Working Paper n°44

April 2026

The Global Allocation of Extractive Windfalls

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April 7, 2026

Abstract

The extraction of oil, gas, and minerals generates large economic rents, yet it remains unknown how commodity price windfalls are distributed across the global networks of multinational enterprises (MNEs) that dominate production in most resource-rich countries. We study this question by combining administrative records covering the worldwide profits, revenues, and employees of large MNEs across all jurisdictions, with comprehensive data on their physical extraction activity at the affiliate level. Extractive MNEs have a substantial presence in countries in which they do not extract: downstream and consumption countries, as well as low-tax jurisdictions. Combining differences in firms' commodity specialization with heterogeneous market price changes in a shift-share design, we find that windfall profits are partly diverted to low-tax jurisdictions. For every additional dollar of consolidated windfall profit, \$0.8 accrues to extractive affiliates, \$0.2 to tax havens, and nothing to the rest of the group. This diversion intensifies during booms: the share of profits booked in tax havens rises by one percentage point for every 10% increase in group profitability.

JEL Codes: H25, H26, F63

*We gratefully acknowledge the financial support of the International Growth Center (IGC) Tax for Growth Initiative, the Paris-Saclay Graduate School Économie-Management, and the Research Council of Norway grant numbers 352981 and 341289. We thank Basile Blanc and Lucas Delbecq for outstanding research assistance. We thank participants of the London Business School Stanford Global Tax conference, the World Bank/IFS Public Finance conference, the EU Tax Observatory internal seminar, the Applied seminar of the Paris School of Economics, the UC Berkeley Public Finance seminar, the IIPF 2025, the CBT Oxford Doctoral conference, and the 2025 Mannheim Taxation conference for helpful discussions. We also thank Pierre Bachas, Mathieu Couttenier, Dhammika Dharmapala, Lucie Gadenne, Irem Guceri, Oliver Harman, Niels Johannesen, Sébastien Laffitte, Marion Mercier, Mathieu Parenti, Steven Poelhekke, Nadine Riedel, Emmanuel Saez, Danny Yagan, and Gabriel Zucman for their help and comments.

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1 Introduction

The extraction of oil, gas, and minerals generates large economic rents whose distribution between host countries and extractive firms is a first-order determinant of GDP and fiscal revenue in much of the world: 15% of fiscal revenues are derived from the extractive sector in Mexico (IMF), 28% in Zambia, 45% in Nigeria and the DRC.[1] As Figure 1 illustrates, foreign multinational enterprises (MNEs) undertake the majority of extraction, from Sub-Saharan Africa to Southeast Asia, providing the required capital and technology. Translating *resource windfalls*, rents derived from commodity booms, into development and fiscal revenues is notoriously difficult (Sachs and Warner, 2001; van der Ploeg, 2011). But how much countries actually benefit depends on how extractive MNEs allocate profits across their global networks. In practice, extractive MNEs are global organizations whose affiliates span the entire commodity value chain. Upstream extraction takes place in resource-rich countries, downstream operations are located closer to consumer markets, and entities in low-tax jurisdictions can affect the total firm's profit distribution (Tørsløv et al., 2023; Guvenen et al., 2022). Who benefits from extractive rents along this global network has remained an open question.

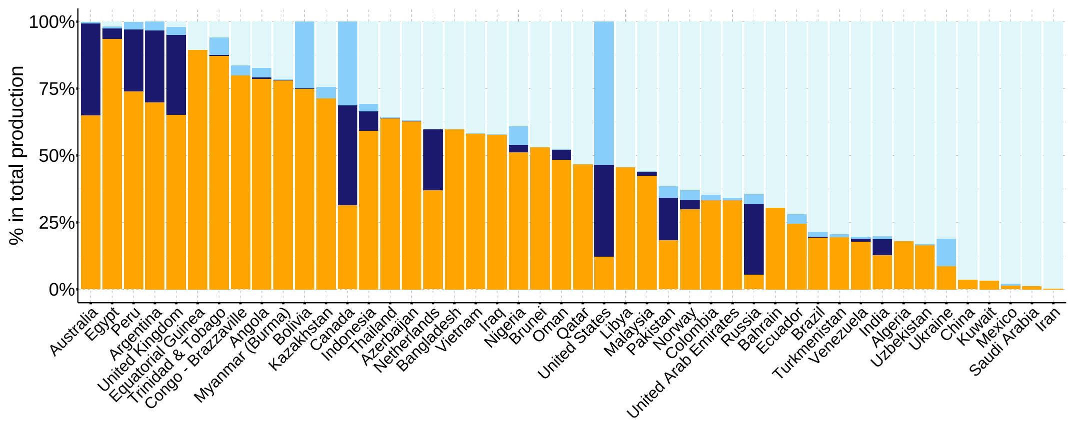
In this paper, we first document where profits of extractive MNEs are allocated across countries: in extraction sites, downstream and consuming economies, and low-tax jurisdictions. Second, and more importantly, we ask how this allocation responds to commodity price shocks, i.e., how are windfall profits allocated? During commodity booms, extractive profits can increase drastically. Whether these windfalls primarily benefit resource-rich host countries, the economies where commodities are processed and consumed, or tax havens, determines the extent to which different parts of the world benefit from the price shocks. It also determines whether windfall profit taxes, such as those adopted by the United Kingdom and the European Union in response to the energy price surge triggered by Russia's invasion of Ukraine in 2022, can effectively capture the rents they target.

To answer these questions, we leverage a unique empirical setting that allows us to trace large profitability shocks across firms' entire global affiliate network. We assemble a novel dataset

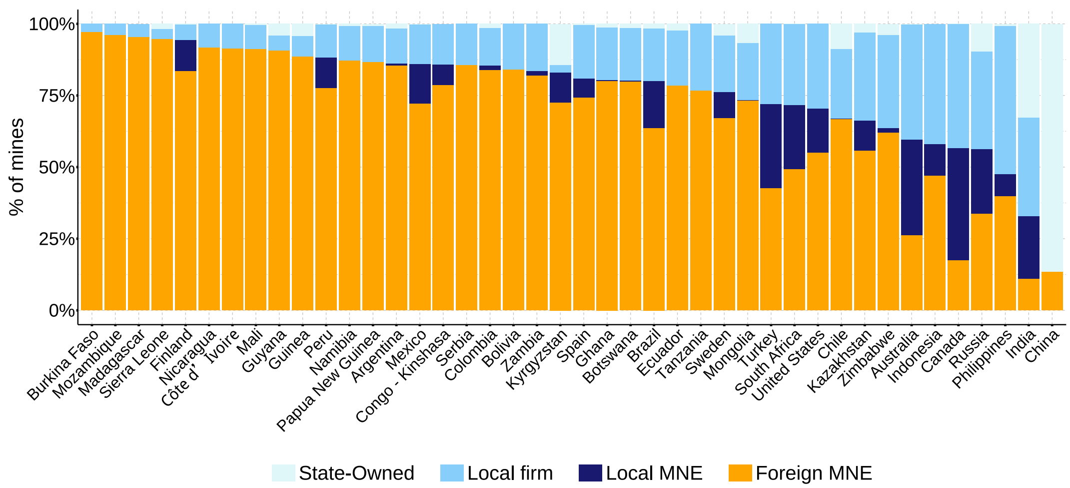
[1] See (Shah, 2021) for Mexico and EITI reports for other countries.

Figure 1: Extraction Ownership by Country

(a) Oil & Gas



(b) Mining



Lecture: Between 2012 and 2022, 62% of oil and gas production was made by foreign MNEs in Thailand, and close to 100% of mines located in Burkina Faso were owned by foreign MNEs.

Data sources: Rystad Upstream (Figure 1a) & S&P Metals and Mining (Figure 1b).

Notes: The countries selected are countries producing more than 500M barrels per year (Figure 1a) and countries with at least 50 mines on their soil (Figure 1b). National oil companies are defined as companies held at more than 50% by the state, directly or indirectly.

that combines two sources of information not previously linked. The first is made of Country-by-Country Reports (CbCRs), introduced under the OECD/G20 BEPS framework, which record the worldwide profits, revenues, taxes, employees, and assets of large MNEs at the firm-country-year level. Unlike commercial databases such as Orbis, which suffer from severe coverage gaps in developing countries and tax havens (Torslov et al., 2023; Fuest et al., 2025), CbCRs provide universal coverage for all jurisdictions where a firm operates.[2] The second source consists of

[2]We correct CbCRs data from double counting of intra-group dividends included in the reports by some of the

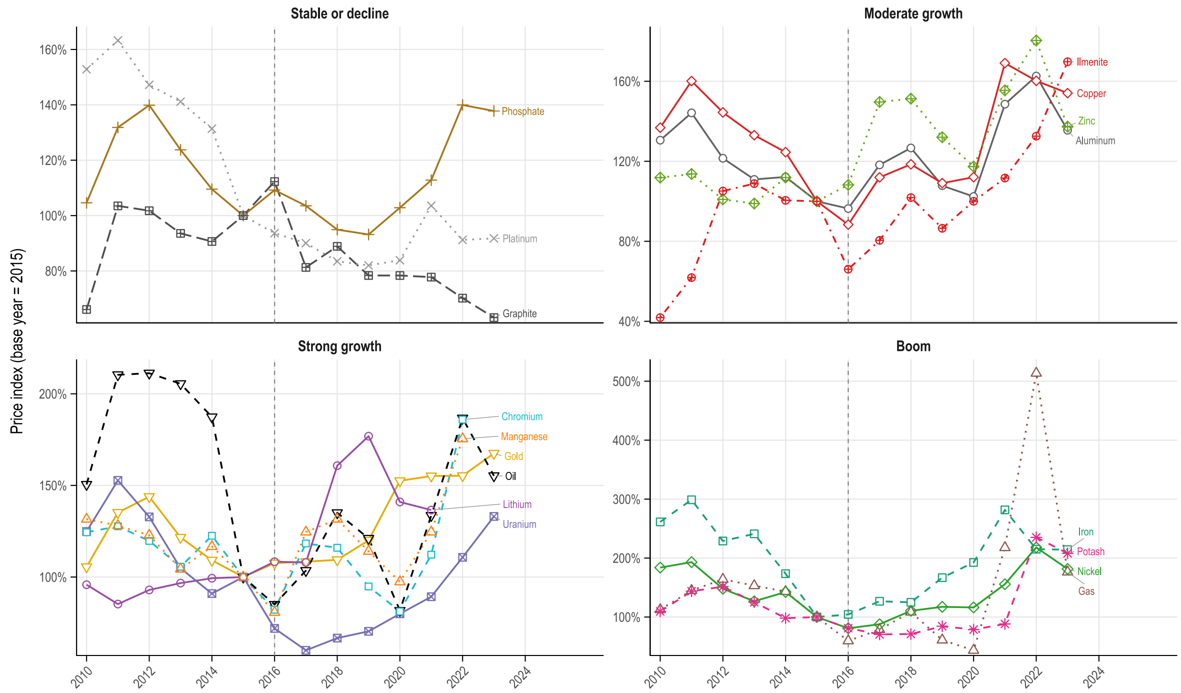
micro-level proprietary databases on physical commodity production: Rystad Upstream and S&P Metals and Mining. Matching these production records to the CbCRs data allows us to identify each MNE's commodity specialization and the precise location of its extraction activities, central to our empirical strategy. Our final sample comprises 77 MNEs active in 206 countries, representing approximately 30% of global mining production, 37% of MNE oil and gas output, and one-third of worldwide listed extractive profits over 2016–2023.

Using this newly assembled data, we first document novel stylized facts on the global extractive sector. We find that while 76% of their profits are declared in countries where they extract, the remaining quarter is spread across downstream economies and low-tax jurisdictions, with tax havens capturing more than half of all non-extractive profits. Across jurisdictions, profitability displays a U-shaped relationship with effective tax rates, high in tax havens, low in high-tax non-resource countries, and high again in resource-rich countries with progressive fiscal regimes. This indicates that the global distribution of extractive rents is shaped by two competing forces: fiscal regimes in source countries designed to capture resource rents, and tax optimization by MNEs, which redirects a portion of those rents to low-tax jurisdictions. Finally, we establish the first-stage relationship underlying our identification strategy: a 1% increase in the price of a firm's primary commodity is associated with a 1.3% increase in its consolidated profits, confirming that commodity prices generate large and relevant profitability shocks.

Second, we identify how the allocation of profits within MNEs responds to these commodity price shocks. Our identification strategy exploits the fact that commodity prices are volatile and that their movements differ across products, as displayed in Figure 2. We implement a shift-share (Bartik) design, constructing firm-specific profitability shocks by interacting global commodity price changes (the shifts) with each MNE's pre-determined commodity specialization (the shares). We interpret this design through the framework of Goldsmith-Pinkham et al. (2020), where identification relies on the exogeneity of the shares rather than the shocks. To causally identify windfall profit shifting, we further compare, within each MNE, the differential change of tax havens' profits, compared to the non-extractive profits in the rest of the group.

firms in our sample (Chiocchetti et al., 2025; Blouin and Robinson, 2025). To our knowledge, this paper is among the first to utilize these global CbCRs data (see Fuest et al. 2025) and the first to explicitly exploit its time variation.

Figure 2: Extractive Commodity Price Changes



Lecture: This graph displays the evolution of mining, oil and gas commodity prices in our sample.
Data sources: US Geological Survey, IMF, Rystad Upstream.
Notes: Prices are normalized by their 2010 levels. The vertical dashed line marks the beginning of the period under study in this paper.

