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HOW MUCH MULTINATIONAL CORPORATIONS PAY IN TAXES AND WHERE: EVIDENCE FROM THEIR COUNTRY-BY-COUNTRY REPORTS

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$$\frac{1}{(m-1)!} p^{m-1} (1-p)^{n-m} = p \sum_{\ell=0}^{n-1} \frac{\ell+1}{n} \frac{(n-1)!}{(n-1-\ell)! \ell!} p^{\ell} (1-p)^{n-1-\ell} = p \frac{n-1}{n} \sum_{\ell=0}^{n-1} \left[\frac{\ell}{n-1} + \frac{1}{n-1} \right] \frac{(n-1)!}{(n-1-\ell)! \ell!} p^{\ell} (1-p)^{n-1-\ell} = p^2 \frac{n-1}{n} +$$

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How Much Multinational Corporations Pay in Taxes and Where: Evidence from their Country-by-Country Reports

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Abstract:

By exploiting country-by-country reports (CBCRs) prepared according to the OECD BEPS Action 13's minimum standards and voluntarily published by multinational corporations (MNCs), we show that the CBCR data can be used to identify how much MNCs pay in taxes and where, as well as how important tax havens and profit shifting are. The largest, hand-collected sample of these CBCRs combines global information from ten MNCs, which are special not only in terms of tax transparency, by being the only MNCs to publish their CBCR, but also in terms of industry composition, with a half of them in the extractive industries, and – perhaps, therefore – the observed tax characteristics. Specifically, we observe that the worldwide effective tax rates of our sample MNCs are higher on average than our comparison estimates based on the aggregate data for large MNCs published in 2020. We also find that the sample MNCs report slightly more profits in tax havens on average than many large MNCs, although most of the sample MNCs are far below that average. We further find some indication of profit shifting as the sample MNCs' profits in tax havens are much higher than their economic activity suggests and we estimate a non-linear relationship between profits and effective tax rates, which is

negative up to effective tax rates of around 30%. We highlight the differences across countries and MNCs by presenting country-level results, both for the whole sample and for specific MNCs, but CBCR data for even more individual MNCs would be needed to test for any systematic, MNC-specific determinants behind these differences.

JEL: F23; H25; H26

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

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1 Introduction

How much multinational corporations (MNCs) pay in taxes and where is a fundamental question, important in itself (Zucman, 2014) and with important implications for tax reform (Clausing, 2020), income inequality (Piketty et al., 2018), tax avoidance (Güvener et al., 2021) and industry concentration (Martin et al., 2020). It might thus come as a surprise that there are no clear-cut answers to it. The current lack of definitive or comprehensive answers is largely due to the data and methodology challenges inherently associated with this question, which have been tackled in various ways – and with an increasing rigour – over the years.

The use of data from confidential tax returns has emerged as the best practice at 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 statistics of foreign direct investment (Bolwijn et al., 2018, Janský & Palanský, 2019) and of foreign affiliates (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 the so called country-by-country reporting (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).

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 MNCs – to identify how much MNCs pay in taxes and where, as well as how important tax havens and profit shifting are. We have hand-collected the largest sample of these CBCRs – 10 of them as of December 2020 – that have shared their CBCRs publicly. In this paper we introduce this new data set and we apply state-of-the-art methods to it to learn about the MNCs’ effective tax rates, profit misalignment, activities in tax havens and profit shifting using the tax semi-elasticity approach.

We arrive at three main findings. First, we observe that the average effective tax rate of the sample MNCs is higher than our comparison estimates based on the aggregate data for large MNCs published in 2020. Specifically, we observe that MNCs’ worldwide ETRs range between 0% and 50%, with 6 out of the 10 sample MNCs having worldwide ETRs above 20%, while in individual countries the effective tax rates range between 0% and 85% (after excluding outliers with ETRs above 100%). Our findings suggest that the MNCs that voluntarily published their CBCRs are more likely to pay *higher* ETRs than MNCs from the aggregate CBCR data. These generally higher worldwide effective tax rates might be related to two specific characteristics of the sample: the sample MNCs are special in terms of tax transparency, by definition, in being the only MNCs to publish their CBCRs, and are also special in terms of industry composition, with half of them in the extractive industries. Both willingness to share the location of their profit and taxes and activities in extractive industries might be positively correlated with worldwide effective tax rates. Indeed, we observe a slight positive correlation of ETR with the share of natural resources rents in GDP, which is probably related to the special tax regimes many countries apply to the oil and gas sector.

Second, we find that the sample MNCs report slightly higher profits in tax havens on average than many large MNCs, although most of the sample MNCs are far below the average. In other words,

while the majority of MNCs in our sample seem to have few activities in tax havens, some MNCs report much of their profit in tax havens. Most MNCs report much higher profitability in tax havens than their worldwide average. In addition, most MNCs in our sample report moderate worldwide ETR and their worldwide ETR does not seem to correlate with their presence in tax havens.

Third, we find some indication of profit shifting, because the sample MNCs' profits in tax havens are much higher than their economic activity suggests and because we estimate a non-linear relationship between profits and effective tax rates, which is negative up to effective tax rates of around 30%. Applying a profit misalignment method, we find that the sample MNCs report more profits than economic activity in most tax havens and in many resource-rich countries. They report less profit than activity in most large economies of the global North, as well as in Eastern European countries and large developing countries. In total, the world's tax havens attract more of our sample's profits than would be in line with their economic activity in them. However, in absolute numbers, the excess profits booked in tax havens are smaller than the MNCs' excess profits in resource-rich countries. In the descriptive analysis, we find no correlation, or possibly a slight *positive* correlation between our sample's ETR and profit misalignment, which implies that higher ETRs are likely associated with lower missing profits or higher excess profits. However, when we then estimate the tax semi-elasticity of the reported profits, controlling for MNC-country and country-level covariates and allowing for a non-linear effect of ETR, we find evidence of a comparably weak but negative relationship for low and moderate levels of ETR, which would be consistent with profit-shifting activities. Overall, we find evidence in line with profit-shifting activities, but the estimated average semi-elasticities seem comparably low and not very robust. For these profit shifting estimates, as well as our other findings, we highlight the differences across countries and MNCs by presenting country-level results both for the whole sample and for individual MNCs. However, we would need CBCR data for even more individual MNCs in order to test for any systematic, MNC-specific determinants behind these differences.

With this paper and its findings, we contribute the fast-developing literature on the use of MNCs' country-by-country reporting data to study MNCs' taxation and profit shifting. As far as we know, this paper is the first to fully exploit the CBCR data that MNCs have voluntarily published and that meets the OECD BEPS Action 13's minimum standards; some of this data for selected companies was already used in earlier analyses (e.g. Clausing, 2020, Cobham & Janský, 2020). Aggregate data for many large MNCs, according to the same standard, was published by the OECD (2020); which we use in this paper for comparison. This aggregate data has also been used in recent profit shifting research (Garcia-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). The analysis presented in this paper is thus the first to use this standard of CBCR data, which is both public and company-level, in full, but there is a related literature using other types of CBCR standards.

While the private CBCR standard studied in this paper covers the widest range of MNCs, the previously implemented public CBCR standards 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 very useful (Janský et al., 2021). There is much more literature studying the financial industry's CBCRs. Banks 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 analyze taxation (Bouvatier et al., 2017, Dutt, Nicolay, et al., 2019, Brown et al., 2019, Fatica & Gregori, 2020, Janský, 2020b). In extending the range of types of CBCR data studied, we contribute to the broader literature studying how informative different kinds of tax-related disclosure are (Müller et al., 2020).

We structure the rest of the paper as follows: first, we describe the data source in general and the specific MNCs' CBCR data in detail. We then introduce our methodology, focusing on the indicators of ETRs and misaligned profits. Third, we present our results, providing descriptive statistics as well as some statistical analysis. Finally, we conclude and discuss policy implications.

2 Data

As part of the OECD's Anti-BEPS Action 13, governments have started to collect CBCRs from large MNCs. In those CBCRs, the MNCs have to 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 at the reporting country level. Only a few companies have decided to 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 necessary. The lack of consistent formatting and terminology results in some resistance to this process¹. Furthermore, we identified a number of MNCs which publish their tax payments by country, albeit not the remaining CBCR data we use in our analysis.

We obtain a dataset of 10 MNCs, which collectively report activity in 134 jurisdictions. Not all of the reports include all the information required by the OECD. In addition, AXA and BT Group limit their data to a small selection of the countries in which they are most active. Our variables of interest include unrelated party revenues, profit/loss before income tax, income tax accrued in the current year, number of employees, and tangible assets. Table 1 provides a summary of all companies that – to our current knowledge - have voluntarily published their CBCRs, and the availability of our variables of interest.

Table 1: List of MNCs that have voluntarily published CBCRs.

MNC	Years	Industry	Notes
Anglo American	2018	Extractives	
AXA	2018	Insurance	Only for selected countries Not reported: unrelated party revenues, number of employees, tangible assets
BT Group	2019	Telecommunications	Only for selected countries. Not reported: income tax accrued,
ENI	2017, 2018	Extractives	Not reported: unrelated revenues
Iberdrola	2019	Insurance	
NN	2018, 2019	Insurance	Not reported: unrelated revenues, tangible assets*
Repsol	2018	Extractives	
Rio Tinto	2018	Extractives	
Shell	2018	Extractives	
Vodafone	2018 (2016, 2017)	Telecommunications	Different reporting in 2016 and 2017.

Source: Authors

¹ For example, we use “total assets” as tangible assets for NN due to the implied definition in the documentation, though this does not affect our main sample.

The largest company in terms of its total number of employees is Vodafone with more than 100,000 employees reported worldwide. This is followed by Shell and Anglo American with about 80,000 and 64,000 employees each. NN is the ‘smallest’ MNC in the sample with about 14,000 employees. Shell and Rio Tinto report by far the highest worldwide sums of profits, and AXA the lowest (due to huge losses in the United States), with Shell’s sum of global profits being about 50 times higher than AXA’s. As an exception, Vodafone reports losses both in total and in 24 out of its 58 reported jurisdictions.

To a certain extent, the distribution of profits across countries reflects the heterogeneity of the MNCs in our sample, but it also reveals some common patterns. While Shell reports significant profits in many different countries, NN’s and Rio Tinto’s profits are highly concentrated in their respective headquarter jurisdictions (the Netherlands for NN; Australia and the UK for Rio Tinto). Repsol and Iberdrola also report a significant share of their profits in their headquarter jurisdiction Spain, as does AXA in France and Vodafone in the UK. ENI is an exception, as it reports losses in its headquarter jurisdiction Italy and the most profits in Libya, Egypt, Norway, Kazakhstan, Algeria and Angola.

Due to Rio Tinto, Australia is the country with the highest sum of reported profits in our sample by far, followed by the United Kingdom, Canada and South Africa. The United States and India rank lowest in terms of absolute profits reported, mostly due to Vodafone’s losses in India and AXA’s losses in the United States. We note that Vodafone, which was the first MNC 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, but we note its potential impact in relation to the share of profits that Vodafone reports in tax havens in Section 4.3.

2.1 Samples

Our sample choice balances the need for consistency over the different sections against the wish to exploit the maximum available observations due to the already small number of MNCs. Most companies report for the year 2018, some report also for 2017 or 2019, Iberdrola only reports for 2019. To avoid losing observations and to not skew the individual country data, we combine data from different years in our analysis and calculate using two-year averages when two years of data are available (ENI and NN).

