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**The Long Way to
Tax Transparency:
Lessons from the
Early Publishers of
Country-by-Country
Reports**

December 2022

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The long way to tax transparency: lessons from the early publishers of country-by-country reports

Sarah Godar, Giulia Aliprandi, Tommaso Faccio, Petr Janský

In this paper, we analyse a hand-collected sample of voluntarily published country-by-country reports (CbCRs) of ten multinational enterprises (MNEs). We assess the value added and the limitations of qualitative and quantitative information provided in the reports based on a comparison to individual MNEs' annual financial reports and aggregate CbCR data provided by the OECD. We find that early publishers of CbCRs do not double-count profits by including intra-company dividends but that the inclusion of equity-accounted participation results may bias tax risk indicators as they account for up to 30% of profits or 10% on average. Our sample MNEs seem to pay higher effective tax rates than the global average and many of them report relatively little profit in tax havens. We only find a very weak correlation of the location of profits and effective tax rates. This might indicate that more tax transparent MNEs avoid taxes less aggressively. However, our assessment of different tax risk indicators reveals important variations between companies.

Keywords: multinational corporation; country-by-country reporting; effective tax rate; profit shifting; tax haven

JEL Classification: F23; H25; H26

1. Introduction

The introduction of Country-by-Country Reporting (CbCR) can be regarded as a major breakthrough for the internationally coordinated efforts to curb corporate tax base erosion and profit shifting. Country-by-Country Reports (CbCRs), prepared according to the minimum standards of OECD BEPS Action 13, provide a global picture of multinational enterprises' (MNEs) tax payments, profits, and economic activities in each country where they operate and should allow tax administrations to better identify potential tax avoidance risks. The OECD has made aggregated country-by-country data available to the wider public, allowing researchers to refine global estimates of profit shifting (García-Bernardo & Janský, 2021) or evaluate the impacts of policy reforms such as the global corporate minimum tax (Barake et al. 2021). Data confidentiality has thus far limited more detailed analyses based on firm-level data including e.g. Fuest et al. (2021), Fuest et al. (2022), and Bratta et al. (2021). The European Union has decided to make EU-wide *public* CbCR mandatory starting from the first financial year after 22 June 2024 (EU, 2021). Until then, most company-level CbCRs will remain confidential. However, an increasing number of MNEs voluntarily publish CbCRs and thereby provide more fiscal transparency.

In this paper we analyse a hand-collected sample of voluntarily published CbCRs of ten MNEs along the following lines: First, what is the value added of CbCR and, more specifically, of these public micro CbCRs for the analysis of corporate tax avoidance, and what are the potential limitations? Second, what can these CbCRs tell us about individual MNEs' tax aggressiveness, and can we observe general differences between MNEs voluntarily publishing CbCRs and the world average with regard to effective tax rates, use of tax havens and other tax risk indicators?

We compare the voluntarily published reports to information obtained from MNEs' consolidated financial accounts and to aggregate CbCR data provided by the OECD to highlight the general benefits of CbCR but also discuss some of their commonly understood limitations (e.g. a known data limitation includes the double-counting of dividends which is considered to be an issue in aggregate CbCR but not in our sample of voluntarily published reports). We also assess to what extent profits of associates and joint ventures might bias tax risk indicators based CbCR profits (globally and by-country) – another potential issue flagged by the OECD (2017) – and identify only a few individual companies which explicitly correct for this. We explore the reasons individual MNEs provide for low effective tax rates (ETRs) and find they explain the frequently observed gap between financial profits and the actual tax base to a limited but non-systematic extent.

The additional qualitative information included in many voluntarily published CbCRs helps us to better understand MNEs' use of tax havens and to assess a potential correlation between their global ETRs and their tax haven use. We provide an overview of high-risk activities our sample MNEs perform in tax havens and non-havens and compute additional tax risk indicators such as the share of profits reported in tax havens and the misalignment of profits and economic activity which may be partly explained by profit shifting activities.

We conclude that concerns raised with respect to data quality and interpretation are valid and that some degree of uncertainty remains attached to tax risk indicators based on CbCR data. Illustrating the sensitivity of results to data corrections, whenever possible, suggests that the adjustments are gradual and do not undermine the general qualitative conclusions drawn from the data. However, a few percentage points higher or lower ETRs might make a difference for individual companies. Some MNEs appear to be aware of this and correct their reports accordingly. This might contribute to establishing best practices and increasing data quality in the future.

Early publishers of CbCR seem to pay higher taxes than the global average and the sample majority reports a lower share of profits in tax havens. For the sample as a whole, we find a weak correlation of the location of profits and ETRs, which would be consistent with some tax-induced profit shifting. However, this correlation is not robust and relatively small. Tax risk indicators vary substantially between MNEs, with Shell leading in terms of identified tax risks.

In the tax avoidance literature, the use of data from confidential tax returns has emerged as the best practice on the research frontier, but these have been available – and used – only in particular countries, such as the United States (Dowd et al., 2017), the United Kingdom (Bilicka, 2019), South Africa (Reynolds & Wier, 2019), and Uganda (Koivisto et al., 2021). Researchers interested in better country coverage and international comparisons have exploited other resources, such as the private databases Orbis (Egger et al., 2009, Fuest & Riedel, 2012) and Compustat (Markle & Shackelford, 2012, Dyreng et al., 2017), official foreign direct investment statistics (Bolwijn et al., 2018, Janský & Palanský, 2019), and foreign affiliate statistics (Tørsløv et al., 2020). Despite increased research interest in recent years, no single data source has emerged as a clear solution to the enduring trade-off between the quality of confidential tax returns data and the need for comprehensive country coverage (Janský, 2020a). Some of the most promising candidates for addressing this trade-off have been, and likely still are, the various types of CbCR data, which have become available in recent years and have been hailed as a potential panacea due to their expected positive impact on corporate behaviour, financial markets and development (Wójcik, 2015).

While the private CbCR standard studied in this paper covers the widest range of MNEs, previously implemented mandatory public CbCR standards only focused on specific industries. The longest-lasting one for the extractive industries may have had an effect (Johannesen & Larsen, 2016), but the data itself has not proven to be very useful (Janský et al., 2021). By comparison, a greater body of literature has focused on CbCRs in the financial industry. Banks and other financial institutions have been required to publish CbCRs since 2016 as part of the Capital Requirements Directive IV, and a number of papers have observed the effects of this new regulation (Dutt, Ludwig et al., 2019, Joshi et al., 2020) while an increasing number of papers have made use of the data to analyse taxation (Bouvatier et al., 2017, Dutt, Nicolay, et al., 2019, Brown et al., 2019, Fatica & Gregori, 2020, Janský, 2020b). A growing body of literature studies the relationship of voluntary disclosure of tax information and tax behaviour (Müller et al., 2020) as tax information is becoming more important for the assessment of companies' corporate social responsibility (CRS). For example, the Global Reporting Initiative has included country-by-country tax reporting into their CRS reporting standard in 2019 (Global Reporting Initiative 2020). In extending the range of types of CbCR data studied, we contribute to the broader literature studying how informative various kinds of tax-related disclosure in fact are.

In this paper we pioneer the use of one specific type of CbCR data – prepared according to the OECD BEPS Action 13's minimum standards and voluntarily published by MNEs. We contribute to the literature by assessing the magnitude of frequently mentioned data limitations of early CbCR data and by analysing indicators of tax aggressiveness at the company level. Micro CbCR based on the OECD BEPS standard is likely to become a key data source in future tax avoidance research and we hope to contribute to the understanding of its value added and potential challenges for research.

The paper is structured as follows: Section 2 introduces the data and sample selection. Section 3 discusses the benefits and limitations of CbCR data and assesses the potential bias introduced by double-counting of profits and the inclusion of associate and joint venture profits. Section 4 analyses our sample based on different tax risk indicators. These include MNEs' high-risk functions and their share of profits located in tax-havens, their global ETRs and an analysis of the tax-sensitivity of profits with regard to tax rate indicators.

2. Data

As part of the OECD's Anti-BEPS Action 13, governments have started to collect CbCRs from large MNEs. In those CbCRs, the MNEs must report profits, tax payments and economic activity for each tax jurisdiction in which they operate. Data from these reports have recently been made publicly available but only in aggregated form by the OECD for the years 2016, 2017 and 2018. Only a few companies have decided to voluntarily publish their individual CbCRs, and we analyse these in this paper. We collected the reports from the companies' websites manually and transformed the data into a processible format when required.

Table 1: MNEs voluntarily publishing CbCRs for 2017–2019.

MNE	Years	Industry	Headquarter	Notes
Anglo American	2018, 2019	Extractives	United Kingdom	
BP	2019	Extractives	United Kingdom	
ENI	2017, 2018, 2019	Extractives	Italy	
Iberdrola	2019	Electricity	Spain	
NN	2018, 2019	Insurance	Netherlands	Not reported: unrelated revenues, tangible assets*
Repsol	2018, 2019	Extractives	Spain	
Rio Tinto	2018, 2019	Extractives	United Kingdom, Australia	
Shell	2018, 2019	Extractives	Netherlands	
Telefonica	2019	Telecommunications	Spain	
Vodafone	2017, 2018, 2019	Telecommunications	United Kingdom	

*NN: total assets reported instead. Source: Authors

We obtain a dataset of ten MNEs, which collectively report activity in 150 jurisdictions. Our variables of interest include profit/loss before income tax, income tax accrued in the current year, number of employees, tangible assets, and unrelated party revenues. Table 1 provides a summary of all companies which – to the best of our knowledge – have voluntarily published at least one CbCR for the years 2017–2019 as well as the availability of our variables of interest.¹

The largest company in terms of total employee numbers is Telefonica with approximately 117,000 employees reported worldwide, followed by Vodafone with 106,000 and Shell with 80,000. NN is the 'smallest' MNE in the sample with approximately 14,000 employees. Shell and Rio Tinto report by far the highest worldwide sums of profits on average over the available years, and NN the lowest positive profit, with Shell's sum of global profits being approximately twelve times higher than NN's. Vodafone and Repsol report losses on average over available years, Vodafone reports losses in each year.

¹ We identified additional MNEs which publish their tax payments by country but do not publish the remaining CbCR data which we use in our analysis or not for all countries. We thus exclude Allianz, AXA, BT Group, and Equinor.

Table 2: Key variables

Company	Profit USD million	Employees	Tangible assets* USD million	Total revenue USD million
Anglo American	4,305	63,717	30,243	55,525
BP	6,860	70,100	132,642	434,056
ENI	5,838	41,144	75,274	127,663
Iberdrola	5,498	35,119	87,303	43,308
NN	2,338	14,271	271,586	23,291
Repsol	-616	24,565	26,986	124,339
Rio Tinto	14,312	43,658	60,933	64,554
Shell	27,801	80,502	239,749	737,638
Telefonica	2,619	117,349	36,088	54,223
Vodafone	-68,699	106,012	36,462	74,156

Note: Total assets reported in the case of NN. The table presents averages over the available years. Source: Publicly available CbCRs collected by the authors.

The distribution of profits across countries reflects the heterogeneity of the MNEs in our sample. While Shell reports significant profits in many different countries, some MNEs such as Iberdrola, NN and Rio Tinto concentrate profits in their headquarter jurisdictions. AngloAmerican’s profits are highly concentrated in Australia, and Telefonica’s in Brazil.

We note that Vodafone, which was the first MNE to publish its CbCR voluntarily, also publishes supplementary country-by-country data alongside the CbCR because it considers the OECD minimum standards unsuitable for its objectives (Faccio & FitzGerald, 2018).² To ensure consistency, we do not include this supplementary data from Vodafone in our analysis.

2.1. Samples

As we compare the CbCRs to consolidated accounts, we use all available observations from the CbCRs in Section 3. In Section 4, we adapt the sample to be more suitable for an analysis of tax risk indicators. As we expect only profitable companies to pay taxes, we drop company-country observations when profits are negative on average over the available years. We do not simply drop all negative-profit observations to account for the possibility of loss carryover which might reduce taxes also in profitable periods. We average observations across all available years to reduce the downward bias of ETRs potentially caused by loss carryovers and to reduce the general volatility of profits. For the computations of ETRs, we set negative tax payments to zero and set resulting ETRs of above 100% to 100%. While such ETR outliers are commonly dropped (e.g. Dowd et al. 2017), we prefer to lose the lowest number of observations possible due to the already small sample size.

² Vodafone argues that “the OECD report does not provide an explanation of the nature of the activity, or activities, that take place in a jurisdiction, which we believe is vitally important in order to understand the context of a multinational company’s CbCR” and that the profit before tax included in their OECD CbCR report “represents the total taxable revenue in each country less expenditure and reflects the starting point for a corporate tax calculation. However, it does not reflect the profit on which we pay tax, as the impact of the tax laws in each jurisdiction are not included, and therefore, tax exempt gains and losses are not taken into account in this number. For example, this number includes dividends received, which are usually tax exempt, as well as all gains and losses arising on the disposal or writing down of a business. We exclude these tax-exempt gains and losses in our voluntary reporting, as these amounts are usually exempt from tax by the standard tax laws of a country. Therefore, the amounts reported in our voluntary report are more closely related to the amounts on which we pay tax in each jurisdiction.” (Vodafone, 2018).

3. Lessons from comparing public micro CbCRs to other data sources

For research on the taxation of MNEs, CbCR data constitutes the most promising candidate to address the trade-off between the quality of confidential tax returns and the need for comprehensive country coverage (Janský, 2020a). Aggregate CbCR data has been used in recent profit shifting research (García-Bernardo & Janský, 2021) while confidential, country-specific company-level data has been used for Germany (Fuest et al., 2021) and Italy (Bratta et al., 2021). Still, research based on CbCRs faces several challenges, which include the small number of years for which CbCR data is currently available, confidentiality of company-level CbCR and quality issues discussed in detail in the OECD's disclaimer regarding the limitations of the country-by-country report statistics (OECD, 2021).