Identification relies on the exogeneity of the shares rather than the shocks: the choice to specialize in, say, copper rather than gold must be orthogonal to unobserved trends in tax haven utilization.[3] We validate this assumption through leave-one-commodity-out tests.

We obtain three main results. First, we show that extractive affiliates display strong comovement with price changes, similar to the consolidated elasticity, while refining and other downstream affiliates do not. Second, a 10% increase in commodity prices generates a 5.5 percentage point larger increase in profits booked in tax havens compared to non-extractive, non-haven affiliates within the same MNE. Using a complementary instrumental variable approach, we estimate that for every additional dollar of consolidated windfall profit, approximately 20 cents are booked in tax haven affiliates and 80 cents in extractive affiliates, with no statistically significant increase in the rest of the group, including affiliates in consuming economies. The marginal allocation to havens—$0.20 per dollar—substantially exceeds the average allocation of

[3] This distinction is important because the extractive sector is oligopolistic: large producers may influence global prices through their supply decisions, making the shocks potentially endogenous.

$0.12, indicating that the reallocation of profits to low-tax jurisdictions intensifies during booms. Third, and most importantly, we show that profit shifting is non-homothetic. When consolidated group profits increase by 10%, the share of global positive profits booked in tax havens rises by approximately 1 percentage point. MNEs do not divert a fixed fraction of their rents to low-tax jurisdictions—they divert a larger fraction when rents are large.

This finding contradicts canonical models of profit shifting with convex concealment costs (Hines Jr and Rice, 1994; Grubert and Slemrod, 1998), which predict that the shifted share should be constant or declining in the pre-tax base. We rationalize it with a simple extension of this framework. The standard model anchors concealment costs to real economic activity, which in most sectors co-moves with profits. We show that this co-movement breaks down in extractives, where short-run supply is inelastic, and price booms can dramatically increase profits without any change in physical operations. Generalizing the cost function to allow its scaling to depend on the profit base, we derive a testable parameter that governs the response of the haven share to profitability shocks, which we recover from our IV estimates.

Finally, we document that this reallocation is asymmetric. Tax haven affiliates benefit from commodity booms, but they do not absorb corresponding losses during downturns. Neither the probability of reporting a loss nor the magnitude of losses in havens responds to negative price shocks. Haven affiliates thus enjoy upside exposure without bearing downside risk, consistent with the strategic allocation of risk to low-tax jurisdictions (Becker et al., 2020).

Our results are robust to a battery of sensitivity checks, including the use of a continuous production-weighted price index, leave-one-commodity-out tests, winsorization, restriction to a balanced panel, a PPML estimator that incorporates zero-profit observations, an alternative data-driven tax haven classification based on effective tax rates below 10%, the inclusion of lagged price shocks to account for dynamic adjustment, and a placebo test using the headquarters country as the destination for profit reallocation. In all cases, the estimated coefficients remain quantitatively similar to the baseline and statistically significant.

We also present several additional results. Conditional on positive profits, however, the response of haven affiliates to price changes is symmetric across booms and busts. Second, we decompose responses along the value chain and find no evidence that refining or downstream affiliates displaying commodity windfalls; the group-wide spillovers of price shocks are entirely absorbed by extractive and tax haven affiliates. Third, exploiting subsidiary-level information on business activities, we show that the reallocation is concentrated in affiliates specialized in intra-group finance, which are predominantly located in tax havens. Finally, we verify that both sales and taxes display patterns consistent with our profit results: intra-group sales in tax havens co-move with commodity prices, and tax payments increase proportionally across affiliate types.

Our findings have direct policy implications for the design of resource taxation. Standard public finance theory typically favors corporate income taxes over production taxes (royalties), as the latter can distort investment and extraction decisions at the margin. However, while income taxes are theoretically efficient, they are highly vulnerable to base erosion during windfalls. Following the energy price surge of 2022, many countries introduced windfall taxes on corporate profits to capture excess rents. Our findings suggest that without robust safeguards against profit shifting, these measures risk being ineffective precisely when the rents they target are largest.

Related Literature and Contributions. First, we contribute to the literature on profit shifting. Cross-sectional estimates converge towards large shares of foreign multinational profits booked in tax havens (around 36% according to Tørsløv et al. (2023) and Guvenen et al. (2022)). This literature identifies several distinct mechanisms through which multinational firms shift profits, such as transfer mispricing of intra-firm trade (Clausing, 2003), international debt shifting (Huizinga et al., 2008; Desai et al., 2004), or the location of intangible assets and associated royalty payments in low-tax subsidiaries (Dischinger and Riedel, 2011; Karkinsky and Riedel, 2012) to cite a few (see Beer et al. (2020); Dharmapala (2014) for comprehensive reviews). Some works have shown that developing countries are particularly harmed by these practices due to weak enforcement capacity and low institutional quality (Johannesen et al., 2020; Laudage Teles et al., 2024; Bachas and Soto, 2021). However, the vast majority of this literature estimates static semi-elasticities of profits to tax differentials, treating profit shifting as a time-invariant phenomenon. Only Dharmapala and Riedel (2013) and Becker et al. (2020) study how the allocation of profits to tax havens responds dynamically to profitability shocks within multinational groups. We advance on both papers in three ways: we exploit commodity price shocks as a source of variation that is both larger in magnitude and highly relevant for firms financials compared to the firm- or sector-level income changes they rely on; our data provide exhaustive coverage of all jurisdictions in which firms operate, including tax havens that are absent from the Orbis-based samples used in prior work; and we document that profit shifting is non-homothetic, intensifying with the scale of the windfall, which contradicts the constant-share prediction embedded in canonical models (Hines Jr and Rice, 1994; Grubert and Slemrod, 1998; Huizinga and Laeven, 2008).

Second, we contribute to a large literature on extractive windfalls and commodity booms, which has mostly focused on local windfalls generated by the extractive industry, treating cross-border spillovers as given. Since Sachs and Warner (2001), the puzzling disconnection between resource endowment and local growth has been explored, showing that countries are adversely exposed to commodity price volatility (Van der Ploeg and Poelhekke, 2009) and that windfall management is challenging (Venables, 2016; Van der Ploeg and Venables, 2012; Arezki and Brückner, 2012; Beck and Poelhekke, 2023). A strand of this literature shows that extractive booms are linked to illicit financial flows (Andersen et al., 2017; Hsieh and Moretti, 2006; Marcolongo and Zambiasi, 2022; Johannesen and Larsen, 2016; Bertinelli et al., 2022). [4] Our paper demonstrates that a crucial stake in the management of windfalls also goes through the risk of profit shifting and the distribution of taxing rights. We show that tax administration should be particularly concerned with the probability of profit shifting in times of commodity price booms.

Third, we contribute to the literature on the transmission of shocks within multinational firms. Cravino and Levchenko (2017) shows that firms contribute to the transmission of shocks across countries through parent-subsidiaries co-movements in productivity. Other papers (Budd

[4] In particular, Andersen et al. (2017) shows that extractive commodity price booms lead to an increase in bank deposits held by source countries in tax havens, which they interpret as resource rent appropriated by ruling elites. These transfers are motivated by opacity, while we focus on the use of tax havens by firms to reduce their tax burden. Though the motivation of both flows is very different, both phenomena contribute to shifting windfalls from extractive countries to tax havens and to reducing states windfalls. We show that if countries rely on multinational firms for commodity extraction, they are exposed to profit shifting risks. The cost of profit shifting should be compared to the cost of other capital flight potentially taking place with alternative extraction systems.

et al., 2005; Boehm et al., 2019; Bena et al., 2022) show that parents' and affiliates' profitability are strongly correlated. We contribute to this literature by emphasizing the role of tax optimization practices in the allocation of revenues within multinational firms. We also provide new facts on large extractive MNEs, firms with a substantial impact on host countries, downstream value chains, as well as the global macroeconomy.

The rest of this paper is organized as follows. Section 2 introduces a model of profit allocation that generates predictions on how the haven share varies with the size of the windfall. Section 3 describes the data source used, and new stylized facts on the links between commodity prices, fiscal windfalls, and extractive groups' profits. Section 4 details our empirical strategy to identify the distribution of extractive windfalls. Section 5 shows the results. Section 6 concludes.

2 Conceptual Framework of Extractive Profit Allocation

We develop a simple model of profit shifting adapted to a context of large profitability shocks. The model clarifies how canonical profit shifting cost models apply when profits are driven by commodity price shocks, and introduces a general parameterization whose key prediction we take to the data.

Canonical model and its prediction. An extractive MNE operates a producing asset in a resource-rich country H (tax rate τ_H) and maintains an affiliate in a tax haven L (tax rate $\tau_L < \tau_H$), with tax differential $\Delta\tau \equiv \tau_H - \tau_L > 0$. The asset produces a fixed quantity $\bar{q}$ of a commodity at global price p, with predetermined operating costs $c > 0$, so pre-tax profits are $\pi(p) = p\bar{q} - c$, with all variation coming from price movements.[5] Following Huizinga et al. (2008) and Hines Jr and Rice (1994), the canonical profit-shifting model assumes a quadratic concealment cost $C(s) = \gamma s^2/2K$, where K captures real economic activity, and the scaling captures the idea that a larger operational presence provides more scope to disguise shifted profits within legitimate intra-group transactions. An analogous structure appears in Chodorow-Reich et al. (2024), where the cost of locating intangible capital abroad depends on the deviation from

[5]This is consistent with the low short-run supply elasticity documented in the literature (Anderson et al., 2018).

tangible capital allocation, providing an independent micro-foundation for this class of cost function. The firm shifts $s^* = \Delta\tau K/\gamma$ to the haven, independently of profits. The haven share $\sigma^* \equiv s^*/\pi(p)$ is therefore *decreasing* in the commodity price: when prices rise, profits grow, but the amount shifted stays constant, so havens capture a shrinking fraction of the total.

Why this prediction may fail in extractives. This prediction rests on a co-movement between profits and real activity that is distinctive to most sectors but breaks down in the extractive sector. In most industries, higher profits are accompanied by expanded operations, so π and K co-move and the haven share remains roughly stable. In extractives, a price boom can double profits with no change in physical operations, creating a wedge between the profit base and the real activity that anchors shifting costs. The standard prediction of a declining haven share thus depends critically on the assumption that shifting costs are anchored to real activity rather than to profits.

General parameterization and testable predictions. We generalize the cost function to allow the cost of shifting to depend on the profit base:

$$C(s, \pi) = \frac{\gamma}{2}\frac{s^2}{\pi^\beta} \tag{1}$$

where $\beta \geq 0$ governs the sensitivity of shifting costs to total profits. When $\beta = 0$, we recover the standard specification (with K normalized). The first-order condition yields $s^* = (\Delta\tau/\gamma)\pi^\beta$, and the optimal haven share is:

$$\sigma^* = \frac{\Delta\tau}{\gamma}\pi^{\beta-1} \tag{2}$$

The response of the haven share to a commodity price shock is:

$$\frac{\partial\sigma^*}{\partial p} = \frac{\Delta\tau}{\gamma}(\beta - 1)\pi^{\beta-2} \cdot \bar{q} \tag{3}$$

which yields three cases. The haven share is *decreasing* in the commodity price if $\beta < 1$, the canonical prediction; *constant* if $\beta = 1$; and *increasing* if $\beta > 1$. The parameter β is a reduced-form object: since K is fixed in the short run, π^{β} is a function of p alone, and β captures any channel through which higher commodity prices relax the effective constraint on profit shifting, whether operating through the firm's shifting technology or the government's enforcement response.[6] The existing literature implicitly assumes $\beta \leq 1$ by anchoring concealment costs to real activity. Whether β exceeds one in the context of large extractive windfalls is an empirical question that our shift-share design allows us to answer directly.

3 Data & Stylized Facts

3.1 Data

3.1.1 Country-by-Country Reports.

Our primary data source is Country-by-Country Reports (CbCRs), introduced by the OECD in 2016 as part of its Base Erosion and Profit Shifting (BEPS) initiative to provide tax administrations with the transparency needed to assess transfer pricing and profit-shifting risks. Reporting is mandatory for multinational enterprises (MNEs) with consolidated worldwide revenues exceeding €750 million. These reports are submitted to the ultimate parent entity's tax authority and exchanged confidentially with other jurisdictions; they are not currently subject to mandatory public disclosure, although some firms decide to publicly disclose theirs.

Each report contains two parts. The first part discloses key financial data disaggregated at the MNE $\times$ country $\times$ year level. It includes revenues split between intra-group and unrelated parties, profit before tax, income tax paid and accrued, stated capital, accumulated earnings, number of employees, and tangible assets.[7] Since our unit of observation is at the country $\times$ MNE level, we use the terms "affiliate" to refer to the consolidated operations of a firm within a single country. The second part reports MNEs' complete list of subsidiaries and description of

[6] On the firm side, shifting infrastructure involves fixed costs that are amortized over the profit base, making additional channels worth activating when profits are large; the informational noise created by commodity price volatility may also reduce the detectability of aggressive transfer pricing during booms. On the government side, enforcement incentives may weaken when fiscal revenues are already inflated by the price shock, and tax authorities face capacity constraints that prevent audit intensity from scaling proportionally with sector-wide profits.

