next, we construct a region-industry-year-specific variable that captures patent activity. In detail, we define a patent density measure which we define as the share of firm-entities in *Orbis* that hold at least one patent. The source of the patent data is Bureau van Dijk's *Orbis Intellectual Property* database.

Share of firm entities with strictly negative EBITDA in $t-1$ in firm entities that have strictly positive EBITDA in t ($Share\ loss\ in\ t-1_{rit}$): Due to the confidentiality of tax accounting data, it is not possible to determine if and to which degree loss carrybacks and loss carryforwards are used by firm entities. Since our EEITRs are based on observations with strictly positive EBITDA, however, we can expect loss carrybacks to play a negligible role.[25] We cannot be sure that losses in $t-1$ are used against profits in t via loss carryforwards to reduce the tax base in t, as, for instance, the losses in $t-1$ could have been used against profits in $t-2$ or earlier periods using loss carrybacks. However, Rechbauer and Rünger (2023) demonstrate that the earnings in $t-1$ serve as reliable indicator for the existence of loss carryforwards in t. As a proxy for the extent of the use of loss carryforwards we calculate the region-industry-year-specific share of firm entities that report strictly negative EBITDA in $t-1$ in firm entities that have a strictly positive EBITDA in t.

GDP ($log\ GDP_{rt}$) and GDP per capita ($log\ GDP\ p.c._{rt}$): As additional controls, we use the logarithm of real GDP as well as real GDP per capita to capture economic development of the NUTS-2 regions. Both variables are obtained from the *ARDECO* online database.

Tax morale ($Tax\ morale_r$): The last variable we use is tax morale. We prepare a regional tax morale measure that we derive from the joint European Values Survey/ World Values Survey 2017-2022 dataset (EVS/WVS, 2022). More precisely, we prepare the question item

[25] It has to be noted that it is possible that firm entities that report a strictly positive EBITDA file a loss carryback in the same period. That is in the case when tax-relevant deductions are higher than the EBITDA, which results in a negative income tax base. However, those cases seem to be an exception, as almost all firm entities that report strictly positive EBITDA figures also report positive tax liabilities in our data.

that asks whether cheating on tax if you have the chance is justifiable.[26] Surveyed individuals could answer this question on a numeric scale from one ("Never justifiable") to ten ("Always justifiable"). The survey results are provided at the individual respondents level and also include information about the NUTS 2 region or in the case of Germany about the NUTS 1 region where the interview was conducted. We aggregate the individual level data to the regional level by taking unweighted averages across all respondents located in the respective region, excluding the answer options "no answer" and "don't know".[27] Note that while the survey was conducted over a time span of several years, the resulting measure is time-constant, as regions in different countries were generally only surveyed once. Further note that we set our aggregated region-specific tax morale measure missing for regions with less than 50 respondents to only include meaningful values into our analysis. In a last step, we standardize the variable such that in the final regression sample it has a mean equal to zero and a standard deviation of one and multiply it with minus one such that a higher value corresponds to a higher tax morale (i.e., higher agreement that cheating on taxes is never justifiable).

Finally, descriptive statistics on the estimation sample are provided in Table 2. The correlation matrix in Panel B suggests a negative relationship between the EEITRs and the corruption measure, as expected. Furthermore, the signs of the correlation coefficients between the EEITRs and the statutory tax measures are in line with basic intuition: a higher NPV of depreciation allowances results in more deductions from the tax base and therefore lower effective tax payments, which is indicated by the negative sign of the coefficient. On the other hand, a higher statutory tax rate or a higher forward-looking EMTR mean that a higher share of the profits is taxed away, which is in line with the positive sign of the respective coefficients.

[26]Note that constructing a proxy for tax morale from survey responses concerning the justifiability of evading taxes is an approach commonly used in the literature (see, e.g., Torgler, 2007; Torgler et al., 2008).

[27]Note that due to lack of data, we cannot calculate averages that are weighted by socio-demographic characteristics.

Table 2: ***DESCRIPTIVE STATISTICS***

The table depicts descriptive statistics on all the variables used for the empirical analysis. Panel A reports summary statistics. Panel B depicts Pearson correlation coefficients for key variables. Definitions of the variables are provided in Section 3.2.

Panel A: Summary statistics

	Observations	Mean	(sd)
$EEITR_{rit}$	19,095	0.128	(0.050)
τ_{ct} (τ_{rt} for DEU)	19,095	0.261	(0.072)
δ_{rit}	19,095	0.557	(0.134)
$FL\ EMTR_{rit}$	19,095	0.134	(0.051)
$Share\ loss\ in\ t-1_{rit}$	19,095	0.123	(0.052)
$IP\ box_{ct}$	19,095	0.503	(0.500)
$Patent\ density_{rit}$	19,095	0.008	(0.023)
$Patent\ density_{rit} \times IP\ box_{ct}$	19,095	0.002	(0.007)
$log\ GDP_{rt}$	19,095	24.351	(0.964)
$log\ GDP\ p.c._{rt}$	19,095	9.994	(0.566)
$Corruption_{rt}$	19,095	0.050	(0.956)
$Tax\ morale_{r}$	15,476	0.000	(1.000)

Panel B: Correlation matrix (19,095 observations)

	$EEITR_{rit}$	τ_{ct}	δ_{rit}	$FL\ EMTR_{rit}$	$Corruption_{rt}$
$EEITR_{rit}$	1.000				
τ_{ct} (τ_{rt} for DEU)	0.381	1.000			
δ_{rit}	-0.035	0.196	1.000		
$FL\ EMTR_{rit}$	0.342	0.737	-0.469	1.000	
$Corruption_{rt}$	-0.117	-0.317	-0.003	-0.240	1.000

4. Results

Our estimation results are provided in Table 3. Note that since our dependent variable, the EEITR, corresponds to β_1 in (3), we bootstrap standard errors. The specification in