In the following sections we present insight gained from the analysis of a sample of voluntarily published CbCRs with respect to data quality and potential best practices on the way to greater tax transparency. Combining CbCRs with information from consolidated financial reports can shed light on the frequently raised issues of double-counting of dividends in CbCR data and the potential bias of ETRs caused by the inclusion of equity-accounted associates and joint ventures. In contrast to what disclaimers for aggregate CbCR suggest, most sample MNEs explicitly exclude intra-company dividends. Some MNEs correct for equity-accounted participation results or provide sufficient information to correct for potential biases. The qualitative information some MNEs include in their CbCRs to explain low ETRs may improve the public's understanding of where MNEs pay taxes and why. Important limitations remain but some are likely to become less problematic as the reporting standard evolves and longer time series become available.

3.1. Double-counting of profits

Profits in CbCR data may be inflated by the inclusion of intracompany dividends leading to double-counting as the earlier OECD guidance on CbCR reporting did not specify the treatment of intra-company dividends for the reporting of pre-tax profits. As a result, some MNEs include intra-group dividends both in the country of origin (as profit) and in the receiving country (as dividends). This occurs, for example, when dividends received from a subsidiary are counted as profits of the subsidiary but also added to the parent's pre-tax profits. This biases ETRs as the tax payments related to this income are counted only once, i.e. in the subsidiary's country of tax residence, while the dividends received by the parent are usually at least partly tax-exempt in the parent's country of tax residence.

Italy, the Netherlands, Sweden, and the UK have issued CbCR country notes quantifying the estimated bias in aggregate CbCR profits due to the double-counting of dividends. Estimates at the macro scale also exist for the United States' CbCR data provided by the BEA (Horst & Curatolo, 2020, García-Bernardo et al., 2021b).

Based on the comparison of CbCRs and tax returns, the Netherlands suggest that double-counting of dividends amounts to approximately EUR 5.8 billion or 16% of total profits for the Dutch CbCR-positive sample. Italy finds that, on average, the share of received dividends amounts to 38% (median 28%) of Italian MNEs' reported profits (positive-profit sample). For the UK, the HMRC estimates that "approximately 25% of UK headquartered groups had included dividends in CbCR" (OECD, n.d.) and that reported profit intragroup dividends receivable included in profits amounted to GBP 55 billion or 49% of domestic CbCR profit reported by UK MNEs. Sweden's country note suggests that in 2017 tax-free dividends included in corporate income tax returns amounted to SEK 266 billion. If all Swedish MNEs included dividends in CbCR profits, total profits of SEK 512 billion should be reduced by SEK 266 billion (52%) (Table 3).

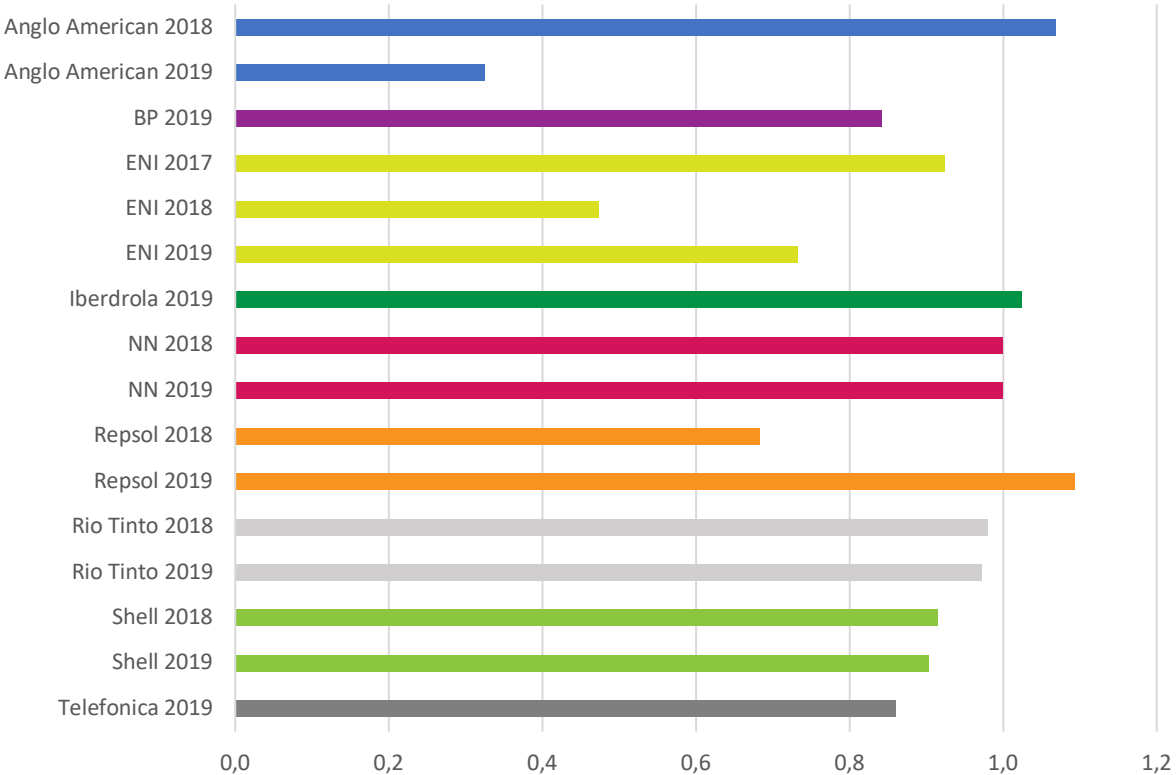
Table 3: Estimated dividends included in aggregate CbCR profits as provided by the OECD for 2017

County	Total domestic profits	Estimated share of MNEs that included dividends	Estimated share of dividends included in CbCR profit
Italy	Positive profit sample	90.7%	38%
Netherlands	EUR 36.8 billion (positive profit sample)	49%	16% (EUR 5.8 billion)
Sweden	SEK 512 billion	Assumption: all	52% (SEK 266 billion)
UK	GBP 110 billion	25%	49% (GBP 55 billion)

Source: OECD (n.d.), notes to the OECD CbCR statistics

Many early publishers of CbCRs explicitly state that they exclude intra-company dividends when compiling CbCR (Anglo American, ENI, Repsol, Rio Tinto, Shell). This can also be confirmed by comparing aggregate CbCR profits to consolidated financial accounts. If the sum of CbCR profits exceeds consolidated global profit, this might indicate the inclusion of intra-company dividends. However, in our sample, the sum of CbCR profits is rarely higher than consolidated profits (Figure 1). The maximum positive deviation is 9% for Repsol in 2019. This contrasts with the comparably important magnitude of the phenomenon in aggregate CbCR data. Estimates of the latter refer to headquarter profits only and might thus also look less important in relation to MNEs' global consolidated profits. However, some double-counting of profits might also occur in the case of foreign affiliates. For example ENI, which explicitly excludes intra-company dividends from its CbCR, highlights that the inclusion of dividends would mostly affect the headquarter jurisdiction Italy but also the Netherlands and the UK.

Figure 1: Ratio of CbCR and consolidated profit



Note: Excluded profits of associates and joint ventures explain part of the gap between the sum of CbCR profits and the consolidated financial result (see Section 3.2.). Vodafone was omitted because it reported high losses for CbCR in all available years which did not match the consolidated results. Source: Publicly available CbCRs and consolidated financial statements.

3.2. Profits of equity-accounted associates and joint ventures

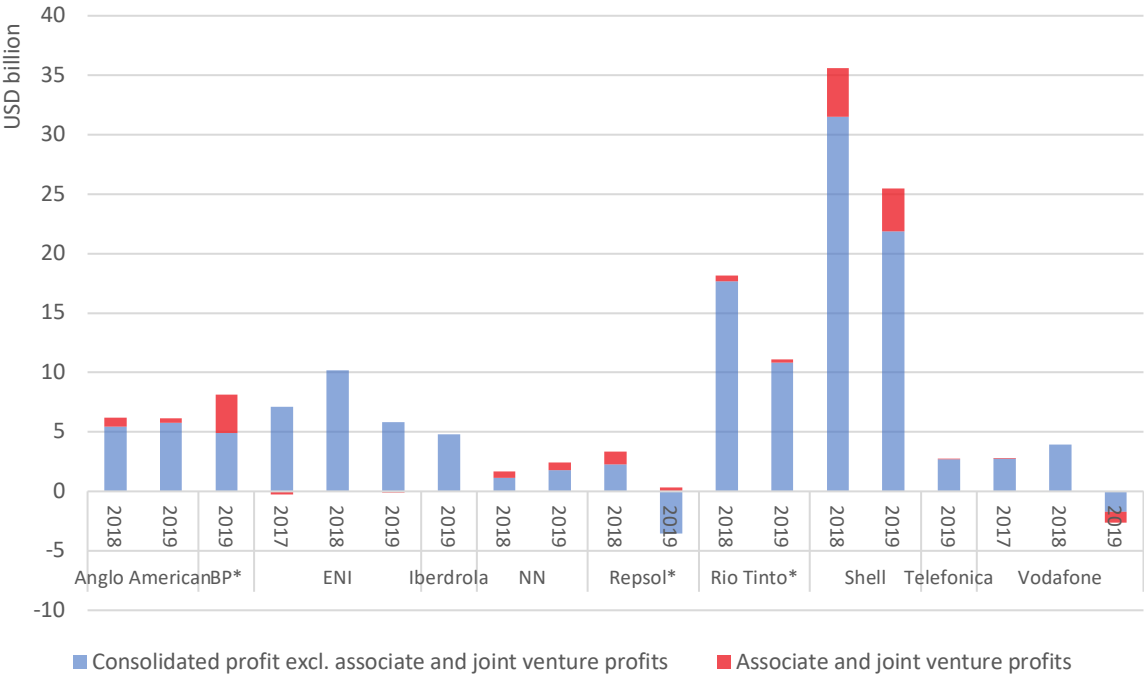
In financial accounting, the net profits of joint ventures and associates may be included in total profits on an accrual basis. As CbCR is based on financial profits, this gives rise to a conceptual challenge: MNEs are allowed to include the participation results from associates and joint ventures in CbCR profits – if accounted based on the equity method. What is problematic is that in line with financial reporting, taxes paid by the associate or joint venture, its employees or other economic variables, are not included in CbCRs. As a result, the inclusion of associates and joint ventures affects reported profits but not the remaining CbCR variables. This is a potential source of bias when calculating ETRs or other tax risk indicators, as has been pointed out by the OECD (2017). The Netherlands’ notes on country-specific analysis, for example, estimate that aggregate positive CbCR profits reported in the Netherlands are biased upwards by 27% “due to shares of result in associates and joint ventures, differences in accounting standards between the two reports, one-off (de)mergers, takeovers, or disposals” (OECD, n.d.).

In our sample the bias caused by the inclusion of participation results potentially affects all groups except for BP, Repsol, and Rio Tinto which explicitly exclude income from joint ventures from their CbCRs. By combining individual MNEs’ CbCRs and consolidated financial accounts we assess the potential magnitude of this bias for our sample. All groups provide net income from associates and joint ventures in their consolidated income statement which accounts for approximately 11% of the sample’s total consolidated profits. Among the groups that do not correct their CbCR profits for

received equity-accounted incomes, the maximum share in consolidated profit is 27% for NN. Interestingly, the two groups with the highest equity-accounted income (BP and Repsol) adjust their CbCR profits, perhaps to prevent misinterpretations resulting from strongly biased profits. For Telefonica and Iberdrola, the net income from associates and joint ventures is close to 0% of consolidated profits (Figure 2). While the annual reports include a list of associates and joint ventures, in most cases with addresses, a breakdown of net income by entity and thus country is not always available or includes only the most important joint ventures and associates. As a result, we can only correct profits by country in an exemplary and non-systematic manner.

Anglo American, ENI, and Vodafone provide a breakdown for the most important joint ventures and associates. Our analysis suggests that, even if moderate at the aggregate level, joint venture profits may distort individual countries’ risk indicators, especially if little economic activity is carried out in the country. For example, ENI’s 2017 profit in Spain might increase by 94% (from USD 5 to 76 million with fewer than 100 employees) if losses from its joint venture Unión Fenosa Gas SA were subtracted. However, in Italy, where ENI has more than 20,000 employees, net income from joint ventures and associates would bias profits only by 0.1–28%. Similarly, AngloAmerican’s losses in Colombia, where it reports only 1.5 employees would look much bigger after subtracting the positive equity-accounted income from Cerrejón. In contrast, in Australia, Brazil, and South Africa a tentative correction for equity-accounted net income would change profit by much less (0.3–37%) (Figure 3). This indicates that individual company-country ETRs or other measures based on individual company–country profits should be interpreted with caution as net income from equity-accounted entities might bias them both upwards or downwards. They might even be meaningless in branches with little economic activity if most of the local financial profits are actually generated from equity-accounted entities. This, however, does not seem to hold for profits in tax havens as hardly any company reports associate or joint venture income in tax havens.

