Appendix for "Taxing Polluters: What is the Impact of a Global Minimum Tax on the Extractive Sector?"

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1   More Details about the Global Minimum Tax

Overview.   In October 2021, close to 140 countries and territories endorsed a landmark agreement establishing a global minimum tax of 15% on the profits of multinational enterprises (MNEs), known as Pillar Two of the OECD's Two-Pillar solution to address base erosion and profit shifting.

The agreement finalized a 15% minimum tax rate, adjusting from the earlier July 2021 statement which had proposed "at least 15%" encouraged by the Biden's administration initial 21% proposal. Additionally, substance-based carve-outs were broadened for a 10-year transition period, initially allowing exclusions of 8% of the value of tangible assets and 10% of payroll. These rates will gradually decrease over the transition period to reach the long-term carve-out rate of 5% for both tangible assets and payroll.

Key mechanisms.   Pillar Two, formally known as the Global Anti-Base Erosion (GloBE) proposal, introduces several interconnected mechanisms designed to ensure that large multinational enterprises pay a minimum effective tax rate of 15% on profits in every jurisdiction where they operate:

- Income Inclusion Rule (IIR): This primary mechanism allows the jurisdiction where the ultimate parent entity is headquartered to impose a "top-up tax" on the income of foreign subsidiaries that are taxed below the 15% minimum rate. The IIR essentially functions as a switch-over rule, automatically taxing income generated in low-tax jurisdictions at the minimum rate;

- Qualified Domestic Minimum Top-up Tax (QDMTT): The IIR creates a clear incentive for host countries to collect the top-up tax themselves rather than having it collected by the parent jurisdiction. They can implement a QDMTT to claim priority taxing rights over low-taxed profits of constituent entities located in their territory.

- Under-Taxed Payments Rule (UTPR): This rule serves as a backstop mechanism when neither the QDMTT nor the IIR has been applied. It allows other implementing jurisdictions to collect a portion of the uncollected top-up tax in proportion to their share of the MNE's tangible assets and employees. For instance, a US firm operating in Europe but shifting its profits to tax havens could be taxed, in last resort, by the EU if the US doesn't collect the top-up tax and if the haven doesn't meet the minimum tax rate.

Discussion.   The self-enforcement design of Pillar Two is a crucial feature of the framework and echoes the tax design of carbon border taxes to be put in place in the EU (CBAM): the EU would tax the carbon content of its imports if exporting countries set a lower price for emissions than the EU. Likewise, if some jurisdictions choose to maintain effective tax rates below the minimum and not to implement a QDMTT, the IIR and UTPR create a system where the tax will be collected somewhere—either by the parent jurisdiction or by other implementing countries as a last resort.

1.1   Principle

Pillar Two introduces a global minimum tax of 15% on the corporate profits of large multinational companies, above a consolidated revenue threshold of 750 million EUR. The new rules apply on a country-by-country basis. Consider a large multinational company m, notably active in country i. Even though m's firm-wide average effective tax rate is above 15%, as soon as the effective tax rate in country j lies below the minimum, some top-up payment is due. Below, we describe how

this top-up payment is computed and allocated. These computations rely on accounting information, which is an important novelty with Pillar Two. The relevant variables are first observed in multinational companies' accounts and then adjusted to proxy tax-relevant quantities.

1.2 Effective tax rate

The first step in applying the global minimum tax consists in computing effective tax rates. We consider one multinational company in scope of Pillar Two and active in a given tax jurisdiction. According to the Model Rules (see OECD (2021)), the effective tax rate is equal to the ratio of the local affiliate's "Adjusted Covered Taxes" to its "GloBE Income or Loss". Both quantities are derived from financial information, with various adjustments to approach tax-relevant variables.

In this study, we focus on one of these adjustments—for loss carry-forwards. It seems particularly important because our sample includes the COVID crisis, and the multinational companies on which we focus reported large losses in many tax jurisdictions. In 2020, 336 pairs of multinational company and tax jurisdiction are associated with zero or negative accounting profits in our country-by-country data, out of 594 observations with valid pre-tax profits (i.e., 57%). These losses amount to 99 billion EUR in total.

We focus on the adjustment for loss carry-forwards. According to the Model Rules, the denominator is not concerned, and we assimilate the GloBE income or loss with pre-tax accounting income. Only the numerator is affected. So, we simplify the computation of effective tax rates as:

$$\text{ETR} = \frac{\text{Adjusted Covered Taxes}}{\text{GloBE Income or Loss}}$$

$$\approx \frac{\text{Current tax expense} + \text{Adjustment for loss carry-forwards}}{\text{Pre-tax accounting income}}$$

Formally, Article 4.4. of the Model Rules describes the adjustment for loss carry-forwards. Article 4.4.1. defines the notion of "Total Deferred Tax Adjustment Amount", used not only for loss carry-forwards but for any temporary differences in book and tax accounting. More specifically, Article 4.4.3. deals with the case where the adjustment stems from a loss. Based on these two articles, the adjustment for loss carry-forwards is equal to the deferred tax expense reported by the firm in its financial accounts, recast at the minimum tax rate. If we denote by τ the tax rate initially applied and by $\bar{\tau}$ the minimum tax rate, we have:

$$\text{Adjustment for loss carry-forwards} = \text{Deferred tax expense} \times \frac{\bar{\tau}}{\tau}$$

Therefore, we retain the following formula for the effective tax rate:

$$\text{ETR} \approx \frac{\text{Current tax expense} + \text{Deferred tax expense} \times \frac{\bar{\tau}}{\tau}}{\text{Pre-tax accounting income}}$$

1.3 Top-up tax rate

The top-up tax rate is given by the difference between the local effective tax rate and the minimum rate. If the firm is already taxed at a rate higher than 15%, then no top-up payment is needed and the top-up tax rate is null.

Overall, it writes as:

$$\text{Top-up rate} = \begin{cases} 0 & \text{if ETR} \geq \bar{\tau} \\ 15\% - \text{ETR} & \text{otherwise.} \end{cases}$$

1.4 Tax base

While our computation of the effective tax rate directly relies on accounting income, the "Substance-Based Income Exclusion" rule excludes some profits, deemed as routine returns on local production factors, from the relevant tax base. It subtracts 8% of the carrying value of tangible assets and 10% of payroll or employee compensation from accounting income. In a transition period of ten years, the amount of excluded income will decline, down to 5% of tangible assets and 5% of payroll. We call this reduction substance-based carve-outs or simply carve-outs in the following. This important aspect of the design of Pillar Two aims at imposing the top-up tax on affiliates with no or little genuine economic activity and less extensively on affiliates with real economic activity.

We obtain the following formula:[1]

$$\text{Tax base} = \text{Accounting income} - \underbrace{(\alpha \times \text{Payroll} + \beta \times \text{Tangible assets})}_{\text{Substance-based carve-outs}}$$

With α and β the deductibility shares for payroll and tangible assets. α is equal to 10% in the first year of implementation, then decreases to 5% over the transition period. β is equal to 8% in the first year of implementation, then decreases to 5%.

1.5 Revenue allocation

The top-up tax may be collected via three interlocking rules. Which rule actually applies determines which country collects the additional revenues.

First, the jurisdiction where low-taxed income is booked has the priority to collect the top-up tax. One way to do so is of course to raise the effective tax rate above the minimum. But it can also adopt a "Qualified Domestic Top-up Tax", or QDMTT.[2] Then, in absence of a QDMTT, the headquarter country of the multinational can collect the top-up tax. It must have implemented the "Income Inclusion Rule", or IIR. Eventually, if neither the affiliate's jurisdiction nor the headquarter country collects the top-up tax, it is split between Pillar Two adopters. Each will collect a share of the top-up tax via the "Under-Taxed Payments Rule", or UTPR. Shares are derived from the distribution of the multinational company's employees and tangible assets within the set of jurisdictions implementing the UTPR.

Once sufficiently many jurisdictions implement the UTPR, the total revenue gains from the global minimum tax remain widely unaffected by implementation choices. However, the allocation of these additional tax revenues is highly sensitive to the instruments applied. In the following section, we briefly describe the current implementation status of Pillar Two.

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1. The formula stated here leaves some complexities aside. As mentioned above, the GloBE Income or Loss may differ from plain accounting income due to a series of adjustments. We ignore these adjustments and assimilate the two notions.

2. Contrarily to a general raise of the statutory corporate income tax rate for instance, the QDMTT narrows down the tax hike to large multinationals in the scope of Pillar Two and preserves substance-based carve-outs.

1.6 Implementation Status

Figure 1: Countries implementing any of the three Pillar Two rules

Source: BDO Global's and PwC's Pillar Two implementation trackers. BDO Global's Pillar Two implementation tracker can be found here; PwC's tracker is available here.
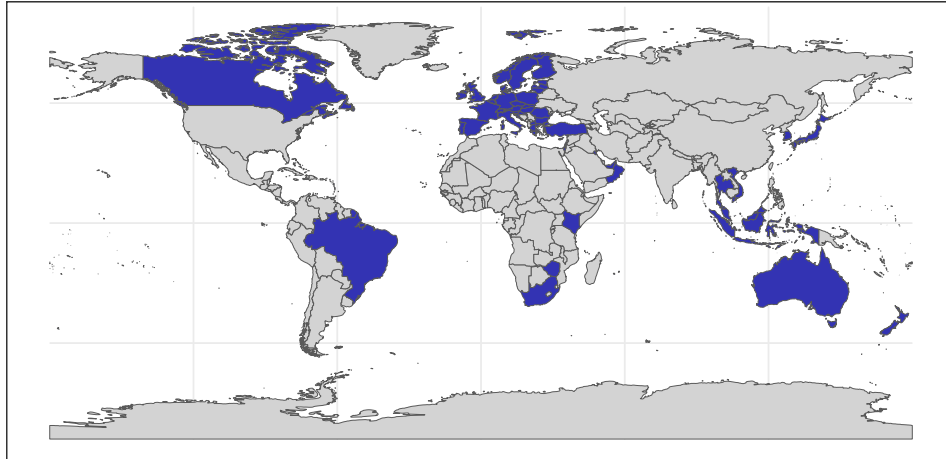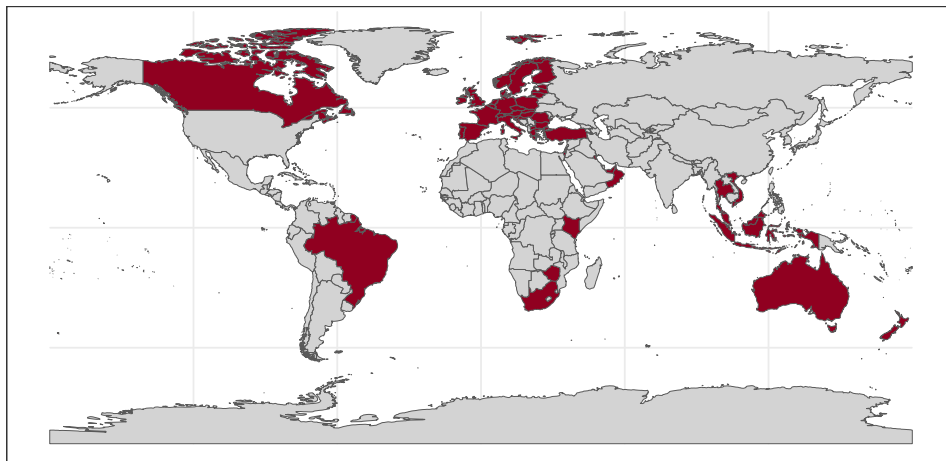

Figure 2: Countries implementing a QDMTT

Source: BDO Global's and PwC's Pillar Two implementation trackers. BDO Global's Pillar Two implementation tracker can be found here; PwC's tracker is available here.