[7] Tangible assets exclude cash and cash equivalents.

their business activities in each jurisdiction.

We construct our dataset by combining three sets of CbCRs: (i) the universe of French MNEs (2016-2022), accessed via confidential administrative files; (ii) foreign MNEs with at least one subsidiary in France (2016-2019), also accessed confidentially; and (iii) publicly available CbCRs voluntarily disclosed by 24 extractive MNEs (2016-2023).[8] The resulting sample forms an unbalanced panel spanning 2016 to 2023.

To define our set of extractive firms, we match CbCRs to the physical production databases described in Section 3.1.2. We explicitly exclude banks, investment funds, and conglomerates that may have passive interests in extractive projects but are not primary operators. We also exclude state-owned enterprises (SOEs) that predominantly produce within their headquarters country, as their economic and fiscal incentives differ from those of private multinationals.[9]

We correct for the double counting of intra-group dividends, as a source of upward bias in reported profits for some firms in CbCRs (Blouin and Robinson, 2025). The profits of lower-tier subsidiaries can be reported once where they are earned, and again when they flow up as equity income or dividends to holding-company jurisdictions (typically tax havens), inflating profits there. Following the procedure detailed in Appendix Section D, we benchmark our aggregated data against MNEs' consolidated accounts to identify excess profits. We then eliminate these discrepancies by reducing the reported profits of subsidiaries with holding activities, allocating the correction in proportion to their reported income.[10] Appendix Table C1 reports the magnitude of these corrections by year.

Our final sample comprises 77 MNEs active in 206 countries. Summary statistics are provided in Appendix Table B1. It shows that extractive firms in our sample are particularly large, generating on average \$44.7 billion in sales each year on average, \$4.4 billion in profits, and employing 41,300 employees worldwide. As detailed in Appendix Table B2, the geographic distribution of activity in our sample is heavily concentrated in resource-rich jurisdictions. Table 1 shows the coverage of our sample: we benchmark our data against global aggregates of oil

[8]Public CbCRs were collected by Aliprandi and Borders (2023) and are available via the EU Tax Observatory.

[9]We retain SOEs that operate significant extractive activity outside their home country, as these firms face incentives closer to those of private MNEs.

[10]See Chiocchetti et al. (2025) for a discussion on how intra-group dividends bias CbCRs data.

Table 1: Coverage of Global Extractive Activity

	Nb Firms	Oil Production		Mining Production		Global Profits	
		World ($bn)	Share (%)	World ($bn)	Share (%)	World ($bn)	Share (%)
2016	43	586.9	45.3	329.6	22.5	68.9	51.8
2017	52	717.6	51.5	375.4	29.1	343.0	41.3
2018	41	911.1	47.2	396.6	29.8	482.3	40.4
2019	49	845.3	40.1	364.2	38.4	281.5	35.5
2020	22	542.2	28.0	392.8	28.1	—	—
2021	24	952.2	28.0	520.7	34.0	733.7	29.8
2022	24	1,379.0	29.2	473.5	32.3	1,067.1	30.5
2023	20	1,059.3	26.1	432.7	30.8	752.4	25.5
2016–2023	77	874.2	36.9	410.7	30.6	446.8	35.0

Sources: Rystad Upstream for oil & gas production, S&P Metals and Mining for mining production, Compustat Northam and Global for global profits.
Notes: The "World" columns report total global production value or profits; "Share" columns report the fraction captured by the MNEs in our sample. The benchmark excludes corporations specialized in coal and large state-owned enterprises. The bottom row displays averages across all years; shares are computed as the ratio of cumulative sample totals to cumulative world totals. Global profits in 2020 are negative for both the sample and the benchmark, so the coverage share is not defined. Figures on global profits of firms in our sample do not match exactly those in our summary statistics tables because a few firms could not be matched to Compustat.

and mining production and the consolidated profits of the extractive sector. Over the 2016-2023 period, our sample captures 31% of global mining production,[11] 37% of MNE oil and gas production, and 35% global profits of listed extractive firms.[12] Coverage is higher in the early part of the panel (2016-2019), where we capture 46% of oil production, 30% of mining production, and 42% of global profits.

3.1.2 MNEs Extractive Production Data

To measure MNE extractive activity at the country level, we rely on two comprehensive proprietary databases.[13] First, the Rystad Upstream database covers global oil and gas production from the late 20th century to 2023. For each asset, it reports production volumes, sales, and cash costs at the year-product level, as well as ownership. Second, we use S&P Global Market Intelligence (formerly SNL Metals & Mining) for the mining sector. This database details ownership structures, commodities extracted, and asset locations for mining companies globally,

[11] Excluding coal production.
[12] Defined as publicly listed firms (excluding SOEs) with NAICS codes 211 or 212.
[13] Both sources are widely used in the literature (Berman et al., 2017; Coulomb et al., 2021).

along with production volumes and values for a large subset of industrial mines.

We use these production data for two purposes. First, matching CbCRs data with the production of each commodity allows us to precisely define the commodity specialization of each MNE. Second, these data allow us to identify the specific jurisdictions where each MNE conducts extractive operations. Figure B2 in Appendix maps the location of the mines and oil fields owned by the reported MNEs, showing extensive spatial coverage of the underlying assets owned by MNEs in our sample. As shown in Appendix Table B2, our sample covers nearly all major extractive jurisdictions, with the notable exception of China. This reflects the composition of our sample, which predominantly comprises Western multinationals.

3.1.3 Other datasets

Commodity Prices. We compile annual global reference prices for the 2016-2023 period. We rely on time series from the IMF Primary Commodity Prices, the World Bank Pink Sheet, USGS Historical Statistics, and Rystad Upstream for oil and gas. Our price data cover 18 major commodities, including oil, gas, and key minerals such as copper, gold, and iron ore.[14] To ensure consistency across data sources, we standardize all prices to US dollars per metric ton. Figure 2 plots the price evolution for the commodities included in our CbCRs sample.

Country-level data. We use a common list of tax havens in the international public finance literature, provided by Tørsløv et al. (2023).[15] This list identifies countries and jurisdictions with preferential tax treatment and financial secrecy. As a robustness check, we use an alternative list of countries with effective tax rates below 10%.

Consolidated data. We use consolidated financial data from Compustat (both Global and North America) to clean CbCRs data from double-counting (as detailed in Appendix D). It

[14]The full set of priced commodities includes: aluminum, chromium, copper, gas, gold, graphite, ilmenite, iron, lithium, manganese, NGL, nickel, oil, phosphate, platinum, potash, uranium, and zinc.

[15]Five OECD countries (Belgium, Ireland, Luxembourg, Netherlands, and Switzerland) and 36 non-OECD countries (Andorra, Anguilla, Antigua and Barbuda, Aruba, The Bahamas, Bahrain, Barbados, Belize, Bermuda, the British Virgin Islands, the Cayman Islands, Curaçao, Cyprus, Gibraltar, Grenada, Guernsey, Hong Kong, the Isle of Man, Jersey, Lebanon, Liechtenstein, Macau, Malta, Marshall Islands, Mauritius, Monaco, Panama, Puerto Rico, Samoa, Seychelles, Singapore, St. Kitts and Nevis, St. Lucia, St. Marteen, St. Vincent & Grenadines, Turks and Caicos, Vanuatu).

also enables us to validate the sensitivity of consolidated profits to commodity prices using a much broader sample of firms, ensuring that the results obtained from our restricted CbCRs sample are representative of the wider extractive sector.

3.2 Stylized Facts and First-Stage Validation

In this section, we document new stylized facts on the global structure of extractive MNEs and establish the first-stage relationship between commodity prices and consolidated group profits that underlie our identification strategy.

Geography of Extractive MNEs. We leverage the granularity of the CbCRs data to characterize the global distribution of extractive MNE activity. Figure 3a reports the distribution of key variables across three mutually exclusive groups of MNE-country observations: (i) extractive affiliates, (ii) tax havens, and (iii) other countries. We define extractive affiliates at the MNE-level as any country in which the MNE carries out an extractive activity. To generate a conservative estimate of tax haven activity, we classify as extractive jurisdictions MNE-countries that are both tax havens and hosts to extractive projects.

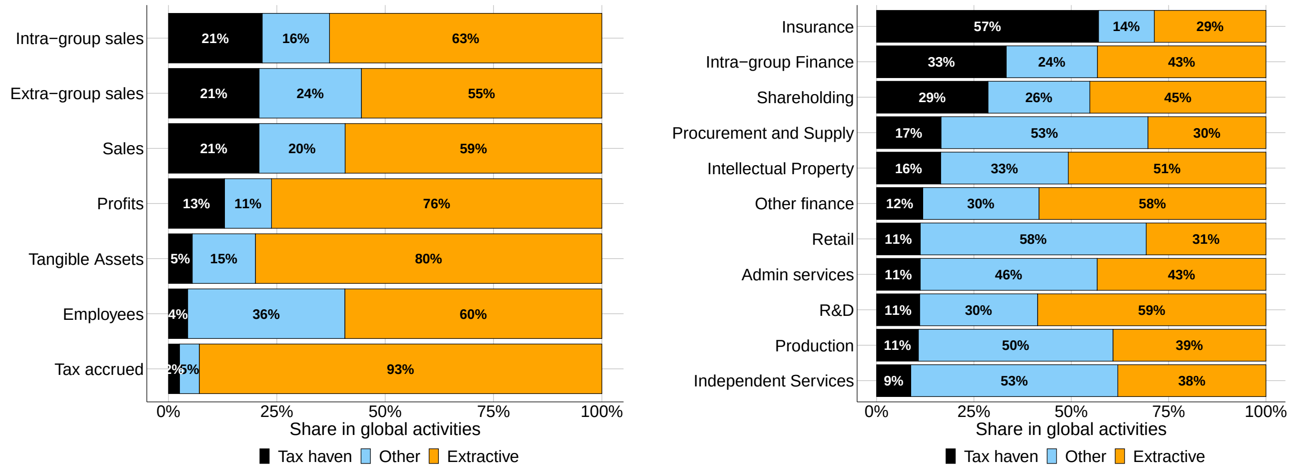
Three key patterns emerge. First, the global activity of these firms is heavily concentrated in the upstream sector. Extractive jurisdictions account for almost 60% of total employees, 55% of unrelated-party revenues, 76% of profits, and 80% of tangible assets.[16] Second, activity in non-extractive jurisdiction is substantial, concentrating 40% of employees and 45% of extra-group sales. Third, we document a misalignment between the location of profits and real economic activity. While tax havens capture 54% of non-extractive profits, they host a negligible share of factors of production (10% of employees and 25% of tangible assets in non-extractive affiliates).

Using the information provided in CbCRs on the specialization of each subsidiary of the MNEs in our sample, we look at where each type of activity is carried out. Figure 3b shows the share of subsidiaries in each business activity that are located in tax havens, extractive affiliates, and other MNE×countries observations. The majority of subsidiaries specialize in insurance,

[16] Because CbCRs data are aggregated at the country level, we cannot separate extractive operations from other business lines within the same jurisdiction; these estimates should therefore be interpreted as upper bounds for the strictly upstream share of activity.

Figure 3: Geography of Extractive MNEs

(a) Distribution of Main Variables (b) Distribution of Business Activities



Lecture: 60 % of total employees of extractive MNEs are employed in a country where the group conducts an extractive activity (Figure 3a). 57% of subsidiaries specialized in insurance are located in a tax haven (Figure 3b).
Notes: This figure shows the distribution of our main variables and business activities along our three groups of MNE×country pairs: tax havens, extractive, and non-extractive non-TH. When an affiliate is both located in a tax haven and extractive, we place it in the extractive category. Profit shares are calculated based on positive profits only, and figures are rounded to the nearest percentage.

Table 2: Share of Positive Profits by Type of Affiliate

Type	Average (%)	Median (%)
Tax Haven	11.8	5.7
Extractive	65.2	78.9
Other	22.0	7.2

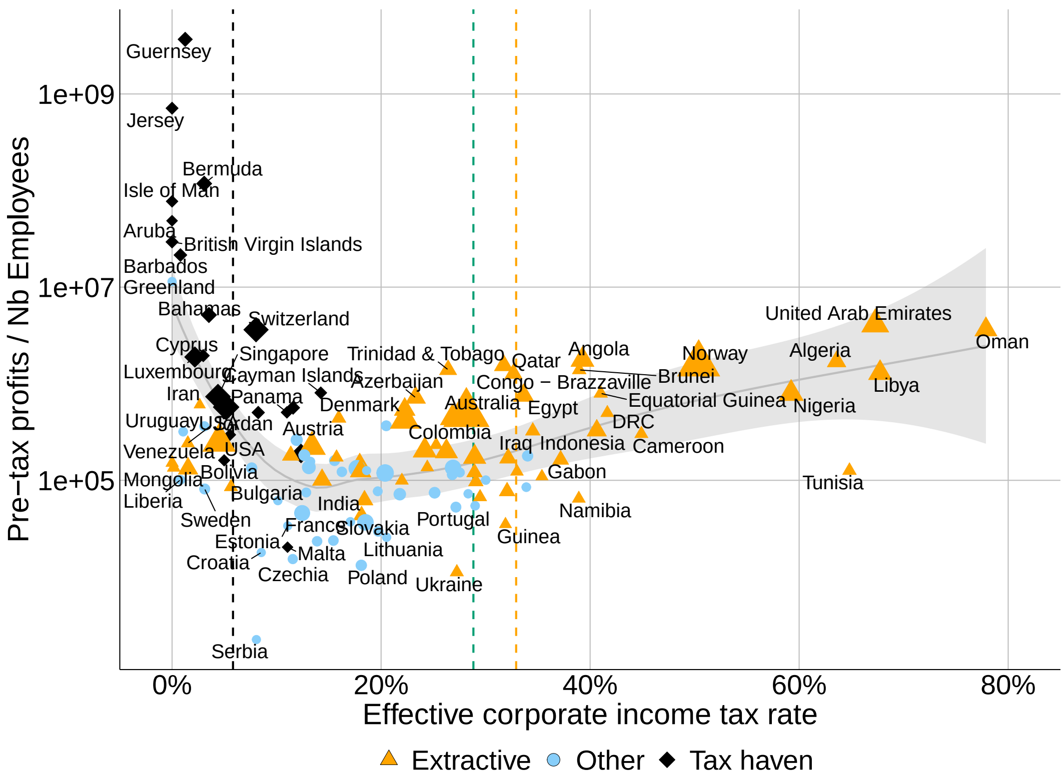
Note: This table presents summary statistics for the share of global positive profits booked in each type of jurisdiction. The mean shows the average share of profits in each type of affiliate.

and a third of subsidiaries that specialize in intra-group financing are located in a tax haven. Since the category "Production" includes both upstream (extraction) and midstream (refining) activities, it is balanced between extractive affiliates and other observations.