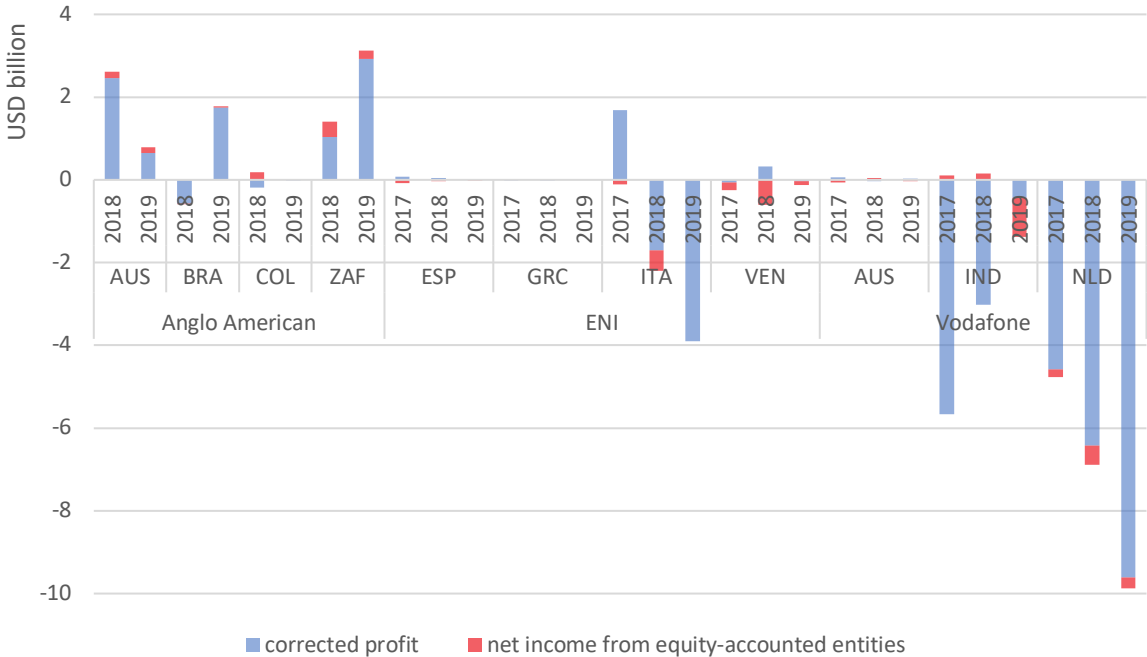
Figure 2: Profit of equity-accounted associates and joint ventures



Note: The Asterisk indicates companies excluding equity-accounted units from CbCR profit. Source: Authors

Profits of equity-accounted associates and joint ventures may thus be a relevant source of bias in our analysis of company-level tax risk indicators. As most MNEs report positive profits from equity-accounted investments, their global ETRs likely need to be corrected upwards. The share of profits reported in tax havens would need to be corrected upwards if we exclude these profits from our analysis, as most sample MNEs do not report any equity-accounted income in tax havens (NN constitutes an exception, with associates and joint ventures in its headquarter country, i.e. the Netherlands). The corrections by country would mostly affect non-haven countries and among those countries hosting only small branches.

Figure 3: CbCR profits by country corrected for net income from equity-accounted entities



Note: A by-country correction can only be carried out for Anglo American, ENI and Vodafone as not all companies provide sufficient information on individual associates and joint ventures in their annual reports. Source: Authors

3.3. Differences between financial profits and the tax base

The voluntarily published CbCRs are mostly sourced from and thus broadly consistent with consolidated financial accounts. Effective tax rates calculated based on CbCRs thus facilitate the assessment of corporate tax payments in relation to financial profits in each country. However, these financial profits are not necessarily consistent with taxable profits due to differences in financial and tax accounting (Hanlon & Maydew, 2009). These include timing differences due to different depreciation rules and permanent differences, e.g. when certain payments are regarded as deductible expense for financial accounting but not for tax purposes. In this regard, ETRs based on CbCR data suffer from similar shortcomings as ETRs based on financial accounts.

As MNEs are not required to publish their tax accounting along with financial accounts, the reasons for observed discrepancies between ETRs and statutory tax rates also remain somewhat opaque in CbCR data. Loss carryover – likely an important share of observed discrepancies – will be easier to control as longer time series become available. However, the effects of other features of the tax system, such as depreciation schemes and tax incentives, cannot be analysed systematically using publicly available data.

Based on data from MNEs' tax filings, the Netherlands' notes on CbCR data (OECD, n.d.) provide rough estimates of how much the distinctive features of the tax system contribute to the observed gap between MNEs' financial and taxable profits. Having corrected CbCR profits for the double-counting of dividends, the authors suggest subtracting an additional 19% for loss carry-overs, and another 9% to make CbCR profits better comparable to taxable profits. The components of this correction include estimated commercial-fiscal differences and adding interest and costs that would not be deductible for tax purposes. The authors also subtract part of the profit that benefits from intellectual property (IP) tax incentives, which illustrates an important controversy regarding the interpretation of ETRs. While a share of IP profits is exempt from the CIT base under the Dutch tax system, this is not so in other countries. For inter-country comparisons of ETRs, it is thus not ideal to use taxable profits as the denominator as they are defined in a non-consistent way across jurisdictions.

Some of our sample MNEs also provide information that is additional and complementary to what is available in the OECD standard. Notably, some MNEs explain why they pay relatively low ETRs in certain jurisdictions.³ For example, Vodafone explains in detail the availability of historic losses in Luxembourg which allows a large amount of income received to be offset so that no corporation tax is recorded in Luxembourg. The availability of historic losses does not form part of the data required by the OECD standard but is provided voluntarily to improve the readers' understanding. Vodafone also indicates that it pays "no or little UK corporation tax" because of a capital allowance and debt interest relief. Similarly, Rio Tinto explains how its entities in Belgium qualify for the Diamond Tax Regime, which results in an effective tax rate lower than the general statutory corporate tax rate in Belgium. Repsol even computes ETRs for each jurisdiction and provides explanations for differences to the statutory rates including tax deductions in Spain, the use of an accelerated amortization tax regime in Peru, losses from the previous year in Mexico, tax credits generated by losses from previous years in Luxembourg, or non-deductible losses in Bolivia and the Netherlands which explain why the ETR is higher than the statutory rate.

This information can help explain why ETRs may differ from statutory rates but is not detailed enough to quantitatively adjust the ETRs or to help clarify how much of the gap between an ETR and the statutory rate can be explained by a certain tax incentive. However, the bias due to loss carryovers can be reduced by averaging CbCR data over several years as more data becomes available. When it comes to tax incentives, it depends on the research question whether or not they should be considered a potential source of bias of ETRs. Even if a tax incentive increases the gap between financial and taxable profits, it results in lower tax payments. This may be captured correctly by ETRs computed based on financial profits but not by ETRs based on taxable profits. In addition, individual features of the tax code such as loss carryover, certain depreciation schemes, and tax incentives can also be used strategically by MNEs and form part of global tax optimisation schemes.

4. Tax risk indicators

In our analysis of voluntarily reported CbCR data we analyse standard tax risk indicators: the MNEs' activities and profits booked in tax havens, effective tax rates, and the misalignment of profits with reported economic activity. We discuss potential biases introduced to our results by the above described shortcomings of CbCR data and illustrate the effect of corrections where possible. When calculating global ETRs, for example, information from financial accounts allows us to correct profits

³ This might be linked the GRI standard which requires companies to explain why their effective tax rates differ from statutory rates.

for participation results as discussed in Section 3.2. For the calculation of tax risk indicators, we drop company-country observations when profits were negative on average over the available years as we would not expect these companies to pay tax and are mainly interested in the distribution of positive profits across countries.

4.1. MNEs' presence in tax havens

Different channels are used by MNEs for aggressive tax planning. Ramboll & Corit (2015) and ZEW (2016) group them into three channels: aggressive tax planning via interest payments, via royalty payments, and via strategic transfer pricing (e.g. intra-group sale of goods or provision of services). CbCRs facilitate a global view of where each MNE locates some of the functions, risks and assets that can be linked to aggressive tax planning. High-risk functions performed in tax havens include intra-group finance, IP licensing, marketing hubs, provision of insurance or headquarter services, and holding functions, each of which is discussed in more detail below.

Tax rules typically allow a deduction for interest paid or payable in arriving at the tax measure of profit. The higher the level of debt in a company, and thus the amount of interest it pays, the lower its taxable profit. Intra-group lending arrangements can result in tax avoidance if the interest payment is structured in a way that allows the interest to be received in a jurisdiction that either does not tax the interest income, or which subjects such interest to a lower tax rate than the jurisdiction from which the payment is made.

MNEs can strategically place their profitable IP rights in low-tax locations to reduce overall tax rates. IP owned in low-tax jurisdictions is licensed to an entity in high tax jurisdiction in return for a royalty payment. Tax rules typically allow a deduction for royalty paid or payable in arriving at the tax measure of profit. Intra-group licensing of IP can result in tax avoidance if the royalty payment is structured in a way that allows the payment to be received in a jurisdiction that either does not tax the IP income, or which subjects such income to a lower tax rate than the jurisdiction from which the payment is made.

As supply chains have grown with increasing globalisation, MNEs have sought to locate specific elements of their supply chain, such as marketing and logistics management (often referred to as "marketing hubs") within entities in low-tax jurisdictions. Through strategic transfer pricing, these entities can be remunerated through a return on the costs incurred (mark-up basis), a return or commission based on the spend under management (e.g. total purchases) or a share of any gain arising from the contribution to the entity (e.g. a fee is charged as a percentage of the value generated/cost reduction achieved). By allocating the return earned by these entities through strategic transfer pricing in low tax jurisdictions, MNEs are able to reduce their overall effective tax rate.

The provision of intra-group services (e.g. insurance/headquarter services) from an entity located in a low-tax jurisdiction to an entity located in high-tax jurisdictions can result in tax avoidance if the payment is structured in a way that allows the payment to be received in a jurisdiction that either does not tax the service income, or which subjects such income to a lower tax rate than the jurisdiction from which the payment is made.

Holding companies are not necessarily located in low-tax jurisdictions for the purposes of profit shifting, but they can benefit from preferential tax treaty networks, which can ensure that dividend payments are received with either low or no withholding taxes whatsoever. Tax treaties between countries can reduce or exempt the application of withholding taxes on intra-group payments (e.g. dividends, interest, royalties, services) which can reduce the MNE's overall effective tax rate. The ability to receive payments with no withholding tax collected at the source also impacts the location of IP and intra-group services.

Table 4: High-risk functions performed in tax havens

Country/MNE	AngloAmerican	BP	ENI	Iberdrola	NN	Repsol	Rio Tinto	Shell	Telefonica	Vodafone
Tax havens										
Netherlands	CORE	CORE	CORE, HOLD, R&D, SUP	no info	no info	CORE, FIN, HOLD	CORE, HOLD	CORE, FIN, HOLD, SUP	-	CORE, HOLD
Singapore	CORE, HOLD, HUB, SUP	CORE, HUB, SUP	CORE	-	no info	CORE, SUP	FIN, INS, HUB, SUP	CORE, FIN, HUB, SUP	-	CORE
Switzerland	CORE, SUP	no info	CORE	-	no info	SUP	CORE, INS, SUP	CORE, FIN, INS, IP, SUP	-	CORE
Bahamas	-	HOLD	IP	-	-	-	-	HUB	-	-
Bermuda	HOLD; INS	DORMANT	HOLD	-	-	INS (dormant)	HOLD	FIN, HOLD, INS, SUP	-	-
Belgium	-	-	CORE, FIN, HOLD	-	no info	-	CORE	CORE	-	CORE
Luxembourg	HOLD	-	-	no info	no info	FIN, HOLD, INS	FIN	CORE, FIN	-	CORE, FIN, HUB, SUP
Hungary	-	-	CORE	no info	no info	-	-	CORE	-	CORE, FIN, SUP
Malta	-	-	HOLD	-	-	-	INS	-	-	CORE, INS
Ireland	CORE, FIN, INS, SUP	-	INS, R&D	no info	-	CORE	-	CORE	-	CORE, SUP
Non-havens										
Australia	CORE, FIN, HOLD, IP, SUP, R&D	CORE	CORE, R&D	no info	-	CORE, HOLD, SUP	CORE	CORE	-	CORE
Canada	CORE, HOLD, SUP	CORE	CORE, HOLD	no info	-	CORE, HOLD	CORE	CORE	-	core
South Africa	CORE, FIN, HOLD, R&D, SUP	CORE	R&D	no info	-	-	CORE	CORE	-	CORE, HOLD
Spain	-	CORE	CORE	no info	no info	CORE, FIN, HOLD	CORE	CORE	CORE	CORE
Libya	-	no info	CORE	-	-	CORE	-	no info	-	-
Oman	-	CORE, HOLD	-	-	-	-	SUP	CORE	-	-
Brazil	CORE, FIN, HOLD, R&D, SUP	no info	R&D	no info	-	CORE, SUP	CORE	CORE	CORE	CORE
United Kingdom	CORE, FIN, HOLD, IP, R&D, SUP	CORE, FIN, HOLD	CORE, HOLD, IP, R&D, SUP	no info	-	CORE, HOLD, SUP	CORE, FIN, HOLD	CORE, FIN, R&D	no info	CORE, HOLD, IP, SUP
Egypt	-	CORE	CORE; R&D; SUP	no info	-	-	-	-	-	CORE
United Arab Emirates	CORE	CORE	CORE	-	-	-	SUP	CORE, HOLD, HUB, SUP	-	no info

Activity	Activity type		
CORE	Manufacturing/production/transportation/extracting/sales/distribution	IN	Group insurance
FIN	Intra-group finance	IP	Intellectual property holding/management
HOLD	Holding of shares	R&D	Research and development services
HUB	Marketing/trade hub	SUP	Support services (payroll, management services, other services)

Note: Countries are ranked in terms of total sample profits within categories. A hyphen indicates that the MNE has no presence in this country. Intra-group finance, group insurance and hubs are highlighted as they are predominantly located in tax havens.

Table 4 summarises MNEs' functions performed in the top ten tax havens⁴ (ranked in terms of total sample profits) and contrasts them with the functions performed in the top ten non-haven countries. While most jurisdictions with important profits do host core functions, we also find that, in total, tax havens host a higher share of functions which are commonly used for aggressive tax planning.