Table 3: *ESTIMATION RESULTS*

The table presents OLS estimates. The dependent variable is the region-industry-year specific EEITR ($EEITR_{rit}$). Bootstrapped standard errors (based on 10,000 bootstrap replications) are reported in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Specification (2) only uses the years 2010, 2013, and 2017, i.e., the years of the sample period for which the corruption survey measure is observed. Specification (3) is identical to (2) but additionally uses linearly interpolated years, which results in all years 2010 to 2018 being included in the sample. Specifications (4) and (5) exclude observations corresponding to Germany and Italy, respectively. Specification (6) excludes the NACE Rev. 2 sections A, B, K, P, and Q (for section descriptions, see Appendix 2). All specifications control for country-industry-year fixed effects (FEs). Definitions and descriptive statistics on the explanatory variables are provided in Section 3.2.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Corruption_{rt}$		-0.004***	-0.003***	-0.003***	-0.004***	-0.004***	-0.003***	-0.006***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
τ_{ct} (τ_{rt} for DEU)	0.406***	0.393***	0.408***		0.417***	0.425***		0.386***
	(0.053)	(0.100)	(0.057)		(0.056)	(0.059)		(0.052)
δ_{rit}	-0.069***	-0.074***	-0.068***	-0.047***	-0.108***	-0.075***		-0.083***
	(0.008)	(0.014)	(0.008)	(0.008)	(0.009)	(0.009)		(0.008)
$FL\ EMTR_{rit}$							0.300***	
							(0.030)	
$Share\ loss\ in\ t-1_{rit}$	-0.030***	-0.022*	-0.024***	-0.028***	-0.012	-0.025***	-0.022***	-0.024***
	(0.007)	(0.012)	(0.008)	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)
$Patent\ density_{rit}$	0.042***	0.035**	0.031***	0.023***	0.002	0.041***	0.029***	0.020**
	(0.009)	(0.015)	(0.009)	(0.008)	(0.007)	(0.010)	(0.009)	(0.008)
$Patent\ density_{rit}\ \times$	-0.086**	-0.139*	-0.130***	-0.116***	-0.150***	-0.165***	-0.131***	-0.014
$IP\ box_{ct}$	(0.039)	(0.081)	(0.044)	(0.044)	(0.053)	(0.050)	(0.043)	(0.053)
$log\ GDP_{rt}$	0.008***	0.009***	0.009***	0.009***	0.008***	0.010***	0.009***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$log\ GDP\ p.c._{rt}$	0.007***	0.006***	0.005***	0.005***	0.005***	0.006***	0.005***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Tax\ morale_r$								0.001***
								(0.000)
Country-industry-year FEs	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.864	0.863	0.866	0.874	0.840	0.852	0.866	0.886
Observations	21,056	6,379	19,095	17,936	16,213	14,888	19,095	15,476

column (1) uses all years 2009 to 2018. The coefficient on the statutory tax rate is positive and suggests that a one percentage point increase in the statutory tax rate is associated with an increase in the EEITR of 0.41 percentage points. The coefficient on the statutory tax rate of 0.41 is very close to a similar estimate of Overesch et al. (2020). The latter paper analyzes GAAP ETR backward-looking tax rates and the estimated coefficient there is about 0.47.

Note that due to the country-industry-year fixed effects, our coefficient estimate is solely determined by the regional variation in the German statutory tax rate due to the regional trade tax. Clearly, all determinants of tax base are natural determinants of the EEITR in our approach. The NPV of depreciation allowances exhibits a negative sign, which is explained by the fact that more depreciation reduces the tax base and therefore yields lower EEITRs. Note that since the statutory depreciation rules are determined at the country level, the regional variation in the depreciation allowances is solely due to regional variation in financing and asset structures. The sign of the coefficient on the share of firm entities that have a strictly negative EBITDA in $t-1$ out of the entities that have a strictly positive EBITDA in t is negative. This suggests that at least some of these firm entities use the losses of the previous period to reduce the tax base in the current period via loss carryforwards. The results further imply that EEITRs are higher in regions with higher patent densities. However, for regions in countries that have low tax regimes for patent revenue in place, a higher patent density is associated with lower EEITRs (compare magnitude of coefficients on $Patent\ density_{rit}$ and $Patent\ density_{rit} \times IP\ box_{ct}$). This finding suggests that firm entities make use of the patent box regimes when filing their tax returns, which results in a more favorable taxation of revenues associated with patents and therefore lower EEITRs. We further find that EEITRs are higher in regions with higher GDP and higher GDP per capita. Columns (2) and (3) introduce the corruption measure, with column (2) only using years in which the EQI survey was conducted (i.e., 2010, 2013, and 2017) and column (3) also using linearly interpolated years, which results in a broader sample that spans across all years 2010 to 2018. Both models yield highly similar results with statistically significant coefficients on the corruption measure, however, the model in column (2) yields a (in absolute terms) slightly larger coefficient than the one in column (3) (-0.004 vs. -0.003). The coefficient estimates on the corruption measure suggest that a one standard deviation increase in the measure is associated with – depending on the specification – a 0.4 or 0.3 percentage point decrease in the EEITR. This is a sizeable effect, considering that there are several EU countries that exhibit within-country and year differences in corruption of more than one standard deviation. Since we control for legal ways to decrease EEITRs, we interpret the effect of corruption as tax evasion via overstated deductions. It has to be noted that the effect of corruption on tax evasion has been established in the empirical literature before (see, e.g., Uslaner, 2010; Alm et al., 2016). However, our approach fundamentally differs from the previous contributions in the sense that we do not measure tax evasion behavior by how much profits or sales are underreported, but instead take the reported EBITDA on which we base our EEITRs as given and estimate the effect of corruption on these EEITRs (see discussion above).