Effective Tax Rates and Profitability. Figure 4 explores the relationship between profitability (measured as the profit-to-employee ratio) and Effective Tax Rates (ETR) across jurisdictions. We split countries between extractive, tax havens, or others: extractives are countries in which the majority of observed groups undertake extraction, tax havens follow our usual definition, and the rest are defined as other countries.

The Figure displays a U-shaped relationship: we observe high profitability at both ends of the tax distribution. Each employee generates high profits in extractive countries: 583.350 USD, compared to 333.496 USD for employees in the rest of the countries in which firms do not extract. Effective tax rates are also higher than in the rest of the world, of 33% compared to 19.8%.[17] In comparison, an employee in a tax haven generates 780.580 USD annually, taxed at an effective rate of 6.18%.

Figure 4: Profitability and Effective Tax Rates by Country



Notes: The Y axis is the log-scaled pretax profit-to-number of employees ratio, in millions $US. The size of the points is a function of the total profits in the country. The black vertical dashed line indicates the average effective tax rate of tax haven countries, the orange vertical line indicates the average effective tax rate in extractive countries, and the green vertical line indicates the global effective tax rate. Effective tax rates are computed as the ratio between positive tax paid and positive profits booked across the whole period (2016-2023). Countries are broken down into extractive and non-extractive countries. A country is defined as extractive if at least half of the MNEs present in the country have an extractive activity. We only included observations with positive profits and tax accrued, as well as countries in which at least five companies are operating. Taxes only include income taxes.

The decreasing portion of the relationship is consistent with profit shifting toward low-tax jurisdictions, a well-documented pattern in the literature (Tørsløv et al., 2023). The increasing portion is specific to the extractive sector: governments in resource-rich countries design fiscal regimes to capture rents from highly profitable projects, resulting in both high profitability and

[17] Extractives ETR here only include income taxes, we do not observe for example production taxes or royalties implemented by extractive tax regimes.

high effective tax rates. Because CBCRs exclude some fiscal instruments specific to the extractive sector, which use a tax base other than profit, we likely underestimate the government share, and the actual increasing slope of the curve may be steeper. Together, these two forces generate the U-shaped relationship. The high profitability per employee in extractive countries also reflects the capital intensity of upstream operations. In Figure B3, we relate ETRs to profits per tangible asset and observe a similar U-shaped pattern.

Commodity specialization. To measure each MNE's exposure to commodity price movements, we define its primary commodity as the single commodity generating the largest cumulative revenue during the pre-sample period (2010-2015).[18] Fixing specialization before the treatment period ensures that our measure is not driven by endogenous production decisions in response to price changes and smooths out temporary firm-level supply shocks.[19] As detailed in Table 3, the sample exhibits significant heterogeneity: of the 77 MNEs, 37 specialize in hydrocarbons (oil, gas, NGL) and 40 in mining. Table B3 illustrates the oligopolistic structure of the sector: while most firms are small producers, five each hold a global market share exceeding 10% in their primary commodity. In the robustness analysis, we explore the sensitivity of our results to alternative definitions of MNE-specific price exposure.

Relationship between commodity prices and worldwide profits. We document the co-movement between global commodity prices and consolidated group-level outcomes by estimating the following specification:

$$\log(Y_{gt}) = \alpha + \beta \log(P_{p(g)t}) + \Gamma X_{gt} + \mu_g + \lambda_t + \varepsilon_{gt} \tag{4}$$

where Y_{gt} denotes the worldwide consolidated profits, revenues, or accrued corporate income tax of MNE g in year t, and $P_{p(g)t}$ is the global price of the MNE's primary commodity. We include

[18] As a robustness check, we also construct a continuous measure of commodity exposure that weights price changes by each commodity's share in the MNE's pre-period production portfolio. Results are reported in Appendix Tables B5, B13 and B14.

[19] We rank commodities by revenue rather than volume to ensure comparability across heterogeneous resources (e.g., gold and iron).

Table 3: Commodities Breakdown

Commodity	Nb MNEs	Nb Obs	Profits ($bn)
Oil	25	671.1	102.4
Gas	12	185.4	8.6
Uranium, Nickel & Zinc	9	79.8	3.1
Iron	7	127.1	19.8
Gold, Platinum, Ilmenite & Graphite	7	81.2	5.9
Copper	6	67.2	4.9
Manganese, Phosphate & Potash	6	91.8	4.3
Aluminum, Chromium & Lithium	5	91.0	1.3
All	77	1,394.6	150.4

Notes: This table shows the commodity specialization of MNEs in our sample, defined as the commodity generating the largest share of each group's total production value.
Lecture: 25 firms in our sample specialize in oil production, accounting for an average of 671 firm-year observations and $102.4 billion in annual profits.

MNE fixed effects (μ_g) and year fixed effects (λ_t) to absorb time-invariant firm heterogeneity and common macroeconomic shocks. The vector $\mathbf{X}_{gt}$ controls for time-varying scale, including total assets and number of employees (both in log). The coefficient β measures the elasticity of consolidated outcomes with respect to the primary commodity price. This is a descriptive, not causal, estimate: as documented in Table B3, the largest firms in our sample hold substantial market shares in their primary commodity and may therefore exert some influence over prices. We address this endogeneity concern in Section 4, where we instrument group profits with commodity prices in a specification that exploits variation across affiliates within the firm. This elasticity also captures both the direct price effect and any short-run adjustment in production volumes.

Table 4 presents the results. We find that consolidated profits, sales, and tax payments are strongly correlated with the price of the main commodity extracted by the firm. Focusing on the specifications with controls, we estimate that a 1% increase in commodity prices is associated with a 1.29% increase in consolidated profits, a 0.44% increase in consolidated sales, and a 1.39% increase in taxes paid. The lower elasticity of sales relative to profits reflects that production costs (capital depreciation and extraction expenses) are largely fixed in the short run. The elasticity of tax payments exceeds the elasticity of consolidated profits, but we do not observe a statistically significant increase in group ETRs in columns (5) and (6). Overall, commodity price variations explain a substantial share of the variance in MNE consolidated financials (6% for profits and

Table 4: Effects of Commodity Price Changes on Worldwide Activity

	Profits (log)		Sales (log)	Taxes (log)	ETR	ETR (log)
	(1)	(2)	(3)	(4)	(5)	(6)
$P_{g(p)t}$ (log)	1.31***	1.29***	0.440***	1.39***	0.070	0.433
	(0.481)	(0.472)	(0.091)	(0.265)	(0.115)	(0.442)
Employees (IHS)		-0.056*	0.072	0.036	0.028***	0.109***
		(0.034)	(0.069)	(0.036)	(0.008)	(0.039)
Tang Assets (IHS)		-0.006	0.057	0.002	-0.0001	0.007
		(0.016)	(0.102)	(0.011)	(0.002)	(0.012)
Observations	215	215	240	236	182	182
R^2	0.89321	0.89381	0.97679	0.93530	0.67028	0.70849
Within R^2	0.05419	0.05948	0.08253	0.10022	0.04243	0.03915
MNE fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓

Notes: This table summarizes our estimates of the effects of a change in commodity prices on extractive MNEs consolidated financial figures. The outcome variables are consolidated worldwide pretax profits (columns 1 and 2), total revenues (column 3), corporate income taxes accrued (column 4), and the effective tax rate comprised between 0 and 1 (column 5 and 6). The outcome variables of columns 1-4 are log-transformed and measured in US dollars. The sample of column 5 and 6 only includes observations with an effective tax rate comprised between 0 and 1 at the consolidated level. Standard errors are clustered at the MNE level.

10% for taxes). We verify that these patterns hold in a larger sample of extractive MNEs from Compustat: Table B4 presents coefficients of the same magnitude (1.28) and significance.

4 Empirical Strategy

To study how an extractive MNE allocates windfall profits across countries and affiliates, and in particular in low-tax countries, we exploit the fact that group specialization in extractive commodities is associated with group-specific profit shocks. We implement this strategy in two complementary steps. First, we estimate a triple-difference specification to document the differential elasticity of affiliate profits to group-level shocks across jurisdictions (tax havens and high-tax countries) with respect to commodity prices. Second, we employ an Instrumental Variable (IV) approach to estimate the effect of total group profitability on both the amounts and the share of global profits booked in tax havens, allowing us to test for non-linearities in profit shifting.

4.1 Allocation of Windfalls

Shift-share strategy. Our empirical strategy uses group-specific commodity price shocks to generate variation in extractive profit, and compares within each group the differential profit price elasticity of tax haven affiliates versus the rest of the group. Our identification strategy employs a shift-share (Bartik) design (Goldsmith-Pinkham et al., 2020), interacting time-varying global commodity prices (the shocks) with pre-determined firm-level production weights (the shares, here 0 or 1).[20]

In the previous subsection, we showed that changes in the price of these commodities correlate strongly with changes in profits (the shift). In this approach, the shares act as a treatment intensity, and matter for exogeneity, and the shifts as relevant changes affecting the outcome. On top of price changes across time, and differences in commodity specialization across multinational groups, we exploit differences within the multinational group between affiliates (here MNE $\times$ country units). In particular, we compare within the group, profits booked in tax havens to profits booked in countries where no extraction is undertaken. The underlying assumption is that in the absence of haven-specific characteristics, the profits of subsidiaries in tax havens would have reacted to prices, such as in the rest of the group, to the group-specific shock in commodity prices.[21]

Estimation. We estimate the following affiliate-level specification:

$$\begin{aligned}\log(Y_{git}) = &\alpha + \beta_M \log(P_{p(g)t}) + \beta_H \left(\log(P_{p(g)t}) \times \text{Haven}_i\right) + \beta_E \left(\log(P_{p(g)t}) \times \text{Extract}_{gi}\right) \\ &+ X'_{git}\theta + \mu_{gi} + \delta_t + \varepsilon_{git}\end{aligned} \tag{5}$$

The outcome Y_{git} is the financial variable of interest for MNE g in country i at time t. Our main outcome of interest is MNE $\times$ country profit, which is the sum of profit affiliates of group g in country i. Note that because the logarithmic transformation is undefined for non-positive

[20]As a robustness check, we replace these binary shares with continuous production-weighted shares across all commodities extracted by the firm. Results are unchanged, both at the consolidated level (Table B5) and at the affiliate level (Tables B13 and B14). The procedure is described in 5.4.

[21]Our empirical strategy is also close to the one from Dharmapala and Riedel (2013) who study different types of group-level income shocks.

values, profit estimates capture responses conditional on positive profitability. We separately investigate responses in cases of losses in Section 5.3.

The variable $P_{p(g)t}$ denotes the price of the primary commodity for MNE g. The term β_M captures the average elasticity of affiliate profits to commodity price shocks across all affiliates in the group. Haven_i is a dummy equal to one if country i is a tax haven. Crucially, we distinguish between two types of affiliates by including the interaction with Extract_{gi} (which equals one if the MNE has physical extraction activity in country i). Extractive affiliates face first-order effects of price changes and are thus much more sensitive to the shock. By explicitly controlling for this interaction (β_E), we ensure that our control group consists of non-extractive, non-haven affiliates (for instance, service centers in high-tax countries) that only receive indirect spillovers. The coefficient of interest, β_H, measures the excess sensitivity of tax haven affiliates to the group-level shock compared to this control group. If $\beta_H > 0$, it implies that profits in tax havens rise disproportionately during a boom, consistent with windfall shifting.

Our baseline specification includes standard two-way fixed effect μ_{gi} and μ_t for MNE $\times$ country and year. MNE $\times$ country fixed effects (μ_{gi}) to control for time-invariant characteristics and unobserved heterogeneity. Year fixed effects (δ_t) are included to absorb global macroeconomic shocks and common trends in commodity markets. We alternatively include MNE $\times$ Year fixed effects in our preferred specification to absorb all time-varying group-level shocks (including $\beta_M \ln P_{p(g)t}$), isolating the within-group, cross-affiliate variation in profit allocation purely. This setup identifies β_H through a triple-difference mechanism. We exploit variation along three dimensions: (1) the time-series variation in global commodity prices, (2) the cross-sectional heterogeneity in firm-level exposure to these shocks, and (3) the within-firm difference between tax haven and non-haven affiliates.