A clear pattern emerges for insurance services and marketing or trade hubs. Six of our sample MNEs locate group insurance in the top ten tax havens, while no insurance activity is reported in the top ten non-havens. Anglo American reports insurance activities in Bermuda and Ireland, Eni in Ireland, Repsol in Luxembourg, and Rio Tinto in Singapore, Switzerland, and Ireland. Shell reports insurance activities in Switzerland and Bermuda and Vodafone in Malta. Marketing or trade hubs, are concentrated in tax havens, mostly in Singapore. This is the case for AngloAmerican, BP, Rio Tinto, and Shell. Vodafone has a hub in Luxembourg. Shell reports two more hubs in the Bahamas and in the United Arab Emirates which is not on our tax haven list but ranks tenth on TJN's corporate tax haven index (Tax Justice Network 2021).

Intra-group finance, intellectual property and holding of shares seem to be more equally distributed across jurisdictions. Intra-group finance is still somewhat more frequent in tax havens. Six out of seven MNEs that systematically report business functions locate intra-group financing in at least one of the top ten tax havens. Intellectual property rights, in contrast, are more frequently located in the United Kingdom (AngloAmerican, Eni, and Vodafone) and only twice in the top ten tax havens (ENI in Bahamas and Shell in Switzerland). IP location in the Bahamas by ENI seems to constitute an exception because the MNE does not report any other business functions in this jurisdiction. Holding of shares is widely spread across jurisdictions. Among the top ten tax havens, the Netherlands and Bermuda seem to be popular locations for holding companies – five and four MNEs report holding shares through these two jurisdictions respectively. Six MNEs report holding companies in the UK with four being headquartered there.

When quantifying MNEs' general presence in tax havens, we find that the share of overall profits they record in tax havens varies significantly in between groups and depending on the tax haven list we use. Seven out of ten of the analysed MNEs report significantly lower shares of profits in tax havens than what we find in aggregate CbCR data published by the OECD: Anglo American, ENI, Iberdrola, Repsol, Rio Tinto, Telefonica, and Vodafone all report between 1% and 7% of their profits in tax havens, while the average share of profits reported in tax havens based on the OECD data is approximately 15% (Table 5).

Three companies in our sample report a higher share of profits in tax havens than the OECD average: BP reports 18.5%, NN 75.8%, and Shell 30.5%. Note however, that NN's high tax haven share is mainly caused by high profits in its headquarter country, the Netherlands. Using Gravelle's tax haven list shrinks NN's tax haven share to 1.4%. Our sample's average share of profits in tax havens, at 16–17%, is higher than the global average based on the OECD data for our preferred tax haven list but lower for

⁴ We use the tax haven list by Gravelle (2015) and add Belgium, Hungary and the Netherlands, as according to the European Parliament's special tax crime committee (2019) they also display tax haven traits and facilitate aggressive tax planning. Gravelle's list includes Andorra, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Bahrain, Barbados, Belize, Bermuda, Cayman Islands, Cook Islands, Costa Rica, Cyprus, Dominica, Gibraltar, Grenada, Guernsey, Hong Kong, Ireland, Isle of Man, Jersey, Jordan, Lebanon, Liberia, Liechtenstein, Luxembourg, Macao, Maldives, Malta, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Netherlands Antilles, Niue, Panama, Saint Lucia, Saint Vincent and the Grenadines, Samoa, San Marino, Seychelles, Singapore, St. Kitts and Nevis, Switzerland, Tonga, Turks and Caicos Islands, Vanuatu, British Virgin Islands, and U.S. Virgin Islands.

Gravelle’s tax haven list. Gravelle’s list (Gravelle, 2012, also used by Gumpert et al., 2016) excludes Belgium, Hungary, and the Netherlands, resulting in a lower sample mean of approximately 10% of profits reported in tax havens versus approximately 12% for the aggregate CbCR data. The averages mask substantial differences between the companies, with mostly BP and Shell standing out due to their comparably high tax-haven shares across lists. These profits coincide with the high-risk activities of Shell in Singapore, Switzerland, Bahamas, and Bermuda. BP concentrates its tax-haven profits in Switzerland (13% of total profits) without providing details on the functions performed there.

Table 5: Share of profit in tax havens (average of available years)

Company	Our tax haven list	Adjusted for associates and joint ventures if necessary	Gravelle's tax haven list	Adjusted for associates and joint ventures if necessary
Anglo American	6.8	7.3	6.7	7.2
BP	18.5		14.3	
ENI	2.1	2.1	1.2	1.2
Iberdrola	1.3	1.3	0.4	0.4
NN	75.8		1.4	
Repsol	3.9		2.4	
Rio Tinto	4.7		4.6	
Shell	30.5	<i>35.0</i>	19.4	22.2
Telefonica	3.8	3.8	3.8	3.8
Vodafone	4.3	4.4	3.1	3.2
Weighted Mean	16.1	17.1*	9.8	10.4*
OECD aggregate CbCR	14.6		11.8	

Note: Adjusted means refer to unadjusted tax haven shares for BP, Repsol, and Rio Tinto which correct CbCR profits themselves and for NN and Shell where adjustments are not possible due to missing country-by-country information. Adjustments for associates and joint ventures assume that these are based in non-haven countries which cannot be verified for Shell and does not hold for NN. For this reason, values for Shell are reported in italics and NN is left blank. The shares of profits in tax havens are calculated excluding company-country observations with losses on average over available years. The share of profit in tax havens for OECD aggregate CbCR statistics is based on the positive-profit sample for 2017.

The most important tax havens for our sample in absolute terms are the Netherlands, Singapore, and Switzerland, followed by the Bahamas, Belgium, and Bermuda (see Figure A1 in the Appendix). These results are mostly driven by Shell, which reports the highest absolute amount of profits in tax havens – approximately USD 9 billion– and by NN and BP, which report approximately USD 1.8 and 1.6 billion respectively.

4.2. Effective tax rates

The second risk indicator we analyse is the effective tax rate, both at MNE level (ETR_{MNE_i}) and at country level ($ETR_{country_j}$). MNEs characterised by low effective tax rates might employ tax avoidance strategies to minimise their tax burden, while countries where effective tax rates are low might be used as tax havens.

We calculate effective tax rates by MNE and for each country where MNEs are active. We take the means of observations by country and company over all available years, to account for loss offset

where possible. For the baseline ETRs, we exclude only those observations which are negative on average over all available years. For consistency with the aggregate OECD data⁵, we also calculate alternative ETRs („ETR_2”) for which we exclude all loss-making years before averaging. We set tax accrued to zero if it was negative on average. ETRs are defined as the ratio between the sum of reported income tax accrued and the sum of reported pre-tax profit (profit/loss before income tax) either by company or by country. For MNE i and country j the ETR is calculated as follows:

$$ETR_{MNE_i} = \frac{\sum_{j=1}^n \text{income tax accrued}_{ij}}{\sum_{j=1}^n \text{gross profits}_{ij}}$$

$$ETR_{country_j} = \frac{\sum_{i=1}^n \text{income tax accrued}_{ij}}{\sum_{i=1}^n \text{gross profits}_{ij}}$$

The MNEs’ worldwide effective tax rates (ETR_{MNE_i}) are thus weighted averages which assign more weight to ETRs in locations where MNEs report relatively more profits. Similarly, the effective tax rates by country ($ETR_{country_j}$) attach more weight to MNEs that account for higher shares of profit in that country.

As shown in Figure 4, global ETRs are above 20% for the majority of the MNEs in our sample and exceed 35% in the case of BP, ENI, and Repsol. Shell, Rio Tinto, NN, Anglo American, and Telefonica range between 20% and 30%. Iberdrola has a worldwide ETR below 20%, while Vodafone has an ETR of zero as a result of reporting negative taxes accrued. By adding up all tax payments and dividing them by the sum of profits across the sample, we obtain an average global ETR of approximately 21%. In contrast, the respective worldwide ETR calculated based on the aggregate OECD CbCR statistics (OECD, 2020) is 15%. It thus appears that companies which voluntarily published their CbCRs are more likely to pay higher ETRs than the world average. However, as discussed in Section 3.1., aggregate OECD data probably overstates total profits, so the global ETR based on this data is biased downwards. As a very blunt proxy for double-counted profits, we may take the mean estimate of the Dutch, Italian, Swedish and UK country notes, which suggests that 38% of headquarter profits might be double-counted due to dividends. Subtracting 38% of domestic MNEs’ profits in all headquarter countries (excluding those which have already provided adjusted profits) would increase the global ETR to 19%. Alternatively, we might assume that double-counted profits amount to 14.4% of total profits reported by MNEs in all jurisdictions, as previously established for the IRS-reported country-by-country profits of MNEs headquartered in the U.S. (Horst & Curatolo, 2020). If applied to the OECD’s aggregate CbCR data, this alternative adjustment would produce a global ETR of 17% (Figure 4).

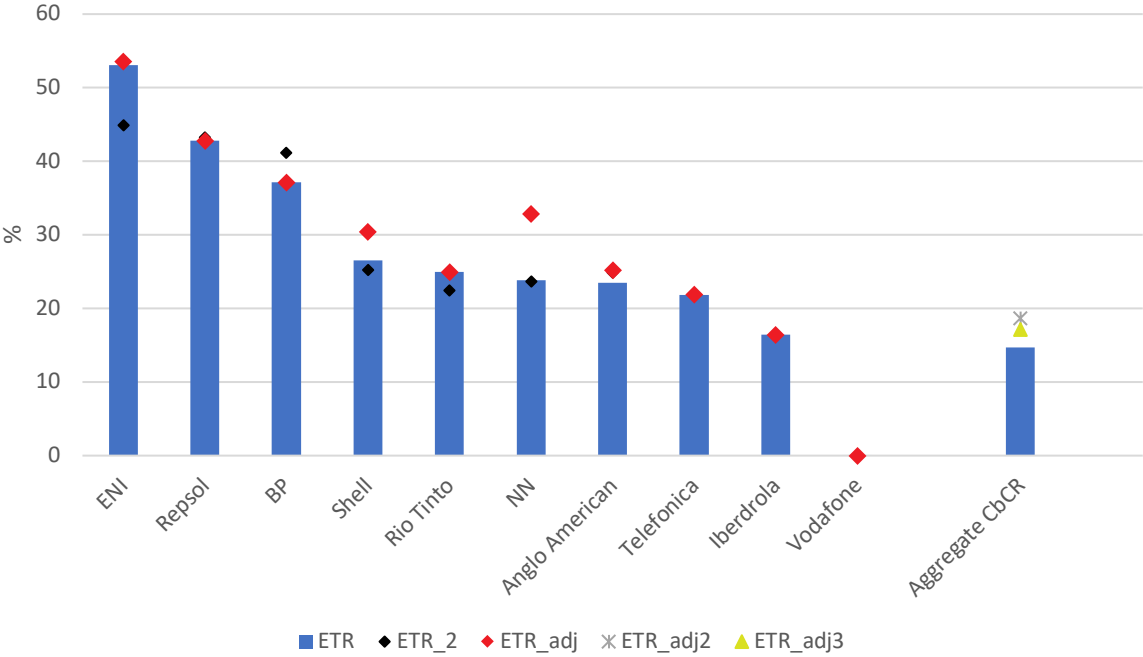
The comparably high global ETRs of ENI, Repsol and BP reflect high tax payments in resource-rich countries. The three MNEs concentrate more than 50% of their tax payments in only three jurisdictions each, some of them with very high ETRs: ENI’s top jurisdictions in terms of tax payments are Libya with an ETR of 76%, Algeria with an ETR of 89% and Egypt with an ETR of 24%. Repsol’s top three jurisdictions are Libya, Spain and Indonesia with ETRs of 70%, 27%, and 80% respectively. For BP, the top jurisdictions are the Middle East (which aggregates Bahrain, Iraq, Kuwait, Lebanon, Oman, Saudi Arabia, and United Arab Emirates), Angola, and Australia with ETRs of 89%, 43%, and 34%. These high ETRs might thus be due to special tax regimes such as excess profits taxes which many countries apply in the extractive sector (Otto, 2017). For example, in 2018, Libya and Norway charged surtaxes on profits from the petroleum industry, implying composite nominal tax rates up to 65% and 78%. Algeria, Angola, Australia, and Nigeria also have special tax regimes for the oil and gas industry, including resource rent taxes, royalties, or additional profit taxes (EY, 2018). Also in Indonesia, corporate income

⁵ We use the positive profit sample from the aggregate OECD data for comparison which excludes all observations with negative profits.

tax rates oil and gas industries or in mining may be calculated based on Production Sharing Contracts or Contract of Works (Deloitte 2022) and might thus deviate from standard rates.

A negative correlation between the share of profits reported in tax havens and the global ETR might constitute an initial indication of profit shifting. Depending on the tax-haven share and ETR measures we employ, the correlation is remarkably close to zero or even positive (varying between -0.04 and 0.12) and would thus not indicate a profit shifting risk for our sample.

Figure 4: Global effective tax rates



Note: Observations by company and country were averaged over available years before calculating the ETRs. For ETR_2, all negative profits were dropped before averaging. Adjusted ETRs (ETR_adj) exclude net income from associates and joint ventures. The global ETR is based on 2017 aggregate CbCR statistics, positive-profit sample. The grey Asterisk indicates a tentative adjustment for double-counting of profits by subtracting 38% of domestic MNEs’ profits in headquarter countries. The yellow triangle was obtained by reducing global aggregate CbCR profits by 14.4%.