The subsequent specifications in columns (4) to (7) present a number of robustness checks. Since the statutory tax rate in Germany is aggregated from the municipality level, at which the trade tax is levied, to the NUTS 2 level, at which the analysis is carried out, we redo specification (3) without any observations corresponding to Germany. The results, depicted in column (4), are similar to those in (3), with the coefficient on the corruption measure being unchanged.[28] As shown above, Italy is the country with the highest within-country variation in the corruption measure and is also among the countries with the highest within-country and industry variation in the EEITRs. To check if the coefficient on the corruption measure is driven by Italy, we rerun specification (3) excluding Italy. Interestingly, the coefficient on corruption is even larger in magnitude when excluding Italy (-0.004; see column (5)). This rules out that the corruption results are exclusively driven by Italy. Specification (6) excludes certain industries that are known to often be subject to differential tax treatment, such as the agricultural or the financial sector.[29] The results in column (6) show that the exclusion of these industries yields a (in absolute terms) slightly larger coefficient of -0.004 on the corruption measure compared to the base specification in (3) that includes all

[28]Note that since all other countries have country-year-specific statutory tax rates, the coefficient on the statutory tax rate is not identified due to the fixed effects.

[29]In detail, the excluded industries are the NACE Rev. 2 sections A, B, K, P, and Q (for section descriptions, see Appendix 2). Note that it is common in tax-related empirical analyses to exclude these industries, see, e.g., Liu (2020), Mc Auliffe et al. (2023), or Steinmüller et al. (2019).

industries (coefficient: -0.003). The model presented in column (7) applies forward-looking, region-industry-year-specific EMTRs that combine both the statutory tax rate and the NPV of depreciation allowances instead of controlling for these two measures individually. The negative sign allows for a similar interpretation as of the sign of the statutory tax rate in that a higher EMTR corresponds to a higher share of the EBITDA being taxed away, which results in higher EEITRs. Compared to (3), the magnitude of the coefficient on corruption remains unchanged.

Finally, column (8) adds a second survey measure, namely the tax morale index. The sign on the tax morale measure is positive and significant, which suggests that EEITRs are on average higher in regions where the citizens agree more with the statement that cheating on taxes is never justifiable, which is in line with the previous literature (Richardson, 2006; Torgler, 2007; Torgler et al., 2008). However, the coefficient of 0.001, which suggests that a one standard deviation increase in the measure is associated with a 0.1 percentage point increase in the EEITRs, is quite small. It has to be noted that the measure is time-constant and that the survey from which it is taken was conducted at the end of our sample period, making it potentially imprecise for the earlier sample years. Additionally, the aggregation from the individual respondent level to the NUTS level was done without taking socio-demographic characteristics into account due to lack of data, which likely further reduces the accuracy of the measure. Interestingly, the coefficient on corruption is twice as large in specification (8) compared to specification (3), which outside of not controlling for tax morale uses the same variables (-0.006 vs. -0.003). However, it has to be noted that due to data availability of the tax morale measure, specification (8) is estimated using a much smaller sample.

In the last step of our analysis, we illustrate the size of the effect of corruption on EEITRs by carrying out a simple back-of-the-envelope calculation. For this purpose, we assume that the relationship between corruption and the EEITRs is causal. Using this assumption, we calculate how much higher country-wide EEITRs of EU countries would

Table 4: *OBSERVED VERSUS HYPOTHETICAL COUNTRY LEVEL EEITRs*

The table depicts country-year-specific observed EEITRs ($EEITR_{ct}$), country-year-specific hypothetical EEITRs ($EEITR_{ct}^{\text{hypoth}}$), as well as the change from the observed to the hypothetical EEITR in percent (Δ in %) for the years 2010, 2013, and 2017. The $EEITR_{ct}$ are obtained by taking weighted averages across all region-industry-year-specific EEITRs ($EEITR_{rit}$; see Section 3.2). The weights are calculated as the share of the region-industry-year-specific sums of strictly positive tax liabilities (obtained from *Orbis*) in the total country-year-specific sum, considering only values corresponding to region-industry-year combinations for which we obtain EEITRs to ensure the weights add up to unity. Note that we drop tax liability values in the top and bottom percentile to mitigate the influence of outliers. The $EEITR_{ct}^{\text{hypoth}}$'s are weighted averages of region-industry-year-specific hypothetical EEITRs ($EEITR_{rit}^{\text{hypoth}}$) that are calculated using the same aforementioned weighting. The $EEITR_{rit}^{\text{hypoth}}$'s reflect the hypothetical scenario in which the respective regional corruption levels are adjusted from the observed level to the average across all Scandinavian EU regions (i.e., regions of the countries Denmark, Finland, and Sweden). For details of the calculation, see Section 4.

	2010			2013			2017		
	$EEITR_{ct}$	$EEITR_{ct}^{\text{hypoth}}$	Δ in %	$EEITR_{ct}$	$EEITR_{ct}^{\text{hypoth}}$	Δ in %	$EEITR_{ct}$	$EEITR_{ct}^{\text{hypoth}}$	Δ in %
AUT	n.a.	n.a.	n.a.	0.151	0.155	3.14	0.145	0.149	2.59
BEL	0.141	0.146	3.58	0.140	0.143	2.37	0.163	0.166	2.06
BGR	0.060	0.075	24.92	0.059	0.073	24.41	n.a.	n.a.	n.a.
CZE	0.106	0.117	10.62	0.105	0.115	9.14	0.109	0.118	8.19
DEU	0.155	0.158	1.95	0.157	0.160	1.82	0.179	0.181	1.24
ESP	0.127	0.133	4.84	0.136	0.142	4.27	0.159	0.168	5.35
EST	0.102	0.109	7.38	0.094	0.100	6.99	0.095	0.100	5.13
FRA	0.140	0.144	3.40	0.135	0.138	2.79	0.148	0.153	3.13
GBR	0.189	0.194	2.44	0.167	0.170	2.14	0.152	0.154	1.47
GRC	0.140	0.151	7.95	0.147	0.159	8.24	0.180	0.192	6.42
HRV	0.108	0.120	11.18	0.101	0.112	10.79	0.090	0.100	11.00
HUN	0.078	0.089	13.83	0.064	0.073	15.05	0.061	0.072	18.09
IRL	0.111	0.114	2.68	0.133	0.137	2.73	0.121	0.124	2.55
ITA	0.218	0.228	4.52	0.215	0.225	4.63	0.195	0.205	5.34
LUX	0.151	0.153	1.09	0.187	0.187	0.37	0.175	0.176	0.46
LVA	0.070	0.082	16.02	0.082	0.091	11.09	0.082	0.091	10.82
NLD	0.142	0.148	4.06	0.145	0.146	0.65	0.190	0.192	1.03
POL	0.141	0.151	7.26	0.140	0.149	6.37	0.130	0.138	6.13
PRT	0.120	0.126	5.66	0.152	0.158	3.88	0.140	0.146	4.61
ROU	0.126	0.140	11.19	0.099	0.112	12.73	0.065	0.076	16.60
SVK	0.092	0.103	11.14	0.110	0.120	8.98	0.127	0.137	8.18
SVN	0.109	0.116	6.72	0.092	0.098	7.26	0.110	0.117	6.75