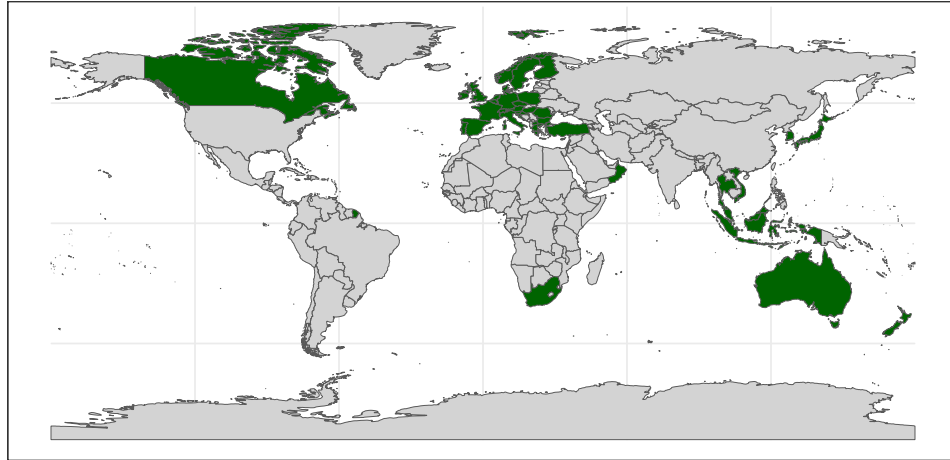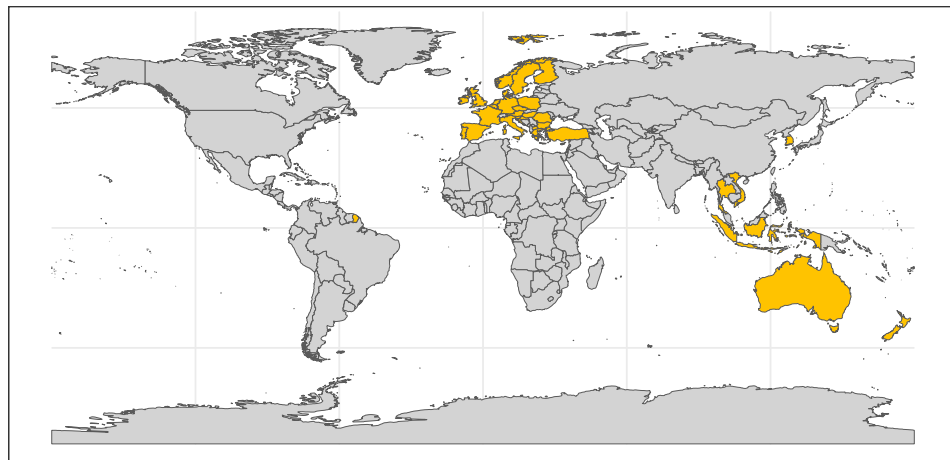Figure 3: Countries implementing the IIR

Figure 4: Countries implementing the UTPR

2 Data

2.1 Available Sources

Voluntarily disclosed country-by-country reports.   Our primary data source is a collection of reports voluntarily published by a subsample of multinationals on their websites. We start from the dataset published by the EU Tax Observatory and complement them with hand-collected reports for the most recent years.[3] The resulting dataset is mainly composed of Country-by-Country Reports (CbCR) that follow the OECD's standards, a blank example of which is given in Figure 5. Firms with global consolidated revenues exceeding 750 million EUR must report this information to the relevant tax administration, and some also decide to voluntarily release it online.[4] Our final dataset comprises 27 extractive multinationals spanning 165 countries. We manually identify whether these firms produce mining or oil and gas commodities.

Name of the MNE group: Fiscal year concerned: Currency:										
Tax Jurisdiction	Revenues			Profit (Loss) Before Income Tax	Income Tax Paid (on cash basis)	Income Tax Accrued – Current Year	Stated capital	Accumulated earnings	Number of Employees	Tangible Assets other than Cash and Cash Equivalents
	Unrelated Party	Related Party	Total							

Figure 5: Blank Country-by-Country report

> **Methodological note: What taxes do we observe?**
>
> Extractive companies often face specific tax instruments. Beyond corporate income taxes, their payments to governments include royalties, license fees, or the transfer of a share of the firm's production. Our measure of taxes should include all and only the payments that enter the computation of the effective tax rate in the OECD's Model Rules. The analysis of UN Tax Committee (2024) suggests that a tax payment should be included if it is based on the firm's profits or if it is paid as a substitute for a corporate income tax.
>
> In practice, we simply use the taxes reported in country-by-country reports, for three reasons. First, the comparison of country-by-country reports with payments to governments suggests that this measure excludes royalties and payments as part of production-sharing agreements. Second, the comments provided by several firms alongside their reports suggest that they clearly distinguish corporate income taxes from other instruments. Third, given our high effective tax rates in resource-rich countries, the omission of relevant instruments is unlikely to substantially over-estimate the revenue gains.

Payments to governments.   We also leverage a compilation of all the payments to governments by the firms in public country-by-country data. Since 2016, firms listed in Canada, the EU, Norway, and the UK that have an extractive activity must publish a report with information on the

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3. See Aliprandi et al. (2022) on voluntary country-by-country reports. The dataset is available here.

4. Since the online publication is not imposed, firms have substantial freedom to truncate the officially reported information by selecting variables, aggregating jurisdictions, or following other reporting standards.

payments that they make to resource-rich countries. These payments must be linked to extraction or exploration activities. We public country-by-country data, to classify countries by type of activities. As soon as a jurisdiction is associated with oil and gas (respectively mineral) extraction in a firm's report of payments to governments over the period, it is classified as an oil and gas (mineral) extraction country. Some countries host both oil and gas and mining activities, and we treat them separately. The other jurisdictions are classified as non-extractive countries.

Compustat Global & North America.   Our data are very detailed, but they narrow down our analysis to a sub-sample of extractive multinationals worldwide. To extrapolate our results, we use consolidated financial information for listed firms from Compustat North America and Global.[5] We restrict the sample to oil and gas or mining firms with more than 750 million USD in consolidated revenues. The final sample is composed of around 600 firms, mostly located in the US (173), China (65), and Canada (62). Table 2 shows how our estimation sample compares to the total amounts of profits of sales generated by the sector worldwide.

Other sources used in our analyses.   We mobilize several secondary data sources. First, we use Rystad Upstream and S&P Metals and Mining to measure oil and gas and mining production respectively. Second, we manually collect the consolidated financial statements of the multinational groups in our sample, over the period of observation. We use them to correct for potential double-counting in the "Profit (loss) before tax" variable of the country-by-country reports. We describe the related methodology in more details in Section 4. Third, we use the statutory corporate income tax rates compiled by the Tax Foundation to impute the missing effective tax rates.[6] Fourth, we use exchange rate data from the World Bank to convert financial data across currencies.

Bureau of Economic Analysis (BEA).   We discuss the representativeness of our main sample right below. One key challenge is that our data over-represent European, Canadian, and Australian firms, while ignoring most of the large US multinationals of the sector. One strategy could thus exploit the BEA's aggregated statistics on the worldwide activities of US multinationals.[7] These statistics notably split the foreign profits (e.g., via the "Profit-Type Return" variable) and taxes (via the "Foreign Income Taxes" variable) of US multinationals by country and industry. However, the relevant breakdowns are based on the sector *of the foreign affiliate*, and not *of the multinational group* as is the case with country-by-country reports.[8] Another strategy could leverage the industry-level aggregations of US country-by-country reports released by the IRS, but the industry group closest to our study ("Agriculture, forestry, fishing and hunting, mining, quarrying, oil and gas extraction, utilities, construction") would still be too broad.[9]

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5. Given the size threshold of Pillar Two—consolidated revenues above 750 million EUR—the vast majority of firms in which we are interested are listed and thus included in Compustat.

6. The historical database compiled and published by the Tax Foundation up to 2024 can be found here.

7. For instance, the BEA's revised statistics on the worldwide activities of US multinationals in 2021 can be found here.

8. Consider an extractive multinational with mining activities in one high-tax jurisdiction and a tax haven affiliate purely dedicated to host shifted profits. In statistics based on the sector of the affiliate, only the activities in the high-tax jurisdiction would be classified as "extractive". In statistics based on the overall sector of the multinational group, both countries would appear. With regards to Pillar Two, the former data source would likely give a truncated view of the top-up taxes due by the multinational.

9. The IRS' aggregated country-by-country report statistics can be found here.

2.2 Sample Representativeness

Sample overview. Our sample covers some of the largest extractive multinationals. The number of publicly disclosed country-by-country reports varies over time, from only 1 firm in 2016 to a maximum of 24 in 2021. We use all the years in our sample (e.g., to compute average effective tax rates), but our result tables omit the revenue gain estimates obtained before 2019 since coverage is more limited in this period.

Table 1 lists the multinationals from the extractive sector whose country-by-country reports we could collect for the income year 2022. We see substantial variation in the level of details that firms provide in their country-by-country reports. Not all firms in our sample are subject to the same reporting requirements, and they may also decide to disclose a more aggregated version of their report to tax administrations. Such aggregation matters for our computations and may lead to lower-bound estimates of the revenues from Pillar Two. In 2022, Shell provides the most detailed report with 82 partner countries and the report identifies 17 jurisdictions classified by Tørsløv, Wier, and Zucman (2022) as tax havens.

Headquarter	Multinational	N. of partners	N. of tax haven partners
Australia	BHP	35	10
Australia	Rio Tinto	48	8
Australia	South32	14	3
Bermuda	Bw Energy	7	3
Bermuda	Geopark	5	0
Canada	Canacol	3	1
Colombia	Ecopetrol	9	3
France	Total Energies	76	9
Italy	ENI	74	16
Italy	Saipem	72	6
Norway	Dno	5	0
Norway	Equinor	43	5
Norway	Panoro	6	0
Norway	Yara	65	6
Spain	Repsol	39	7
UK	Anglo American	43	10
UK	BP	69	13
UK	Shell	82	17
US	Newmont	9	0

Table 1: Coverage by multinational in 2022

Geographic distribution of extraction. We locate the oil and gas fields and mines operated by firms in our sample thanks to firms' payments to governments. Our sample is not representative of worldwide extraction. Oil multinationals headquartered in Europe tend to be overrepresented, consistently with the stricter reporting requirements in the EU, Canada, Norway, and the UK. We obtain our best coverage for oil extraction in Norway, for which we capture 43% of total production from 2020 to 2023.