We control for total assets and employees. These variables often display zero values for MNE $\times$ countries in our sample: we use Inverse Hyperbolic Sine (IHS) transformation.[22] Standard errors are clustered at the MNE level to account for correlation in shocks across affiliates within the same group.

[22]We do not seek to recover interpretable coefficients on these variables and avoid recent concerns of the literature Aihounton and Henningsen (2021).

Validity Assumptions. To interpret these estimates causally, our shift-share design relies on the exogeneity of the shares (initial specialization) and the relevance of the shifts (price shocks) (Goldsmith-Pinkham et al., 2020). As shown in Section 3.2, the group-specific commodity prices are strongly predictive of consolidated group profits. Identification relies on the exogeneity of the shares rather than the shocks: this distinction is critical in our setting. The extractive sector is characterized by large firms with potential market power (see Table B3 in Appendix). Consequently, aggregate commodity prices may be endogenous to the strategic supply decisions of the firms in our sample (reverse causality).

By relying on the exogeneity of shares, our strategy remains valid even if price shocks are endogenous, provided that a firm's initial specialization pattern is orthogonal to unobserved trends in tax haven utilization. In other words, the identifying assumption is that firms specializing in different commodities *ex ante* (copper vs. gold, for instance) would have followed parallel trends in profit shifting in the absence of differential price shocks. As we document in Appendix Figure B1, there is no systematic correlation between commodity specialization and the average reliance on tax havens.

This approach further assumes that (i)there is no windfall shifting spillover from one group to another (ii) that the data consist of steady-states, and there is no dynamic adjustment (Jaeger et al., 2018). For the latter, we verify in Appendix Section 5.4 that lagged prices are not relevant predictors of affiliates' windfalls.

4.2 Allocation of the Marginal Dollar

Instrumental Variable Estimation. The Shift-Share approach decomposes windfall allocation while making use of the full variation available in our sample, but estimated coefficients can be hard to interpret economically. We complete this approach to estimate the economic magnitude of profit shifting and non-linearities in shifting behavior. We showed in Section 3.2 that group-specific prices are relevant predictors of group profits. To the extent that the differential commodity price-responses of tax haven profits reflect profit shifting, group-level windfalls serve as a valid instrument for profits reported in tax havens. We estimate two complementary parameters: (i) the marginal propensity to allocate a dollar of windfall profit across jurisdictions, and (ii) the semi-elasticity of tax havens' share in positive profits.

First Stage. We instrument group profits with the group-specific commodity price index. The first-stage equation isolates the variation driven purely by exogenous price changes:

$$\Pi_{gt} = \gamma log(P_{p(g)t}) + \mu_g + \tau_t + \epsilon_{gt} \tag{6}$$

where Π_{gt} represents consolidated group profits (expressed either in levels or logs depending on the second-stage specification) and P_{gt} is the commodity price instrument. This first stage is similar to regressions presented in Section 3.2.

Allocation of the Marginal Dollar. To quantify how the marginal dollar of windfall profit is distributed, we regress the level of profits booked by MNE g in countries of type h (π_{ght}) on the instrumented level of consolidated group profits ($\widehat{\Pi}_{gt}$):

$$\pi_{ght} = \beta_i \cdot \widehat{\Pi}_{gt} + \mu_g + \tau_t + \nu_{ght} \tag{7}$$

In this equation, β_i captures the marginal propensity to allocate profits to jurisdiction type i. Compared to the triple difference, this specification provides a direct accounting of the windfall allocation.

Sensitivity of the shares. Second, we test whether the intensity of profit shifting varies with the magnitude of the shock. We estimate the semi-elasticity of the tax haven share with respect to the log of MNE profits:

$$\frac{\text{Haven Profits}_{gt}}{\text{Positive Profits}_{gt}} = \lambda \cdot \widehat{\log(\Pi_{gt})} + \mu_g + \tau_t + \epsilon_{gt} \tag{8}$$

The dependent variable is the share of global positive profits booked in tax havens. The coefficient λ tests for non-homotheticity. A positive $\lambda > 0$ indicates that profit shifting is non-linear:

as the tax base expands, MNEs optimize more aggressively, diverting a larger slice of the pie to low-tax jurisdictions.

Validity. We assume that global commodity prices affect the profitability of tax haven affiliates only through the channel of the group's extractive activity. Since the tax havens in our sample are generally resource-poor, they experience no direct real effect from commodity price booms. Any surge in profits recorded in these jurisdictions during a price boom is therefore attributable to profit shifting rather than local value creation.

5 Results

We start by presenting the baseline results of the affiliate-level Shift-Share approach, studying within-group allocation of windfalls by type of affiliate. We then explore the marginal allocation of windfalls and the dynamics of profit shifting using our aggregate IV approach. We finally revert to the affiliate level specification to present further results and robustness tests.

5.1 Baseline Shift-Share Results: Allocation of Windfalls

Table 5 presents the baseline estimates for the differential allocation of windfall profits. Column (1) reports the average co-movement of commodity price shocks with subsidiary profits, without distinguishing between affiliate types. The elasticity is positive (0.46) and statistically significant. Notably, this subsidiary-level elasticity is lower than the consolidated group-level elasticity estimated in Section 3.2. This discrepancy likely reflects composition effects: larger affiliates (which weigh more in the consolidated total) tend to react more strongly to price shocks than the average subsidiary. Additionally, the log specification restricts this sample to profitable affiliates, excluding loss-making entities that may be included in the consolidated accounts.

In Column (2), we introduce the triple-difference interaction terms. Two key patterns emerge. First, the coefficient on extractive activity is large and highly significant, confirming that, unsurprisingly, the change associated with price changes is concentrated in the affiliates that physically extract the commodity. Second, and most importantly, we find a positive and statistically

Table 5: Triple Difference-in-Difference Results

	Profits (log)				
	(1)	(2)	(3)	(4)	(5)
$P_{g(p)t}$ (log)	0.457**	0.073	0.068		
	(0.212)	(0.210)	(0.209)		
$P_{g(p)t}$ (log) $\times$ Extract$_{gi}$		1.30***	1.32***	1.24***	1.25***
		(0.261)	(0.272)	(0.315)	(0.328)
$P_{g(p)t}$ (log) $\times$ Haven$_i$		0.519**	0.536**	0.592***	0.609***
		(0.197)	(0.206)	(0.186)	(0.197)
$P_{g(p)t}$ (log) $\times$ Extract$_{gi}$ $\times$ Haven$_i$			-0.402		-0.374
			(0.511)		(0.557)
Employees (IHS)	0.236***	0.236***	0.236***	0.241***	0.241***
	(0.061)	(0.061)	(0.061)	(0.056)	(0.056)
Tang Assets (IHS)	0.076***	0.080***	0.080***	0.059***	0.059***
	(0.028)	(0.028)	(0.028)	(0.016)	(0.016)
Observations	5,754	5,754	5,754	5,754	5,754
R^2	0.92644	0.92751	0.92751	0.93850	0.93850
MNE-Country fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓		
MNE-Year fixed effects				✓	✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on pretax profits in different types of affiliates. The outcome variable is the log of pretax profits at the subgroup (MNE x country level). Standard errors are clustered at the MNE level.

significant coefficient on the interaction term for tax havens (β_H). The estimate indicates that for a 1% increase in global commodity prices, profits in tax haven affiliates have an elasticity of 0.54 percentage points higher compared to the control group (non-extractive, non-haven affiliates). This differential elasticity is substantial, approximately ten times larger than comparable estimates of profit shifting in the literature (Dharmapala and Riedel, 2013), suggesting that MNEs substantially reallocate windfalls to low-tax jurisdictions.[23]

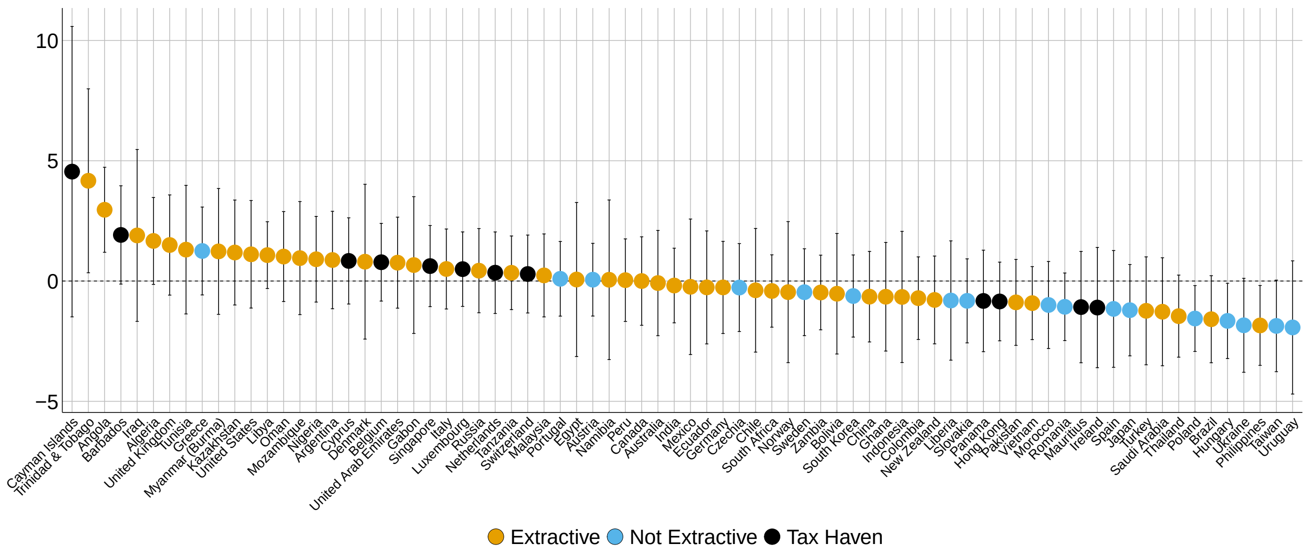
In contrast, the baseline coefficient for non-extractive, non-haven affiliates (the constant term in this interaction) is small (0.073) and statistically insignificant. This implies that the group-wide spillovers of the price shock are almost entirely captured by two specific types of affiliates: those that produce the oil/minerals, and those located in tax havens.

In Column (3), we verify that our result is not driven by extractive havens (such as the Netherlands) by controlling for the interaction of *Haven* $\times$ *Extractive*. The coefficient is insignificant, confirming that our main effect is driven by distinct tax haven affiliates, not production

[23] Dharmapala and Riedel (2013) study the differential response to *sectoral* income changes, compared to our price changes that are firm specific within a sector.

entities. Finally, Columns (4) and (5) include MNE × Year fixed effects. This specification absorbs all common group-level shocks (including the main price effect). The tax haven coefficient remains robust and even increases slightly in precision, providing strong evidence that the result is driven by the within-group reallocation of profits rather than unobserved heterogeneity.

Figure 5: Profit Price-Coefficient per Country



Notes: This graph plots the coefficients β_i associated with each country dummy interacted with the commodity price variable by running the following regression: $\log(y_{git}) = \alpha + \beta_i Country \times \log(P_{g(p)t}) + \theta' Controls_{git} + \mu_{gi} + \mu_{gt} + \varepsilon_{gt}$. Countries are defined as extractive if at least one MNE carries out extractive activity there. The reference country is France. The sample is restricted to countries where at least 10 MNEs are active and for which we have at least 50 observations. Whiskers represent 95% confidence intervals. Standard errors are clustered at the MNE level.

Figure 5 plots the estimated price elasticity of profits separately for each country in our sample (using France as the reference point). We color coefficients according to our three groups: tax havens, other countries, and extractive countries.[24] The results visually confirm our econometric estimates: the jurisdictions displaying the largest profit responses are either major resource producers or tax havens. In contrast, non-resource, high-tax jurisdictions show negligible sensitivity to commodity prices.[25]

[24]This time, conservatively defining an extractive country as a jurisdiction where at least one project is undertaken, as the coefficient will aggregate both extractive and non-extractive MNE×country responses.

[25]We note that the large response from Greece could likely be due to the shipping industry.

5.2 Instrumental Variable: Marginal Allocation of Windfalls

While the baseline results establish that tax havens capture a disproportionate share of windfalls, they do not directly quantify the allocation of the marginal dollar compared to the average dollar. This marginal allocation is particularly relevant to understanding whether windfalls increase in times of commodity booms. At baseline, tax havens capture 11.8% of positive profits, while extractive subsidiaries capture 65.2% on average (Table 2).

Table 6 presents the second stage results. Columns (1) to (3) estimate the allocation of the marginal dollar of consolidated profits predicted by price changes, in monetary units. Columns (4) to (7) explore the change in the share of each type of affiliates at the group level in total positive profits. The validity of the instrumental variable presented in section 4 is reported in Appendix Table B6 and summarized in the bottom panel of Tables 6. The group commodity price is a good predictor of consolidated profits, with F-statistics of 11.1 and 11.8 for the level and log specifications.