4.3. Misaligned profits in tax havens

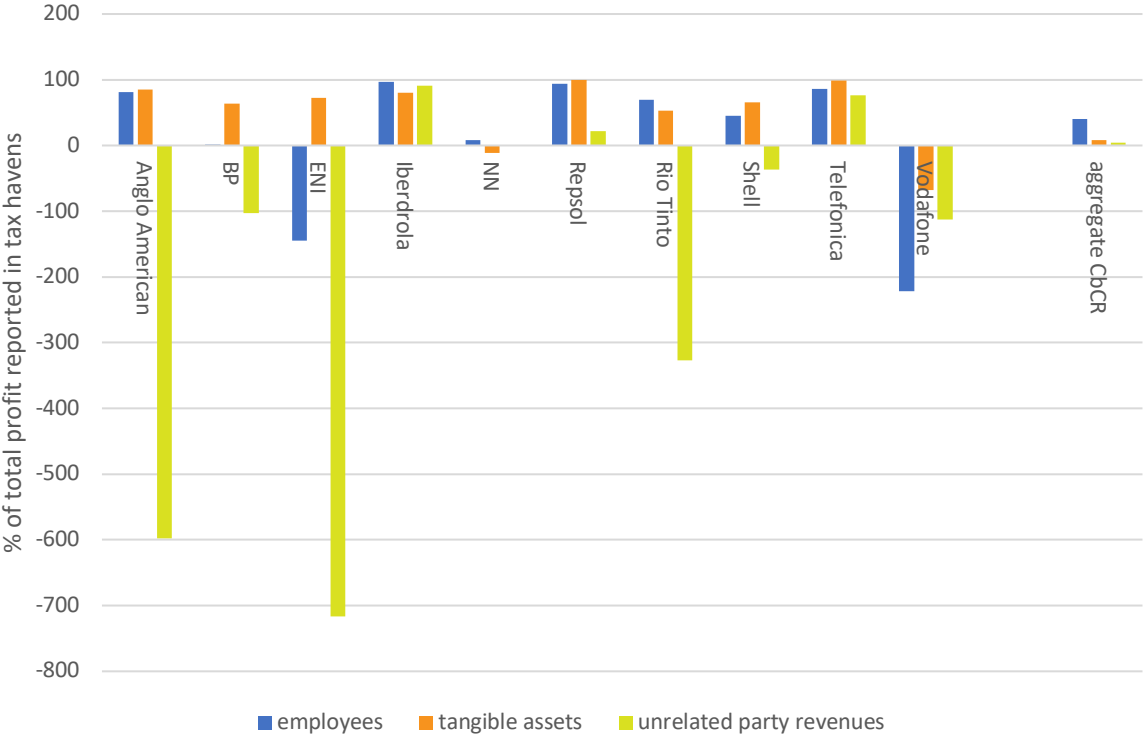
Although several companies report below world-average shares of profits in tax havens, their activities in tax havens are much more profitable than those in other jurisdictions. Average profits per employee are USD 0.2 million worldwide but USD 0.4 million in tax havens: profitability per employee is twice as high in tax havens than the worldwide average or even five times higher if we use Gravelle’s tax haven list (see Figure A2 in the Appendix). To assess the misalignment of tax-haven profit with reported activity more systematically, we compare each company *i*’s share of global profits in tax havens to its share of employees, tangible assets and unrelated-party revenues reported there. We compute misalignment by company *i* and country *j* as follows:

$$Misaligned_profit_{ij} = actual\ profit_{ij} - share\ of\ economic\ activity_{ij} * global\ profit_i \quad (1)$$

If the reported profits of an MNE in a given country are higher than profits predicted by that country’s share of the MNE’s total economic activity, this gives rise to ‘excess’ profit. If the reported profits are lower than the predicted profits based on the MNE’s economic activity, this gives rise to ‘missing profit.’ We obtain relative misalignment by dividing the absolute misaligned profits in each country by the profits MNEs actually report there.

When we measure economic activity in terms of the number of employees or tangible assets, most sample MNEs seem to report excess profits in tax havens which appear to be misaligned with economic activity by 40–100%. This is not the case for BP, ENI, NN, and Vodafone, where misalignment in terms of employees is either close to negligible (<10% for BP and NN) or even negative (ENI and Vodafone). The latter implies that, with respect to the total number of employees reported in tax havens, we would have expected ENI and Vodafone to make more profits there. When measured in terms of unrelated party revenues, misalignment is negative for half of the sample MNEs (Figure 5). This illustrates the sensitivity of the misalignment approach to the activity measure chosen. It also shows that tax havens attract a significantly higher share of the sample MNEs’ global unrelated party revenues compared to the share of MNEs’ global employees and tangible assets which these jurisdictions host. By strategically routing sales through tax havens, unrelated party revenues might already be over-reported in profit shifting destinations (Lafitte & Toubal, 2022). García-Bernardo & Janský (2022) suggest that even tangible assets may be strategically located as they find that US MNEs report the second highest value of tangible assets in Europe in Luxembourg.

Figure 5: Misalignment of profit and economic activity in tax havens by MNE



Note: The figure shows to what extent aggregate profits reported in tax havens are misaligned with aggregate economic activity in terms of the number of employees, the value of tangible assets and unrelated party revenues. If companies report a higher share of global profits than their share of global activity in tax havens, this gives rise to excess profits (positive misalignment). If companies report a lower share of profit than their share of global activity in tax havens, this gives rise to missing profits (negative misalignment).

4.4. Misalignment and effective tax rates

We further analyse the misalignment of profits and economic activity at country level to assess whether or not it correlates with average effective tax rates. As in recent applications of the misalignment methodology (Cobham & Janský, 2019) to CbCR data from large US MNEs (García-Bernardo et al., 2021) and to public CbCR data from banks (Janský, 2020b), we compute each country’s share in the total profits of the sample and compare it to each country’s share in the total economic

activity. We use the number of employees as the preferred proxy for economic activity as employees are less likely to be strategically located compared to tangible assets and unrelated-party revenues.

We compute misaligned profit in each country j as follows:

$$\text{Misaligned profit}_j = \text{actual profit}_j - \text{share of economic activity}_j * \text{total global profits}$$

As expected, we find that most tax havens exhibit both excess profit and very low ETR. This holds true for e.g. Singapore, Switzerland, Bermuda, and the Bahamas, for which our sample ETRs range between 0 and 10%; over 70% of profits reported there seem to be misaligned with economic activity. Likewise, Canada and the United Kingdom have ETRs between 0 and 10%, which coincides with excess profits, albeit to a lesser degree. Additional countries with relatively important excess profits include the Netherlands with an average sample ETR of 14%. Countries with a share of resource rent in GDP above 5%, which we refer to as resource-rich countries, often have both high ETRs and relatively high excess profits, e.g. Angola, Norway, Nigeria, Libya, and Oman with ETRs in excess of 40% (Figure 6).

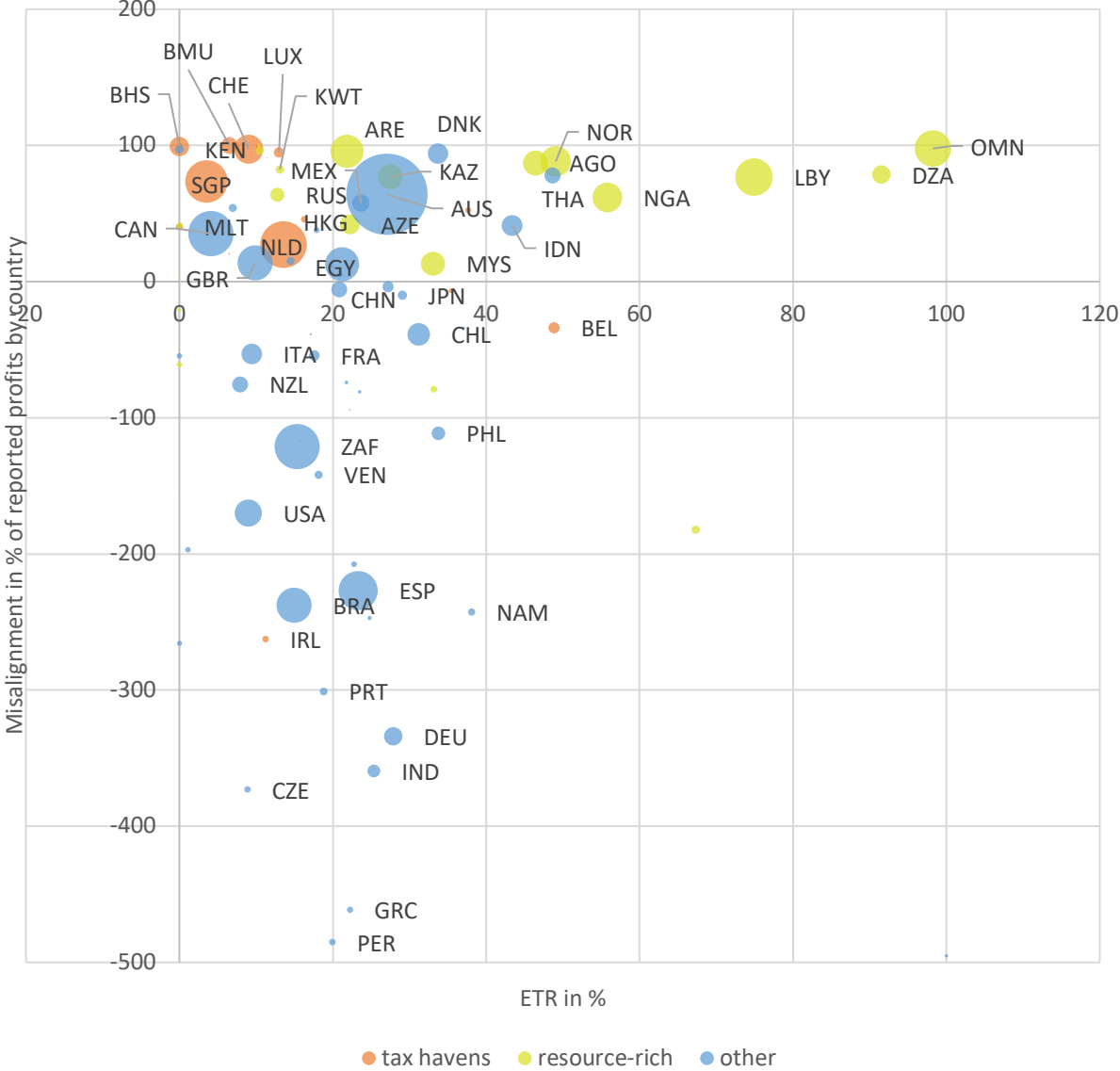
Countries with important missing profits are South Africa, Spain, Brazil, the United States, Italy, and Germany. However, the sample's ETRs in Italy, the United States, and New Zealand also range between 0 and 10% and between 10% and 20% for South Africa and Brazil.

For the total sample, misalignment and ETRs do not seem to be correlated. However, we find a correlation of -0.28 between relative misalignment and ETRs, significant at the 5%-level after excluding countries with a share of resources rent in GDP above 5%. When measuring economic activity in terms of tangible assets, the results are similar: no correlation for the total sample, and a negative correlation of -0.22 when we exclude resource-rich countries, but only significant at the 10% level. The high ETRs and excess profits of resource-rich countries seem to blur the expected negative correlation of ETRs and misalignment which points to the specific role of extractive industries in our sample.

How can the findings of excess profits and high ETR in several resource-rich countries be reconciled? Very high ETR may partly reflect measurement errors e.g. due to the previously discussed differences in financial and tax accounting (Section 3.3.). However, as discussed in section 4.2. special tax regimes such as excess profits taxes often applied in the extractive sector (Otto, 2017) may also explain the high sample ETRs in resource-rich countries. Despite the high ETRs, the sample MNEs report above-average profits in these jurisdictions, in total but also per employee. Part of these profits may derive from resource rents rather than economic activity measured in terms of employee numbers. Most of them would also be identified as 'excess profit' countries if we used tangible assets as a proxy for economic activity (see Figure A5 in the Appendix). The misalignment approach identifies them as 'excess profits' but this is very unlikely to be related to tax-induced profit shifting.

At company level we observe a negative correlation of relative misalignment with ETRs for ENI (-0.37), NN (-0.45), Shell (-0.37), significant at the 5% level. Taken together with the above-average share of tax-haven profits in total profits for NN and Shell (Section 4.2.), this might indicate that these companies locate their profits strategically to reduce global tax payments. While their rather moderate global ETRs of 24–33% for NN and 27–30% for Shell do not look especially suspicious, it can be noted that compared to Shell, the other oil companies in the sample seem to have paid relatively more taxes globally.

Figure 6: Misalignment and ETR by country



estimated ETR at country level to operationalize the tax incentive variable. We use the log profit of each multinational group i in country j as the dependent variable and regress it on the estimated ETR of country j , including control variables at the MNE-country level and country level and a set of group dummy variables.

$$\ln \pi_{ij} = \beta_0 + \beta_1 \tau_j + \beta_2 \ln L_{ij} + \beta_3 \ln K_{ij} + \beta_X X_j + \sum_{i=1}^9 \delta_i D_i + \varepsilon \quad (2)$$

τ_j is the ETR of country j , L and K are the number of employees and the tangible assets reported by group i in country j , X are country-level controls, which include GDP per capita, population size, an indicator for the rule of law and the share of natural resource rents in GDP. All country-level controls are taken from the World Bank (2022a, 2022b). The share of natural resource rent in GDP accounts for the fact that the extractive industries generate a natural resource rent which is less likely to be explained by labour and capital inputs. D_i are the nine group dummies, leaving out Anglo American as the reference case.

As in Dowd et al. (2017), we compare the linear relationship (2) between profits and ETR to a quadratic form (3):

$$\ln \pi_{ij} = \beta_0 + \beta_1 \tau_j + \beta_2 \ln L_{ij} + \beta_3 \ln K_{ij} + \beta_4 \tau_j^2 + \beta_X X_j + \sum_{i=1}^9 \delta_i D_i + \varepsilon \quad (3)$$

As we only have a small number of observations and pool them into a single cross-section, our objectives in applying this tax semi-elasticity method are mostly carried out to formalise the correlations between the variables that we observe in our descriptive analysis and to include additional covariates that help explain the global allocation of multinational profits.

We estimate a simple OLS regression. Controlling for MNE-country and country-level covariates, profits do not seem to be at all correlated with ETRs in the linear model. The coefficients are negative but very small and not significant. Allowing for a non-linear functional form we find a negative relationship between ETRs and the location of profits, but the coefficients are very small and not robust. For example, according to regression (4), at an ETR of 5% a one-percentage-point difference between countries would only explain 0.05% of the difference in reported profits. At an ETR of 30% the semi-elasticity would only be 0.03. In regression (3), the respective semi-elasticities would be even smaller with 0.03 at an ETR of 5% and 0.02 at an ETR of 30% (Figure 7).