Representativeness. Our sample only covers a fraction of worldwide extractive activities, even when we exclude firms below the Pillar Two consolidated revenue threshold. In Compustat, we sum the sales and (positive) pre-tax profits of all the extractive firms that satisfy the consolidated revenue threshold of 750 million EUR. Table 2 shows that our sample covers around 17% of worldwide profits and sales in the sector, and around 11% and 14% of oil and gas and mining production respectively. However, since our dataset includes some of the largest extractive multinationals, we can compute effective tax rates for almost all countries where an extractive activity occurs.

Year	Sales	Profits	% Sales	% Profits	% Oil Prod.	% Mining Prod.
2019	1056	84	18.3	13.0	11.3	10.1
2020	772	39	18.5	12.2	12.7	14.4
2021	1086	213	17.3	19.8	12.2	17.5
2022	1497	315	18.4	19.2	11.3	13.5
2023	1121	158	15.6	13.0	9.3	14.3
Average	**1106**	**162**	**17.5**	**16.5**	**11.3**	**14.2**

Table 2: Coverage of our sample within the extractive industry

G7 members have recently exempted US-headquartered multinationals from the global minimum tax. Therefore, we may want to assess the representativeness of our *non-US* sample against the whole extractive industry *except for US firms*. Table 3 provides this comparison. We cover around 20% and 22% of the profits and sales of non-US firms in the sector, and around 14-16% of oil, gas, and mining production.

Year	Sales	Profits	% Sales	% Profits	% Oil Prod.	% Mining Prod.
2019	1055	83	23.4	15.0	16.6	10.1
2020	771	39	23.2	12.8	18.4	14.4
2021	1072	212	21.6	22.6	17.4	17.5
2022	1484	314	24.0	24.6	16.3	13.5
2023	1108	157	19.9	16.5	13.5	14.3
Average	**1098**	**161**	**22.4**	**20.0**	**16.4**	**14.2**

Table 3: Coverage of our sample within the extractive industry, excluding US firms

2.3 Descriptive Statistics for Public Country-by-Country Reports

2.3.1 Main Sectors

Sector	N. of MNEs	N. of obs.	Total revenues (bn. EUR)
Mining & Extraction	24	690	1849
Banking, Insurance & Financial Services	16	276	500
Utilities	11	149	201
Communications	9	149	172
Chemicals, Petroleum, Rubber & Plastic	18	307	65
Industrial, Electric & Electronic Machinery	8	179	55
Business Services	7	186	54
Transport, Freight & Storage	7	90	37
Wholesale	3	67	25
Construction	4	74	22
Top 10 - Total	107	2167	2980
Full sample - Total	139	2718	3077
Top 10 - Share (%)	77	80	97

Table 4: Top 10 sectors in our public country-by-country data in 2021, according to total revenues

Sector	N. of MNEs	N. of obs.	Profits before tax (bn. EUR)
Mining & Extraction	24	690	185
Communications	9	149	54
Banking, Insurance & Financial Services	16	276	44
Utilities	11	149	17
Chemicals, Petroleum, Rubber & Plastic	18	307	7
Industrial, Electric & Electronic Machinery	8	179	6
Transport, Freight & Storage	7	90	5
Textiles & Clothing Manufacturing	3	27	4
Property Services	3	15	3
Business Services	7	186	2
Top 10 - Total	106	2068	327
Full sample - Total	139	2718	336
Top 10 - Share (%)	76	76	98

Table 5: Top 10 sectors in our public country-by-country data in 2021 according to profits before tax

Sector	N. of MNEs	N. of obs.	Employees (k)
Mining & Extraction	24	690	705
Banking, Insurance & Financial Services	16	276	501
Communications	9	149	347
Chemicals, Petroleum, Rubber & Plastic	18	307	221
Food & Tobacco Manufacturing	4	124	185
Utilities	11	149	164
Industrial, Electric & Electronic Machinery	8	179	138
Transport, Freight & Storage	7	90	131
Business Services	7	186	116
Construction	4	74	102
Top 10 - Total	108	2224	2611
Full sample - Total	139	2718	2807
Top 10 - Share (%)	78	82	93

Table 6: Top 10 sectors in our public country-by-country data in 2021, according to employees

2.3.2 Main Firms

Multinational	Number of observations	Total revenues (bn. EUR)
Shell	84	533
Total Energies	73	356
BP	73	261
Allianz	46	132
ENI	75	128
Generali	21	114
Enel	40	112
AXA	28	112
Repsol	41	110
Equinor	46	109
BHP	34	85
Rio Tinto	52	75
Anglo American	47	74
America Movil	26	67
Telefonica	16	56
Aegon	25	53
Iberdrola	36	42
Philips	74	33
Ecopetrol	9	27
Yara	65	26
Top 20 - Total	911	2506
Full sample - Total	2718	3077
Top 20 - Share (%)	34	81

Table 7: Top 20 firms in our public country-by-country data in 2021, according to total revenues

Multinational	Number of observations	Profits before tax (bn. EUR)
America Movil	26	37
Equinor	46	32
Rio Tinto	52	25
Shell	84	22
BHP	34	22
Total Energies	73	19
Anglo American	47	15
Telefonica	16	12
BP	73	11
ENI	75	10
Allianz	46	10
AXA	28	9
Ecopetrol	9	8
Evraz	8	7
Iberdrola	36	6
Generali	21	5
Enel	40	5
Sse	10	5
Philips	74	4
Repsol	41	4
Top 20 - Total	839	268
Full sample - Total	2718	336
Top 20 - Share (%)	31	80

Table 8: Top 20 firms in our public country-by-country data in 2021, according to profits before tax

Multinational	Number of observations	Employees (k)
America Movil	26	183
Allianz	46	155
Unilever	96	148
Total Energies	73	116
Telefonica	16	107
AXA	28	92
Shell	84	82
Ferrovie Dello Stato Italiane	30	81
Philips	74	78
Generali	21	75
BHP	34	75
Evraz	8	68
Enel	40	66
BP	73	66
Wesfarmers	11	65
Anglo American	47	61
Ferrovial	35	60
Leonardo	5	50
Rio Tinto	52	46
ENI	75	42
Top 20 - Total	874	1715
Full sample - Total	2718	2807
Top 20 - Share (%)	32	61

Table 9: Top 20 firms in our public country-by-country data in 2021, according to employees

2.3.3 Main Firms in the Extractive Industry

Multinational	Number of observations	Total revenues (bn. EUR)
Shell	84	533
Total Energies	73	356
BP	73	261
ENI	75	128
Repsol	41	110
Equinor	46	109
BHP	34	85
Rio Tinto	52	75
Anglo American	47	74
Ecopetrol	9	27
Top 10 - Total	534	1758
Full sample - Total	690	1849
Top 10 - Share (%)	77	95

Table 10: Top 10 extractive firms in our public country-by-country data in 2021, according to total revenues

Multinational	Number of observations	Profits before tax (bn. EUR)
Equinor	46	32
Rio Tinto	52	25
Shell	84	22
BHP	34	22
Total Energies	73	19
Anglo American	47	15
BP	73	11
ENI	75	10
Ecopetrol	9	8
Evraz	8	7
Top 10 - Total	501	171
Full sample - Total	690	185
Top 10 - Share (%)	73	93

Table 11: Top 10 extractive firms in our public country-by-country data in 2021, according to profits before tax

Multinational	Number of observations	Employees (k)
Total Energies	73	116
Shell	84	82
BHP	34	75
Evraz	8	68
BP	73	66
Anglo American	47	61
Rio Tinto	52	46
ENI	75	42
Saipem	1	32
Repsol	41	24
Top 10 - Total	488	611
Full sample - Total	690	705
Top 10 - Share (%)	71	87

Table 12: Top 10 extractive firms in our public country-by-country data in 2021, according to employees

2.3.4 Main Partner Jurisdictions for the Extractive Industry

Country	N. of extractive MNEs	Revenues (bn. EUR)	Rank for non-extractives
United States	17	272	4
United Kingdom	17	193	6
Singapore	13	181	19
Australia	14	105	12
Spain	8	101	2
Netherlands	13	94	7
Norway	7	92	28
Germany	9	85	3
France	8	81	5
Canada	15	77	35
Italy	8	60	1
South Africa	12	31	17
Belgium	8	29	21
Colombia	12	28	24
United Arab Emirates	5	26	66
Brazil	15	19	8
Bahamas	3	18	
Chile	8	16	20
Switzerland	12	14	10
Russia	8	13	44

Table 13: Top 20 countries for the extractive industry in our public country-by-country data in 2021, according to revenues

Country	N. of extractive MNEs	Profits before tax (bn. EUR)	Rank for non-extractives
Australia	14	45	11
Norway	7	33	35
United States	17	14	6
South Africa	12	11	14
Colombia	12	8	18
Chile	8	8	29
Canada	15	6	32
Russia	8	6	33
Brazil	15	4	9
Nigeria	6	4	125
Libya	5	3	
Angola	6	3	134
Netherlands	13	3	5
Oman	4	3	139
Kazakhstan	6	3	69
Egypt	4	2	66
Azerbaijan	2	2	
Italy	8	2	4
Spain	8	2	2
Singapore	13	2	20

Table 14: Top 20 countries for the extractive industry in our public country-by-country data in 2021, according to profits before tax

Country	N. of extractive MNEs	Employees (k)	Rank for non-extractive firms
Australia	14	83	10
Russia	8	66	19
South Africa	12	48	12
United States	17	47	5
France	8	39	9
Canada	15	30	29
Chile	8	29	23
United Kingdom	17	27	8
Italy	8	23	1
Spain	8	21	4
Norway	7	20	31
Colombia	12	20	22
Poland	6	17	15
Brazil	15	15	3
Germany	9	15	2
India	8	14	6
Mexico	13	13	7
Netherlands	13	13	11
Philippines	8	8	44
China	10	7	13

Table 15: Top 20 countries for the extractive industry in our public country-by-country data in 2021, according to employees

2.4 Comparison with Country-by-Country Statistics

Variable	2019	2020	2021
Total revenues	1.45	1.03	1.31
Unrelated-party revenues	1.12	0.75	0.98
Related-party revenues	2.06	1.48	1.97
Profit before tax	0.59	-0.50	1.52
Profit before tax if positive	0.85	0.92	1.66
Number of employees	0.21	0.27	0.26
Total assets	1.18	1.10	1.10
Tax accrued	1.61	1.34	2.07
Tax paid	1.64	1.46	2.04

Table 16: Ratios of our main sample to the OECD's aggregated country-by-country report statistics (%)

Variable	2019	2020	2021
Total revenues	1.29	1.03	1.29
Unrelated-party revenues	1.00	0.74	0.96
Related-party revenues	1.84	1.48	1.95
Profit before tax	0.54	-0.49	1.40
Profit before tax if positive	0.80	0.89	1.53
Number of employees	0.20	0.27	0.25
Total assets	1.12	1.08	1.05
Tax accrued	1.41	1.33	1.99
Tax paid	1.45	1.45	1.96

Table 17: Ratios of our sample with non-missing top-up taxes to the OECD's aggregated country-by-country report statistics (%)

3   Methodology

3.1   Effective Tax Rates

Observable items.   Recall the formula that we retained for the effective tax rate in Section 1.2:

$$\text{ETR} = \frac{\text{Current tax expense} + \text{Deferred tax expense} \times \frac{\bar{\tau}}{\tau}}{\text{Pre-tax accounting income}}$$

In country-by-country reports, we directly observe the current tax expense. It corresponds to the "Income tax accrued-Current year" variable, which we denote as Taxes accrued in the following.[10]

The "Profit (loss) before income tax" variable is very close to pre-tax accounting income in theory. In practice however, previous studies have highlighted double-counting issues with this variable.[11] In particular, until 2019, the OECD had not provided any explicit guidance regarding the inclusion of intra-company dividends in pre-tax profits.[12] Because their inclusion may distort effective tax rates, we try and correct the "Profit (loss) before income tax" variable. Section 4 describes the proposed adjustment, and we denote as Profit before tax the corrected variable.