Table 6: Instrumental Variable - Second Stage Results

	Profits			Share in Profits			
	Tax Havens (1)	Extractive (2)	Other (3)	Tax Havens (4)	Extractive (5)	Other (6)	Tax Havens Non-Extrac. (7)
Conso. Profits	0.212**	0.888***	-0.074				
	(0.091)	(0.090)	(0.066)				
Conso. Profits (log)				0.100**	-0.025	-0.077	0.298*
				(0.049)	(0.057)	(0.057)	(0.163)
F-test (1st stage)	11.148	11.148	11.148	11.803	11.803	11.803	12.584
Observations	272	272	272	215	215	215	201
MNE fixed effects	✓	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓	✓

Notes: This table summarizes estimates of the effects of an increase in consolidated profits instrumented by commodity prices. Columns 1–3 show profit amounts; columns 4–6 show shares in total positive profits. Column 7 displays the share of tax havens in non-extractive profits. Standard errors are clustered at the MNE level.

In column 1, we find a high pass-through of windfall dollars to tax havens: for every $1 increase in instrumented global profit, $0.21 is booked in tax haven affiliates. This marginal allocation of $0.21 is higher than the average allocation of $0.12 reported in Table 2, which indicates that profit shifting is higher during commodity booms. Columns (2) and (3) present coefficients for extractive and other affiliates. The exogeneity assumption is likely violated given that the profits of extractive affiliates can be affected by direct production responses to prices, but we report coefficients as a benchmark. We find that $0.89 is allocated to extractive affiliates (Column 2), and the coefficient for other affiliates (Column 3) is negative and not statistically significant from zero. Reconciled with the zero coefficient on the average correlation with commodity price for non-extractive non-haven affiliates in Table 5, we can infer that all residual windfalls go to extractive affiliates.

In Columns (4) to (7), we test the assumption of constant profit shifting intensity. Here, we regress the share of global positive profits booked in a jurisdiction on the log of consolidated profits. If the propensity to shift were constant, the share of profits in havens should be independent of the scale of the rent. The results in Column (4) reject this hypothesis. We estimate a positive and significant semi-elasticity of 0.1 for tax havens. Economically, this implies that a 10% increase in group profitability is associated with a 1 percentage point increase in the share of global profits booked in havens. The point estimate is three times larger when removing extractive affiliates from the denominator, although imprecise and not statistically different (Column (7)). This result provides causal evidence that profit shifting is non-linear: as the tax base expands, MNEs shift an increasing proportion of profits.

Back-of-the-envelope recovery of the concealment cost parameter β. Our theoretical framework in Section 2 predicts that the optimal haven share satisfies $\sigma^* = (\Delta\tau/\gamma) \cdot \pi^{\beta-1}$, so that $\partial\sigma^*/\partial \ln \pi = (\beta - 1) \cdot \sigma^*$. Combining our IV semi-elasticity estimate $\hat{\lambda} = 0.100$ (Table 6, Column (4)) with the average haven share $\bar{\sigma} = 0.118$ (Table 2) yields an implied curvature parameter $\hat{\beta} = 1 + \hat{\lambda}/\bar{\sigma} \approx 1.85$. This value substantially exceeds the unit threshold that separates the canonical model ($\beta = 1$, constant shifted share) from the non-linear case, confirming that concealment costs decline in the profit base faster than standard quadratic specifications assume.

5.3 Additional Results at the Affiliate Level

We present additional results now, making use of our disaggregated sample at the affiliate level, following the approach of Equation 5.

Allocation of losses. Commodity price volatility generates large windfalls but also entails significant downside risk. In our sample, approximately one-third of observations record negative profits. Since our baseline logarithmic specification restricts the sample to positive profits, we employ alternative empirical approaches to analyze the allocation of losses.

Table B8 presents the results. Columns (1) and (2) replicate our baseline estimates for comparison. Columns (3) and (4) estimate a linear probability model where the dependent variable is a dummy equal to one if the subsidiary reports a loss. The results indicate that the probability of incurring a loss in extractive countries is decreasing with prices, while the coefficient for tax havens is statistically indistinguishable from zero when we control for MNE-year fixed effects. This suggests that while extractive affiliates bear the downside risk of price drops, tax haven affiliates are less affected by these shocks at the extensive margin.

Columns (5) and (6) examine the intensive margin of losses, using the logarithm of the absolute value of losses as the dependent variable. Consistent with the extensive margin results, the magnitude of losses in extractive countries changes with price shocks when we control for MNE-year fixed effects. However, we find no significant response in tax havens. Collectively, these findings imply an asymmetry in profit shifting: while tax havens capture the upside of price booms (as shown in the baseline), they do not absorb the corresponding downside risk during busts.

Symmetry between price increases and decreases. We investigate whether the sensitivity of profits to commodity prices depends on the direction of the price shock. To do so, we interact our price variable with an indicator for year-on-year price decreases. The results are displayed in Table B9 in the Appendix. We find no evidence of asymmetry: the elasticity of reported profits to commodity prices is statistically insignificant during boom and bust. This implies that as long as profits remain positive, tax haven affiliates absorb the downside of price drops as fully as they capture the upside of price spikes. This symmetric exposure to volatility supports the results of Becker et al. (2020), who argue that MNEs strategically allocate risk to low-tax jurisdictions. By demonstrating that haven affiliates bear significant risk, MNEs can substantiate high average returns to tax authorities under standard risk-return transfer pricing principles.

Integrated value chain. We investigate changes in the group of non-extractive and non-haven affiliates that are vertically integrated with extraction. We identify the location country of affiliates transforming oil, gas and mining products, or specialized in direct downstream industries by using NACE codes from Orbis.[26] We introduce new interaction terms of the main price with indicator variables for refining and downstream activity of MNE g in country i. This specification also selects a more comparable control group for tax haven affiliates by removing production affiliates potentially affected by input-output linkages with extractive affiliates. Results are presented in Table B7. We find a negative but not statistically significant co-movement of refining and downstream affiliates' profits with commodity prices. There is no evidence of windfalls spilling over to downstream affiliates. The coefficient on tax haven affiliates stays the same.

Business activity. Using the information on the business activities of the subsidiaries belonging to the MNEs in our sample, we investigate whether some types of activities are driving our results more than others. For each MNE $\times$ country, we define primary activity as the activity in which the MNE has the largest number of affiliates. We then regress our profit variable on the interaction of a set of dummies for each primary activity, interacted with our MNE-level price shocks. The equation estimated is the following:

$$y_{g(p)it} = \alpha + \sum_s \beta_s \log P_{g(p)t} \times \mathbb{1}BusinessActivity_{s,gi} + \mu_g + \mu_t + \epsilon_{git} \tag{9}$$

With $y_{g(p)it}$ the profits of MNE g at times t in country i and $BusinessActivity_{s,gi}$ an indicator variable if the main business activity of MNE g in country i is s.

Figure B4 shows the associated coefficients. Because each MNE $\times$ country can have multiple

[26] Ownership structure and sectoral classification suffer much less from limited coverage than unconsolidated financial data in Orbis.

activities in each country, the identification is challenging, and our coefficients are not precisely estimated. Figure B4, however, shows that MNE × country specialized more in intra-group finance seem to react the most to commodity price changes, predominantly located in tax havens (Figure 3b).

Sales and taxes. In tables B10 and B11, we explore the differential changes of sales and taxes across affiliates. Extra-Group and Intra-Group Sales increase both with prices for extractive affiliates. Sales also increase for Tax Haven affiliates compared to the rest of the group, imprecisely estimated. Taxes display a proportional increase in profits in all affiliates.

5.4 Robustness

Weighted price index. Some MNEs in our sample are multi-product firms. We alternatively measure firm-level heterogeneity in commodity specialization by constructing a weighted price index:

$$P_{g,t} = \sum_{p} \omega_{g,p} \times \log(P_{p,t}) \tag{10}$$

where $P_{p,t}$ is the USD price per ton of commodity p. The weights $\omega_{g,p}$ capture the group's exposure to commodity p during 2010-2015, measured by production volume for oil & gas firms[27] and the share of active mines for mining firms. As shown in Table B13, our main findings remain robust to accounting for these specialization patterns, despite a loss in precision. In Appendix Table B13, we demonstrate the robustness of our results to an alternative, continuous measure of exposure: a shift-share index that weights price changes by the share of each commodity in the MNE's pre-period production portfolio.

Leave-one-out. We re-run the triple difference regression excluding one commodity at a time (Figure B5). The positive coefficient on the tax haven dummy interaction remains robust to these exclusions. We note that excluding oil companies reduces precision, as they make up a substantial part of our sample.

[27] Converted into barrel equivalents.

Alternative estimator. We estimate Equation (5) using the Poisson Pseudo Maximum Likelihood (PPML) estimator. This approach allows us to include observations with zero profits and addresses the inconsistency of the log-linear OLS estimator in the presence of heteroskedasticity (Silva and Tenreyro, 2006). Columns (2) to (5) of Table B16 confirm that tax havens book significantly higher profits than the non-extractive rest of the group in response to commodity price shocks. The estimated magnitudes are larger than in the OLS specification, consistent with PPML placing relatively more weight on larger observations (Breinlich et al., 2024).

Alternative tax haven list. To ensure our findings are not driven by the specific selection of jurisdictions in our baseline list, we employ an alternative, data-driven definition of tax havens. We reconstruct the tax haven indicator to include all countries with an effective tax rate (ETR) below 10%. Table B17 demonstrates that our main results are robust to this reclassification: the estimated coefficients remain positive and statistically significant, confirming that our findings capture the response to low effective taxation rather than idiosyncratic features of a specific list.

Outliers and Sample Composition. To ensure our main estimates are not driven by extreme values, we re-estimate the baseline model winsorizing the dependent variable at the 1st and 99th percentiles within each year. Additionally, to rule out composition effects from firm entry and exit, we restrict the sample to a balanced panel of MNEs observed continuously between 2016 and 2019. Table B18 confirms that our results remain robust: the coefficients are quantitatively similar to the baseline and statistically significant.

Dynamic specification. Our baseline estimates focus on the contemporaneous response to commodity price shocks. We test this assumption by explicitly including lagged price shocks to account for potential dynamic adjustments and intertemporal spillovers, following Jaeger et al. (2018). We find that our main results remain robust to this dynamic specification, suggesting that our baseline estimates are not confounded by the persistence of price shocks or delayed adjustment processes. The results are displayed in column (2) of Table B15.

Profit repatriation to headquarters. We also investigate whether the observed reallocation reflects a general centralization of profits during commodity booms rather than strategic shifting to low-tax jurisdictions. To test this, we re-estimate the model using the parent company's headquarters as the destination for profit booking. Column (3) of Table B15 shows no statistically significant increase in profits reported in headquarters countries following price shocks. This null result reinforces our main finding: the intra-group reallocation is specifically directed toward tax havens, consistent with tax-motivated profit shifting rather than operational consolidation.

6 Conclusion

This paper studies how commodity price windfalls are allocated across the global networks of extractive multinationals. Combining Country-by-Country Reports with asset-level production data, we exploit variation in firms' commodity specialization to trace the flow of windfall profits across jurisdictions. Three main findings emerge. First, for every additional dollar of consolidated windfall profit, approximately $0.20 is booked in tax haven affiliates, $0.80 in extractive countries, and nothing in the rest of the group. Second, this diversion intensifies during booms: the share of profits booked in havens increases with total group profitability. Third, while tax haven affiliates capture the upside of commodity booms, they do not absorb the corresponding downside risk during busts, that are allocated to resource-rich countries. This suggests that the costs of concealment are asymmetric.

These results speak to a broader debate on the design of resource taxation. Standard public finance theory favors corporate income taxes over production-based instruments such as royalties, on the grounds that the latter distort investment and extraction decisions at the margin. Our findings reveal a countervailing force: income taxes are highly vulnerable to base erosion precisely when the tax base is largest. This vulnerability is particularly relevant in light of the windfall taxes on corporate profits introduced by many countries following the 2022 energy price surge. Without robust safeguards against profit shifting, such measures risk failing to capture the rents they target.

Our analysis also points to two concrete policy responses in resource-rich countries. First, the intensity of tax enforcement could be designed to scale with commodity prices, concentrating audit resources during boom periods when the incentive to shift profits is greatest. Second, our results support the adoption of price-contingent royalties (a mechanism implemented notably in Alberta, Canada), which reduce base erosion risks while remaining less distortive than flat production taxes during low-price periods. More broadly, the optimal tax mix in the extractive sector may need to place greater weight on gross-based instruments than standard theory suggests, particularly in jurisdictions with limited enforcement capacity.

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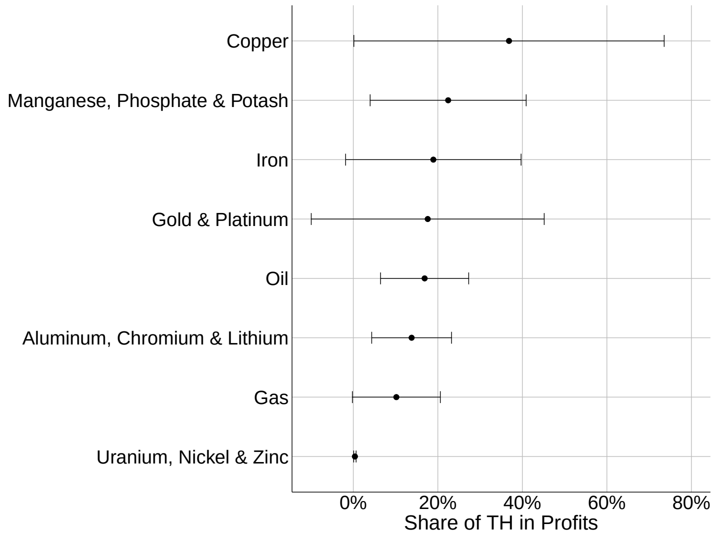
Appendix

A Data & Descriptive Statistics

Figure B1: Average share of tax haven in non-extractive profits



Lecture: This graph shows the average share of tax havens in total profits by specialization and confidence intervals.
Notes: Some commodities are grouped for confidentiality reasons.