be if all of the regional corruption levels decreased to the mean corruption level of the Scandinavian countries Denmark, Finland, and Sweden of the respective year. In a first step, we calculate hypothetical EEITRs ($EEITR_{rit}^{\text{hypoth}}$) that consist of the sum of the observed EEITR ($EEITR_{rit}$) plus the difference between the respective observed regional corruption level ($Corruption_{rt}$) and the mean Scandinavian corruption level ($Corruption_{t}^{\text{Scandinavia}}$), multiplied by the marginal effect of a one unit decrease in corruption on the EEITR (i.e., 0.004; see Table 3, Column (2)). Formally, we get

$$EEITR_{rit}^{\text{hypoth}} = EEITR_{rit} + (Corruption_{rt} - Corruption_{t}^{\text{Scandinavia}}) \cdot 0.004. \tag{7}$$

Next, we aggregate both the observed region-industry-year-specific EEITRs as well as the hypothetical counterparts to the respective country-year-levels by taking weighted averages. The weights that we use proxy the contribution of the different region-sector-combinations to the countries' overall corporate income tax revenue in the respective year and are derived from *Orbis* data.[30] Table 4 provides a juxtaposition of the aggregated country-level observed EEITRs and the hypothetical counterparts for the years 2010, 2013, and 2017. The increase from the observed to the hypothetical EEITRs is substantial for high-corruption-countries like Bulgaria, the Czech Republic, Greece, Croatia, Hungary, Italy, Latvia, Poland, Romania, or Slovakia, with differences of one percentage point or more. This suggests substantial increases in the corporate income tax revenues collected by these countries in the hypothetical scenario compared to the observed one.

5. Conclusions

This paper provides evidence on tax evasion associated with overstated deductions. We show that this tax evasion strategy is more extensively used in regions of the EU with higher levels of corruption. Our analysis suggests that policymakers seeking to combat tax evasion and increase corporate income tax revenue should focus on tackling high corruption environments within the respective country. Our paper thus adds to the literature on fiscal capacity.

From a methodological perspective, we propose a novel approach for calculating EEITRs in scenarios where only an aggregated tax liability variable is available that can contain all types of taxes that the respective firm entities paid in a given year.

[30] In detail, we construct region-industry-year-specific sums of the firm-entity-level variable total tax liability, considering only observations with strictly positive values. The weights are then obtained as the share of these region-industry-year-specific sums in the total country-year-specific sum, with the latter only comprising values corresponding to region-industry-year combinations for which we obtain EEITRs to ensure the weights add up to unity. Note that we drop tax liability values in the top and bottom percentile to mitigate the influence of outliers.

Appendix 1. Range of NUTS 2-specific Ratio Tax Liability over EBITDA by Country and Industry in 2013

Table A.1: *RANGE OF THE NUTS 2-SPECIFIC RATIO TAX LIABILITY OVER EARNINGS BEFORE INTEREST, TAXES, DEPRECIATION, AND AMORTIZATION BY COUNTRY AND INDUSTRY IN 2013*

The table depicts descriptive statistics on the firm-entity-specific ratio tax liability over Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) for different NUTS 2 regions (version 2016) of EU 28 countries. Panel A states the percentage point difference between the NUTS 2 regions with the highest and the lowest median of this ratio for a given country and industry (NACE Rev. 2 section). Panel B states the respective percentage point difference for the mean of NUTS 2-specific ratios. All data corresponds to the year 2013. Firm entities belonging to MNEs are excluded. Only observations with strictly positive EBITDA are used for the calculation. Observations of the depicted ratio in the top and bottom one percentile were excluded from the sample. A minimum of 25 firm entity observations per region and industry combination was required. Country-industry combinations with less than two observed ratios are set missing. Note that Cyprus, Estonia, Luxembourg, Latvia, and Malta are excluded, as these countries only have one NUTS 2 region, i.e., the whole country. Furthermore, Lithuania is excluded due to poor data coverage. The sections O, T, and U are not depicted due data coverage. For descriptions of the sections, see Appendix 2. The source of the data is *Orbis*.