We still lack information about the firm's deferred tax expense recast at the minimum rate. Below, we describe how we estimate this quantity from the history of pre-tax profits and losses observed in country-by-country data.

Loss balance.   We start by reconstructing the firm's loss balance. Imagine that we observe a loss in year t. This loss accrues to the loss balance as in:

$$\text{if Profit before tax}_t < 0,$$
$$\text{then Loss balance}_t = \text{Loss balance}_{t-1} - \text{Profit before tax}_t$$

If we observe positive profits in year $t+1$, then the loss balance inherited from the previous year will give rise to some deferred tax expense. Two cases arise. In the first case, the positive profits are sufficiently large to entirely exhaust the loss balance. In that case, some positive taxable income remains, and the loss balance is brought back to Loss balance$_{t+1} = 0$. In the second case, the loss balance exceeds positive profits. In that case, there is no current tax expense, and the loss balance is reduced but remains positive. That is:

$$\text{Loss balance}_{t+1} = \text{Loss balance}_t - \text{Profit before tax}_{t+1}$$

Gathering all cases, the loss balance is defined recursively by:

$$\text{Loss balance}_{t+1} = \max\left(0, \text{Loss balance}_t - \text{Profit before tax}_{t+1}\right) \tag{1}$$

We apply this formula in our country-by-country data. We must add an assumption about the initial value of the loss balance, and we set Loss balance$_0 = 0$ for all multinationals and tax jurisdictions. Because firms may have an unobservable positive loss balance at the beginning of the period, we end up with an estimator for the loss balance, Loss $\widehat{\text{balance}}_t$, instead of the true value.

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10. The OECD's guidance on the implementation of country-by-country reporting explicitly states that the variable "Income tax accrued-Current year" is restricted to current taxes and excludes deferred taxes (see OECD (2024)).

11. See for instance Horst and Curatolo (2020), Blouin and Robinson (2023), or Aliprandi et al. (n.d.).

12. In 2019, updated guidance was released. It was expected to clarify the treatment of intra-group dividends with regards to the "Profit (loss) before income tax" as of the 2020 fiscal year. For instance, see the disclaimer associated with the OECD's aggregated country-by-country report statistics here.

Recast deferred tax expense.   Now that we have enriched country-by-country data with the Loss balance, we can estimate a proxy for deferred tax expenses recast at the minimum rate. We distinguish several cases. On the one hand, because the firm will not face any top-up tax if pre-tax profits are non-positive, we exclude these observations from the estimation of effective tax rates. On the other hand, if pre-tax profits are positive, the same two cases as above arise. If positive profits are sufficiently large to entirely exhaust the loss balance inherited from the previous period, we expect both a current and a deferred tax expense. We then have:

$$\text{if Profit before tax}_t \geq \text{Loss balance}_{t-1},$$
$$\text{then Deferred tax expense}_t = \text{Loss balance}_{t-1} \times \tau$$

If the loss balance from the previous period exceeds positive profits, we only expect a deferred tax expense. It is then given by:

$$\text{if Profit before tax}_t < \text{Loss balance}_{t-1},$$
$$\text{then Deferred tax expense}_t = \text{Profit before tax}_t \times \tau$$

We gather these two cases and recast the deferred tax expense to $\bar{\tau}$:

$$\text{Deferred tax expense}_t \times \frac{\bar{\tau}}{\tau} = \min\left(\text{Loss balance}_{t-1}, \ \text{Profit before tax}_t\right) \times \bar{\tau}$$

We end up with the following estimator for the recast deferred tax expense:

$$\widehat{\text{Recast deferred tax expense}}_t = \min\left(\widehat{\text{Loss balance}}_{t-1}, \ \text{Profit before tax}_t\right) \times \bar{\tau}$$

Final computation.   We plug our various estimators into the effective tax rate formula. This yields:

$$\widehat{\text{ETR}}_t = \frac{\text{Taxes accrued}_t + \widehat{\text{Recast deferred tax expense}}_t}{\text{Profit before tax}_t}$$

We compute this estimator for the effective tax rate in all the years in which pre-tax profits at the denominator are positive. Then, we average the estimator across years, within each pair of multinational and jurisdiction. Taking the mean over time allows to mitigate some noise that could lead to excessively low or high effective tax rates in specific years. We end up with:

$$\bar{\text{ETR}} = \frac{1}{T} \sum_{t=0}^{T} \widehat{\text{ETR}}_t$$

We impute missing values by a similar average across years and multinationals, within the relevant jurisdiction. The missing values that may still remain are imputed based on the local statutory corporate income tax rate.

3.2   Firm-Level Revenue Gains

To estimate the top-up taxes that each firm is expected to pay, we need two ingredients. For each jurisdiction, we must (i) compute the top-up tax rate and (ii) estimate the relevant tax base. We describe each step successively and conclude on firm-level revenue gains.

Top-up tax rates. Section 1.3 explains how the top-up tax rate is computed under Pillar Two. We simply adapt this formula to our estimator for the effective tax rate:

$$\widehat{\text{Top-up rate}} = \begin{cases} 0 & \text{if } \overline{\text{ETR}} \geq \bar{\tau} \\ \bar{\tau} - \overline{\text{ETR}} & \text{otherwise.} \end{cases}$$

Relevant tax base. Having defined top-up tax rates, we estimate tax bases according to the formula exposed in Section 1.4.

What do we observe in country-by-country reports? Multinational firms report pre-tax profits, which we correct for potential double-counting of intra-firm dividends in Section 3.1. We then have a proxy for pre-tax accounting income. Besides, we observe the carrying value of tangible assets.[13] However, we still have to estimate payroll expenditures. Indeed, country-by-country reports only indicate employment, in full-time-equivalent terms according to the OECD's guidelines.

To extrapolate the observed employment into payroll expenditures, we leverage Eurostat's Foreign Affiliates Statistics (FATS). Outward FATS statistics provide bilateral information on the foreign activities of multinational companies. For instance, we can observe the total number of employees and the employee benefits of French multinational companies in the foreign countries where they have affiliates. The data are provided at an annual frequency and split by industry group; we focus on the year 2021 and on the "Mining and Quarrying" sector.

We use FATS information on the number of employees and employee benefits to estimate annual wages in the extractive sector. First, we restrict the dataset to the observations for which the number of employees and employee benefits are both reported. Then, we sum the two variables by affiliate country. Eventually, we divide aggregate employee benefits by the total number of employees to derive a proxy for the annual wage. Denoting by FATS the set of multinationals included in these aggregate statistics and by j the relevant affiliate country, we compute:

$$\widehat{\text{Wage}}_j = \frac{\sum_{m \in \text{FATS}} \text{Employee benefits}_{mj}}{\sum_{m \in \text{FATS}} \text{Number of employees}_{mj}}$$

We use this annual wage proxy to estimate payroll in country-by-country data. Consider a multinational reporting full-time equivalent Employment$_{jt}$ in country j at time t. We estimate the corresponding payroll as:

$$\widehat{\text{Payroll}}_{jt} = \widehat{\text{Wage}}_j \times \text{Employment}_{jt}$$

Eventually, we estimate the global minimum tax base of a given multinational in country j at time t as in:

$$\widehat{\text{Top-up tax base}}_{jt} = \text{Profit before tax}_{jt} - \left(\alpha \times \widehat{\text{Payroll}}_{jt} + \beta \times \text{Tangible assets}_{jt} \right)$$

If we lack information about employment and / or tangible assets, this formula yields a missing value. We impute such missing values based on the average impact of substance-based carve-outs on the top-up tax base. We compute the average ratio of the estimated top-up tax base to pre-tax profits separately for domestic observations, foreign tax havens, and foreign non-haven jurisdictions. We then apply this ratio to pre-tax profits and impute missing values with the result.

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13. More precisely, the variable "Tangible assets other than cash and cash equivalents" in country-by-country reports includes inventories, which are excluded from substance-based carve-outs. We tolerate this difference because it leads to inflated substance-based carve-outs and ultimately to conservative revenue gain estimates.

Top-up tax payments.   Considering the activities of a given multinational in country j at time t, we estimate the top-up taxes due after the reform with:

$$\text{Top-up } \widehat{\text{tax}} \text{ payment}_{jt} = \text{Top-}\widehat{\text{up}} \text{ rate}_j \times \text{Top-up } \widehat{\text{tax}} \text{ base}_{jt} \qquad (2)$$

3.3 Revenue Allocation

Generalities.   As we saw in Section 1.5, the distribution of the revenue gains across countries essentially depends on how the reform is implemented. In the priority order, Qualified Domestic Minimum Top-up Taxes (QDMTTs) come first, the Income Inclusion Rule (IIR) comes second, and the Under-Taxed Payments Rule (UTPR) acts as a safety net. We draw information about implementation from the Pillar Two trackers of BDO Global and PwC.[14]

Notations.   We write down the formulas that we use to allocate the revenue gains from the global minimum tax. We need additional notations. In all equations, index m designates a multinational group, j stands for the jurisdiction of the affiliate, and t corresponds to the income year considered. We slightly extend Equation 2 to account for the case where the multinational does not report any affiliate in jurisdiction j:

$$\text{Top-up } \widehat{\text{tax}} \text{ payment}_{mjt} = \begin{cases} \text{Top-}\widehat{\text{up}} \text{ rate}_j \times \text{Top-up } \widehat{\text{tax}} \text{ base}_{jt} & \text{if } m \text{ is present in } j \\ 0 & \text{otherwise} \end{cases}$$

We also denote by M_i the set of multinational companies headquartered in i. Note that this set is empty for most countries in our dataset. Eventually, we introduce a set of indicator variables indicating each country's implementation status. The dummy QDMTT_k takes value 1 if country k adopts a QDMTT and 0 otherwise; IIR_k is equal to 1 if and only if k implements the IIR; UTPR_k is equal to 1 if and only if k implements the UTPR.