Our preferred sample excludes loss-making companies, as only companies with positive profits should pay corporate income tax. One might argue that individual year losses level out with other years’ profits or other companies’ profits in the same country and thus that including losses would provide a more realistic picture of the companies’ profitability and tax due. However, in our case, both the

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).

number of observations by country and the maximum number of years are exceptionally low, so including losses would bias our estimates of effective tax rates too much.³ We do nevertheless report results for an alternative sample in the Appendix, where we include loss-making companies but set aggregate country profits to zero in case loss-making companies dominate the whole country result. As we need economic activity data for our misalignment analysis, we drop companies for which there is no information about the number of employees in sections 4.2., 4.4. and 4.5. This leads to the exclusion of all AXA observations. We also set instances of negative economic activity (poor quality data) to zero. Similarly, the lack of income tax data for the BT Group leads to the company’s absence from our analysis of effective tax rates.

In our main sample there are 10 MNCs with 260 observations across 99 countries. These MNCs are responsible for a total of 338,802 employees, \$722bn tangible assets and \$599bn turnover.

Table 2: Summary statistics

Variable	n	min	q25	mean	q75	max	sd
Profit/loss before income tax	260	35264.46	3119750	3.66E+08	2.19E+08	1.18E+10	9.87E+08
Income tax accrued (current year)	217	-4.1E+08	4016	92493803	36837540	3.71E+09	4.02E+08
Number of employees	228	0	17	1486	868	46575	4222
Tangible assets	227	-187	5855117	3.18E+09	9.01E+08	2.16E+11	1.56E+10
Unrelated party revenue	168	-4	6447318	3.57E+09	1.64E+09	9.05E+10	1.18E+10

Note: For ENI and NN, two-year averages were taken.

To proxy the representativeness of those MNCs and judge the selection bias possibly in play, we compare these MNCs with the data published for all large MNCs in July 2020 by OECD (2020) and recently exploited by Garcia-Bernardo & Janský (2021).

3 Methodology

For our analysis of the voluntarily reported CBCR data, we apply state-of-the art methods to learn about the MNCs’ effective tax rates, profit misalignment, activities in tax havens and profit shifting using the tax semi-elasticity approach. In this section we briefly describe each of these methods.

3.1 Effective tax rates

We calculate effective tax rates by MNC and for each country where the MNCs are active. We calculate the ETR for each observation at the company-country level by dividing the reported income tax accrued by the reported gross profit (“profit/loss before income tax”). The MNCs’ worldwide effective tax rates are weighted by their respective profits in each country j . The effective tax rates by country are weighted by the profits reported by each MNC i in country j . This can also be written as follows:

³ For example, it is not realistic to assume that a country has a negative effective tax rate in a non-crisis year just because one of the sample companies made an exceptionally high loss or received a tax refund in that year.

$$ETR\ MNC_i = \frac{\sum_{j=1}^n income\ tax\ accrued_{ij}}{\sum_{j=1}^n gross\ profits_{ij}}$$

$$ETR\ country_j = \frac{\sum_{i=1}^n income\ tax\ accrued_{ij}}{\sum_{i=1}^n gross\ profits_{ij}}$$

For these ETR calculations, we set negative income taxes to zero. Very low effective tax rates may serve as indirect measures of profit shifting or as indicators of tax havens.

3.2 Profit misalignment

We further analyse the MNCs' CBCRs in order to assess the extent to which their profits are misaligned with the economic activity they report in each country. As in recent applications of the misalignment methodology (Cobham & Janský, 2019) to CBCR data from large US MNCs (Garcia-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 compute misaligned profit in each country in the following way:

$$Misaligned\ profit = actual\ gross\ profit - share\ of\ economic\ activity * total\ global\ gross\ profits$$

If the reported profits in a given country are higher than we would estimate based on that country's share of the MNC's economic activity, this gives rise to 'excess' profit. If the reported profits are lower than we would estimate based on the MNC's economic activity, this gives rise to 'missing profit'.

We use the number of employees as the preferred proxy for economic activity, and provide additional results based on tangible assets and revenues of unrelated parties in the Appendix. One advantage of using employee numbers over tangible assets for this calculation is that more companies report their numbers of employees. The advantage of employees over unrelated party revenues is that the latter might already be over-reported in profit-shifting destinations.

We report each country's absolute misaligned profits as a share of the sample's total profits. This allows us to show, on the one hand, which countries attract the most excess profits in our sample, and which countries lose out on the most profit. On the other hand, it also enables us to compare our results to estimates of misaligned profits based on aggregate CBCR data from the OECD, which are of course much higher in absolute terms, as more companies are included. We also present misaligned profits in relation to each country's total reported profits: some smaller countries' excess profits may appear unimportant in absolute terms, but their degree of misalignment may still be significant.

3.3 Tax semi-elasticity

In a second step, we perform a simple regression analysis to estimate the semi-elasticity of the reported profits with regard to a tax incentive variable, as is usually done in the related literature (Beer et al., 2020). We use our estimated ETR at country level as an operationalisation of 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 MNC-country level and country level and a set of group dummy variables.

$$\ln \pi_{ij} = \beta_0 + \beta_1 \tau_j + \beta_2 \ln L_{ij} + \beta_3 \ln K_{ij} + \beta_X X_j + \sum_{i=1}^8 \delta_i D_i + \varepsilon \quad (1)$$

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 and in regressions 3-5 also the share of natural resources rent in GDP. This latter 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 eight group dummies, leaving out Anglo American as the reference case (AXA is omitted from the regression as economic activity is not included in its CBCR). As our calculations indicate that most groups report high shares of profits in their headquarter jurisdictions, we also add a headquarter dummy H_{ij} , when country j is the headquarter jurisdiction of group i , to some regressions.

As in Dowd et al. (2017), we compare the linear relationship (1) between profits and ETR to a quadratic form (2):

$$\ln \pi_{ij} = \beta_0 + \beta_1 \tau_j + \beta_2 \ln L_{ij} + \beta_3 \ln K_{ij} + \beta_4 \tau_j^2 + \beta_X X_j + \sum_{i=1}^8 \delta_i D_i + \varepsilon \quad (2)$$

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 to formalise the correlations between the variables that we observe in our descriptive analysis and to have an alternative to the profit misalignment method.

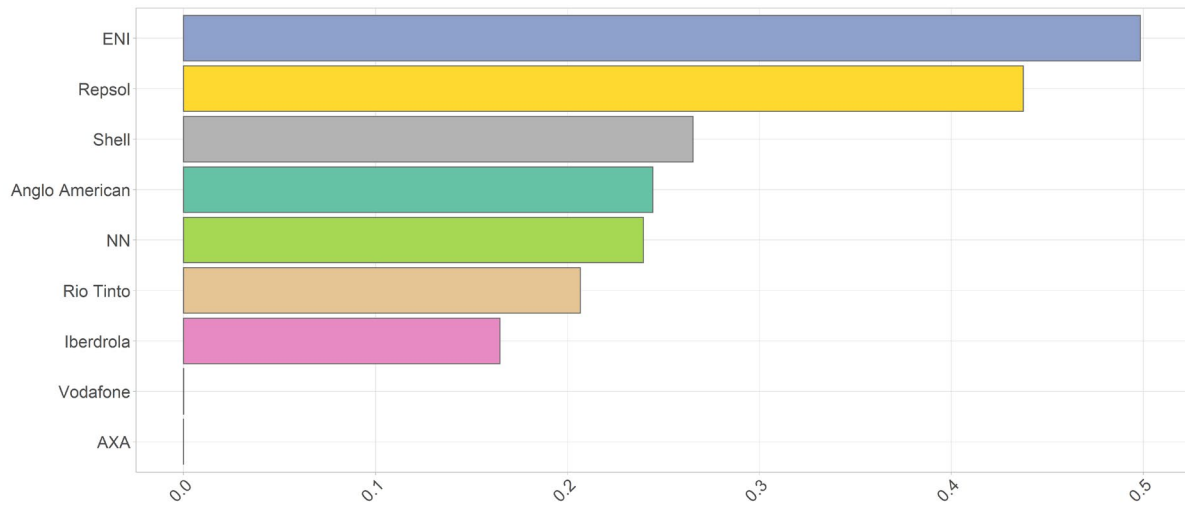
4 Results

4.1 ETR

The worldwide ETRs are above 20 percent for the majority of the MNCs in our sample, and exceed 40 percent for ENI and Repsol. Iberdrola has a worldwide ETR below 20 percent, while AXA and Vodafone have ETRs of zero because they reported more negative than positive taxes accrued. There does not seem to be any correlation between worldwide ETRs and the share of profits reported in tax havens. If we can speak of a pattern at all, it is that ETRs are generally higher for MNCs in the natural resource sector (mostly mining and oil) than for those in insurance and communication. This might partly be explained by special taxation regimes in the extractive sector, such as excess profits taxes or royalties levied on the extraction of minerals (Otto, 2017).

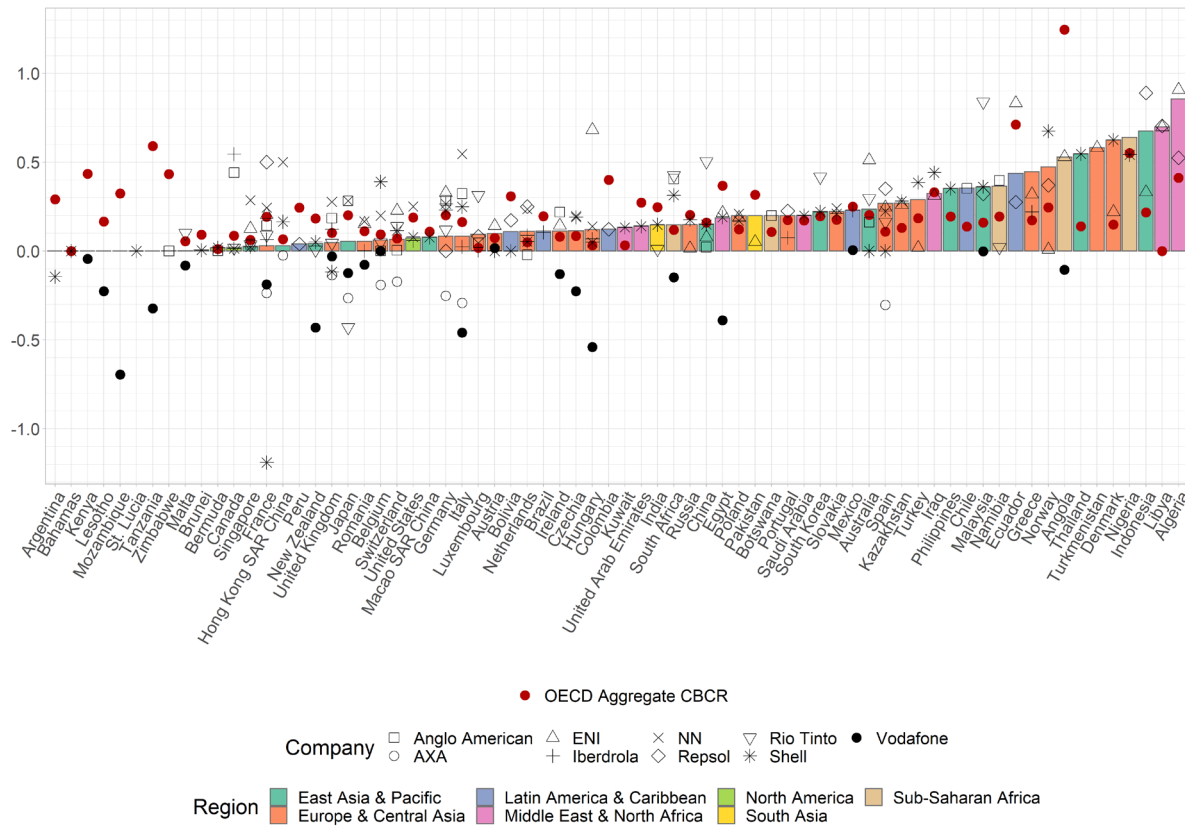
By adding up all tax payments and dividing them by the sum of profits across the sample, we obtain an average “worldwide” effective tax rate of about 21%. In contrast, the respective worldwide ETR calculated based on the aggregate CBCR data is 16%. It thus appears that companies that voluntarily published their CBCRs are more likely to pay higher ETRs than the world average.