Panel A: Difference between maximum and minimum of NUTS 2-specific median of tax liability over EBITDA ratio

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S
AUT	n.a.	n.a.	9.1	n.a.	n.a.	8.0	10.1	11.4	n.a.	n.a.	n.a.	4.1	0.0	n.a.	n.a.	n.a.	n.a.	n.a.
BEL	4.4	n.a.	4.7	0.2	5.1	6.6	3.7	6.8	3.3	13.1	4.4	2.1	3.8	10.5	8.0	2.5	10.4	5.4
BGR	6.0	n.a.	1.3	n.a.	n.a.	n.a.	0.1	0.0	n.a.	n.a.	n.a.	0.0	0.7	n.a.	n.a.	n.a.	n.a.	n.a.
CZE	3.6	n.a.	1.2	2.4	5.9	3.4	3.4	3.9	0.0	4.4	7.1	2.6	4.2	6.1	9.5	2.5	8.1	5.3
DEU	6.5	n.a.	11.5	9.3	10.5	7.5	7.6	10.1	12.3	16.8	17.0	5.5	8.8	10.5	1.1	2.1	16.9	9.7
DNK	n.a.	n.a.	9.0	n.a.	n.a.	7.2	4.3	12.1	3.1	2.7	8.2	2.8	3.7	5.0	n.a.	1.4	n.a.	n.a.
ESP	6.6	15.6	4.3	7.7	8.1	6.4	5.7	5.2	6.7	12.8	7.6	6.2	6.9	8.3	10.7	6.7	9.9	6.6
FIN	8.1	0.4	7.5	1.8	7.7	2.1	2.4	2.3	8.8	3.4	3.5	4.2	1.5	2.5	1.0	1.2	2.3	1.3
FRA	2.3	13.3	6.8	3.5	12.7	10.7	5.5	6.2	4.3	10.3	9.7	4.2	13.6	8.9	9.1	10.8	4.8	1.0
GBR	8.3	n.a.	8.0	5.4	n.a.	2.5	3.6	10.8	14.7	2.5	19.6	9.5	1.8	5.0	2.8	10.6	14.8	7.3
GRC	n.a.	n.a.	10.3	1.3	n.a.	12.5	18.6	15.0	0.4	1.2	n.a.	8.9	1.5	12.9	n.a.	5.3	n.a.	n.a.
HRV	0.3	0.4	0.5	4.0	0.4	0.2	0.3	0.6	1.0	1.2	4.1	1.0	0.7	2.3	0.7	0.9	0.4	2.9
HUN	1.4	1.3	0.9	2.1	1.3	0.7	1.0	1.3	1.7	1.5	0.8	0.3	0.6	1.0	1.8	0.5	1.4	1.1
IRL	n.a.	n.a.	0.3	n.a.	n.a.	n.a.	2.8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	n.a.	n.a.	n.a.	n.a.
ITA	7.3	9.8	13.9	11.4	10.3	8.7	10.8	19.9	10.9	15.9	10.3	6.7	13.6	17.1	19.7	22.9	8.9	12.6
NLD	n.a.	n.a.	5.6	n.a.	n.a.	3.5	5.4	3.3	n.a.	3.4	4.6	n.a.	15.3	2.8	n.a.	n.a.	n.a.	n.a.
POL	19.8	2.5	3.0	5.6	6.7	4.6	3.4	6.2	3.8	7.5	2.7	7.2	3.4	2.6	8.9	11.1	4.9	n.a.
PRT	3.7	1.6	9.1	4.5	4.3	7.0	7.6	10.3	5.9	13.9	10.5	7.6	12.5	12.1	4.9	8.9	10.6	8.9
ROU	2.8	5.7	2.0	6.5	2.0	1.5	1.1	1.9	2.2	2.0	3.2	1.1	1.8	1.3	2.7	1.8	2.1	3.0
SVK	0.7	n.a.	2.9	2.1	2.3	1.7	1.1	1.1	0.1	4.6	2.7	1.2	1.8	1.1	5.6	1.8	1.6	1.1
SVN	0.9	n.a.	0.6	1.0	1.2	0.9	0.1	0.7	1.2	0.4	1.4	0.2	0.3	0.5	0.2	1.3	1.0	2.3
SWE	6.0	5.7	2.5	2.3	5.9	3.4	1.7	4.0	1.4	2.4	1.9	1.9	1.3	5.0	3.7	2.3	7.2	2.3

Panel B: Difference between maximum and minimum of NUTS 2-specific mean of tax liability over EBITDA ratio