QDMTT revenues.   Consider affiliate jurisdiction j. If the local government adopts a QDMTT, it can collect all the top-up tax payments that arise there, regardless of where the multinationals are headquartered. This writes as:

$$\text{QDMT} \widehat{\text{T}} \text{ revenues}_{jt} = \text{QDMTT}_j \times \sum_i \sum_{m \in M_i} \text{Top-up } \widehat{\text{tax}} \text{ payment}_{mjt}$$

IIR revenues.   If headquarter country i implements the IIR, it can collect the top-up tax payments due by its multinational companies for low-taxed profits in jurisdictions that do not adopt a QDMTT. The formula for IIR revenues is:

$$\text{IIR } \widehat{\text{revenues}}_{it} = \text{IIR}_i \times \sum_{m \in M_i} \sum_j \left(1 - \text{QDMTT}_j\right) \times \text{Top-up } \widehat{\text{tax}} \text{ payment}_{mjt}$$

UTPR revenues.   To define a country's revenues from the UTPR, it may be useful to start with the top-up taxes collected via the UTPR at the level of one multinational m headquartered in i. If i implements the IIR, then there are no top-up taxes left to collect via the UTPR. If i does not

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14. See Section 1.6. BDO Global's Pillar Two implementation tracker can be found here. PwC's tracker is available here.

implement the IIR, then some UTPR payments may arise to the extent that m registers low-taxed profits in jurisdictions without a QDMTT. The multinational's total UTPR charge thus writes as:

$$\widehat{\text{UTPR payment}}_{mt} = (1 - \text{IIR}_i) \times \sum_j \left(1 - \text{QDMTT}_j\right) \times \widehat{\text{Top-up tax payment}}_{mjt}$$

These UTPR payments are allocated across the countries that implement the UTPR and where the multinational has some real economic activity. Country j's share in the UTPR payments of multinational m depends on the distribution of the firm's employees and tangible assets:

$$\widehat{\text{UTPR share}}_{mjt}$$
$$= 50\% \times \frac{\text{UTPR}_j \times \text{Employment}_{mjt}}{\sum_k \text{UTPR}_k \times \text{Employment}_{mkt}} + 50\% \times \frac{\text{UTPR}_j \times \text{Tangible assets}_{mjt}}{\sum_k \text{UTPR}_k \times \times \text{Tangible assets}_{mkt}}$$

The UTPR revenues that country j derives from multinational m are given by the product of the firm's total UTPR charge, $\widehat{\text{UTPR payment}}_{mt}$, and the country's share in these payments, $\widehat{\text{UTPR share}}_{mjt}$. Aggregating over all firms yields the following expression for UTPR revenues:

$$\widehat{\text{UTPR revenues}}_{jt} = \sum_i \sum_{m \in M_i} \widehat{\text{UTPR payment}}_{mt} \times \widehat{\text{UTPR share}}_{mjt}$$

Total revenues. The total revenues from the global minimum tax account for the three instruments through which a country may collect top-up taxes:

$$\widehat{\text{Top-up tax revenues}}_{kt} = \widehat{\text{QDMTT revenues}}_{kt} + \widehat{\text{IIR revenues}}_{kt} + \widehat{\text{UTPR revenues}}_{kt}$$

3.4 Behavioral Responses

Principle. Our methodology thus far relies on the assumption that firms' pre-tax profits, effective tax rates, and production factors remain constant with the reform. This assumption may seem heroic when we consider the magnitude of the shock, up to 15 percentage points in the effective tax rate faced by some affiliates, and its worldwide nature. We propose an adjustment to relax our hypothesis about pre-tax profits.

Drawing from Baraké et al. (2022) in their Online Appendix, we proceed in two steps. First, we assume that multinationals move some profits out of the jurisdictions where they are initially taxed below the minimum rate and top-up taxes arise. We designate these profits as being "unshifted". Implicitly indeed, we consider that these profits were artificially shifted into a low-tax jurisdiction. Because shifting becomes less profitable with the global minimum tax, a portion of this income gets relocated. Second, we allocate the unshifted profits to their hypothetical origins, proportionally to production factors.

Unshifted profits. The magnitude of unshifted profits depends on how sensitive multinationals' pre-tax profits are to changes in effective tax rates. Traditionally, the empirical literature estimates the semi-elasticity of pre-tax profits to the tax rate. That is, the percentage change in pre-tax profits associated with a tax hike of one percentage point. We expect it to be negative as a higher tax rate makes the jurisdiction less attractive for the firm to book its income.

We have the following expression for unshifted profits:

$$\text{Unshifted profits} = \text{Profits before tax} \times |\text{Semi-elasticity}| \times \text{Top-up rate} \tag{3}$$

Where the Top-up rate is expressed in percentage points. When we multiply it with the Semi-elasticity, we obtain the percentage change in pre-tax profits due to the tax hike perceived by the firm. Applying this percentage change to baseline Profits before tax yields the amount of unshifted profits.

We slightly adapt the formula to reflect the fact that we only have an estimator for the top-up tax rate, and we introduce the same notations as above. Our estimate of the profits unshifted from jurisdiction j by multinational m in year t is given by:

$$\widehat{\text{Unshifted profits}}_{mjt} = \text{Profits before tax}_{mjt} \times |\text{Semi-elasticity}| \times \widehat{\text{Top-up rate}}_{mjt}$$

The total profits unshifted by multinational m write as:

$$\widehat{\text{Unshifted profits}}_{mt} = \sum_j \widehat{\text{Unshifted profits}}_{mjt}$$

Allocating unshifted profits. Next, we allocate the unshifted profits to their hypothetical origin countries. We assume that unshifted profits only accrue to jurisdictions where the multinational faces an effective tax rate of at least 15% and where constituent entities are thus outside the scope of the global minimum tax. We also assume that, absent shifting, pre-tax profits would be distributed proportionally to real economic activity. We thus apportion the multinational's total unshifted profits according to employment and tangible assets. Country k's share in the total profits unshifted by multinational m is defined as:

$$\widehat{\text{Unshifted share}}_{mkt}$$

$$= 50\% \times \frac{\mathbb{1}\{\widehat{\text{ETR}}_{mk} \geq \bar{\tau}\} \times \text{Employment}_{mkt}}{\sum_l \mathbb{1}\{\widehat{\text{ETR}}_{ml} \geq \bar{\tau}\} \times \text{Employment}_{mlt}} + 50\% \times \frac{\mathbb{1}\{\widehat{\text{ETR}}_{mk} \geq \bar{\tau}\} \times \text{Tangible assets}_{mkt}}{\sum_l \mathbb{1}\{\widehat{\text{ETR}}_{ml} \geq \bar{\tau}\} \times \text{Tangible assets}_{mlt}}$$

We now aggregate these variables over all firms. The net effect on pre-tax profits in country j accounts for (i) the profits unshifted out of country j and (ii) the profits unshifted out of any other jurisdiction into country j. We have:

$$\Delta \widehat{\text{Profits before tax}}_{jt}$$

$$= \underbrace{- \sum_i \sum_{m \in M_i} \widehat{\text{Unshifted profits}}_{mjt}}_{(i)}$$

$$\underbrace{+ \sum_i \sum_{m \in M_i} \widehat{\text{Unshifted share}}_{mjt} \times \widehat{\text{Unshifted profits}}_{mt}}_{(ii)}$$

We have written changes in the distribution of pre-tax profits. To translate these into changes in tax revenues, we add the assumption that pre-tax profits are taxed at the conventional effective tax rate observed in country-by-country data. We distinguish the corporate income tax revenues lost in jurisdictions out of which profits are unshifted from the revenues gained by the countries into which unshifted profits are relocated. These two quantities respectively write as:

$$\begin{cases} \widehat{\text{CIT revenue loss}}_{jt} = \sum_i \sum_{m \in M_i} \widehat{\text{Unshifted profits}}_{mjt} \times \text{ETR}_{mj}^{\text{Conventional}} \\ \widehat{\text{CIT revenue gain}}_{jt} = \sum_i \sum_{m \in M_i} \widehat{\text{Unshifted share}}_{mjt} \times \widehat{\text{Unshifted profits}}_{mt} \times \text{ETR}_{mj}^{\text{Conventional}} \end{cases}$$

$$(4)$$

Eventually, the net effect of the reform on the conventional corporate income tax revenues of country j combines the gain and loss of revenues. It may happen that a given jurisdiction gains and loses corporate income tax revenues if at least one multinational is taxed below the minimum rate and at least another one is taxed above. We have:

$$\Delta\widehat{\text{CIT revenue}}_{jt} = \widehat{\text{CIT revenue gain}}_{jt} - \widehat{\text{CIT revenue loss}}_{jt}$$

Underlying assumptions. This treatment of behavioral responses involves several important assumptions. Two assumptions are related to the use of a single sufficient statistic, the semi-elasticity described above, to estimate the response of pre-tax profits to the global minimum tax. First, our formula in Equation 3 comes down to a first-order approximation of the effect of the tax hike on pre-tax profits. In theory, this approximation is only valid for small top-up tax rates. Here, we extend to potentially substantial changes, up to 15 percentage points. Second, we assume that the semi-elasticity is constant. We impose that it is common across jurisdictions, multinationals, etc.

Further assumptions relate to the choice of the semi-elasticity estimates that we borrow from the literature. We assume that multinationals only respond to the reform by adjusting their profit shifting behavior, and we ignore their real responses to taxation. Correspondingly, we consider studies that estimate the semi-elasticity of profits with respect to corporate income taxation while controlling for employment and / or tangible assets. While we may expect multinationals to also adjust their real economic activities, this assumption provides a useful benchmark for extractive industries, whose production is likely less mobile than that of other sectors. As a simplification, we also assume that semi-elasticities with respect to *statutory* tax rates apply to our setup where *effective* tax rates are affected.[15]

In practice. Several studies have found a semi-elasticity of profits with respect to tax rate differentials of about -0.8% to -1%. This is the case of Dharmapala (2014), Heckemeyer and Overesch (2017), Johansson et al. (2017), or Beer, Mooij, and Liu (2020). In other words, a one-percentage-point increase in the tax rate of a jurisdiction with respect to other jurisdictions is associated with a 0.8% to 1% decrease in pre-tax profits booked by multinationals in this jurisdiction. We consider these two bounds for our scenarios with behavioral responses.

Another point worth highlighting is that we do not use the same effective tax rates to compute top-up tax rates and the revenue losses or gains of Equation 4. The former reflects the very specific Pillar Two rules but cannot be interpreted as the tax rate that the firm normally faces on its corporate income. For the latter, we estimate the firm's current effective tax rate from the history of pre-tax profits and taxes accrued in country-by-country data. Similarly to the above, we have one effective tax rate per pair of multinational and jurisdiction, averaged over the years.