In line with other researchers' results, the non-linear model would imply that the profit shifting incentive of a one percentage point difference between tax rates is higher at very low ETR levels and approaches zero at moderate ETR levels. For example, the ETRs of Austria, the UK, and Germany are 5%, 15% and 25%, respectively. Our results would imply that the tax difference of 10 percentage points between Austria and the UK explains a more important share of the distribution of profits between these two countries than the tax difference between UK and Germany explains of the distribution of profits between the UK and Germany. Intuitively, it makes sense that very low tax jurisdictions would attract most of the shifted profits while jurisdictions with moderate tax rates would attract none or very little.

As expected, we find that the number of employees and assets are positively correlated with the profits reported by each multinational group in each jurisdiction. Population size correlates negatively or is not significant. The share of natural resources rent in GDP is positive and significant as expected. As discussed in the misalignment section, our sample MNEs seem to make above-average profits in resource-rich countries which may confound the correlation of profits and ETR.

For robustness checks we test the pooled regressions with nominal corporate tax rates (NCTRs) and ETRs based on aggregate CbCR data from the OECD. There seems to be no correlation whatsoever with the NCTR. For the ETRs based on aggregate CbCR data, the sign and size of tax coefficients correspond to those of our sample's ETRs but are only significant at the 10%-level (Table A2 in the Appendix). We also run regressions separately for each multinational group to test whether the small average coefficients mask important differences between companies. However, we do not find any significant and meaningful correlations between reported profits and country-level ETRs (see Table A3 in the Appendix).

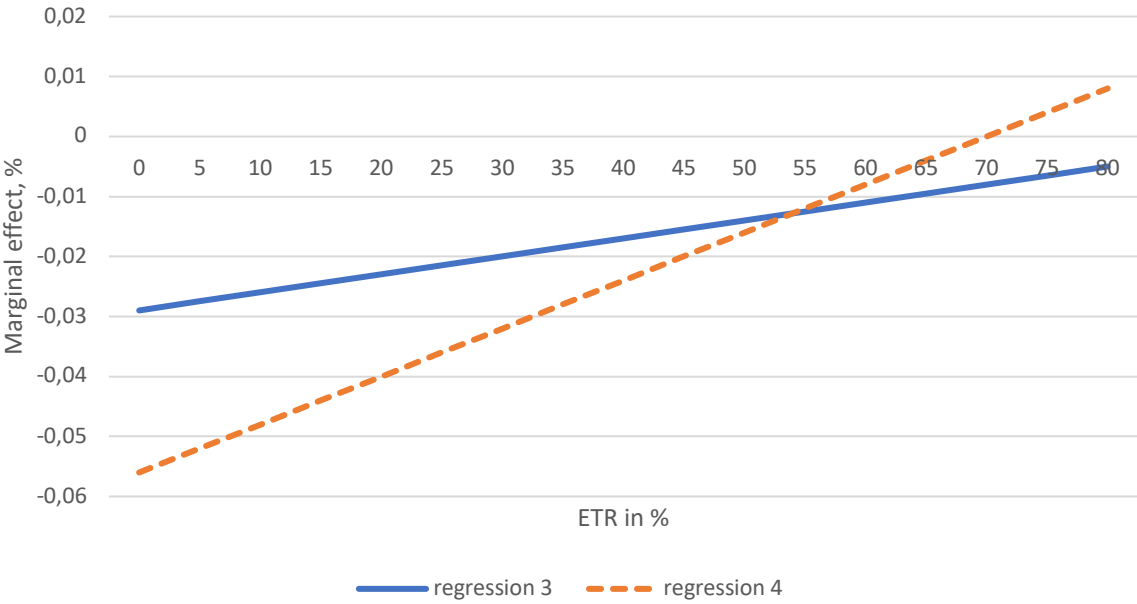
One result from the pooled regressions might suggest that our sample's reported profits are on average negatively correlated with ETRs, which would be consistent with profit shifting activities. However, the estimated average coefficient size is much smaller than in other studies and not robust. Even though the non-linear relationship of profit and ETR makes sense intuitively, and is qualitatively in line with existing literature (e.g. Dowd et al. 2017, García-Bernardo & Janský 2021), the small number and cross-sectional nature of observations do not allow us to identify profit-shifting behaviour of the sample MNEs. The relatively weak correlation profits and ETRs is, however, in line with our previous descriptive findings, i.e. the comparably high global ETRs and moderate tax-haven profits of the sample MNEs on average.

Table 6: Pooled regression

	(1)	(2)	(3)	(4)
	linear b/se	linear excluding outliers b/se	quadratic b/se	quadratic excluding outliers b/se
ETR_COUNTRY	-0.008 (0.006)	-0.009 (0.007)	-0.029+ (0.016)	-0.056** (0.021)
ETR_COUNTRY²			0.000 (0.000)	0.001* (0.000)
LN_EMPLOYEES	0.540*** (0.095)	0.546*** (0.096)	0.541*** (0.095)	0.543*** (0.095)
LN_ASSETS	0.274*** (0.069)	0.265*** (0.069)	0.275*** (0.069)	0.264*** (0.068)
LN_GDP_PC	0.272 (0.200)	0.255 (0.201)	0.318 (0.195)	0.251 (0.203)
LN_POPULATION	-0.169+ (0.088)	-0.172+ (0.088)	-0.136 (0.089)	-0.115 (0.092)
RESOURCE-RICH	0.054* (0.023)	0.049* (0.024)	0.052* (0.023)	0.046+ (0.024)
RULE OF LAW	-0.002 (0.009)	-0.002 (0.009)	-0.003 (0.009)	0.001 (0.010)
R2	0.664	0.658	0.667	0.666
R2_A	0.640	0.634	0.642	0.641
N	247	241	247	241

Note: + p<0.10, * p<0.05, ** p<0.01, *** p<0.001. Regressions (2) and (4) exclude observations with ETR>80%.

Figure 7: Marginal effect of ETR on reported profits



Note: Calculation based on pooled regressions 3 and 4 in Table 6.

4.5. Evaluation of tax risk indicators by company

To evaluate and compare tax risk indicators by company, we suggest simple thresholds for each indicator which allow us to identify some differences in tax risks between companies. Ideally, a very tax-aggressive company would locate high-risk functions in several tax havens (1), report an above-average share of profits in tax havens (2), and have a below-average global ETR (3). The profits in tax havens would not be aligned with economic activity reported there (4). Instead, the location of profits would correlate with corporate tax rates (5a) even when adding further country-level and company-level covariates (5b). As these criteria depend strongly on their empirical operationalisation, we suggest several thresholds for some of them. For example, an above-average share of profits in tax havens may be defined relative to aggregate CbCR data (the population of large MNEs) or to the sample and may vary depending on the tax-haven list. Similarly, the global ETR may be compared to aggregate CbCR or to the sample mean (Table 7). Due to the specific tax rules applicable in the extractive industries, it might make sense to also use sector-specific ETRs as benchmark ETRs to assess an MNE’s tax aggressiveness. For example, PWC (2015) finds that the average ETR of the global oil and gas sector was 31.5% on average over the years 2011-2013 which was higher than in other sectors.⁶ Unfortunately, comparable consistent and up-to-date benchmarks are not available for all industries represented in our sample.

We find that none of the sample MNEs fulfil all of the ‘tax aggressiveness’ criteria across all operationalisations. Notably, most have relatively low shares of tax-haven profits, high ETRs, and no correlation between profits and tax rates. Shell is the only company that surpasses at least one threshold in four out of the five tax-risk indicators. It reports high-risk activity in more than three different tax havens, and an above-average share of profits in tax havens (compared to the sample and

⁶ The ETRs for other sectors ranged between 22%-25% for engineering and construction and 28%-30% for transportation and logistics.

to aggregate CbCR data) for both tax haven lists. Its tax haven profits seem misaligned with economic activity in terms of employees and tangible assets, and this misalignment seems to be correlated with ETRs. However, the correlation is not significant when further control variables are included. Shell's global ETR of 27–30% looks moderate compared to the sample but also to the aggregate CbCR data.⁷ All remaining MNEs surpass the thresholds of a maximum of two indicators, although it should be noted that BP, Iberdrola, and NN do not report the functions performed in tax havens so that this indicator cannot be assessed.

Do more transparent MNEs avoid taxes less aggressively? Our analysis of tax risk indicators would support this view as most of the sample MNEs fulfil not more than two of the five suggested criteria for tax aggressiveness. The limited sample size and the heterogeneity in terms of company size and industry makes such a general conclusion difficult. As discussed previously, the relatively high global ETRs might be specific to the extractive industries. However, four out of 6 MNEs in extractive industries combine the high to moderate ETR with a relatively low share of profits in tax havens and the location of profits seems not to be correlated with effective tax rates. In our sample, this does not seem to be industry-specific as we find low tax-haven profits and uncorrelated profits and tax rates for Iberdrola, Telefonica and Vodafone. Furthermore, recent research by Beer and Loeprick (2017) and Beer and Devlin (2021) suggests significant profit shifting risks in the extractive sector so that low tax haven profits are unlikely to be a general characteristic of the extractive industries.

⁷ It is a bit lower though than the benchmark tax rate of 31.5% computed by PWC (2015) for oil and gas companies.

Table 7: Evaluation of tax risk indicators by company

Tax risk indicator	Thresholds	Anglo A.	BP	ENI	Iberdrola	NN	Repsol	Rio Tinto	Shell	Telefonica	Vodafone
(1) High-risk functions	High-risk functions in at least three different tax havens	yes	n/a	yes	n/a	n/a	yes	yes	yes	no	yes
(2) Share of profit in tax havens	Share above aggregate CbCR mean and sample mean (list 1)	no	yes	no	no	yes	no	no	yes	no	no
	Share above aggregate CbCR mean and sample mean (list 2)	no	yes	no	no	no	no	no	yes	no	no
(3) Global ETR	below aggregate CbCR mean	no	no	no	no	no	no	no	no	no	yes
	below sample mean	no	no	no	yes	no	no	no	no	no	yes
(4) Misaligned profit in tax havens	Excess profit based on at least two different activity measures	yes	no	no	yes	no	yes	yes	yes	yes	no
(5) Tax sensitivity	negative correlation of misalignment and ETR	no	no	yes	no	yes	no	no	yes	no	no
	negative correlation of profit and ETR with covariates	no	no	no	no	no	no	no	no	no	no

5. Conclusion

In this paper we explore voluntarily published CbCRs by ten MNEs which provide an exceptional level of corporate tax transparency on a global scale. We assess the quality of the data by comparing it to consolidated financial accounts and discuss the role of double-counting of profits, the inclusion of associate and joint venture profits, and other issues which may impede a meaningful interpretation of CbCR data. Based on several tax risk indicators, we assess to what extent our sample MNEs may differ from the global population of large MNEs as included in the aggregate CbCR data. We further provide a tentative framework to evaluate tax risk indicators across sample MNEs and assess their potential overall tax aggressiveness even in the absence of a clear identification of profit shifting.

Our analysis confirms that CbCR data need to be interpreted with some caution, as reporting across MNEs is not uniform and tax risk indicators may be biased by dividends or profits of equity-accounted entities. However, it seems that MNEs voluntarily publishing CbCRs are aware of these risks as they seem to completely avoid the double-counting of profits in the form of dividends, and some even correct for profits of associates and joint ventures. For those who do not, we find that correction for associates and joint ventures mostly leads to gradual adjustments of aggregate risk indicators, while individual adjustments at company and country level may be more important. Even if those problems can be avoided as the reporting standard improves, conceptual gaps between financial profits and taxable profits remain. While loss carryover can to some extent be addressed by averaging observations over several years, a certain degree of uncertainty with regard to ETRs seems to be unavoidable as long as MNEs' tax accounts are kept confidential. Some MNEs provide additional

qualitative information to explain low tax payments in individual countries but the data does not allow for a systematic correction of the calculated ETRs by country. Nevertheless, the voluntary publishing of CbCRs may in itself be regarded as a major step towards greater transparency.

The early publishers of CbCR, which we analyse in this paper, generally seem to score low on typical tax risk indicators. Most of the sample MNEs report comparably low profits in tax havens, moderate to high global ETRs and high-risk functions in tax havens. We also find some degree of correlation between the location of profits and ETRs, but the correlation coefficient seems exceptionally low compared to other studies when controlling for covariates and not robust across specifications. As some tax risk indicators vary substantially between MNEs, we provide a tentative assessment of overall tax aggressiveness by company and find that only one company fulfils three out of five criteria completely.

We cannot conclude that our sample MNEs shift less profits than the global average even if several indicators point into this direction. The comparably high global ETRs may also be explained by high resource taxes applicable in the extractive industries, which are overrepresented in our sample. Sectoral benchmark ETRs might thus improve the operationalisation of this tax risk indicator. High ETRs may also be the result of the correct accounting of dividends and adjustments for associate and joint venture profits, which may distinguish our sample from the average MNE included in aggregate CbCR data or other CbCR datasets used in profit shifting analyses. To draw a more reliable conclusions, further analyses of more CbCRs and from different economic sectors are needed. This will likely become possible in the coming years given that an increasing number of MNEs are voluntarily deciding to publish such data and EU-wide public CbCR will become mandatory in 2024.