Figure 1: MNCs' worldwide effective tax rates



Source: CBCRs published by MNCs, own calculations.

Figure 2: Effective tax rates



Note: The figure includes countries which have over \$10m in profits. Source: CBCRs published by MNCs and OECD (2020) aggregate CBCR data, own calculations.

We find a strong variation in average ETR across countries. It comes as little surprise that the well-known tax haven or low tax jurisdictions Bahamas, Bermuda, Hong Kong, Malta, Singapore, and St.

Lucia all have ETRs of zero or below 5 percent, while Belgium, Luxembourg, Macao, Romania, and Switzerland have ETRs between 5 and 10 percent. More surprising is the large number of other countries whose ETRs are similar to these: Argentina, Canada, France, Peru, Tanzania, and UK all have ETRs between 0 and 5% and Austria, Japan, United States, Germany, and Italy have ETRs between 5 and 10%.⁴ As the number of observations is low – especially for Argentina, Tanzania, and Peru with only one each – we compare our sample ETRs to ETR estimates based on the aggregate CBCR data from the OECD. We find that the low tax rates based on our sample appear to be sample-specific results for Argentina, France, Germany, Italy, Japan, Macao, Peru, Romania, Tanzania, the United Kingdom, and the United States, but not for Austria, Bahamas, Bermuda, Canada, Hong Kong, Luxembourg, Malta, Singapore, and Switzerland, which also have ETRs between 0 and 10 percent according to our estimates based on OECD data. For transparency, we include individual company dots in the graph.

At the other end of the spectrum, Algeria, Angola, Denmark, Indonesia, Libya, Nigeria, and Thailand all have ETRs above 50% based on our sample. Of these, our OECD data estimates support high ETRs in Algeria, Angola, and Nigeria, but not in Denmark, Indonesia, and Libya. In our sample, special tax regimes for the oil and gas industry are likely to have resulted in higher ETR estimates for oil and gas producing countries as compared to their general statutory corporate income tax rates. For example, in 2018 Libya and Norway charged surtaxes on profits from the petroleum industry, implying composite 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).

In general, we observe a positive correlation (32%) between the estimated ETR and the share of natural resources rents in GDP⁵ (Worldbank 2020). This seems to be specific to our sample, which includes many companies from the mining and oil sector. In contrast, this correlation is only 5% using the OECD data. In total, the correlation between our sample's ETRs and the ETRs estimated based on the aggregate OECD data is 65-69%.

4.2 Misalignment

Our calculations of misalignment between profits and economic activity (measured as the number of employees) confirm the role of known tax havens, where MNCs report relatively more profits than would be justified by their economic activity. Our analysis also identifies a number of other countries where excess profit is reported, including several resource-rich countries, such as Angola, Australia, Bolivia, Kuwait, Libya, Nigeria, Norway, Oman, Russia, Saudi Arabia, and United Arab Emirates.⁶ However, some resource-rich economies, such as Iraq, Peru and South Africa, are identified as missing-profit countries based on our data. The majority of countries in Sub-Saharan Africa are identified as missing-profit countries, where less profit is reported than the MNCs' economic activity would suggest, even though some of them are resource-rich, such as Cameroon, Mozambique and

⁴ Including negative MNC-country observations would lead to significantly higher ETRs for Belgium, Germany, and Italy (see figure A1 in the Appendix).

⁵ A 5-year average of the latest available data, which is 2014-2018 for most countries

⁶ Note that Bolivia may be considered a mixed case, as it would be considered an excess-profit country when economic activity is measured in terms of tangible assets. The same applies to Russia and Saudi Arabia when economic activity is measured in terms of unrelated party revenues (figures A3 and A4 in the Appendix).

Zimbabwe.⁷ Most large economies from the global North are missing-profit countries, for example France, Germany, Italy, Spain, and the United States. All Eastern European countries (except for Latvia) are missing-profit countries and rank among the countries where the highest shares of total profits are misaligned.

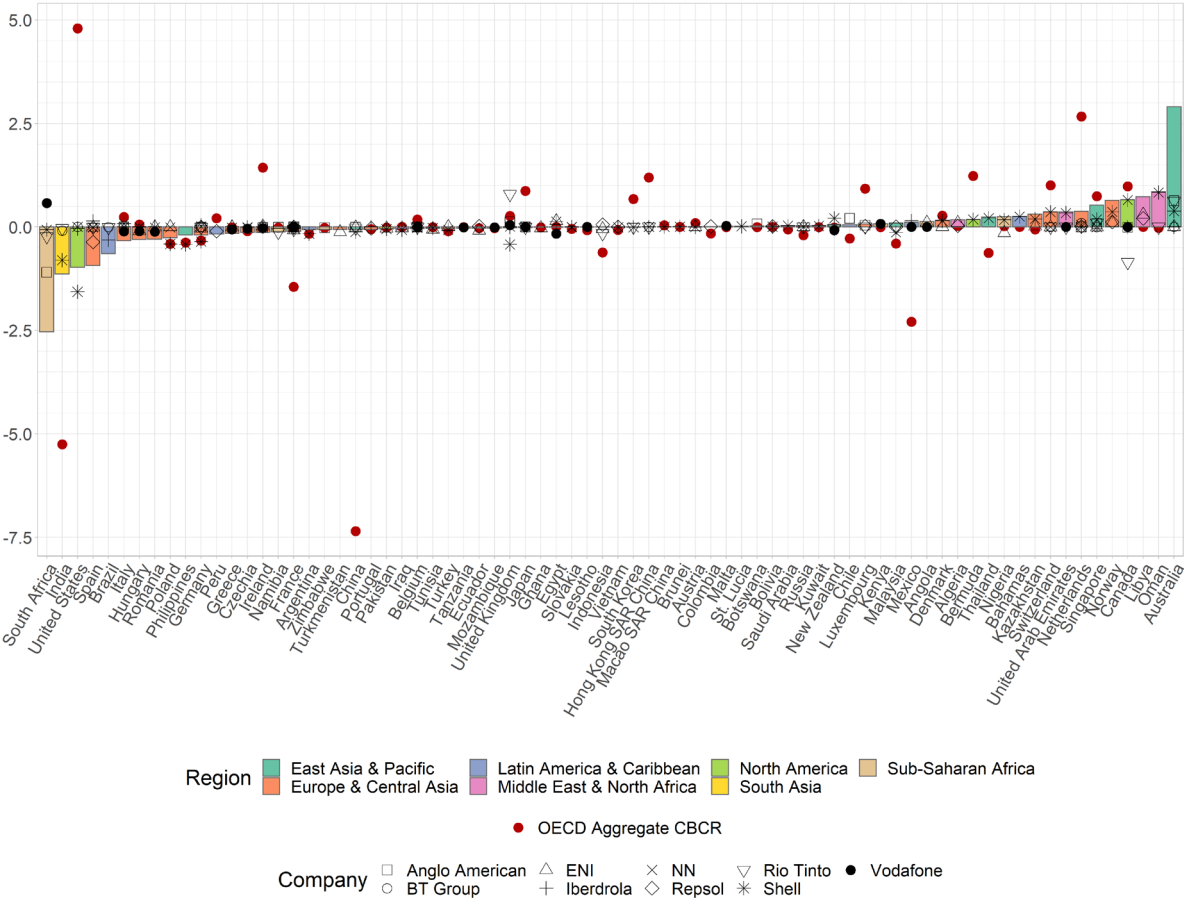
In absolute values, the missing profits are most striking in South Africa, India⁸, the United States, Spain, and Brazil, while the excess profits are highest in Australia, Oman, Libya, Canada, and Norway. The sample results for Australia, Canada, Norway, South Africa, India are broadly in line with the results based on aggregate CBCR data, while Spain and Brazil are still missing-profit countries based on the aggregate data, but to a lesser extent (see figure 3). When we consider misaligned profits as a percentage of total profits, Macao, St. Lucia, Bermuda, Bahamas, and Luxembourg lead the list of excess-profit countries based on our sample; this occurs mostly because of Shell, but we do find similar results using the aggregate data. In contrast, the highest shares of missing profits can be found in Romania, India, Greece, Hungary, and Turkmenistan. For Romania, and India, we find a similar result based on the aggregate CBCR data (see figure A2 in the Appendix).

A scatter plot reveals no obvious correlation between the estimated ETRs and profit misalignment, but we observe that tax havens have low ETRs and relatively high excess profits, while resource-rich countries have both high ETRs and high excess profits; this points to the specific role played by natural-resource-rich countries in our sample (figure 4). As part of the profits reported in these countries might be explained by resource rents rather than economic activity, the misalignment approach identifies them as ‘excess-profit’ countries.

⁷ Cameroon and South Africa may be considered mixed cases as they are missing-profit countries when economic activity is measured in terms of employees but appear as excess-profit countries when economic activity is measured in terms of tangible assets or unrelated party revenues (figures A3 and A4 in the Appendix).