Table B1: Summary Statistics

Year	MNEs	Countries	Subsidiaries	Sales	Profits	Employees
Panel A: Totals						
	(Nb)	(Nb)	(th)	($bn)	($bn)	(th)
2016	42	193	1,857	1,555.8	-0.9	1,695.1
2017	51	198	2,161	2,185.9	163.5	2,345.8
2018	40	196	1,711	2,014.7	211.0	1,759.3
2019	49	194	1,963	2,103.2	127.1	1,991.2
2020	22	181	952	751.9	-39.9	952.1
2021	24	174	903	1,079.7	226.6	963.1
2022	24	173	912	1,385.7	288.4	828.7
2023	20	151	698	1,082.1	227.1	705.6
2016-2023	77	206	1,394.6	1,519.9	150.4	1,405.1
Panel B: Average per MNE						
		(Nb)	(th)	($bn)	($bn)	(th)
2016		44.2	44.2	37.0	0.0	40.4
2017		42.4	42.4	42.9	3.2	46.0
2018		42.8	42.8	50.4	5.3	44.0
2019		40.0	40.1	42.9	2.6	40.6
2020		43.1	43.3	34.2	-1.8	43.3
2021		37.6	37.6	45.0	9.4	40.1
2022		38.0	38.0	57.7	12.0	34.5
2023		34.9	34.9	54.1	11.4	35.3
2016-2023		41.0	41.0	44.7	4.4	41.3
Panel C: Average per Subsidiary						
				($M)	($M)	
2016				840.9	-0.5	916.3
2017				1,016.2	76.0	1,091.1
2018				1,182.3	123.3	1,028.8
2019				1,094.8	65.5	1,020.6
2020				1,075.7	-44.6	1,165.4
2021				1,505.9	267.3	1,231.6
2022				2,074.4	328.4	980.7
2023				2,249.7	340.0	1,061.1
2016-2023				1,193.1	109.9	1,043.7

Notes: This table shows the distribution of the main variables in our CbCR sample. Panel A shows the total number of MNEs, countries covered, affiliates, number of employees and total amounts of sales and profits each year. Panel B shows the averages across MNEs in our sample. Panel C shows averages at the MNE × country level. In each Panel, the last line shows the total number of MNEs and countries appearing at least once in our sample, and the average number of subsidiaries, amounts of sales, profits and number of employees across years 2016 to 2023.

Lecture: in 2016, there are 42 MNEs in our sample, present in 193 countries, generating 1,555.8 billion US$ in sales, -0.9 in profits, and have in total 1,695.1 thousand employees in full-time equivalent. On average, MNEs were present in 44.2 countries, generated 37$bn in sales, 0 profits, and employed 40.4 thousand employees. Affiliates of these MNEs generated on average 840$M in revenues, -0.5$M in profits, and employes 916.3 employees.

Table B2: Summary Statistics by Country

	Profits		Taxes		Sales		Employees		MNEs	
	($bn)	(%)	($bn)	(%)	($bn)	(%)	(th)	(%)	(Nb)	(%)
Australia	29.5	20.0	8.5	14.3	104.4	3.4	80.2	5.9	57	74.0
Norway	25.7	17.4	12.9	21.7	76.3	2.5	19.8	1.5	36	46.8
United Arab Emirates	6.9	4.7	5.4	9.1	42.9	1.4	14.9	1.1	30	39.0
Singapore	6.1	4.1	0.2	0.4	296.4	9.6	12.8	0.9	55	71.4
Switzerland	5.9	4.0	0.5	0.8	142.8	4.6	3.2	0.2	38	49.4
Colombia	5.5	3.7	1.5	2.4	17.3	0.6	16.2	1.2	31	40.3
United States	4.7	3.2	−0.2	−0.3	583.7	18.9	146.4	10.8	65	84.4
Nigeria	4.5	3.0	2.9	4.8	15.7	0.5	8.6	0.6	20	26.0
Chile	4.3	2.9	0.8	1.4	17.9	0.6	29.9	2.2	29	37.7
Netherlands	4.0	2.7	0.6	1.1	132.7	4.3	23.8	1.8	60	77.9
South Africa	4.0	2.7	0.7	1.2	34.8	1.1	69.1	5.1	37	48.1
Libya	3.7	2.5	2.5	4.1	6.3	0.2	3.8	0.3	12	15.6
Angola	3.7	2.5	1.6	2.6	12.7	0.4	4.6	0.3	13	16.9
Malaysia	3.7	2.5	1.0	1.6	23.1	0.7	23.1	1.7	35	45.5
Oman	3.5	2.4	2.8	4.7	9.5	0.3	1.3	0.1	11	14.3
Thailand	3.4	2.3	0.8	1.4	36.3	1.2	18.9	1.4	30	39.0
Spain	3.2	2.1	0.5	0.9	136.6	4.4	36.8	2.7	39	50.6
Japan	2.7	1.8	0.6	0.9	85.9	2.8	87.2	6.4	43	55.8
Kazakhstan	2.5	1.7	0.4	0.7	8.5	0.3	33.2	2.4	21	27.3
Denmark	2.2	1.5	0.6	0.9	15.3	0.5	6.7	0.5	27	35.1
Egypt	2.0	1.4	0.9	1.4	8.5	0.3	3.8	0.3	18	23.4
Indonesia	1.6	1.1	0.7	1.2	7.5	0.2	8.3	0.6	37	48.1
Qatar	1.5	1.0	0.4	0.7	3.2	0.1	1.7	0.1	12	15.6
China	1.4	0.9	0.3	0.4	19.2	0.6	21.4	1.6	51	66.2
Algeria	1.3	0.9	1.1	1.8	3.7	0.1	1.3	0.1	14	18.2
Canada	1.2	0.8	1.1	1.8	112.1	3.6	49.3	3.6	57	74.0
United Kingdom	1.2	0.8	2.6	4.3	340.0	11.0	63.8	4.7	60	77.9
Germany	1.1	0.8	0.8	1.3	132.6	4.3	42.6	3.1	49	63.6
Bermuda	0.8	0.5	0.0	0.0	2.6	0.1	0.0	0.0	28	36.4
World	150.4	100.0	60.4	100.0	3,144.6	100.0	1,405.1	100.0	77	100.0

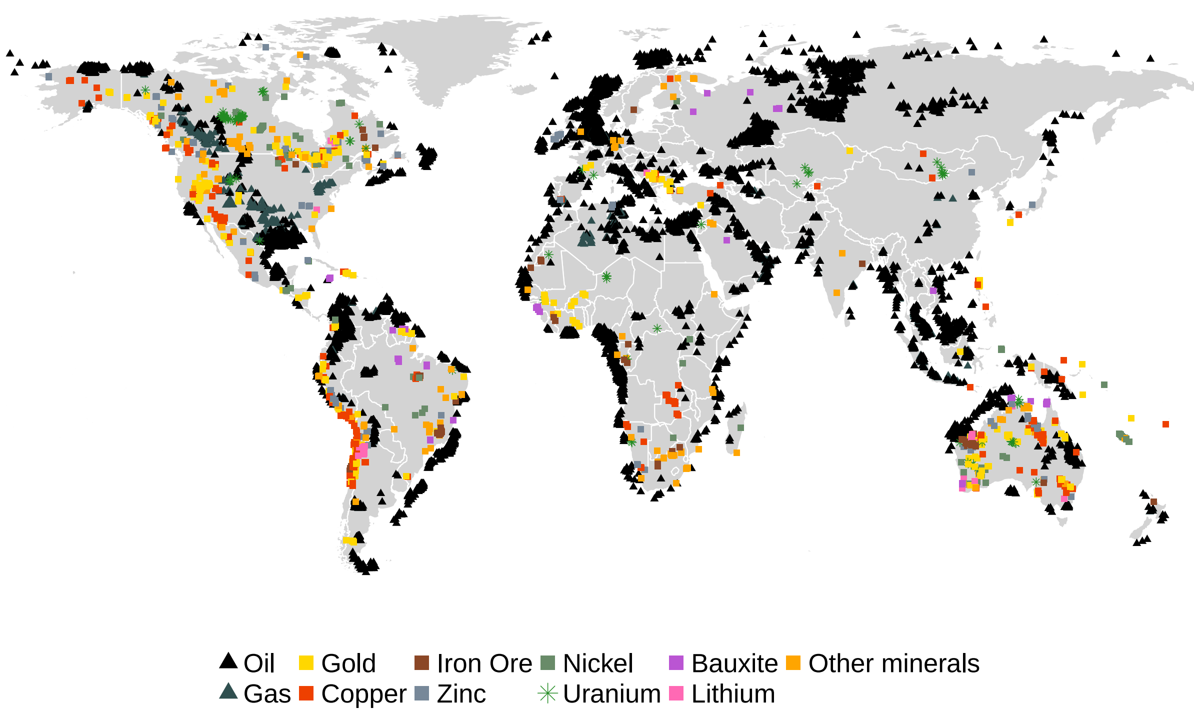
Notes: This table shows the distribution of the main variables in our CbCR sample by country, ranked by total amounts of profits. All figures except shares and MNE counts are annual averages over the 2016–2023 period. In Australia, extractive firms in our sample booked an average of $29.5bn in annual profits, representing 20% of the sample total. The last column reports the share of the 77 MNEs in our sample that have at least one affiliate in the country.

Table B3: Distribution of Firms by Global Production Share

Global Market Share	Number of Firms	Average Share of World Production
Less than 5%	54	1.0%
5% - 10%	5	7.7%
More than 10%	5	15.3%

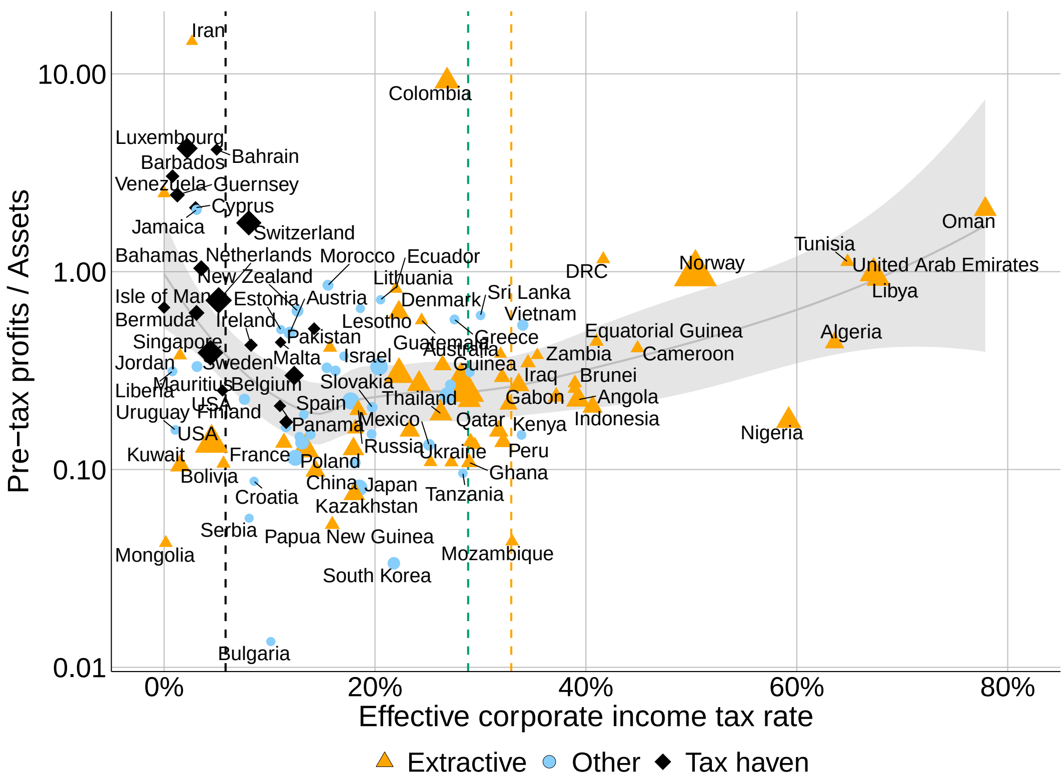
Note: This table classifies firms in the sample based on their share of total worldwide production for their primary commodity. Comprehensive production data was not available for part of our sample, which explains the lower overall number of MNEs in this table. Worldwide production is taken from USGS data.

Figure B2: Extractive activity of MNEs in our CbCRs sample



Sources: Rystad Upstream (oil & gas) & S&P Metals and Mining.
Notes: This graph shows the location of all extractive projects majority-owned by MNEs in our CbCRs sample. Mines and oil/gas fields can be at either the exploration or production stage.