3.5 Extrapolation

To say something about the amounts of worldwide revenues that would be derived from a global minimum tax on the extractive industry, we extrapolate our results to the whole sector. In our sample and in our extrapolation, we exclude US-headquartered firms to reflect the recent decision by the G7 to exempt them from the global minimum tax. We use data from Compustat to measure the total pre-tax profits generated each year by extractive firms with a consolidated turnover above 750 million USD. We compute the weight of our sample in this global total. As shown in Table 3,

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15. In their meta-analysis of the semi-elasticities estimated in the literature, Beer, Mooij, and Liu (2020) do not find any significant effect associated with the use of effective tax rates instead of statutory ones as regressor (see their Table 2).

our sample accounts for 20% of the pre-tax profits of non-US extractive firms on average between 2019 and 2023. We then multiply our sample-specific revenue gain estimates by the inverse of this share (e.g., by $1/20\% \approx 5$ on average over the period). Given the lack of data on worldwide profits for particular sectors, this extrapolation is the most satisfying solution to get to worldwide results. Our final results however rely on the strong assumption that the revenue gains from a global minimum tax are proportional to the pre-tax profits concerned.

4 Dividend Double-Counting

4.1 Description of the Issue

Double-counting issues in the pre-tax profit variable have been a key limitation of country-by-country reports since their onset in 2016. These issues directly hinder the use of country-by-country reports to study the distribution of multinational companies' income and their taxation. In particular, until 2019, the OECD had not provided any explicit guidance regarding the inclusion of intra-company dividends in pre-tax profits. Horst and Curatolo (2020), Blouin and Robinson (2023), or Aliprandi et al. (n.d.) stressed this lack of standardisation and its potential consequences. We must pay close attention to this problem which could lead us to over-estimating the revenue potential of a global minimum tax.

Take the example of multinational company $\mathcal{F}$. It is present in jurisdictions A and B, with the affiliate in A the sole shareholder of the affiliate in B. Suppose that the affiliate in B distributes \$100 of profits as dividends to its parent in A. Besides, the affiliate in A generates profits of \$100. We observe the distribution of $\mathcal{F}$'s pre-tax profits in its country-by-country report. If the multinational includes intra-firm dividends in pre-tax profits, we find $100 + 100 = \$200$ in jurisdiction A and \$100 in B; if the multinational does not include dividends, we measure the "true" profits of \$100 in both jurisdictions. Clearly, the inclusion of dividends inflates pre-tax profits in A, the jurisdiction of the parent entity.

How does this affect our estimates of the revenue gains from a 15% minimum tax? Let us focus on jurisdiction A. We assume that the profits generated in A are taxed at an effective rate of 10%, and that dividends from B to A are not subject to any tax.[16] Taxes in A thus amount to \$10. First, consider the case where we directly observe the effective tax rate. The revenues from the minimum tax then write as:

$$\max\left(15\% - \text{Effective tax rate}_A\right) \times \text{Profits}_A$$

$$= \begin{cases} 5\% \times 200 = \$10 & \text{if dividends are included} \\ 5\% \times 100 = \$5 & \text{if dividends are not included} \end{cases}$$

If the firm includes intra-firm dividends in the pre-tax profit variable, we over-estimate the revenue gains from the global minimum tax. Instead of the true amount of \$10, we estimate \$5. This upward bias is a direct consequence of reported pre-tax profits being too high in jurisdiction A.

Besides, intra-firm dividends may also affect the estimation of effective tax rates, based on the same country-by-country data. Simply put, we estimate the effective tax rate as the ratio of taxes to pre-tax profits:

$$\widehat{\text{Effective tax rate}}_A = \frac{\text{Taxes}_A}{\text{Profits}_A} = \begin{cases} \frac{10}{200} = 5\% & \text{if dividends are included} \\ \frac{10}{100} = 10\% & \text{if dividends are not included} \end{cases}$$

The inclusion of intra-firm dividends leads us to under-estimating the effective tax rate in A. Now that we are equipped with effective tax rates, we estimate the following revenues from the

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16. In general, intra-firm dividends are lightly taxed, or not at all. For instance, within the EU, the "Parent-Subsidiary" Council Directive 2011/96/EU limits such taxes.

minimum tax:

$$\max \left(15\% - \widehat{\text{Effective tax rate}}_A \right) \times \text{Profits}_A$$

$$= \begin{cases} (15\% - 5\%) \times 200 = 10\% \times 200 = \$20 & \text{if dividends are included} \\ (15\% - 10\%) \times 200 = 5\% \times 200 = \$5 & \text{if dividends are not included} \end{cases}$$

When the multinational includes dividends in pre-tax profits and we fail to take them into account, our excessively low estimate for the effective tax rate aggravates the upward bias in revenue gains. However, if we properly account for dividends, our simplified computation retrieves the true revenue gains.

4.2 Proposed Correction

Our methodology to account for intra-firm dividends broadly follows Aliprandi et al. (n.d.). First, we collect the consolidated financial statements of the multinational companies in our sample. Second, for each multinational-year pair, we compare the total revenues and profits observed in the country-by-country report with consolidated financials. In cases where we obtain a satisfying match on total revenues, we estimate double-counted dividends as the difference between total pre-tax profits in country-by-country data and consolidated profits. Third, we reduce pre-tax profits in various jurisdictions in the country-by-country report to eliminate double-counted dividends at the aggregate level.

Consolidated financial statements. We manually collect the consolidated financial statements of the multinational companies in our sample. We focus on two variables of the income statement, revenues and pre-tax profits. We ensure that both variables exclude the income or loss derived from minority-stake investments and joint ventures consolidated with the equity method. We gather these consolidated financials for 24 unique multinationals and 122 multinational-year observations.

Comparison with country-by-country reports. We aggregate country-by-country reports at the multinational-year level, summing unrelated-party revenues and pre-tax profits. We ignore the cases where either of these variables is missing. We expect the sum of unrelated-party revenues to compare closely with consolidated revenues. Both variables net out intra-firm transactions, and the OECD's guidelines for the preparation of country-by-country reports explicitly excluded intra-group dividends from revenue variables.

We identify the cases where dividends may be double-counted as follows: Either (i) the sum of unrelated-party revenues in the country-by-country report is comprised between 80% and 120% of consolidated revenues, consolidated pre-tax profits are non-negative, and the sum of pre-tax profits is larger than 120% of the consolidated ones, or (ii) the sum of pre-tax profits is positive while the consolidated ones are negative. For the multinational-year pairs that satisfy (i) or (ii), we estimate double-counted dividends as the difference between summed and consolidated pre-tax profits.

Adjusting country-by-country pre-tax profits. Having estimated the amount of double-counted dividends for each pair of multinational company and year, we must adjust the pre-tax profit variable. This comes down to "distributing" double-counted dividends across locations. Aliprandi et al. (n.d.) argue that dividends should result in excessively high profit margins, defined as the ratio of pre-tax profits to total revenues, and excessively low effective tax rates in the jurisdictions where they are double-counted. For each country-by-country report, they flag the locations with

outlying values for the two indicators and allocate double-counted dividends among those, as well as to the ultimate parent jurisdiction.

We propose a simplified adjustment where we distribute double-counted dividends to the ultimate parent jurisdiction and to tax havens. In principle, if one such location represents 10% of the total positive pre-tax profits of this group of jurisdictions, then we reduce its pre-tax profits by 10% of double-counted dividends. We apply this adjustment iteratively so that it does not bring positive pre-tax profits below 0: If the double-counted dividends attributed to a given location are larger than its pre-tax profits, we bring pre-tax profits to 0 and attribute the remaining adjustment to another jurisdiction. This specificity of the method is conservative in the sense that it maximizes the reduction in estimated revenue gains involved by the adjustment for double-counting.

The choice of locations from which we remove double-counted dividends is guided by two arguments. First, Francois and Vicard (2023) show that multinationals locate many intermediary entities of their ownership structure in tax havens. The affiliates in these jurisdictions would thus be more likely to received dividends from the entities that they own. Similarly, the issue of dividend double-counting may be particularly pronounced in the ultimate parent jurisdiction. Second, holding everything else constant, this assumption should yield conservative revenue gain estimates. Effective tax rates lie more probably below the minimum rate in tax havens than in other jurisdictions. By reducing pre-tax profits specifically in tax havens, we again expect to maximize the downward adjustment of estimated revenue gains due to dividend double-counting.

4.3 Results

Matching revenues.   When we apply the methodology described above, we first confirm that revenues provide a useful benchmark to compare country-by-country reports and consolidated financial statements. On average over all multinational-year pairs, the ratio of the sum of unrelated-party revenues to consolidated revenues is 1.003, meaning that country-by-country reports would inflate total revenues by 0.3%. The median of this ratio is 1.02. Besides, the sum of unrelated-party revenues falls outside of 80%-120% of consolidated revenues for only 5 multinational-year pairs out of 64. These observations only account for 1.1% of total unrelated-party revenues in the sample. Because we fail to match revenues for these observations, we exclude most of them from the following estimation of double-counted dividends.[17]

Identifying problematic cases.   Among the 59 multinational-year pairs for which the match on revenues is satisfying, we flag specific observations with excessive pre-tax profits in country-by-country data. 6 observations display non-negative consolidated pre-tax profits and total country-by-country profits larger by at least 20%. They account for 7% of total unrelated-party revenues and 9% of total pre-tax profits. On average, their ratio of country-by-country pre-tax profits to the consolidated ones is 1.81 while it is 0.90 for the other 53 cases. For the 6 problematic observations, we attribute the gap in pre-tax profits between both sources to double-counted dividends. Additionally, 1 multinational-year pair displays negative consolidated pre-tax profits while the sum of pre-tax profits in the country-by-country report is positive. In this case too, we interpret the discrepancy as a result of double-counting.

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17. Three of these multinational-year pairs display lower total profits in country-by-country data than in consolidated financial statements, hence a limited risk of double-counting. For one, total pre-tax profits are higher in country-by-country data than in consolidated financial statements by less than 8%, so that the gap would not be attributed to double-counting with our proposed methodology. Eventually, the last observation displays negative consolidated profits and positive total profits in country-by-country data. It is thus accounted for as double-counting in the next steps.

Double-counted dividends. Table 18 shows our estimate of double-counted dividends over the years. It increases each year between 2018 and 2021, from 1.0 to 12.8 billion EUR. This increase is not only driven by the expansion of our sample, from 5 to 16 firms in total, but the intensity of double-counting also seems to aggravate. Double-counting by problematic firm increases from 1.0 to 3.2 billion EUR, and double-counted dividends represent a growing share of total pre-tax profits. However, as of 2022, the double-counting issue seems to virtually disappear.