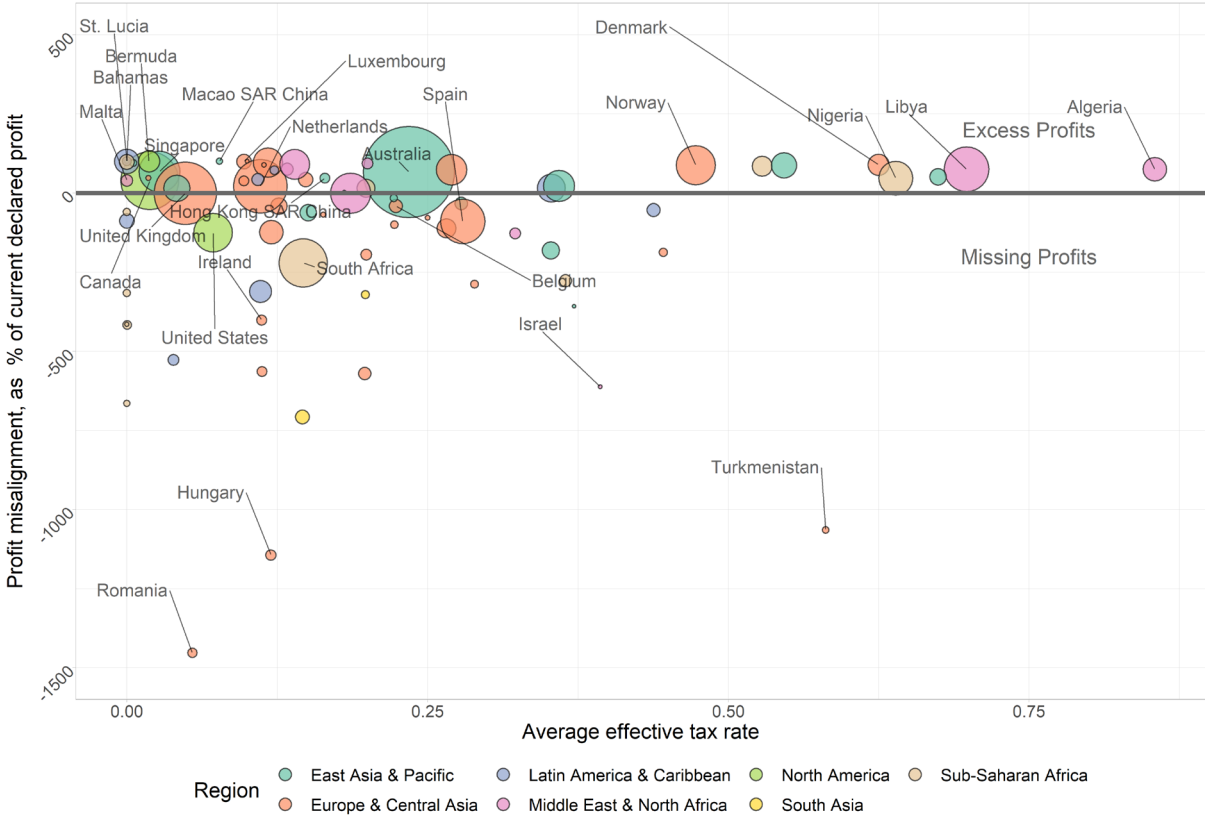
⁸ India may be considered a mixed case, as measuring economic activity in terms of real assets or unrelated party revenues makes India an excess-profit country (figures A3 and A4 in the Appendix).

Figure 3: Misaligned profits as % of the total sample's profits



Note: The figure includes countries where more than \$10m profits are reported. Source: voluntary CBCRs published by MNCs and OECD (2020) aggregate CBCR data, own calculations.

Figure 4: ETR and Misalignment



Source: voluntary CBCRs published by MNCs, own calculations.

4.3 The role of tax havens

Companies that voluntarily publish their CBCRs are present in tax havens,⁹ but the share of overall profits they record in tax havens varies significantly between these companies.

Six out of ten of the analysed MNCs report significantly lower shares of profits in tax havens than the aggregate CBCR data published by OECD would suggest: Anglo American, ENI, Iberdrola, Repsol, Rio Tinto, and Vodafone all report between one and seven percent of their profits in tax havens, while the average share of profits reported in tax havens based on the OECD data is 14 percent.

However, four companies in our sample report a much higher share of profits in tax havens than the OECD average: AXA, BT Group, NN, and Shell all report between 26 and 76 percent of their profits in tax havens. Our sample’s average share of profits in tax havens, at 16 percent, is thus higher than

⁹ We use the tax haven list by Gravelle (2015) and add Belgium, Hungary and 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.

the average based on the OECD data, but this average masks substantial differences between the companies. The picture changes a bit when we use a more conservative tax haven list (Gravelle’s list, used e.g. by Gumpert et al., 2016), excluding Netherlands, Belgium, and Hungary. In this case, the companies that voluntarily publish their CBCRs also report lower shares of their profits in tax havens than the OECD average.¹⁰

Table 3: Share of profits reported in tax havens

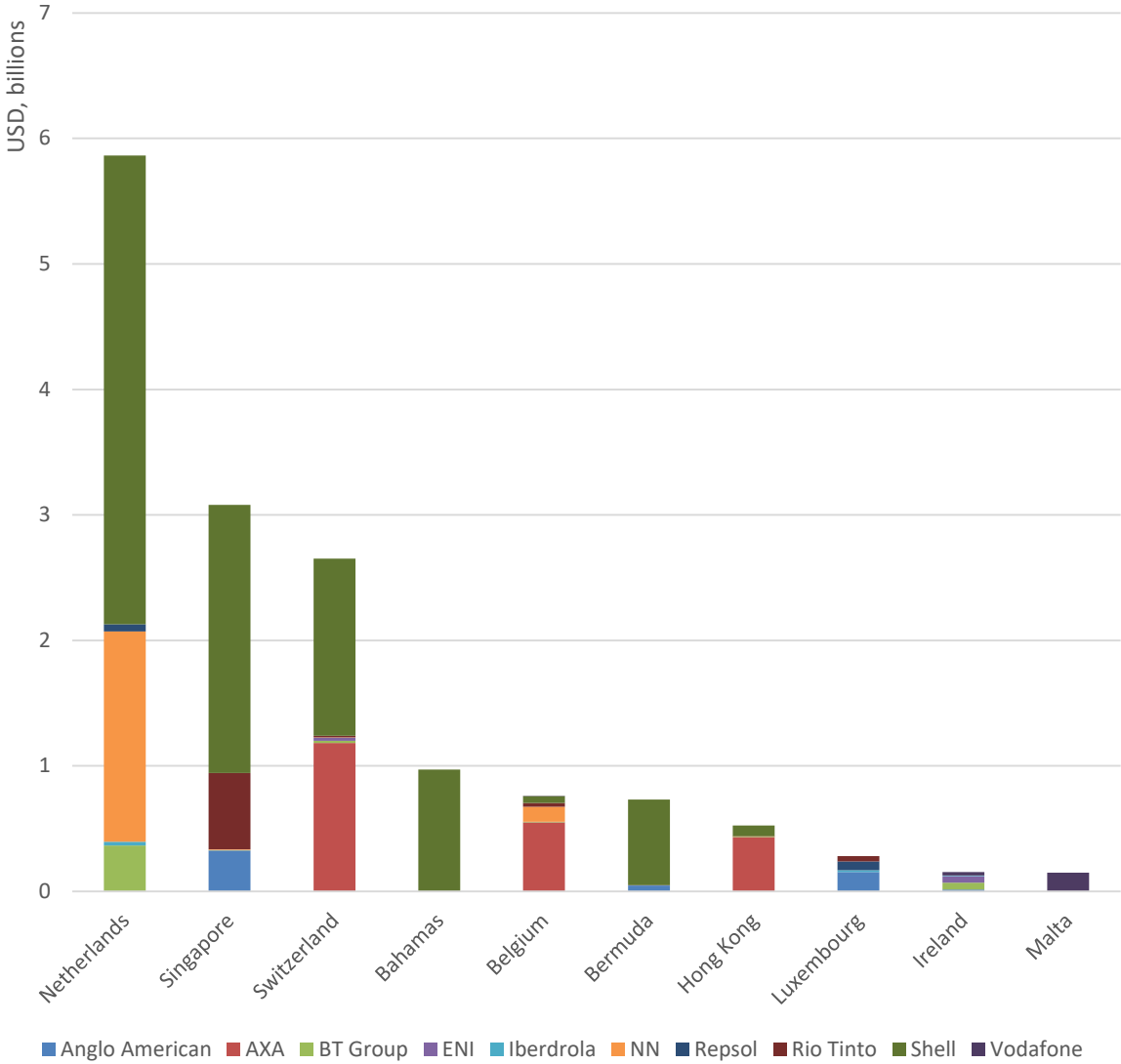
Company	Share of profits reported in tax havens (preferred list)	Share of profits reported in tax havens (Gravelle’s list)
OECD	14.2	9.5
Voluntary sample	16.3	8.8
NN	75.9	2.2
BT Group	64.0	10.9
AXA	34.8	26.0
Shell	26.1	15.3
Anglo American	7.5	7.5
ENI	6.3	0.8
Rio Tinto	3.7	3.6
Vodafone	3.7	3.3
Repsol	3.3	1.8
Iberdrola	1.3	0.4

Source: voluntary CBCRs published by MNCs and OECD (2020) aggregate CBCR data, own calculations

The most important tax havens for our sample are Netherlands, Singapore and Switzerland, followed by Bahamas, Belgium and Bermuda (figure 5). These results are mostly driven by Shell, which reports the highest absolute amount of profits in tax havens – approximately 9 billion USD – and by AXA and NN, which report approximately 2 billion USD each.

¹⁰ It is worth noting that if we look at Vodafone’s additional voluntary reports, we find that 24% and 78% of profits before tax are recorded in Luxembourg in FY17/18 and FY17/16 respectively (2017/18 €1,448m; 2017/16 €1,450m). By contrast, in the OECD CBCR data for 2017, Vodafone reports a loss before tax of €94bn in Luxembourg. Taking the alternative reports into account would suggest that 5 of the 10 MNCs that voluntarily publish their CBCRs have higher shares of profits in tax havens than the OECD average.

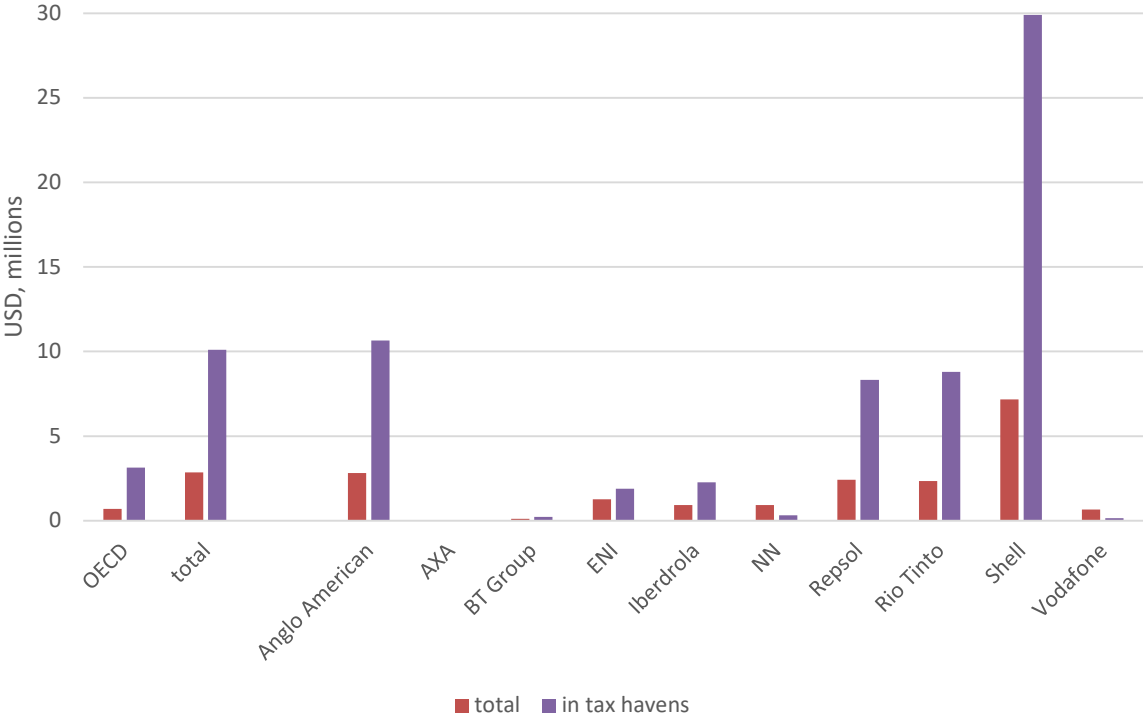
Figure 5: Total profits in top 10 tax havens by multinational group



Source: voluntary CBCRs published by MNCs, own calculations.