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Appendix

Figure A1: Absolute profits by tax haven

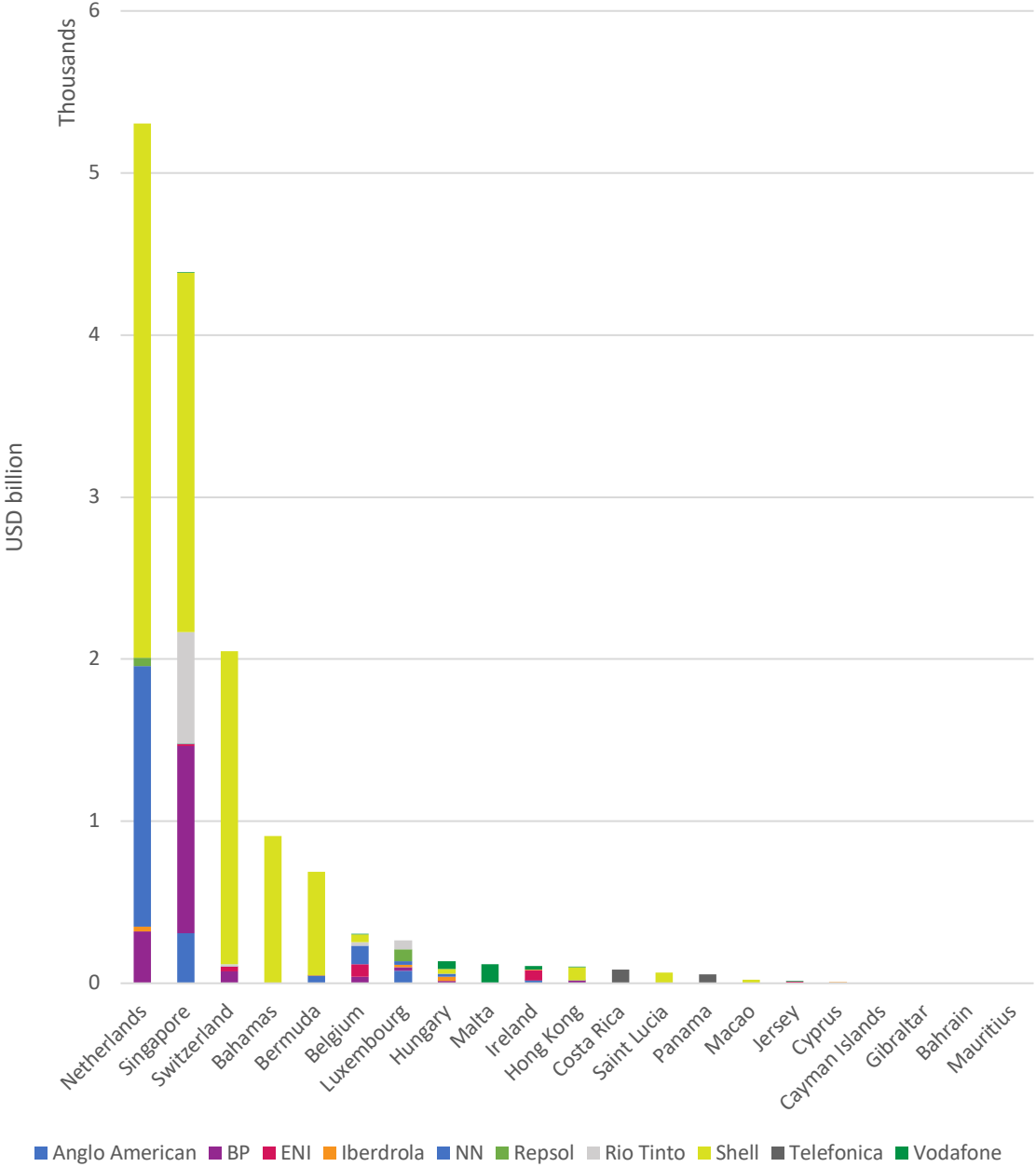
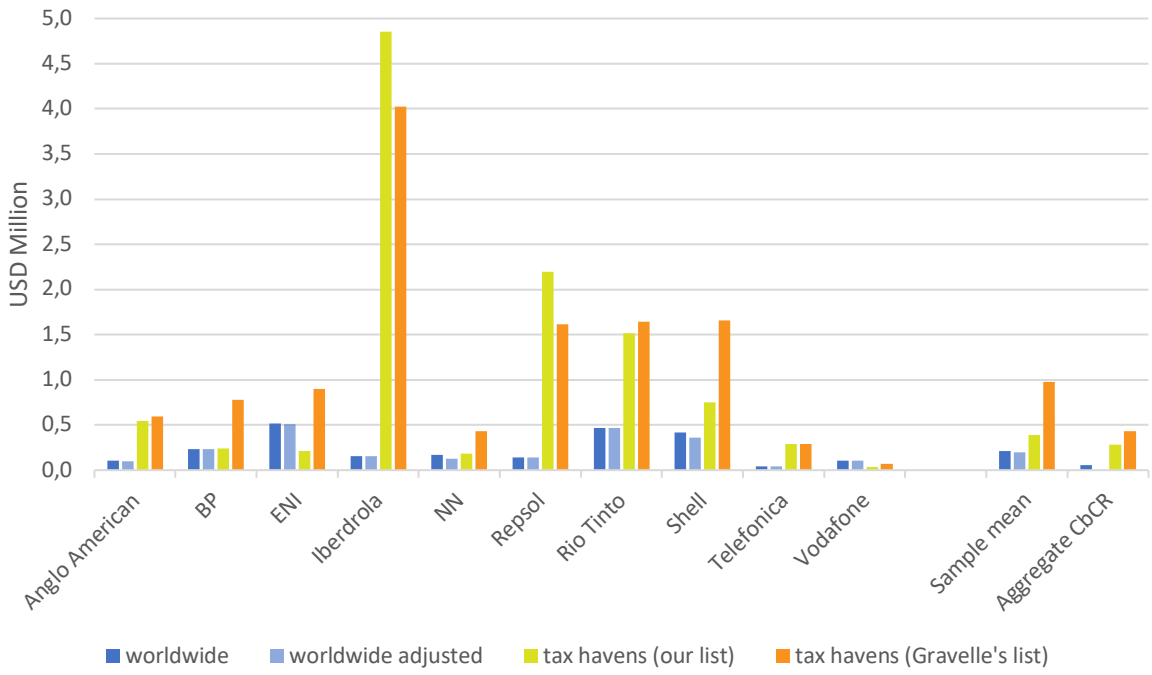
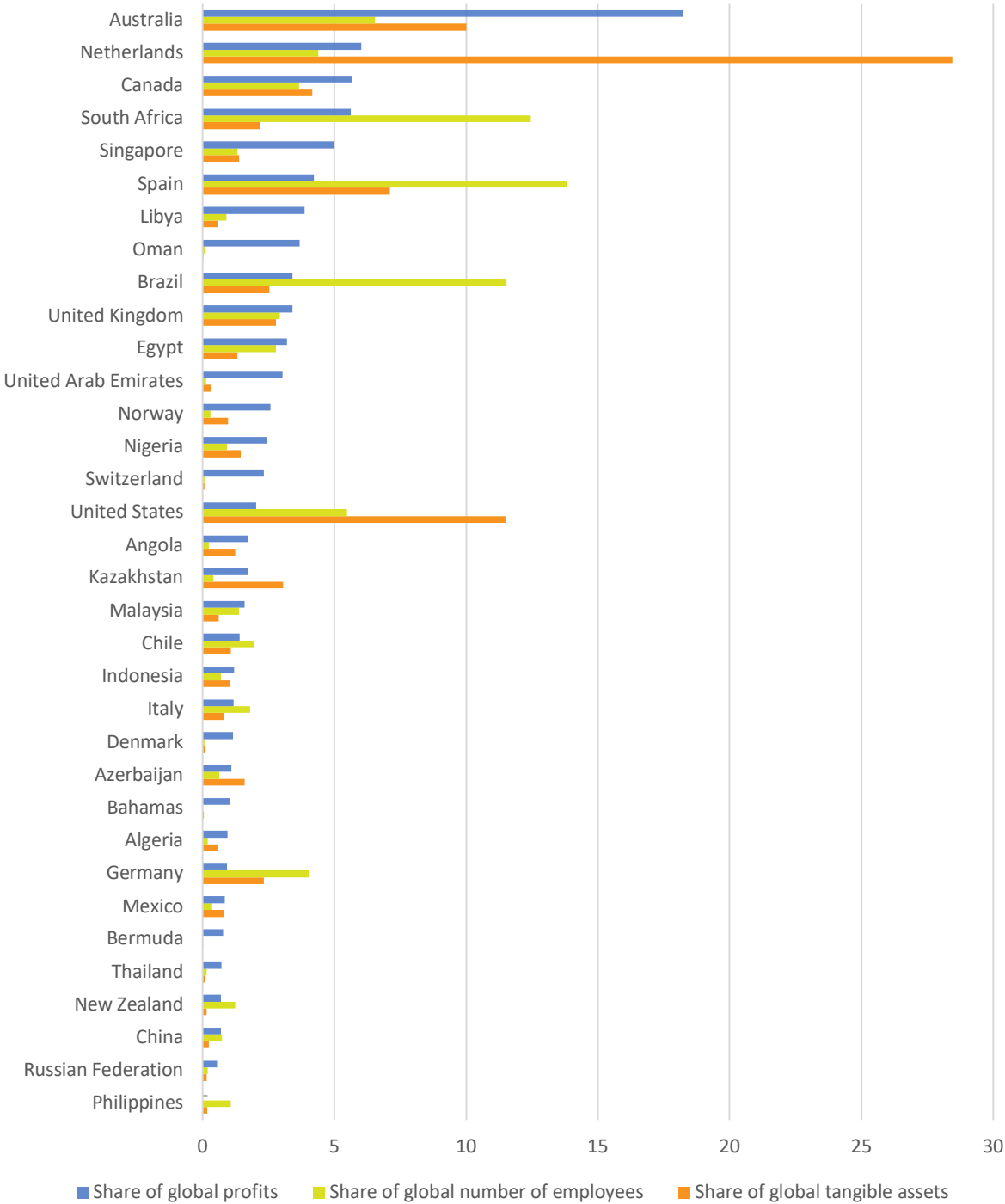


Figure A2: Profit per employee worldwide and in tax havens



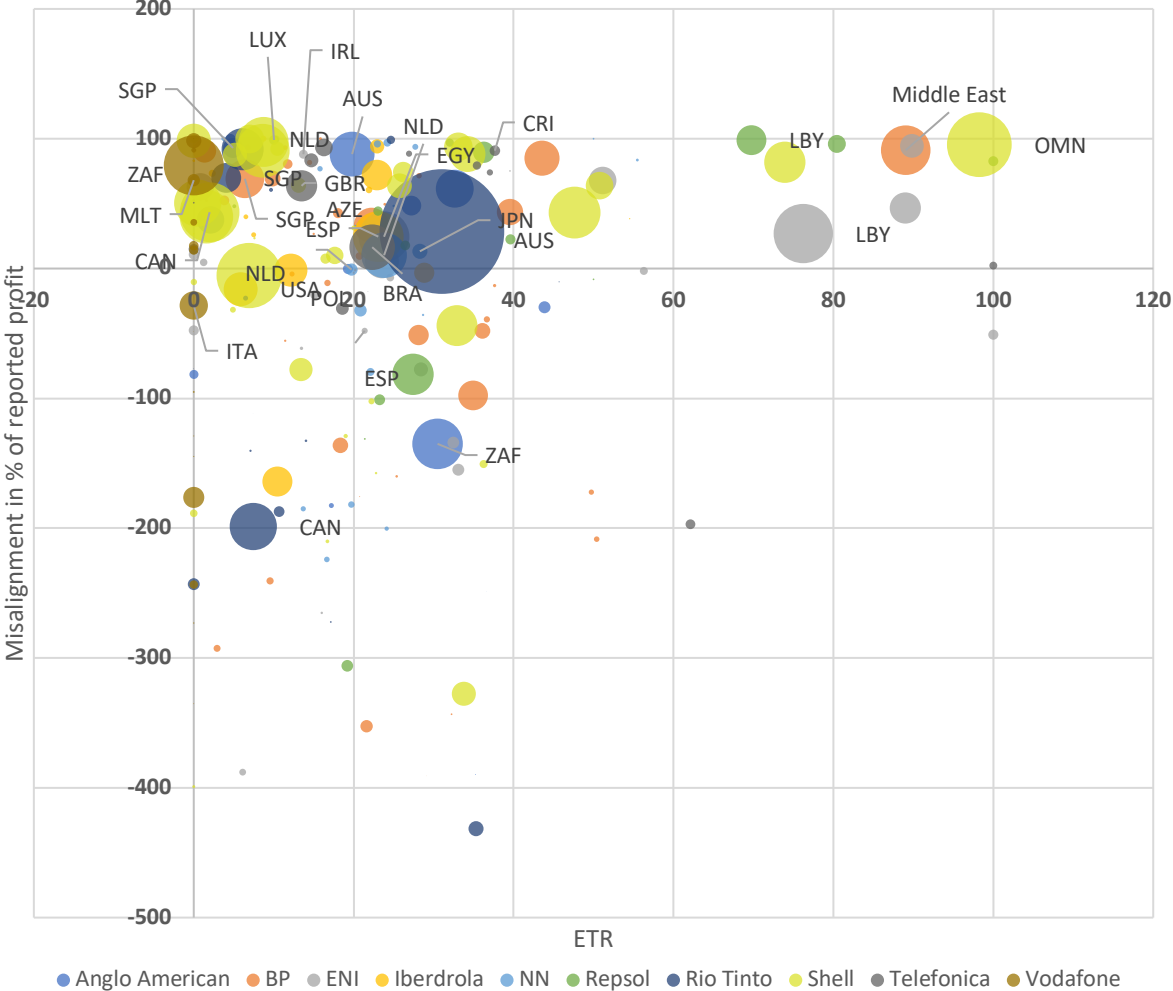
Note: Average profits per employee are USD 0.2 million worldwide but USD 0.4 million in tax havens: profitability per employee is twice as high in tax havens than the worldwide average or even five times higher if we use Gravelle’s tax haven list. We identify the largest discrepancy between worldwide and tax haven profits per employee for Iberdrola and Repsol. The extreme value by Iberdrola is mainly caused by its Cyprus location where it reports USD 3 million of profit and one employee. In relation to its total profit, however, these Cyprus profits seem negligible (see Section 4.2.). For BP, ENI, and NN, a positive discrepancy between profitability worldwide and in tax havens can only be observed if tax havens are defined according to Gravelle’s list instead of according to our preferred list. Vodafone’s activities seem to be less profitable in tax havens than in the rest of the world.