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S
AUT	n.a.	n.a.	8.4	n.a.	n.a.	8.5	6.5	6.6	n.a.	n.a.	n.a.	0.5	6.8	n.a.	n.a.	n.a.	n.a.	n.a.
BEL	9.0	n.a.	3.8	2.4	3.1	5.4	3.9	4.8	3.8	10.7	3.1	2.3	3.0	8.7	5.8	1.9	7.6	4.6
BGR	6.5	n.a.	2.9	n.a.	n.a.	n.a.	1.6	0.2	n.a.	n.a.	n.a.	1.2	0.2	n.a.	n.a.	n.a.	n.a.	n.a.
CZE	1.6	n.a.	0.6	2.4	5.0	1.4	1.6	1.3	1.0	2.0	2.3	1.8	1.8	3.2	7.4	2.0	10.0	2.7
DEU	2.5	n.a.	6.6	15.6	9.9	6.2	5.1	7.8	8.5	9.9	11.5	10.8	11.7	11.0	2.6	13.4	19.2	8.3
DNK	n.a.	n.a.	6.4	n.a.	n.a.	7.6	2.7	6.0	3.0	4.6	2.5	5.5	3.5	15.5	n.a.	1.2	n.a.	n.a.
ESP	10.3	11.5	5.5	12.2	8.8	6.3	4.9	6.0	11.3	14.9	7.8	5.8	5.9	10.7	12.4	6.5	11.0	7.0
FIN	4.2	0.8	6.7	0.7	3.8	1.6	1.0	0.9	5.7	2.1	3.3	1.2	2.5	3.0	1.3	1.2	1.1	1.5
FRA	10.1	9.8	6.9	8.2	15.3	7.5	7.1	5.6	9.6	7.0	9.3	5.7	8.1	8.6	6.3	9.6	10.0	6.8
GBR	6.5	n.a.	9.4	3.6	n.a.	6.7	3.4	10.3	12.2	8.8	11.8	11.9	5.3	8.9	7.0	9.3	8.3	7.7
GRC	n.a.	n.a.	7.0	0.4	n.a.	9.7	8.6	4.4	3.5	1.4	n.a.	0.2	2.9	5.2	n.a.	4.1	n.a.	n.a.
HRV	0.4	0.4	0.3	2.1	0.3	0.1	0.0	0.1	0.9	1.2	1.6	0.4	0.2	0.8	1.0	0.2	0.8	1.0
HUN	2.1	1.9	1.6	8.3	2.4	0.9	1.2	2.3	1.6	2.4	1.5	0.6	1.1	1.1	2.2	1.3	1.6	2.2
IRL	n.a.	n.a.	0.6	n.a.	n.a.	n.a.	2.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.8	n.a.	n.a.	n.a.	n.a.
ITA	8.9	10.5	11.8	12.5	10.4	8.8	9.7	17.7	9.0	13.3	12.5	5.7	11.3	13.1	13.6	19.4	10.3	11.7
NLD	n.a.	n.a.	9.1	n.a.	n.a.	6.8	3.3	3.9	n.a.	5.9	8.0	n.a.	5.0	2.8	n.a.	n.a.	n.a.	n.a.
POL	21.5	3.7	3.9	8.5	6.5	8.2	3.5	7.1	5.0	3.4	6.5	8.7	4.6	5.5	5.6	7.3	2.3	n.a.
PRT	6.6	1.0	9.5	2.9	5.8	7.2	8.3	7.2	7.3	11.4	13.2	7.8	8.9	10.3	3.6	7.9	9.3	7.4
ROU	1.6	4.4	1.9	5.6	2.8	1.7	2.6	1.8	4.6	2.3	2.9	2.1	0.9	2.0	6.7	2.3	3.8	6.7
SVK	0.7	n.a.	1.6	2.9	2.0	1.0	0.6	1.7	0.3	1.8	3.9	1.4	1.0	1.3	3.3	1.0	2.6	1.8
SVN	1.7	n.a.	1.0	0.9	0.4	0.6	0.1	0.6	0.5	0.1	3.8	0.3	0.5	0.1	0.7	2.5	0.6	1.2
SWE	5.3	2.5	2.8	1.9	5.6	3.6	1.9	3.1	2.3	3.6	2.2	1.3	1.6	5.6	4.1	2.6	6.5	3.9

Appendix 2. NACE REV. 2 (ISIC REV.4) Section Description

Table A.2: *NACE REV. 2 (ISIC REV.4) SECTION DESCRIPTIONS*

The table depicts the descriptions of the sections of the *Statistical classification of economic activities in the European Community (NACE) Rev. 2* and the *International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 4* that are used throughout this paper. Note that since NACE Rev. 2 was created based on ISIC Rev. 4, the classification systems are equal at the section level.

Section code	section description
A	Agriculture, forestry and fishing
B	Mining and quarrying
C	Manufacturing
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage, waste management and remediation activities
F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific and technical activities
N	Administrative and support service activities
O	Public administration and defence; compulsory social security
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation
S	Other service activities
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
U	Activities of extraterritorial organizations and bodies

Appendix 3. Country-specific Definitions of the *Orbis* Tax Liability Variable

Table A.3: *COUNTRY-SPECIFIC DEFINITIONS OF THE ORBIS TAX LIABILITY VARIABLE*

The table depicts the country-specific definitions of the *Orbis* variable tax liability (TAX_{jt}) for EU 28 countries. The definitions are taken from the country-specific correspondence tables that are provided in the Orbis User Guide (Bureau van Dijk, 2011, ch. 15.8.2). For France, the correspondence tables give varying definitions for consolidated and unconsolidated accounts. The definition for France depicted in the table refers to the one for unconsolidated accounts. For Finland, the correspondence table lists four different definitions. It is not clear which format was used for the Finnish data in the *Orbis* dataset at hand.

Country	Definition of TAX_{jt} variable
AUT	Income taxes + Other taxes
BEL	Income taxes + Transfer to postponed taxes Transfer from postponed taxes
BGR	n.a.
CYP	n.a.
CZE	Income tax from current activity
DEU	Taxes on income + Other taxes
DNK	Pre-tax profit - Annual result
ESP	Taxes on profits
EST	Income tax
FIN	Income tax + Other indirect taxes + Change in deferred tax liability /
	Income tax + Other indirect taxes + Change in deferred tax liability + Taxes in the fiscal period/periods /
	Income tax + Other direct taxes + Change in deferred tax liability /
	Income tax + Other direct taxes + Change in deferred tax liability + Taxes for fiscal period/periods + Minority share
FRA	Corporate income tax
GBR	Taxation
GRC	Applicable Income Tax for the Year + Other Taxes - Prior Period Tax Audit Adjustments
HRV	Taxation
HUN	Tax liability
IRL	Taxation
ITA	Total current, deferred and prepaid income taxes
LTU	Profit tax
LUX	Income taxes + Transfer to postponed taxes Transfer from postponed taxes
LVA	Tax on profit for the financial year + Deferred income tax + Other taxes
MLT	Taxes
NLD	Income taxes
POL	Taxation
PRT	Corporate income tax
ROU	Profit tax + Income tax and other taxes not included above
SVK	Income tax on operations
SVN	Income Tax + Deferred taxes
SWE	Tax