Although several companies report below-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 2.8 million USD worldwide but 10 million USD in tax havens: profitability per employee is 3.5 times higher in tax havens than the worldwide average. In our sample, both the company average and the individual company results are lower than the OECD average profits per employee of 4.5. We identify the largest discrepancy between profits per employee in total and in tax havens for Shell, which makes about 4 times more profit per employee in tax havens than on average worldwide. In absolute values, this corresponds to a profit of about 7 million USD per employee worldwide but of 30 million USD per employee in tax havens. NN and Vodafone, in contrast, are less profitable in tax havens than on average worldwide (figure 6).

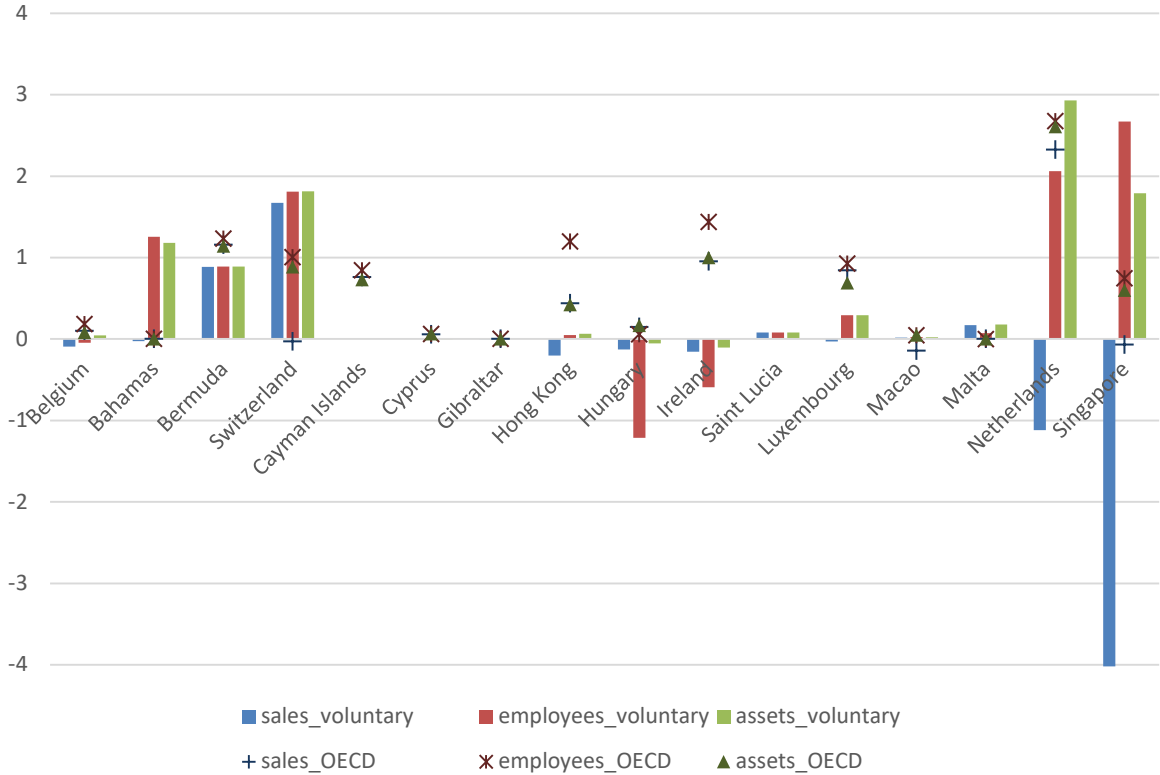
Figure 6: Profit per employee worldwide and in tax havens



Note: As AXA does not report employment data. Source: Source: voluntary CBCRs published by MNCs, own calculations.

The other misalignment measures broadly confirm this pattern. The 9 companies in our sample, for which activity data is available, report more profits in Bahamas, Bermuda, Gibraltar, Hong Kong, Saint Lucia, Luxembourg, Macao, Malta, Netherlands, Singapore, and Switzerland than their economic activity in terms of number of employees and tangible assets would suggest. In terms of unrelated revenues, the picture is less clear, although this is not surprising as unrelated revenues might also artificially be shifted to tax havens as part of tax optimization. Surprisingly, Hungary and Ireland appear as missing-profit countries in our sample, implying that the companies on average report less profits there than their economic activity would suggest. Comparison with the OECD data reveals that this might be a sample selection effect, as Hungary and Ireland clearly appear as excess-profit countries based on the OECD data (figure 7).

Figure 7: Excess or missing profits in tax havens, in % of the total sample's profits



Source: voluntary CBCRs published by MNCs and OECD (2020) aggregate CBCR data, own calculations.

In the following matrix (table 4) we formalise some of the correlations we have observed in our analysis of ETRs and misalignment. In contrast to the visual evidence from our scatter plot, we find a slight positive correlation between misalignment and our sample ETRs, which is surprising, as it indicates that countries with higher ETRs are more likely to be excess-profit countries. The negative correlation between misalignment and the ETRs based on the OECD data is more intuitive: countries with higher ETRs are more likely to be missing-profit countries. The same holds for the correlation between misalignment and statutory corporate income tax. As observed above, tax havens are more likely to be excess-profit countries, as are resource-rich countries. This might explain the unexpected positive correlation between misalignment and ETRs in our sample, as resource-rich countries are also likely to have higher ETRs.

Table 4: Correlation Matrix: Misalignment as a percentage of each country’s total profit

Obs: 83	Misalignment	ETR	ETR_OECD	CIT_2018	Tax haven	Resources
Misalignment	1					
ETR	0.1507	1				
ETR_OECD	-0.001	0.2528	1			
CIT_2018	-0.2119	0.0667	0.3517	1		
Tax haven	0.1159	-0.207	-0.3367	-0.3924	1	
Resources	0.1268	0.274	0.1607	-0.1776	-0.2595	1

Source: voluntary CBCRs published by MNCs, OECD (2020) aggregate CBCR data, KPMG (2020), World Bank (2020), own calculations.

4.4 Regression analysis

It is common in the profit shifting literature to estimate the semi-elasticity of reported profits with regard to a tax incentive variable. We estimate a simple OLS regression and thereby formalise some of the correlations we have observed in our analysis of ETRs and misalignment (table 5). Controlling for MNC-country and country-level covariates and allowing for a non-linear functional form, the regressions shed new light on the relationship between reported profits and ETRs. As expected, we find that number of employees, assets, and GDP per capita are positively correlated with the profits reported by each multinational group in each jurisdiction. A simple linear regression seems to confirm our initial impression that profits are not correlated with ETRs by country or possibly suggest that there is a slight positive correlation, implying that higher ETRs may be associated with higher reported profits.

When we allow for a quadratic relationship, however, the results are more in line with our expectations and qualitatively similar to the results reported by Garcia-Bernardo & Janský (2021) based on the aggregate CBCR data. The negative ETR coefficient in regressions (2), (4), and (5), implies that up to a certain level of ETR, we find the expected negative relationship between reported profits and ETR, but that this relationship turns positive at very high levels of ETR. Based on the quadratic model, figure 8 depicts the estimated marginal effects of the ETR as a function of the level of ETR. We find that for the basic model, the effect of ETR is negative until the ETR exceeds approximately 27 percent. This threshold increases to 34 percent when we include the headquarter dummy and the share of natural resource rent in GDP as additional control variables. In line with other researchers’ results, this implies that the profit-shifting incentive of a one percentage point difference between tax rates is higher at very low levels of ETR and approaches zero at moderate levels of ETR. To give an example, we can take the case of Bahamas, UK and Germany, whose estimated ETRs are 0%, 4% and 8%. Our result implies that the tax difference of 4 percentage points between Bahamas and UK has a stronger effect on the distribution of profits between these two countries, than the tax difference between UK and Germany has on the distribution of profits between UK and Germany. At ETRs above 34 percent, the effect switches sign and implies that on average, higher ETRs are associated with higher reported profits. This might be caused by the high excess profits reported in some resource-rich countries with very high ETRs, such as Libya, Norway, and Nigeria which our model might not sufficiently explain.

The inclusion of the headquarter dummy and the share of natural resource rent in GDP improve the fit of the model somewhat. As most of the MNCs in our sample are in the extractive industries, we include an extractive industry dummy in regression (5) instead of the multinational group dummies. The relationship is significant and positive, which once again confirms the existence of natural

resource rents that our model only captures to a limited extent. Even though our estimates are qualitatively similar to García-Bernardo and Janský, emphasising the importance of the functional form, our semi-elasticities are much smaller. In line with our descriptive findings, we can thus conclude that the sensitivity of our sample's profits with regard to ETRs is much smaller than on the worldwide average.