Year	All firms	"Problematic" firms	Double counting (bn. EUR)	Share of profits (%)
2018	5	1	1.0	1.8
2019	9	1	1.8	3.4
2020	13	1	2.0	
2021	16	4	12.8	7.4
2022	11	1	0.4	0.1
2023	9	1	0.1	0.1

Table 18: Estimated double-counted dividends

5 Main Revenue Gain Estimates

5.1 Aggregate Revenue Gains

5.1.1 Varying the Minimum Rate

Year	Revenues at 15%	15% to 25%	15% to 30%	15% to 40%
2019	1.22	1.97	3.35	8.11
2020	0.96	1.63	2.57	6.93
2021	1.68	3.10	5.10	14.26
2022	3.34	5.63	9.39	22.15
2023	1.58	2.89	4.74	12.08

Table 19: Incremental revenue gains for various minimum rates (billion EUR)

5.1.2 Varying Carve-Out Rates

Year	No carve-outs	First-year carve-outs	Long-run carve-outs
2019	1.22	0.88	1.00
2020	0.96	0.71	0.80
2021	1.68	1.07	1.29
2022	3.34	2.60	2.86
2023	1.58	1.10	1.26

Table 20: Aggregate revenue gains for various carve-outs (billion EUR)

5.1.3 Varying Behavioral Responses

Year	No behavioral responses	Semi-elasticity of 0.8%	Semi-elasticity of 1%
2019	1.22	1.45	1.50
2020	0.96	1.15	1.19
2021	1.68	2.29	2.45
2022	3.34	4.05	4.23
2023	1.58	2.00	2.11

Table 21: Aggregate revenues with various assumptions for behavioral responses

Year	Lost CIT	Top-up taxes	Additional CIT	Total revenue gains
2019	-0.04	1.12	0.36	1.45
2020	-0.03	0.89	0.29	1.15
2021	-0.05	1.56	0.79	2.29
2022	-0.08	3.07	1.06	4.05
2023	-0.04	1.46	0.59	2.00

Table 22: Decomposing revenue changes with behavioral responses (semi-elasticity: 0.8%)

5.2 Revenue Gains by Country

5.2.1 Top 15 Countries

Country	2020	2021	2022	2023
Singapore	325	401	1301	337
United Kingdom	5	352	708	398
Bahamas	86	72	221	221
Canada	0	129	221	0
France	16	75	134	103
Netherlands	118	23	126	16
Italy	17	37	104	88
Switzerland	114	81	96	141
United Arab Emirates	50	71	94	123
Brazil	50	300	85	16
Australia	14	29	71	29
Norway	110	28	61	0
Spain	0	9	27	25
Guernsey	16	12	20	26
Germany	12	11	15	0
Total - Top 15	934	1630	3283	1524
Total - Full sample	962	1675	3335	1570
Share - Top 15 (%)	97	97	98	97

Table 23: Revenue gains by country and year (million EUR)

5.2.2 Split by Tax Instrument

Country	IIR	QDMTT	UTPR	Total
Singapore	0	1301	0	1301
United Kingdom	708	0	0	708
Bahamas	0	221	0	221
Canada	0	221	0	221
France	134	0	0	134
Netherlands	0	126	0	126
Italy	104	0	0	104
Switzerland	0	96	0	96
United Arab Emirates	0	94	0	94
Brazil	0	85	0	85
Australia	30	41	0	71
Norway	4	58	0	61
Spain	2	25	0	27
Guernsey	0	20	0	20
Germany	0	15	0	15
Total - Top 15	981	2302	0	3283
Total - Full sample	981	2354	0	3335
Share - Top 15 (%)	100	98		98

Table 24: Revenue gains by country and instrument (million EUR)

5.2.3 Varying the Minimum Rate

Country	15%	25%	30%	40%
Singapore	1301	2361	2891	3976
United Kingdom	708	1543	2161	3627
Bahamas	221	368	442	589
Canada	221	648	868	1500
France	134	1318	1997	3358
Netherlands	126	380	520	804
Italy	104	277	414	959
Switzerland	96	264	351	523
United Arab Emirates	94	344	613	1150
Brazil	85	190	276	457
Australia	71	701	1141	5065
Norway	61	175	265	528
Spain	27	51	118	443
Guernsey	20	36	44	59
Germany	15	45	61	176
Top 15 - Total	3283	8699	12159	23216
Full sample - Total	3335	8921	12655	24778
Top 15 - Share (%)	98	98	96	94

Table 25: Revenue gains by country for various minimum rates (million EUR)

5.2.4 Varying Behavioral Responses

Country	No behavioral responses	Semi-elasticity of 0.8%	Semi-elasticity of 1%
Singapore	1301	1147	1108
UK	708	860	898
Senegal	0	176	220
Canada	221	211	209
Australia	71	180	208
Bahamas	221	194	188
France	134	148	152
Netherlands	126	133	134
Italy	104	111	112
Germany	15	83	100
Brazil	85	95	97
Switzerland	96	85	82
UAE	94	84	81
Norway	61	70	72
India	0	35	44
Top 15 - Total	3236	3612	3706
Full sample - Total	3335	4049	4228
Top 15 - Share (%)	97	89	88

Table 26: Revenue gains by country for various behavioral response assumptions

5.3 Further Analyses

5.3.1 Top 10 Multinationals

Multinational company	2020	2021	2022	2023
Shell	337	395	1372	369
BP	0	355	695	399
Rio Tinto	125	232	281	248
Anglo-American	59	270	97	25
Total Energies	66	168	269	262
Yara	249	69	163	2
BHP	76	81	209	96
ENI	21	43	109	110
SAIPEM		0	58	
ECOPETROL	4	12	38	53
Total - Top 10	937	1624	3290	1563
Total - Full sample	962	1676	3335	1570
Share - Top 10 (%)	97	97	99	100

Table 27: Top 10 multinationals in terms of revenue gains

5.3.2 Split by Type of Jurisdiction

Year	Domestic	Foreign tax havens	Foreign non-havens	Total
2019	0.03	0.73	0.46	1.22
2020	0.11	0.67	0.18	0.96
2021	0.03	0.61	1.04	1.68
2022	0.06	1.79	1.48	3.34
2023	0.00	0.80	0.77	1.57

Table 28: Aggregate revenue gains by type of jurisdiction (billion EUR)

5.3.3 Split by Type of Activities

Year	No extraction	Some extraction	Total
2019	0.76	0.46	1.22
2020	0.57	0.39	0.96
2021	0.63	1.04	1.68
2022	1.80	1.53	3.34
2023	0.86	0.71	1.57

Table 29: Revenue gains by nature of the activities (billion EUR)

5.4 Extrapolated Results

Year	Revenues at 15%	15% to 25%	15% to 30%	15% to 40%
2019	8.13	13.12	22.26	53.88
2020	7.49	12.71	20.00	53.99
2021	7.41	13.68	22.54	62.99
2022	13.56	22.89	38.17	90.07
2023	9.56	17.52	28.72	73.22

Table 30: Extrapolated incremental revenues (billion EUR)

Year	No carve-outs	First-year carve-outs	Long-run carve-outs
2019	8.13	5.83	6.65
2020	7.49	5.55	6.23
2021	7.41	4.73	5.68
2022	13.56	10.58	11.64
2023	9.56	6.69	7.67

Table 31: Extrapolated revenue gains for various carve-outs (billion EUR)

Year	No behavioral responses	Semi-elasticity of 0.8%	Semi-elasticity of 1%
2019	8.13	9.61	9.98
2020	7.49	8.92	9.28
2021	7.41	10.13	10.82
2022	13.56	16.47	17.19
2023	9.56	12.14	12.79

Table 32: Extrapolated revenue gains for various behavioral responses (billion EUR)

5.5 Extrapolated Results with US Multinationals

Year	Revenues at 15%	15% to 25%	15% to 30%	15% to 40%
2019	9.43	15.22	25.82	62.51
2020	7.86	13.34	21.00	56.67
2021	8.45	15.62	25.73	71.90
2022	17.33	29.26	48.78	115.11
2023	12.14	22.27	36.49	93.03

Table 33: Extrapolated incremental revenues, with US multinationals (billion EUR)

Year	No carve-outs	First-year carve-outs	Long-run carve-outs
2019	9.43	6.76	7.71
2020	7.86	5.82	6.54
2021	8.45	5.40	6.48
2022	17.33	13.52	14.88
2023	12.14	8.50	9.74

Table 34: Extrapolated revenue gains for various carve-outs, with US multinationals (billion EUR)

Year	No behavioral responses	Semi-elasticity of 0.8%	Semi-elasticity of 1%
2019	9.43	11.15	11.58
2020	7.86	9.36	9.74
2021	8.45	11.57	12.35
2022	17.33	21.04	21.97
2023	12.14	15.43	16.25

Table 35: Extrapolated revenue gains for various behavioral responses, with US multinationals (billion EUR)

6 Additional Results

6.1 Descriptive Statistics
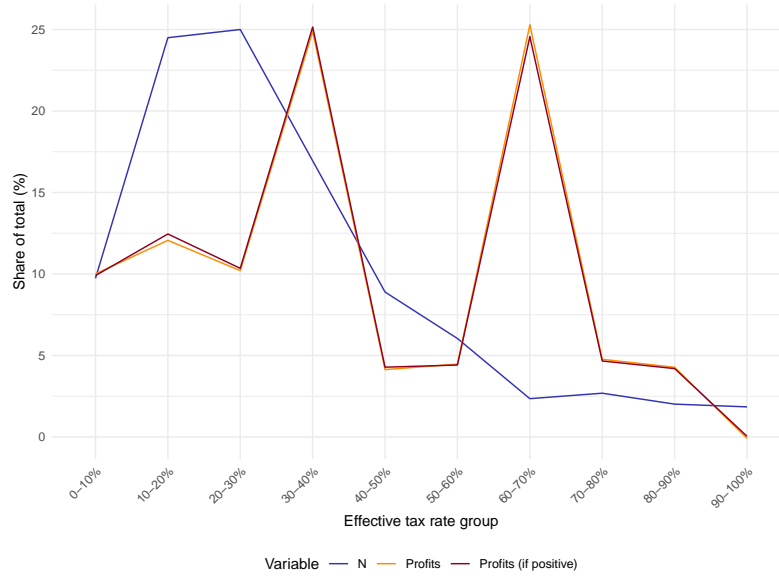
(a) Ten-percentage-point intervals, between 0 and 100%
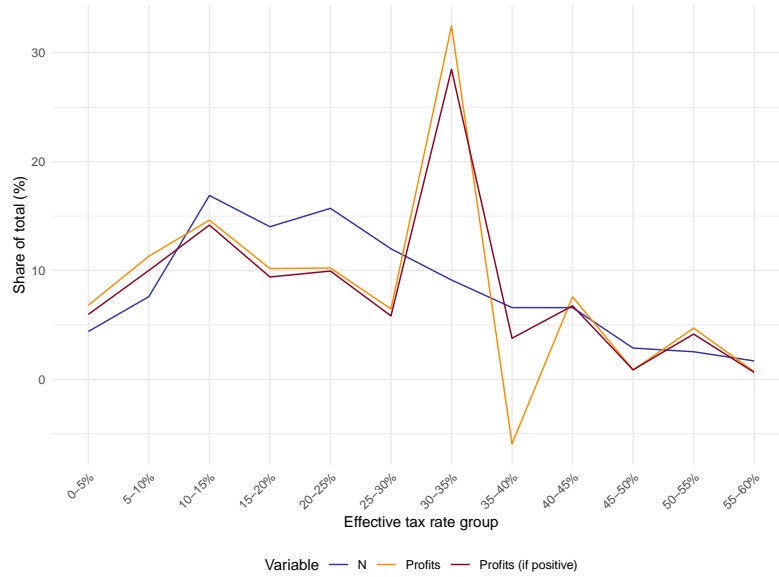
(b) Five-percentage-point intervals, between 0 and 60%