Appendix 4. Estimation Results including MNEs

Table A.4: ***ESTIMATION RESULTS INCLUDING MNEs***

The table presents OLS estimates similar to the ones depicted in Table 3, however, MNEs were not excluded in the computation of the variables. The dependent variable is the region-industry-year specific EEITR ($EEITR_{rit}$). Bootstrapped standard errors (based on 10,000 bootstrap replications) are reported in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level. Specification (2) only uses the years 2010, 2013, and 2017, i.e., the years of the sample period for which the corruption survey measure is observed. Specification (3) is identical to (2) but additionally uses linearly interpolated years, which results in all years 2010 to 2018 being included in the sample. Specifications (4) and (5) exclude observations corresponding to Germany and Italy, respectively. Specification (6) excludes the NACE Rev. 2 sections A, B, K, P, and Q (for section descriptions, see Appendix 2). All specifications control for country-industry-year fixed effects (FEs). Definitions of the explanatory variables are provided in Section 3.2.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
τ_{ct} (τ_{rt} for DEU)	0.386***	0.368***	0.381***		0.386***	0.374***		0.391***
	(0.049)	(0.088)	(0.052)		(0.051)	(0.052)		(0.053)
δ_{rit}	-0.071***	-0.071***	-0.073***	-0.052***	-0.114***	-0.075***		-0.076***
	(0.008)	(0.014)	(0.008)	(0.008)	(0.009)	(0.009)		(0.008)
$FL\ EMTR_{rit}$							0.320***	
							(0.030)	
$Share\ loss\ in\ t-1_{rit}$	-0.032***	-0.030**	-0.028***	-0.030***	-0.018**	-0.032***	-0.027***	-0.024***
	(0.007)	(0.012)	(0.007)	(0.007)	(0.008)	(0.009)	(0.007)	(0.008)
$Patent\ density_{rit}$	0.237***	0.235***	0.213***	0.213***	0.073**	0.237***	0.204***	0.229***
	(0.024)	(0.043)	(0.026)	(0.029)	(0.029)	(0.028)	(0.025)	(0.026)
$Patent\ density_{rit}\ \times$	-0.219***	-0.255***	-0.233***	-0.226***	-0.150***	-0.216***	-0.227***	-0.145***
$IP\ box_{ct}$	(0.040)	(0.083)	(0.043)	(0.045)	(0.053)	(0.047)	(0.042)	(0.047)
$log\ GDP_{rt}$	0.008***	0.009***	0.009***	0.009***	0.008***	0.010***	0.009***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$log\ GDP\ p.c._{rt}$	0.007***	0.005***	0.006***	0.005***	0.006***	0.006***	0.006***	0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Corruption_{rt}$		-0.003***	-0.002***	-0.002***	-0.005***	-0.003***	-0.002***	-0.005***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Tax\ morale_{r}$								0.001***
								(0.000)
Country-industry-year FEs	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.855	0.854	0.858	0.869	0.829	0.843	0.858	0.887
Observations	22,043	6,699	20,022	18,569	17,117	15,692	20,022	15,501

References

Advani, A., Elming, W., & Shaw, J. (2021). The Dynamic Effects of Tax Audits. *Review of Economics and Statistics*, 105(3), 545–561.

Alm, J., Martinez-Vazquez, J., & McClellan, C. (2016). Corruption and firm tax evasion. *Journal of Economic Behavior & Organization*, 124, 146-163.

Alm, J., Liu, Y., & Zhang, K. (2019). Financial constraints and firm tax evasion. *International Tax and Public Finance*, 26, 71-102.

Arulampalam, W., Devereux, M. P., & Maffini, G. (2012). The direct incidence of corporate income tax on wages. *European Economic Review*, 56(6), 1038-1054.

Beck, T., Lin, C., & Ma, Y. (2014). Why do firms evade taxes? The role of information sharing and financial sector outreach. *The Journal of Finance*, 69(2), 763-817.

Bergolo, M., Ceni, R., Cruces, G., Giaccobasso, M., & Perez-Truglia, R. (2023). Tax Audits as Scarecrows: Evidence from a Large-Scale Field Experiment. *American Economic Journal: Economic Policy*, 15(1), 110-153.

Besley, T., & Persson, T. (2013). Taxation and Development. In A.J. Auerbach, R. Chetty, M. Feldstein, & E. Saez (Eds.), *Handbook of public economics* (Vol. 5, pp. 51-110). Elsevier.

Besley, T., & Persson, T. (2014). Why Do Developing Countries Tax So Little?. *Journal of Economic Perspectives*, 28(4), 99-120.

Best, M. C., Brockmeyer, A., Kleven, H. J., Spinnewijn, J., & Waseem, M. (2015). Production versus revenue efficiency with limited tax capacity: theory and evidence from Pakistan. *Journal of Political Economy*, 123(6), 1311-1355.

Bird, R. M., Martinez-Vazquez, J., & Torgler, B. (2008). Tax effort in developing countries and high income countries: The impact of corruption, voice and accountability. *Economic Analysis and Policy*, 38(1), 55-71.

Brueckner, J. K. (2000). Fiscal decentralization in developing countries: The effects of local corruption and tax evasion. *Annals of Economics and Finance*, 1(1), 1-18.

Carrillo, P., Pomeranz, D., & Singhal, M. (2017). Dodging the taxman: Firm misreporting and limits to tax enforcement. *American Economic Journal: Applied Economics*, 9(2), 144-164.

Charron, N., Dijkstra, L., & Lapuente, V. (2014). Regional governance matters: Quality of government within European Union member states. *Regional studies*, 48(1), 68-90.

Charron, N., Dijkstra, L., & Lapuente, V. (2015). Mapping the regional divide in Europe: A measure for assessing quality of government in 206 European regions. *Social indicators research*, 122, 315-346.

Charron, N., Lapuente, V., & Annoni, P. (2019). Measuring quality of government in EU regions across space and time. *Papers in Regional Science*, 98(5), 1925-1953.

Charron, N., Lapuente, V., Bauhr, M., & Annoni, P. (2022). Change and Continuity in Quality of Government: Trends in subnational quality of government in EU member states. *Investigaciones Regionales-Journal of Regional Research*, 2022(53), 5-23.

DeBacker, J., Heim, B. T., & Tran, A. (2015). Importing corruption culture from overseas: Evidence from corporate tax evasion in the United States. *Journal of Financial Economics*, 117(1), 122-138.

DeBacker, J., Heim, B. T., Tran, A., & Yuskavage, A. (2018). Once bitten, twice shy? The lasting impact of enforcement on tax compliance. *The Journal of Law and Economics*, 61(1), 1-35.