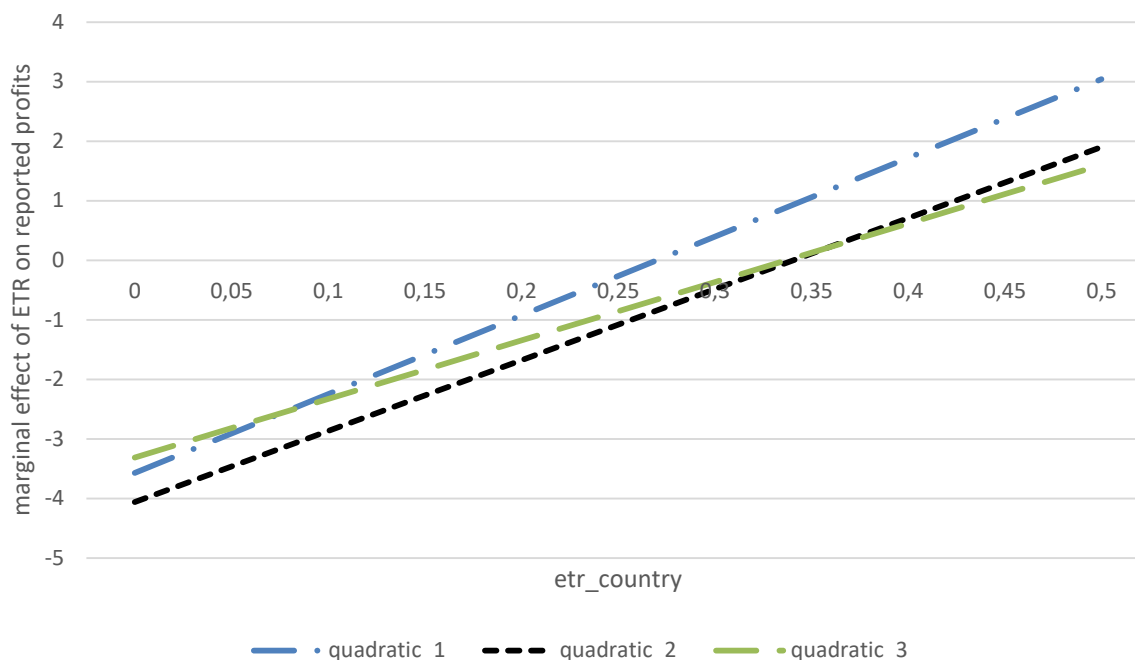
Table 5: Pooled regression

	(1)	(2)	(3)	(4)	(5)
	linear	quadratic	linear2	quadratic2	quadratic3
	b/se	b/se	b/se	b/se	b/se
ETR_COUNTRY	0.63	-3.57+	-0.31	-4.06*	-3.31+
	(0.85)	(2.10)	(0.86)	(2.01)	(1.91)
ETR_COUNTRY²		6.61*		5.96*	4.91*
		(2.68)		(2.58)	(2.48)
LN_EMPLOYEES	0.54***	0.56***	0.52***	0.54***	0.49***
	(0.12)	(0.12)	(0.11)	(0.11)	(0.09)
LN_ASSETS	0.24*	0.23*	0.23**	0.22**	0.28***
	(0.10)	(0.10)	(0.08)	(0.08)	(0.07)
LN_GDP_PC	0.28+	0.28+	0.31*	0.31*	0.33*
	(0.15)	(0.14)	(0.15)	(0.15)	(0.15)
BT GROUP	-0.66	-0.72	-0.52	-0.57	
	(0.57)	(0.59)	(0.56)	(0.58)	
ENI	0.38	0.37	0.22	0.22	
	(0.56)	(0.58)	(0.53)	(0.55)	
IBERDROLA	0.54	0.61	0.61	0.67	
	(0.60)	(0.62)	(0.59)	(0.60)	
NN	-0.20	-0.16	-0.05	-0.03	
	(0.65)	(0.65)	(0.61)	(0.62)	
REPSOL	1.31*	1.18+	1.05+	0.93	
	(0.62)	(0.61)	(0.59)	(0.59)	
RIO TINTO	0.39	0.39	0.27	0.27	
	(0.62)	(0.62)	(0.58)	(0.58)	
SHELL	1.15+	1.18*	1.08+	1.12*	
	(0.59)	(0.59)	(0.55)	(0.56)	
VODA	-0.33	-0.45	-0.43	-0.54	
	(0.62)	(0.63)	(0.59)	(0.61)	
HEADQUARTER			1.43*	1.49**	1.45**
			(0.56)	(0.53)	(0.47)
NATURAL RESOURCE RENT			0.08***	0.08***	0.07***
			(0.02)	(0.02)	(0.02)
EXTRACTIVE					0.75**
					(0.25)
_CONS	6.89***	7.35***	6.68***	7.17***	5.98**
	(1.90)	(1.91)	(1.90)	(1.94)	(1.79)
R2	0.64	0.65	0.68	0.68	0.66
R2_A	0.61	0.62	0.65	0.66	0.64
N	194.00	194.00	194.00	194.00	194.00

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

Source: voluntary CBCRs published by MNCs, World Bank (2020), own calculations.

Figure 8: Marginal effect of ETR on reported profits, pooled regressions



Source: own calculations based on table 5.

We also repeat the regression separately for each multinational group and find significant correlations between reported profits and ETRs for BT Group, NN, Rio Tinto and Shell (table 6). This is consistent with our previous finding that BT Group, NN and Shell report above-average shares of profits in tax havens. We do not find any significant correlation for Anglo American, ENI, Iberdrola, Repsol or Vodafone. Note however, that the number of observations ranges between 11 and 44, so these results should not be over-interpreted. Shell and Rio Tinto confirm the non-linear pattern observed in the pooled regression with a negative correlation between profits and ETRs for low and moderate levels of ETR, and a positive correlation between profits and ETRs at higher levels of ETR (with the threshold at 24 for Rio Tinto and 19 for Shell).

The observed counter-intuitive positive correlation between reported profits and ETRs at high levels of ETR does not hold for NN or BT group, which are two of the few non-extractive MNCs in our sample. For BT Group, the marginal effect of the ETR is initially positive but turns negative for tax rates above 0.15 and then decreases further very steeply. For NN, the marginal effect is negative for all ETR levels and also becomes more negative with rising levels of ETR, which is counter-intuitive and might raise doubts about the adequacy of the assumed functional form.

Table 6: Regressions by multinational group

	ANGLO	BT	ENI	IBER	NN	REPS	RIO	SHELL	VODA
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
LN_EMPL OYEES	-0.45 (0.61)	0.51 (0.42)	0.11 (0.20)	0.66** (0.15)	0.03 (0.14)	-0.08 (0.17)	0.74*** (0.15)	0.63*** (0.16)	1.15+ (0.64)
LN_ASSE TS	1.07* (0.40)	0.13 (0.20)	0.59*** (0.15)	0.11 (0.16)	0.58*** (0.06)	0.32 (0.26)	0.14 (0.08)	0.12 (0.11)	-0.45 (0.59)
LN_GDPP C	0.15 (0.29)	0.61 (0.36)	0.24 (0.27)	-0.21 (0.22)	1.48** (0.40)	0.20 (0.28)	0.64+ (0.31)	0.58 (0.35)	-0.35 (0.32)
ETR_COU NTRY	15.09 (13.94)	58.22+ (24.87)	1.74 (3.17)	9.75 (12.10)	4.90 (3.86)	5.86 (5.22)	- (5.81) 19.07**	-10.52+ (5.28)	4.85 (10.66)
ETR_COU NTRY²	-32.70 (33.85)	- (73.67) 182.61*	-1.31 (3.45)	-20.95 (24.07)	-15.02+ (7.08)	-6.43 (6.19)	48.67** (15.67)	20.82* (7.91)	-21.59 (20.61)
RESOURC ES	0.07 (0.14)	-0.20 (0.15)	0.03 (0.03)	-0.28 (0.18)	1.89** (0.59)	0.05* (0.01)	-0.10* (0.04)	0.10** (0.03)	0.04 (0.08)
HEADQU ARTER	2.00+ (1.06)	0.00 (.)	0.00 (.)	-0.38 (1.06)	-0.46 (0.72)	1.60 (0.97)	3.17*** (0.67)	0.97* (0.46)	2.69** (0.88)
_CONS	-2.46 (3.71)	1.98 (4.62)	2.86 (2.55)	14.26** (4.00)	-11.03* (4.87)	9.74 (4.46)	5.48+ (3.03)	7.22+ (4.17)	21.02* (8.27)
R2	0.87	0.76	0.81	0.94	0.94	0.90	0.94	0.61	0.68
R2_A	0.77	0.55	0.76	0.88	0.90	0.68	0.90	0.53	0.55
N	18.00	14.00	29.00	15.00	18.00	11.00	20.00	44.00	25.00

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

Source: voluntary CBCRs published by MNCs, World Bank (2020), own calculations.

The results from the pooled regression suggest that our sample's reported profits are on average negatively correlated with ETRs at low to moderate levels of ETR, which would be in line with profit-shifting activities. However, the estimated average effect size is much smaller than in other studies and not very robust. A quadratic functional form seems more adequate for capturing the average relationship between profits and ETRs in our sample but does not hold for all multinational groups individually, as the signs of the coefficients are not significant or switch sign in the individual group regressions.

As a robustness check, we repeat the regressions with ETR estimates based on the aggregate OECD data and using statutory tax rates from KPMG. The signs of the simple and quadratic ETRs based on OECD data correspond to those of regressions (1)-(5) but the coefficients are not significant. In the individual-MNC regressions we find a significant non-linear pattern for four multinational groups with a negative relationship between profits and ETR up to a certain level of ETR, but the threshold after which the relationship turns positive is quite low in three cases (12-14%) and hard to interpret intuitively. When we use statutory rather than effective tax rates, the tax rate coefficients are not significant, are negative for the linear models and are of opposed sign as compared to regression (4). In the individual-MNC regressions, the statutory tax rate is never significant (see Appendix tables A1-A4 for detailed results).

5 Conclusions

Despite recent growth in research interest in tax havens and tax avoidance practices, reliable information on where MNCs locate their profits and pay the associated corporate taxes is still lacking. On the one hand, a growing body of economics literature has shown that multinational corporations (MNCs) do shift their profits to tax havens, regardless of whether these analyses are based on confidential company-level tax return data or aggregate macroeconomic statistics. On the other hand, case studies of specific MNCs' tax structures have been the focus of numerous studies by non-governmental organisations (e.g. ActionAid, 2010) and regulatory disputes (e.g. European Commission, 2014). While the rigorousness of the former has been questioned by some (see e.g. Gunn et al., 2020), the latter has often not provided conclusive outcomes (e.g. Byrnes, 2019). In this paper, we take the middle way – applying rigorous economics methods to the best available public data of as many individual MNCs as possible, with good country coverage. The tax semi-elasticity and profit misalignment methods we use are among the most rigorous methods available today, and the data with the best available country coverage are the CBCR data voluntarily published by certain MNCs.

For the largest available, hand-collected sample of, currently, ten large MNCs, half of which are in the extractive industries, we find substantial variance in both the worldwide and country-level effective tax rates (ETRs) these MNCs pay and we observe that varied shares of their profits are reported in tax havens. We find that their worldwide ETRs range between 0% and 50%, while the ETRs in individual countries range between 0% and 85%. We find that MNCs that voluntarily publish their CBCRs are more likely to pay higher worldwide ETRs compared to the average MNC, despite these companies making use of tax havens to varying extents. Six multinationals in our sample belong to the oil and other extractive industries and we do observe high ETRs especially in natural-resource-rich countries, which may partially explain why MNCs in these industries pay higher worldwide ETRs on average.

The public data for our sample confirms the role of tax havens in attracting excess profits that are not in line with economic activity. While the majority of the MNCs in our sample report relatively little activity in tax havens, a few report much of their profits in tax havens. This might be indirect evidence of profit-shifting activities. At first sight, we do not find any correlation between ETRs and profit misalignment or the use of tax havens, based on descriptive evidence. However, a regression analysis controlling for MNC-country and country-level covariates and allowing for a non-linear relationship reveals a negative correlation between reported profits and ETRs for low and intermediate levels of ETR up to 34%. This result is in line with previous evidence of profit shifting but the estimated semi-elasticities of reported profits with regard to the tax rates are much lower and the robustness of the regressions is limited.

Our results allow for two different interpretations: either somewhat less aggressive profit-shifting behaviour among the MNCs that voluntarily publish their CBCRs or methodological difficulties with the identification of profit shifting in the extractive industries. We need more data to better account for heterogeneity across industries or we need to refine our modelling of profitability in the extractive industries.

In order to draw more reliable conclusions, further analysis of more CBCRs from different economic sectors would be needed. This is likely to become possible in the coming years given that an increasing number of multinationals are voluntarily deciding to publish this data and negotiations are currently underway for the adoption of mandatory public reporting for all large multinationals at EU level.