Figure A3: Shares of global profits and activity by country



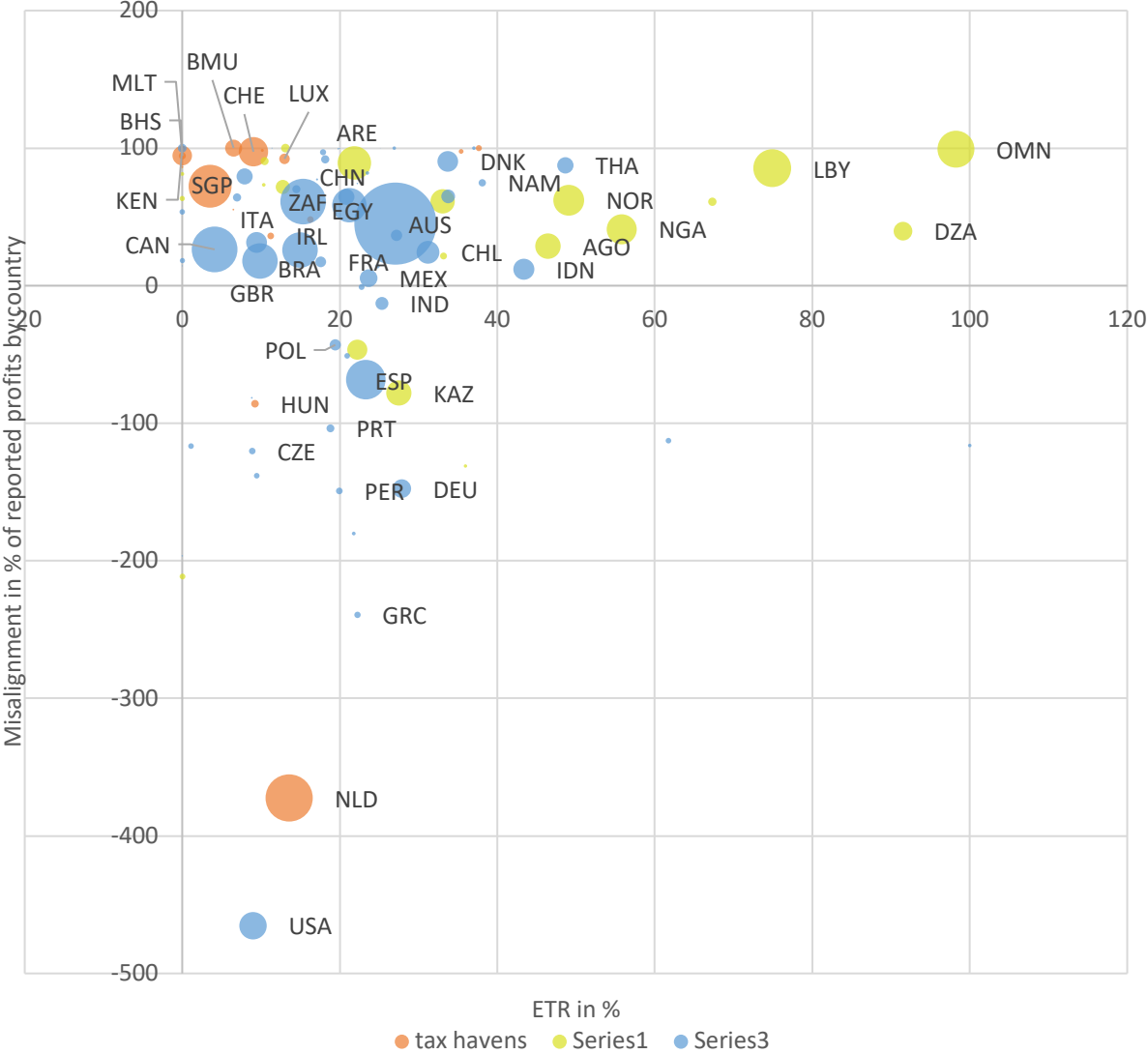
Note: This figure plots each country’s share in the sample’s total global profits, number of employees and total tangible assets. The figure includes only countries with a share of global profits above 0.5%.

Figure A4: Misalignment and ETR by company and country



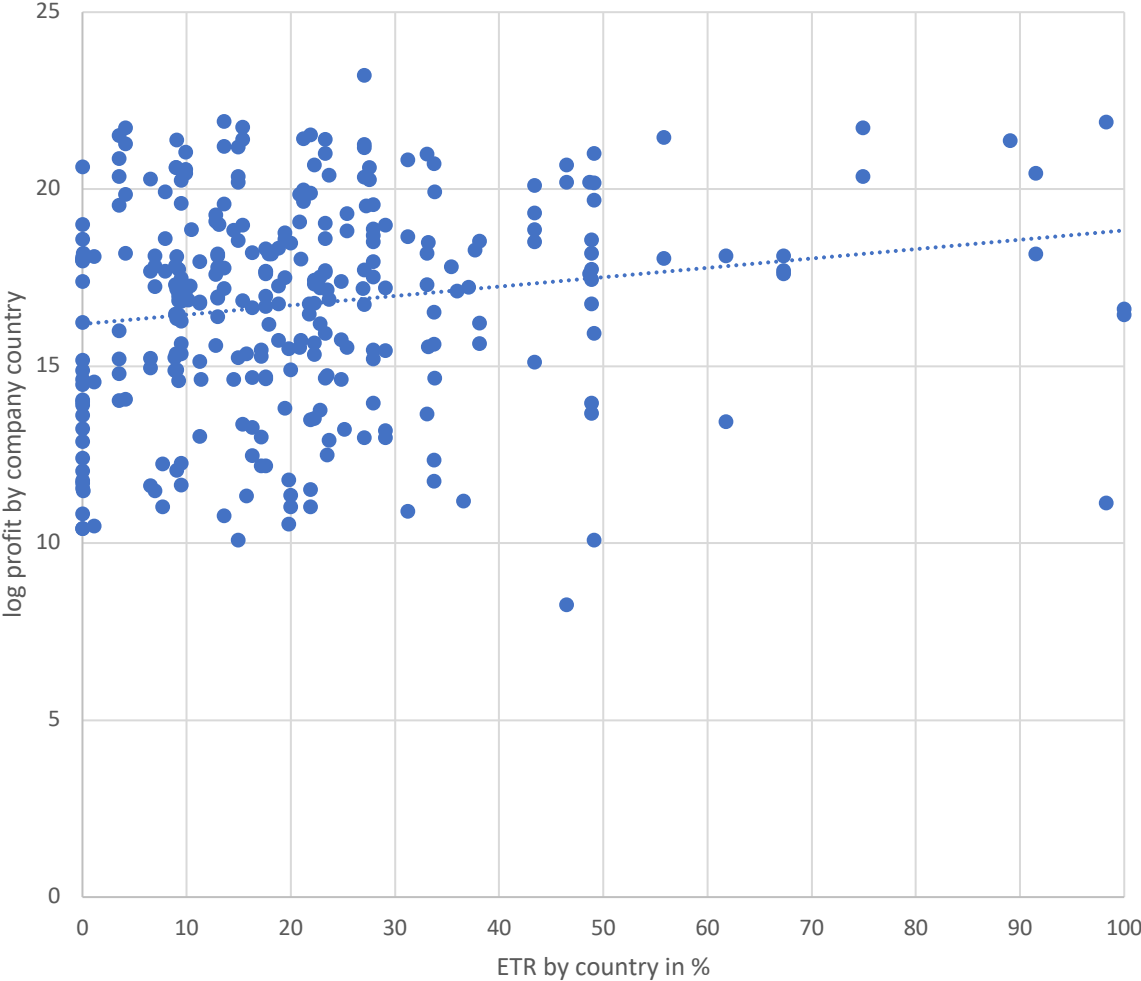
Note: Misalignment based on number of employees. BP reports Bahrain, Iraq, Kuwait, Lebanon, Oman, Saudi Arabia, and United Arab Emirates subsumed under "Middle East." Annotations are displayed for two most important non-havens and tax havens in terms of total reported profit by company.

Figure A5: Misalignment in terms of tangible assets and ETR by country



Note: Misalignment is based on the value of tangible assets. A country is considered resource-rich if it derives more than 5% of its GDP from resource rents according to World Bank (2022). The bubble size indicates the absolute number of profits which the sample MNEs report in each jurisdiction.

Figure A6: Log profits and effective tax rates



Note: The figure plots log profits by company country and ETR by country as used in the regressions in Section 4.5.

Table A1: Profit of equity-accounted associates and joint ventures

Company	Year	CbCR corrected for equity-accounted entities	Total CbCR profit	Total consolidated profit	Net income from associates and joint ventures	in % of consolidated profit	Breakdown of net income by entity available	Countries potentially affected
Anglo American	2018, 2019	No	4,305	6,168	559	9.1%	yes	Australia, Brazil, Colombia, South Africa
BP	2019	Yes	6,860	8,154	3,257	39.9%		
ENI	2017, 2018, 2019	No	5,838	8,700	-160	-1.8%	Yes	Angola, Greece, Italy, Mozambique, South Korea, Spain, Venezuela
Iberdrola	2019	N/A	5,498	5,368	-8	-0.2%	No	Brazil, Italy, Mexico, Spain, UK, USA
NN	2018, 2019	N/A	2,338	2,338	642	27.4%	No	Germany, Netherlands, N/A
Repsol	2018, 2019	Yes	-616	175	818	466.8%		
Rio Tinto	2018, 2019	Yes	14,312	14,643	407	2.8%		
Shell	2018, 2019	No	27,801	30,553	3855	12.6%	No	all continents
Telefonica	2019	N/A	2,619	3,044	15	0.5%	No	
Vodafone *	2017, 2018, 2019	N/A	-68,699	1,602	-344	-21.5%	Yes	Australia, India, Kenya, Netherlands

Note: Reported values are means of available years. Source: authors

Table A2: Regressions with alternative tax rate variables

	(1)	(2)	(3)	(4)
	linear	quadratic	linear	quadratic
	b/se	b/se	b/se	b/se
NCTR	-0.002 (0.020)	-0.092 (0.095)		
NCTR²		0.002 (0.002)		
ETR_OECD			-0.012 (0.012)	-0.048+ (0.026)
ETR_OECD²				0.001+ (0.000)
LN_EMPLOYEES	0.541*** (0.096)	0.538*** (0.097)	0.546*** (0.096)	0.549*** (0.096)
LN_ASSETS	0.273*** (0.070)	0.277*** (0.071)	0.270*** (0.070)	0.265*** (0.070)
LN_GDP_PC	0.292 (0.200)	0.296 (0.197)	0.311 (0.199)	0.286 (0.200)
LN_POPULATION	-0.169+ (0.092)	-0.164+ (0.086)	-0.165+ (0.090)	-0.129 (0.090)
RESOURCE RENT IN GDP	0.047* (0.023)	0.048* (0.022)	0.048* (0.023)	0.051* (0.022)
RULE OF LAW	-0.002 (0.009)	-0.002 (0.009)	-0.005 (0.009)	-0.003 (0.009)
R2	0.661	0.664	0.666	0.669
R2_A	0.638	0.639	0.643	0.644
N	247	247	246	246

Note: + p<0.10, * p<0.05, ** p<0.01, *** p<0.001. NCTR is nominal corporate tax rate. ETR_OECD is the effective tax rate based on aggregate CbCR statistics by the OECD.

Table A3: Regressions by multinational group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	AngloAmerican	BP	ENI	Iberdrola	NN	Repsol	Rio Tinto	Shell	Telefonica	Vodafone
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
ETR	-0.06	-0.06	0.05	-0.29	0.03	0.08*	-0.04	-0.04	-0.13	-0.01
	(0.08)	(0.07)	(0.03)	(0.31)	(0.04)	(0.03)	(0.04)	(0.04)	(0.09)	(0.09)
ETR²	0.00	0.00	-0.00	0.01	-0.00	-0.00+	0.00	0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LN_EMP	-0.40	0.43*	0.15	0.79***	0.03	0.11	0.82***	0.58**	1.73+	0.63
	(0.59)	(0.19)	(0.25)	(0.11)	(0.12)	(0.18)	(0.18)	(0.19)	(0.69)	(0.40)
LN_ASSETS	1.17**	0.30***	0.55**	0.00	0.57***	0.42**	0.16	0.14	-1.19	0.05
	(0.34)	(0.08)	(0.15)	(0.09)	(0.09)	(0.09)	(0.09)	(0.12)	(0.60)	(0.38)
LN_GDP_PC	0.30	0.04	0.32+	-0.41	1.50***	0.33	0.87**	0.96***	1.95+	-0.40
	(0.25)	(0.22)	(0.18)	(0.30)	(0.26)	(0.18)	(0.25)	(0.24)	(0.80)	(0.34)
RESOURCE RENT IN GDP	0.13*	0.05	0.02	-0.16	2.47**	0.06+	-0.09	0.07+	0.69	-0.10
	(0.05)	(0.04)	(0.03)	(0.12)	(0.79)	(0.02)	(0.06)	(0.04)	(0.46)	(0.10)
R2	0.88	0.76	0.80	0.94	0.93	0.93	0.91	0.47	0.88	0.67
R2_A	0.88	0.76	0.80	0.94	0.93	0.85	0.87	0.40	0.64	0.57
N	11	37	23	10	12	5	13	43	3	20

+ P<0.10, * P<0.05, ** P<0.01, *** P<0.001