Devereux, M. P., & Griffith, R. (1998). The taxation of discrete investment choices. IFS working papers No. W98/16.

Doerr, A., & Necker, S. (2021). Collaborative tax evasion in the provision of services to consumers: A field experiment. *American Economic Journal: Economic Policy*, 13(4), 185-216.

Egger, P., & Loretz, S. (2010). Homogeneous profit tax effects for heterogeneous firms? *The World Economy*, 33(8), 1023-1041.

Egger, P., Loretz, S., Pfaffermayr, M., & Winner, H. (2009). Firm-specific forward-looking effective tax rates. *International Tax and Public Finance*, 16(6), 850-870.

EVS/WVS (2022). European Values Study and World Values Survey: Joint EVS/WVS 2017-2022 Dataset (Joint EVS/WVS). GESIS Data Archive, Cologne. ZA7505. Dataset Version 3.0.0, doi:10.4232/1.13899.

Fabling, R., Gemmell, N., Kneller, R., & Sanderson, L. (2014). Estimating firm-level effective marginal tax rates and the user cost of capital in New Zealand. Motu working paper 13-14. Motu Economic and Public Policy Research.

Flatters, F., & MacLeod, W. B. (1995). Administrative corruption and taxation. *International Tax and Public Finance*, 2, 397-417.

Graham, J. R., Raedy, J. S., & Shackelford, D. A. (2012). Research in accounting for income taxes. *Journal of Accounting and Economics*, 53(1-2), 412-434.

Ghura, M. D. (1998). Tax revenue in Sub-Saharan Africa: Effects of economic policies and corruption. IMF Working Paper WP/98/135.

Hall, R. E., & Jorgenson, D. W. (1967). Tax policy and investment behavior. *American Economic Review*, 57(3), 391-414.

Janský, P. (2023). Corporate effective tax rates for research and policy. *Public Finance Review*, 51(2), 171-205.

Kaldor, N. (1963). Taxation for economic development. *The Journal of Modern African Studies*, 1(1), 7-23.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The worldwide governance indicators: Methodology and analytical issues. *Hague Journal on the Rule of Law*, 3(2), 220-246.

King, M. A. (1974). Taxation and the cost of capital. *Review of Economic Studies*, 41(1), 21-35.

King, M. A., & Fullerton, D. (1984). Introduction to "The taxation of income from capital: A comparative study of the United States, the United Kingdom, Sweden, and Germany". In M.A. King, D. Fullerton (Eds.), *The taxation of income from capital: A comparative study of the United States, the United Kingdom, Sweden, and Germany* (pp. 1-6). University of Chicago Press.

Kleven, H. J., Knudsen, M. B., Kreiner, C. T., Pedersen, S., & Saez, E. (2011). Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark. *Econometrica*, 79(3), 651-692.

Lediga, C., Riedel, N., & Strohmaier, K. (2020). Tax Enforcement Spillovers – Evidence from Business Audits in South Africa. Available at SSRN 3616817.

Litina, A., & Palivos, T. (2016). Corruption, tax evasion and social values. *Journal of Economic Behavior & Organization*, 124, 164-177.

Liu, L. (2020). Where does multinational investment go with territorial taxation? Evidence from the United Kingdom. *American Economic Journal: Economic Policy*, 12(1), 325-358.

Mc Auliffe, S., Thunecke, G. U., & Wamser, G. (2023). The Tax-Elasticity of Tangible Fixed Assets: Evidence from Novel Corporate Tax Data. CESifo Working Paper No. 10628.

OECD (1991). *Taxing profits in a global economy: domestic and international issues.* OECD Publication and Information Center.

Overesch, M., Strueder, S., & Wamser, G. (2020). Do US Firms Avoid More Taxes Than Their European Peers? On Firm Characteristics and Tax Legislation as Determinants of Tax Differentials. *National Tax Journal*, 73(2), 361-400.

Pomeranz, D. (2015). No taxation without information: Deterrence and self-enforcement in the value added tax. *American Economic Review*, 105(8), 2539-2569.

Rechbauer, M., & Rünger, S. (2023). Measuring the impact of tax loss carryforwards on capital structure choice: the accuracy of earnings-based proxies. *Review of Managerial Science*, 1-28.

Richardson, G. (2006). Determinants of tax evasion: A cross-country investigation. *Journal of International Accounting, Auditing and Taxation*, 15(2), 150-169.

Steinmüller, E., Thunecke, G. U., & Wamser, G. (2019). Corporate income taxes around the world: A survey on forward-looking tax measures and two applications. *International Tax and Public Finance*, 26(2), 418-456.

Tennekes, M. (2018). tmap: Thematic Maps in R. *Journal of Statistical Software*, 84(6), 1-39.

Torgler, B. (2007). *Tax compliance and tax morale: A theoretical and empirical analysis.* Edward Elgar Publishing.

Torgler, B., Demir, I. C., Macintyre, A., & Schaffner, M. (2008). Causes and consequences of tax morale: An empirical investigation. *Economic Analysis and Policy*, 38(2), 313-339.

Uslaner, E. M. (2010). Tax evasion, corruption, and the social contract in transition. In J. Alm, J. Martinez-Vazquez, & B. Torgler (Eds.), *Developing alternative frameworks for explaining tax compliance* (pp. 174–190). Routledge International Studies in Money and Banking

Wamser, G., Merlo, V., Ruf, M., Stähler, F., Strohmaier, K., Eklund, J., Hansen, J., Laudage, S., Mc Auliffe, S., Paraknewitz, J., & Thunecke, G. U. (2023). A new database on international tax institutions. Forthcoming in RSIT Working Papers.

Xu, H., Dao, M., & Petkevich, A. (2019). Political corruption and auditor behavior: Evidence from US firms. *European Accounting Review*, 28(3), 513-540.