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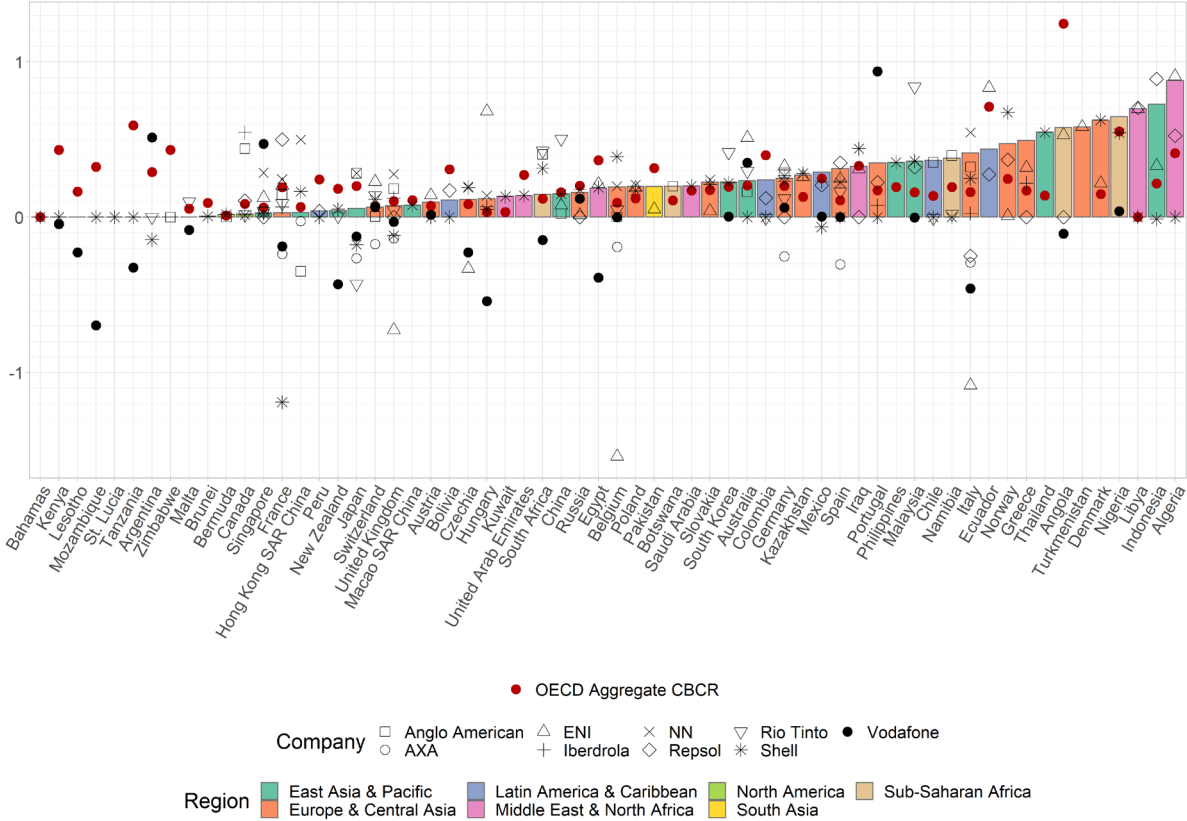
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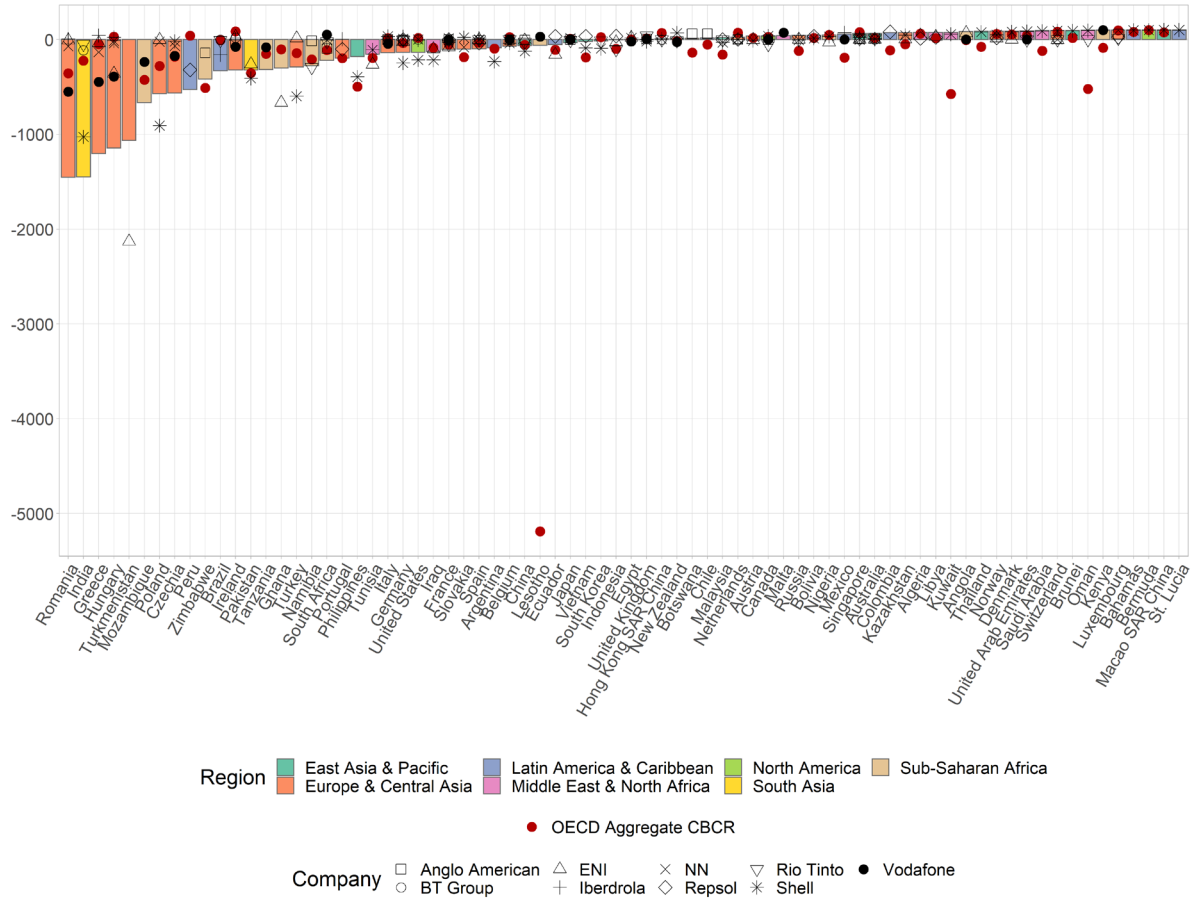
7 Appendix

Figure A1: ETR including negative profits at MNC-country level



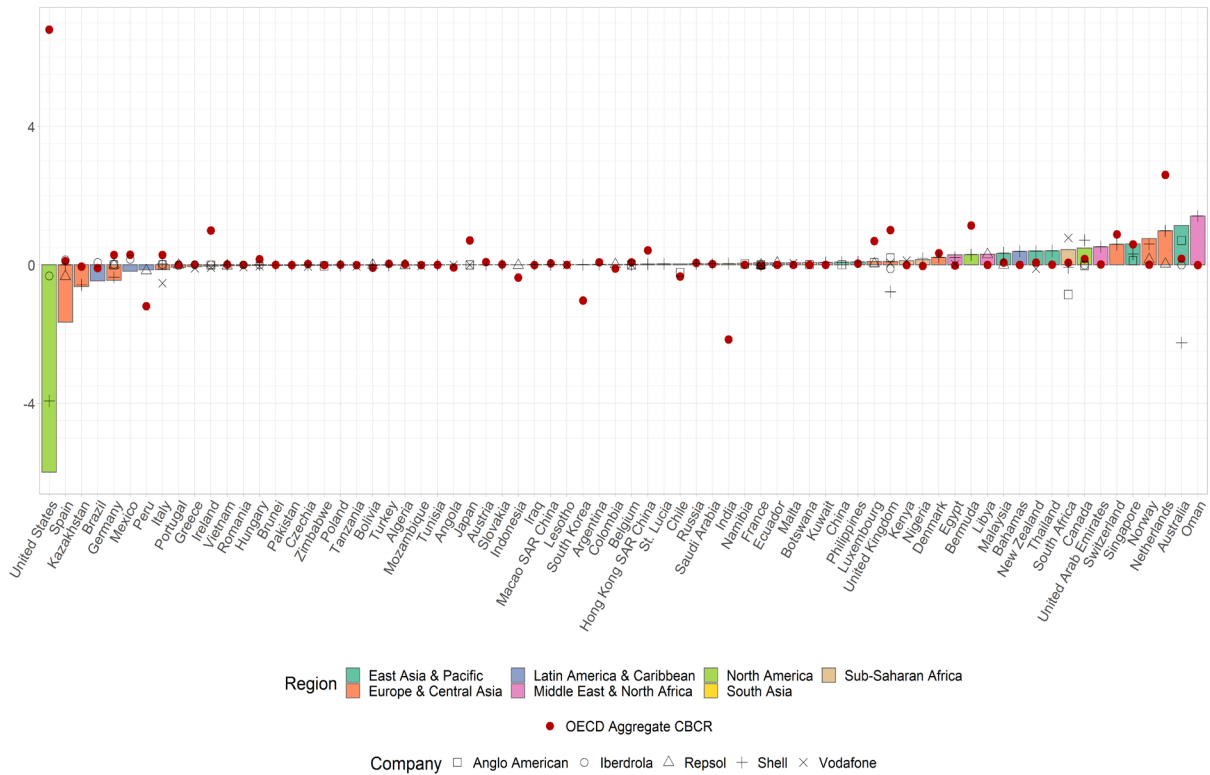
Note: The figure includes countries where more than \$10m is reported in profits. Source: voluntary CBCRs published by MNCs and OECD (2020) aggregate CBCR data, own calculations.

Figure A2: Misaligned profits in % of total profits reported in each country.



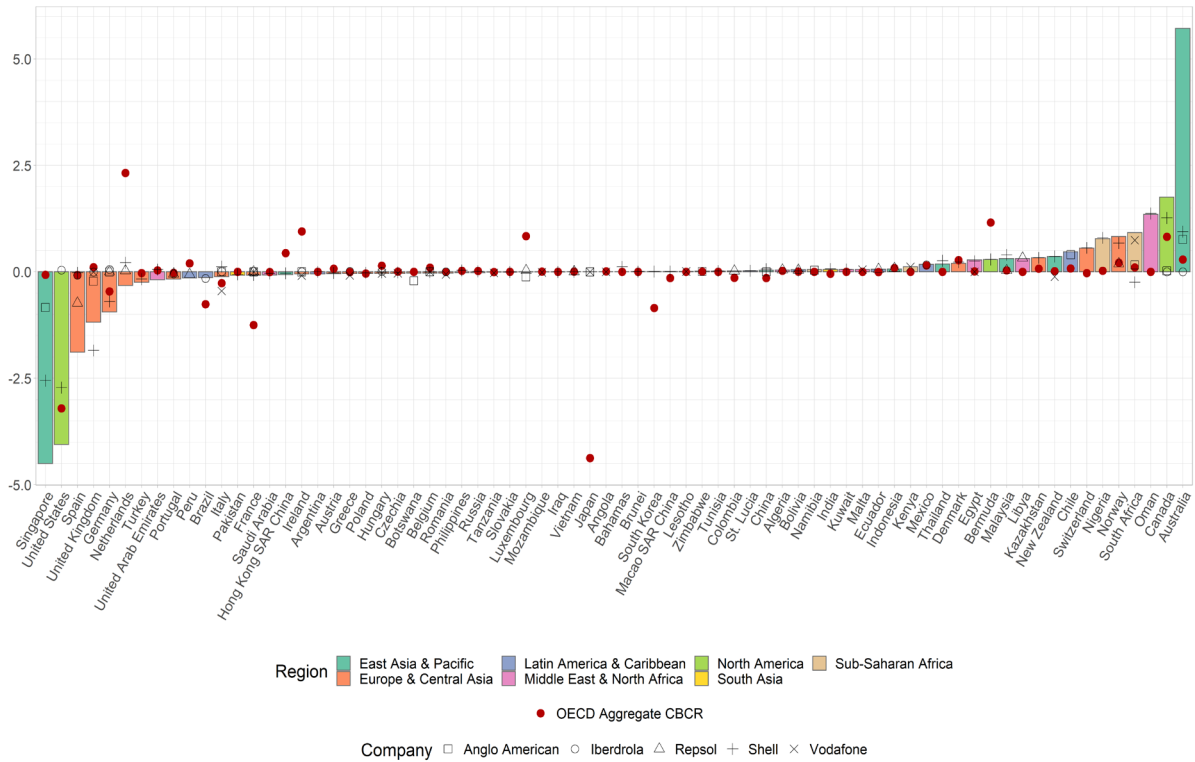
Note: The figure includes countries in which more than \$10m is reported in profits. Source: voluntary CBCRs published by MNCs and OECD (2020) aggregate CBCR data, own calculations.