Figure 6: Distribution of pre-tax profits along effective tax rates, with benchmark effective tax rates
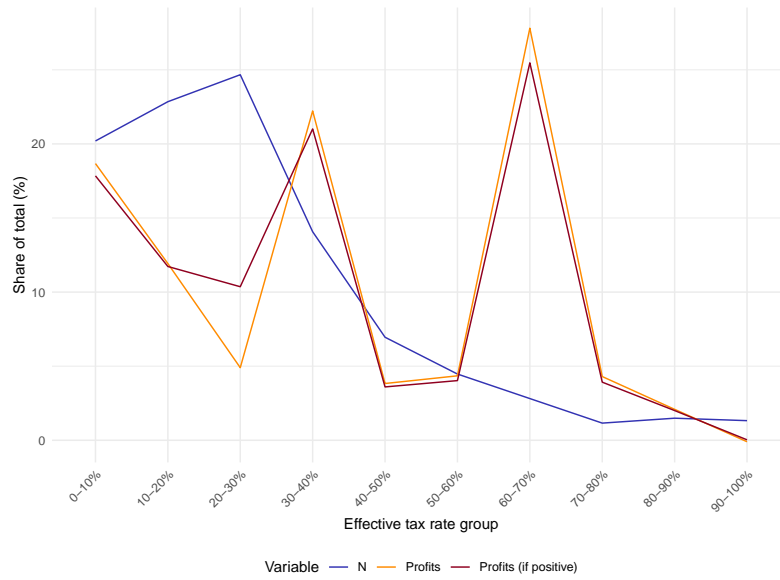
(a) Ten-percentage-point intervals, between 0 and 100%
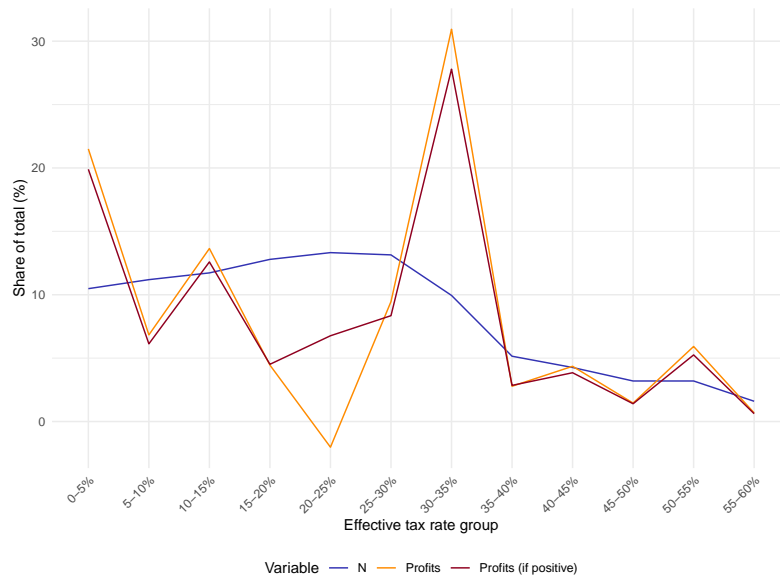
(b) Five-percentage-point intervals, between 0 and 60%

Figure 7: Distribution of pre-tax profits along effective tax rates, with effective tax rates that do not account for losses

6.2 Revenue Gain Estimates from Country-by-Country Data

6.2.1 Varying the Minimum Rate

Year	Revenues at 15% (bn EUR)	15% to 25% (%)	15% to 30% (%)	15% to 40% (%)
2019	1.22	161	274	663
2020	0.96	170	267	721
2021	1.68	185	304	851
2022	3.34	169	281	664
2023	1.58	183	300	766

Table 36: Relative increment in revenue gains for various minimum rates

6.2.2 Varying Effective Tax Rates

Year	Benchmark	Weighting by profits	Losses in denominator	Not adjusting for losses
2019	1.22	1.44	1.64	1.70
2020	0.96	1.26	1.29	1.30
2021	1.68	2.22	3.58	3.94
2022	3.34	4.40	7.12	7.82
2023	1.58	2.28	3.05	3.07

Table 37: Aggregate revenue gains for various measures of effective tax rates (billion EUR)

6.2.3 By Type of Activities

Year	No extraction	Some extraction
2019	62.2	37.8
2020	59.5	40.5
2021	37.7	62.3
2022	54.1	45.9
2023	55.0	45.0

Table 38: Shares of revenue gains by nature of the activities (%)

Year	No extraction	Some extraction	Total
2019	12.18	71.81	84.00
2020	10.49	55.20	65.69
2021	17.32	171.34	188.66
2022	38.42	299.01	337.43
2023	28.31	121.05	149.36

Table 39: Global minimum tax base by nature of the activities (billion EUR)

Year	No extraction	Some extraction
2019	14.5	85.5
2020	16.0	84.0
2021	9.2	90.8
2022	11.4	88.6
2023	19.0	81.0

Table 40: Shares of the GMT base by nature of the activities (%)

Year	No extraction	Some extraction	Total
2019	6.25	0.64	1.46
2020	5.46	0.71	1.46
2021	3.65	0.61	0.89
2022	4.70	0.51	0.99
2023	3.05	0.58	1.05

Table 41: Average top-up tax rate by nature of the activities (%)

6.2.4 By Type of Extraction

Year	Mining	Oil & Gas	Both	No extraction
2019	0.4	14.8	22.5	62.2
2020	1.5	31.2	7.8	59.5
2021	1.0	9.2	52.1	37.7
2022	0.7	10.6	34.6	54.1
2023	0.3	12.4	32.3	55.0

Table 42: Shares of revenue gains by nature of the extraction (%)

Year	Mining	Oil & Gas	Both	No extraction	Total
2019	1.05	32.67	38.09	12.18	84.00
2020	2.67	16.42	36.11	10.49	65.69
2021	8.90	59.20	103.23	17.32	188.66
2022	7.59	148.65	142.77	38.42	337.43
2023	3.74	42.19	75.11	28.31	149.36

Table 43: Global minimum tax base by nature of the extraction (billion EUR)

Year	Mining	Oil & Gas	Both	No extraction
2019	1.2	38.9	45.4	14.5
2020	4.1	25.0	55.0	16.0
2021	4.7	31.4	54.7	9.2
2022	2.3	44.1	42.3	11.4
2023	2.5	28.3	50.3	19.0

Table 44: Shares of the GMT base by nature of the extraction (%)

Year	Mining	Oil & Gas	Both	No extraction	Total
2019	0.48	0.55	0.72	6.25	1.46
2020	0.53	1.83	0.21	5.46	1.46
2021	0.18	0.26	0.85	3.65	0.89
2022	0.30	0.24	0.81	4.70	0.99
2023	0.13	0.46	0.67	3.05	1.05

Table 45: Average top-up tax rate by nature of the extraction (%)

6.3 Revenue Gain Estimates from BEA Data

6.3.1 Varying the Minimum Rate

Year	Revenues at 15%	15% to 25%	15% to 30%	15% to 40%
2019	0.64	0.45	0.73	1.71
2020	0.03	0.05	0.14	0.41
2021	0.17	0.16	0.36	1.21
2022	0.63	0.62	1.04	2.65

Table 46: Incremental revenues for various minimum rates in BEA data (billion EUR)

Year	Revenues at 15% (bn EUR)	15% to 25% (%)	15% to 30% (%)	15% to 40% (%)
2019	0.64	70	115	269
2020	0.03	185	484	1375
2021	0.17	95	214	723
2022	0.63	98	165	420

Table 47: Relative increment in revenues for various minimum rates in BEA data

6.3.2 Varying Carve-Outs

Year	No carve-outs	First-year carve-outs	Long-run carve-outs
2019	0.64	0.52	0.56
2020	0.03	0.02	0.02
2021	0.17	0.10	0.12
2022	0.63	0.43	0.51

Table 48: Aggregate revenues for various carve-outs in BEA data (billion EUR)

6.3.3 Varying Behavioral Responses

Year	No behavioral responses	Semi-elasticity of 0.8%	Semi-elasticity of 1%
2019	0.64	0.72	0.74
2020	0.03	0.03	0.03
2021	0.17	0.19	0.20
2022	0.63	0.71	0.73

Table 49: Aggregate revenues with various behavioral responses in BEA data

6.3.4 Varying Effective Tax Rates

Year	Benchmark	Weighting by profits	Losses in denominator	Not adjusting for losses
2019	0.64	0.65	0.65	0.65
2020	0.03	0.05	0.05	0.05
2021	0.17	0.18	0.18	0.18
2022	0.63	0.69	0.69	0.69

Table 50: Aggregate revenue gains for various measures of effective tax rates in BEA data (billion EUR)

6.3.5 Allocating Revenue Gains by Country

Country	2020	2021	2022
Australia	6	42	207
Indonesia	3	25	121
Bermuda	15	59	108
UK	2	15	74
Norway	1	9	44
Netherlands	1	5	21
Ireland	0	3	15
Luxembourg	1	4	12
Thailand	0	2	10
Germany	0	2	9
Total - Top 10	29	166	621
Total - Full sample	30	168	631
Share - Top 10 (%)	98	99	98

Table 51: Revenue gains by country and year in BEA data (million EUR)

Country	IIR	QDMTT	UTPR	Total
Australia	0	0	207	207
Indonesia	0	0	121	121
Bermuda	0	108	0	108
UK	0	0	74	74
Norway	0	0	44	44
Netherlands	0	0	21	21
Ireland	0	0	15	15
Luxembourg	0	5	7	12
Thailand	0	0	10	10
Germany	0	0	9	9
Total - Top 10	0	113	508	621
Total - Full sample	0	113	518	631
Share - Top 10 (%)		100	98	98

Table 52: Revenue gains by country and instrument in BEA data (million EUR)

6.3.6 Revenue Gains by Type of Jurisdiction

Year	Domestic	Foreign tax havens	Foreign non-havens
2019	0	8	92
2020	0	54	46
2021	0	37	63
2022	0	18	82

Table 53: Shares of revenue gains by type of jurisdiction in BEA data (%)