Figure A3: Misaligned profits in % of the total sample's profits. Activity measure: tangible assets



Note: The figure includes countries in which more than \$10m is reported in profits. Source: voluntary CBCRs published by MNCs and OECD (2020) aggregate CBCR data, own calculations.

Figure A4: Misaligned profits in % of the total sample's profits. Activity measure: revenues of unrelated parties



Note: The figure includes countries in which more than \$10m is reported in profits. Source: voluntary CBCRs published by MNCs and OECD (2020) aggregate CBCR data, own calculations.

Table A1: Pooled regression with ETRs based on aggregate CBCR data by OECD

	LINEAR	QUADRATIC	LINEAR2	QUADRATIC2	QUADRATIC3
	b/se	b/se	b/se	b/se	b/se
LN_EMPLOYEES	0.55*** (0.12)	0.55*** (0.12)	0.53*** (0.11)	0.54*** (0.11)	0.49*** (0.09)
LN_ASSETS	0.24* (0.10)	0.25* (0.10)	0.22** (0.08)	0.23** (0.09)	0.28*** (0.07)
LN_GDP_PC	0.28+ (0.15)	0.26+ (0.15)	0.35* (0.15)	0.34* (0.15)	0.33* (0.15)
BT	-0.69 (0.58)	-0.69 (0.57)	-0.54 (0.56)	-0.54 (0.55)	
ENI	0.46 (0.56)	0.45 (0.56)	0.23 (0.52)	0.22 (0.52)	
IBER	0.56 (0.61)	0.57 (0.59)	0.63 (0.59)	0.64 (0.58)	
NN	-0.18 (0.65)	-0.23 (0.65)	-0.01 (0.61)	-0.05 (0.62)	
REPSOL	1.43* (0.65)	1.42* (0.63)	0.96+ (0.58)	0.96+ (0.57)	
RIO	0.39 (0.62)	0.42 (0.60)	0.26 (0.59)	0.29 (0.57)	
SHELL	1.17* (0.59)	1.16* (0.58)	1.08+ (0.55)	1.07+ (0.55)	
VODA	-0.39 (0.62)	-0.45 (0.62)	-0.40 (0.60)	-0.44 (0.60)	
ETR_OECD	0.34 (1.04)	-2.53 (3.02)	0.41 (0.91)	-1.73 (2.81)	-1.79 (2.77)
ETR_OECD²		4.31 (3.55)		3.21 (3.36)	3.04 (3.33)
HEADQUARTER			1.44* (0.57)	1.38* (0.58)	1.37** (0.52)
RESOURCES			0.08*** (0.02)	0.08*** (0.02)	0.08*** (0.02)
EXTRACTIVE					0.72** (0.25)
_CONS	6.85*** (1.84)	7.26*** (1.85)	6.30*** (1.79)	6.58*** (1.76)	5.79*** (1.73)
R2	0.63	0.64	0.68	0.68	0.65
R2_A	0.61	0.61	0.65	0.65	0.64
N	191.00	191.00	191.00	191.00	191.00

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

Source: voluntary CBCRs published by MNCs and OECD (2020) aggregate CBCR data, World Bank (2020), own calculations.

Table A2: Regressions by multinational group with ETRs based on aggregate CBCR data by OECD

	ANGLO	BT	ENI	IBER	NN	REPSOL	RIO	SHELL	VODA
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
LN_EMPLOYEES	-0.18 (0.59)	0.28 (0.48)	0.32 (0.22)	0.69** (0.17)	-0.02 (0.13)	-0.37* (0.09)	0.86*** (0.18)	0.66*** (0.15)	1.12* (0.49)
LN_ASSETS	0.82 (0.45)	1.08* (0.37)	0.45* (0.17)	0.05 (0.16)	0.63*** (0.08)	0.71* (0.19)	0.08 (0.10)	0.13 (0.13)	-0.43 (0.48)
LN_GDPPC	-0.07 (0.55)	0.56 (0.33)	0.31 (0.24)	-0.04 (0.25)	1.56*** (0.34)	0.50+ (0.19)	0.64* (0.29)	0.82* (0.38)	-0.42 (0.31)
ETR_OECD	-25.59 (21.47)	-92.25** (24.47)	5.69 (5.77)	-36.50* (11.40)	-19.28* (6.53)	-8.85+ (3.33)	-18.12 (21.20)	-7.01 (8.24)	3.81 (9.29)
ETR_OECD²	37.45 (38.47)	322.78** (90.11)	-8.18 (7.31)	144.28* (41.48)	73.13* (28.62)	13.95* (4.25)	22.35 (67.67)	20.19 (12.44)	-5.77 (8.73)
RESOURCES	0.19 (0.19)	0.15 (0.15)	0.05 (0.04)	-0.30+ (0.14)	2.54** (0.72)	0.01 (0.02)	-0.04 (0.08)	0.09** (0.03)	-0.02 (0.10)
HEADQUARTER	1.62* (0.63)	0.00 (.)	0.00 (.)	0.73+ (0.34)	-0.80 (0.60)	0.92+ (0.39)	2.84** (0.84)	0.26 (0.73)	2.92* (1.07)
_CONS	6.34 (8.97)	-4.33 (5.55)	3.29 (2.50)	15.93** (3.76)	-11.66* (4.50)	3.17 (4.92)	6.89+ (3.47)	4.19 (3.82)	21.30* (7.78)
R2	0.89	0.77	0.83	0.96	0.94	0.96	0.94	0.56	0.62
R2_A	0.82	0.58	0.78	0.92	0.90	0.85	0.91	0.48	0.45
N	18.00	14.00	27.00	15.00	18.00	11.00	20.00	44.00	24.00

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

Source: voluntary CBCRs published by MNCs and OECD (2020) aggregate CBCR data, World Bank (2020), own calculations.

Table A3: Regressions with statutory tax rates

	LINEAR	QUADRATIC	LINEAR2	QUADRATIC2	QUADRATIC3
	b/se	b/se	b/se	b/se	b/se
LN_EMPLOYEES	0.55*** (0.12)	0.55*** (0.12)	0.51*** (0.11)	0.51*** (0.11)	0.48*** (0.09)
LN_ASSETS	0.24* (0.09)	0.24* (0.10)	0.24** (0.08)	0.24** (0.08)	0.28*** (0.07)
LN_GDP_PC	0.22+ (0.13)	0.21 (0.13)	0.31* (0.15)	0.30* (0.15)	0.32* (0.14)
BT	-0.65 (0.57)	-0.62 (0.58)	-0.51 (0.56)	-0.46 (0.56)	
ENI	0.33 (0.54)	0.33 (0.54)	0.15 (0.52)	0.13 (0.51)	
IBER	0.54 (0.58)	0.56 (0.59)	0.51 (0.58)	0.54 (0.59)	
NN	-0.32 (0.64)	-0.32 (0.64)	-0.17 (0.60)	-0.16 (0.60)	
REPSOL	1.42* (0.61)	1.40* (0.60)	1.02+ (0.57)	0.99+ (0.56)	
RIO	0.41 (0.61)	0.43 (0.61)	0.28 (0.59)	0.32 (0.58)	
SHELL	1.09+ (0.57)	1.10+ (0.57)	1.08* (0.55)	1.09* (0.55)	
VODA	-0.39 (0.60)	-0.38 (0.60)	-0.37 (0.58)	-0.36 (0.58)	
CIT_2018	-2.41 (1.69)	-0.46 (5.09)	-0.30 (1.70)	3.00 (5.53)	2.11 (5.74)
CIT2018²		-4.55 (9.91)		-7.64 (10.49)	-6.01 (10.90)
HEADQUARTER			1.44* (0.55)	1.41* (0.55)	1.41** (0.49)
RESOURCES			0.07*** (0.02)	0.07*** (0.02)	0.07*** (0.02)
EXTRACTIVE					0.70** (0.24)
_CONS	8.16*** (1.78)	8.07*** (1.77)	6.69*** (1.88)	6.47*** (1.90)	5.78** (1.86)
R2	0.64	0.65	0.68	0.68	0.65
R2_A	0.62	0.62	0.65	0.65	0.64
N	199.00	199.00	199.00	199.00	199.00

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

Source: voluntary CBCRs published by MNCs, KPMG (2020), World Bank (2020), own calculations.

Table A4: Regressions by MNC with statutory tax rate

	ANGLO	BT	ENI	IBER	NN	REPSOL	RIO	SHELL	VODA
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
LN_EMPLOYEES	-0.27 (0.44)	-0.40 (1.03)	0.22 (0.24)	0.69* (0.23)	0.03 (0.12)	-0.06 (0.17)	0.86** (0.25)	0.73*** (0.17)	1.27* (0.54)
LN_ASSETS	1.05** (0.28)	1.09 (0.63)	0.52** (0.15)	0.11 (0.22)	0.62*** (0.12)	0.17 (0.23)	0.14 (0.11)	0.11 (0.12)	-0.50 (0.50)
LN_GDPPC	0.45 (0.45)	0.82+ (0.42)	0.20 (0.25)	-0.24 (0.33)	1.96** (0.50)	0.26 (0.21)	0.40 (0.35)	0.57 (0.40)	-0.23 (0.48)
CIT_2018	94.32 (66.51)	-27.82 (15.56)	-6.60 (11.23)	-2.78 (18.18)	-19.27 (13.32)	-76.42 (91.29)	-10.93 (12.34)	-7.38 (7.73)	-0.10 (27.75)
CIT2018²	-212.48 (150.70)	68.79 (38.95)	19.00 (28.56)	0.36 (39.09)	40.12 (33.57)	117.86 (157.09)	5.95 (19.63)	6.30 (14.71)	9.75 (67.13)
RESOURCES	0.01 (0.12)	0.04 (0.13)	0.05 (0.04)	-0.16 (0.15)	2.58** (0.75)	0.01 (0.04)	-0.25* (0.09)	0.07+ (0.03)	0.03 (0.17)
HEADQUARTER	0.44 (0.81)	0.00 (.)	0.00 (.)	0.08 (0.43)	-0.74 (0.76)	1.72 (0.84)	2.79*** (0.49)	0.52 (0.50)	2.80* (1.13)
_CONS	-14.51 (11.30)	-5.99 (7.11)	4.76 (3.12)	15.66* (5.67)	-14.65* (6.47)	25.19 (13.01)	9.01* (3.87)	7.64 (4.70)	19.65+ (10.83)
R2	0.90	0.58	0.82	0.93	0.93	0.91	0.93	0.55	0.61
R2_A	0.83	0.23	0.77	0.87	0.89	0.71	0.89	0.47	0.44
N	18.00	14.00	27.00	15.00	18.00	11.00	20.00	44.00	24.00

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

Source: voluntary CBCRs published by MNCs, KPMG (2020), World Bank (2020), own calculations.

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