Figure B3: Profitability per Asset and Effective Tax Rates by Country



Notes: The Y axis is the log-scaled pretax profit-to-asset ratio. The size of the points is a function of the total profits in the country. The black vertical dashed line indicates the average effective tax rate of tax haven countries, the orange vertical line indicates the average effective tax rate in extractive countries, and the green vertical line indicates the global effective tax rate. Effective tax rates are computed as the ratio between positive tax paid and positive profits booked across the whole period (2016-2023). Countries are broken down into extractive and non-extractive countries. A country is defined as extractive when at least one MNE has an extractive activity in the country. We only included observations with positive profits and tax accrued, as well as countries in which at least five companies are operating.

B Additional Results

Table B4: Elasticity of consolidated profits to commodity prices

	Profit (log)		Sales (log)	
	(1)	(2)	(3)	(4)
$P_{g(p)t}$ (log)	1.38***	1.28***	0.488***	0.439***
	(0.143)	(0.155)	(0.101)	(0.072)
Employees (log)		0.071		0.389***
		(0.179)		(0.070)
Assets (log)		0.512***		0.571***
		(0.146)		(0.093)
Observations	2,228	1,752	3,752	2,886
R^2	0.90489	0.90797	0.95808	0.97890
Within R^2	0.06539	0.09986	0.01790	0.33303
Year fixed effects	✓	✓	✓	✓
Group fixed effects	✓	✓	✓	✓

Notes: This table summarizes our estimates of the effects of commodity prices on consolidated profits using Compustat data. The outcome variables are consolidated profits and consolidated sales in US dollars. Standard Errors are clustered at the MNE level.

Table B5: Effects of Commodity Price Changes on Worldwide Activity - Weighted Price Index

	Profits (log)		Sales (log)	Taxes (log)	ETR	ETR (log)
	(1)	(2)	(3)	(4)	(5)	(6)
$P'_{g,t}$	1.21**	1.26**	0.482***	1.22***	-0.025	0.271
	(0.547)	(0.595)	(0.128)	(0.368)	(0.149)	(0.634)
Employees (IHS)		-0.058	0.072	0.031	0.027***	0.108***
		(0.035)	(0.068)	(0.039)	(0.008)	(0.039)
Tang Assets (IHS)		-0.012	0.057	-0.0003	0.0006	0.007
		(0.017)	(0.102)	(0.011)	(0.003)	(0.015)
Observations	209	209	236	230	177	177
R^2	0.88220	0.88317	0.97540	0.92722	0.66655	0.70558
Within R^2	0.03206	0.04001	0.07149	0.05386	0.03951	0.03344
MNE fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓

Notes: This table summarizes our estimates of the effects of a change in commodity prices on extractive MNEs consolidated financial figures, with an alternative measure of commodity prices being equal, for each firm, to the weighted average of the log of the prices of the commodities it extracts, weighted by the share of this commodity in total sales between 2010 and 2015. The outcome variables are consolidated worldwide pretax profits (columns 1 and 2), total revenues (column 3), corporate income taxes accrued (column 4), and the effective tax rate comprised between 0 and 1 (column 5 and 6). The outcome variables of columns 1-4 are log-transformed and measured in US dollars. The sample of column 5 and 6 only includes observations with an effective tax rate comprised between 0 and 1 at the consolidated level. Standard errors are clustered at the MNE level.

Table B6: First Stage of the Instrumental Variable Regression

	Consolidated Profits		Consolidated Profits (log)	
	(1)	(2)	(3)	(4)
$P_{g(p)t}$ (log)	10.9**	10.5**	1.31***	1.24***
	(4.29)	(4.16)	(0.481)	(0.467)
Observations	272	272	215	215
R^2	0.62408	0.62743	0.89321	0.89521
MNE fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on consolidated profits. The outcome variables are the amounts of worldwide profits in billion $ in columns (1) and (2), and the log of worldwide profits in columns (3) and (4). Standard errors are clustered at the MNE level.

Table B7: Decomposition Along the Value Chain

	Profits (log)			
	(1)	(2)	(3)	(4)
$P_{g(p)t}$ (log)	0.099		0.118	
	(0.209)		(0.212)	
$P_{g(p)t}$ (log) × Extract_{gi}	1.31***	1.25***	1.32***	1.26***
	(0.257)	(0.312)	(0.254)	(0.308)
$P_{g(p)t}$ (log) × Haven_i	0.515**	0.590***	0.509**	0.587***
	(0.198)	(0.185)	(0.200)	(0.187)
$P_{g(p)t}$ (log) × Refining_{gi}	-0.400	-0.306	-0.373	-0.294
	(0.437)	(0.373)	(0.430)	(0.371)
$P_{g(p)t}$ (log) × Downstream_{gi}			-0.202	-0.110
			(0.133)	(0.123)
Employees (IHS)	0.238***	0.242***	0.238***	0.242***
	(0.061)	(0.056)	(0.061)	(0.056)
Tang Assets (IHS)	0.079***	0.058***	0.079***	0.058***
	(0.028)	(0.016)	(0.028)	(0.016)
Observations	5,754	5,754	5,754	5,754
R^2	0.92749	0.93848	0.92750	0.93848
MNE-Country fixed effects	✓	✓	✓	✓
Year fixed effects	✓		✓	
Year-MNE fixed effects		✓		✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on pretax profits in different types of affiliates. The outcome variable is the log of profits at the subgroup (MNE x country level). Standard errors are clustered at the MNE level.

Table B8: Effects of Commodity Prices on Gains versus Losses

	Profits (log)		Losses = 1		|Losses| (log)	
	(1)	(2)	(3)	(4)	(5)	(6)
$P_{g(p)t}$ (log)	0.068		0.093**		-0.123	
	(0.209)		(0.046)		(0.347)	
$P_{g(p)t}$ (log) × $\text{Extract}_{g(p)i}$	1.32***	1.25***	-0.336***	-0.307***	-0.208	-0.457*
	(0.272)	(0.328)	(0.052)	(0.050)	(0.278)	(0.252)
$P_{g(p)t}$ (log) × Haven_i	0.536**	0.609***	-0.095*	-0.082	-0.003	0.040
	(0.206)	(0.197)	(0.056)	(0.057)	(0.476)	(0.467)
$P_{g(p)t}$ (log) × $\text{Extract}_{g(p)i}$ × Haven_i	-0.402	-0.374	0.350	0.303	-0.492	0.008
	(0.511)	(0.557)	(0.364)	(0.338)	(1.57)	(1.60)
Employees (IHS)	0.236***	0.241***	-0.017***	-0.019***	0.367***	0.343***
	(0.061)	(0.056)	(0.005)	(0.006)	(0.077)	(0.070)
Tang Assets (IHS)	0.080***	0.059***	0.004**	0.003**	0.061***	0.053***
	(0.028)	(0.016)	(0.001)	(0.001)	(0.020)	(0.017)
Observations	5,754	5,754	10,221	10,221	3,790	3,790
R^2	0.92751	0.93850	0.59523	0.60934	0.88098	0.89548
MNE-Country fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓		✓		✓	
Year-MNE fixed effects		✓		✓		✓

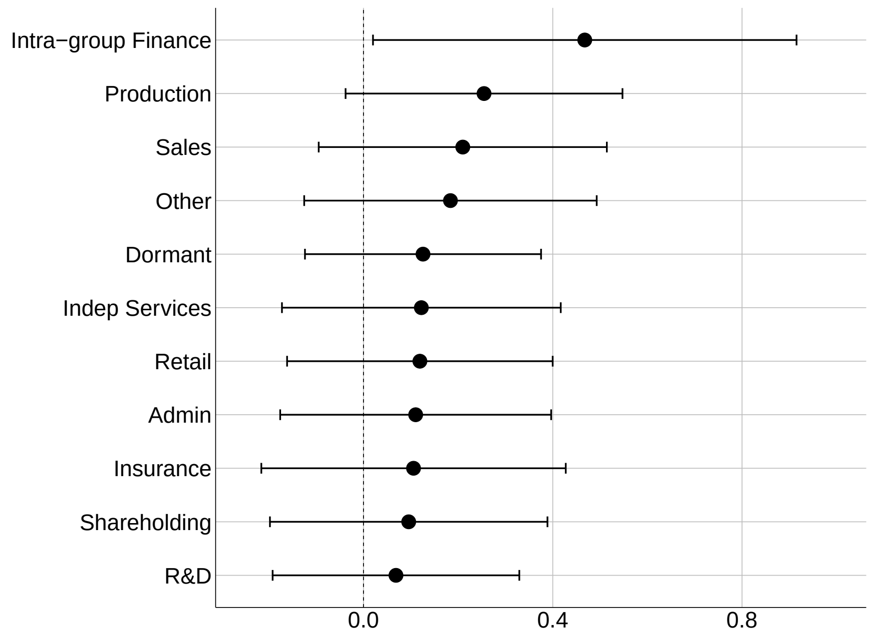
Notes: This table summarizes our estimates of the effects of an increase in commodity prices on profits in each country, with a comparison between gains and losses. Standard errors are clustered at the MNE level.

Table B9: Price Increases versus Decreases

	Profits (log)			
	(1)	(2)	(3)	(4)
$P_{g(p)t}$ (log)	0.073	-0.027		
	(0.210)	(0.178)		
$P_{g(p)t}$ (log) × $\text{Extract}_{g(p)i}$	1.30***	1.22***	1.24***	1.09***
	(0.261)	(0.288)	(0.315)	(0.405)
$P_{g(p)t}$ (log) × Haven_i	0.519**	0.641***	0.592***	0.635***
	(0.197)	(0.208)	(0.186)	(0.209)
$P_{g(p)t}$ (log) × Increase		0.009		0.077
		(0.010)		(0.224)
$P_{g(p)t}$ (log) × Increase × $\text{Extract}_{g(p)i}$		-0.002		0.004
		(0.012)		(0.013)
$P_{g(p)t}$ (log) × Increase × Haven_i		-0.007		-0.003
		(0.014)		(0.014)
Employees (IHS)	0.236***	0.262***	0.241***	0.233***
	(0.061)	(0.083)	(0.056)	(0.083)
Tang Assets (IHS)	0.080***	0.064***	0.059***	0.061***
	(0.028)	(0.022)	(0.016)	(0.020)
Observations	5,754	4,241	5,754	4,241
R^2	0.92751	0.94219	0.93850	0.94550
MNE-Country fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓		
MNE-Year fixed effects			✓	✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on profits in each country during commodity price increases and decreases. The outcome variable is the log of pretax profits. Standard errors are clustered at the MNE level.

Figure B4: Profit Price-Elasticity by Primary Activity



Notes: Each coefficient is the coefficient associated with the interaction of the MNE-specific commodity price with a set of dummy variables indicating the primary activity of the MNE in a given country. Error bars display 95% confidence intervals. Primary activity is defined as the activity with the largest number of subsidiaries. The reference point is intellectual property leasing. Regression includes controls for the IHS of the number of employees and assets, fixed effects at the group-country and group-year level. Standard errors clustered at the group level.

Table B10: Triple Difference-in-Difference - Sales

	Extra-Group Sales (log)		Intra-Group Sales (log)		Total Sales (log)	
	(1)	(2)	(3)	(4)	(5)	(6)
$P_{g(p)t}$ (log)	0.131	-0.002	0.387*	0.168	0.332	0.194
	(0.215)	(0.232)	(0.206)	(0.272)	(0.204)	(0.221)
$P_{g(p)t}$ (log) × $\text{Extract}_{g(p)i}$		0.348**		0.496**		0.313*
		(0.154)		(0.241)		(0.169)
$P_{g(p)t}$ (log) × Haven_i		0.263		0.441		0.388*
		(0.299)		(0.334)		(0.205)
Employees (IHS)	0.418***	0.418***	0.394***	0.393***	0.407***	0.407***
	(0.104)	(0.104)	(0.110)	(0.111)	(0.094)	(0.095)
Tang Assets (IHS)	0.101***	0.102***	0.052**	0.053**	0.086***	0.086***
	(0.029)	(0.029)	(0.024)	(0.024)	(0.027)	(0.027)
Observations	7,670	7,670	6,724	6,724	8,500	8,500
R^2	0.93030	0.93036	0.92473	0.92491	0.93015	0.93024
MNE-Country fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on sales in each country. The outcome variable is the log of extra-group sales (columns 1 and 2) and extra-group sales (columns 3 and 4). Standard errors are clustered at the MNE level.

Table B11: Triple Difference-in-Difference - Taxes

	Taxes Accrued (log)				
	(1)	(2)	(3)	(4)	(5)
$P_{g(p)t}$ (log)	0.467**	0.048	0.068		
	(0.195)	(0.210)	(0.212)		
$P_{g(p)t}$ (log) $\times$ $\text{Extract}_{g(p)i}$		1.08***	1.03***	1.02***	0.961***
		(0.201)	(0.210)	(0.240)	(0.253)
$P_{g(p)t}$ (log) $\times$ Haven_i		0.594***	0.510**	0.642***	0.553**
		(0.204)	(0.230)	(0.213)	(0.243)
$P_{g(p)t}$ (log) $\times$ $\text{Extract}_{g(p)i}$ $\times$ Haven_i			1.64*		1.66*
			(0.929)		(0.927)
Employees (IHS)	0.142*	0.140*	0.141*	0.160**	0.161**
	(0.072)	(0.072)	(0.071)	(0.071)	(0.071)
Tang Assets (IHS)	0.058**	0.061**	0.060**	0.039***	0.038***
	(0.025)	(0.025)	(0.025)	(0.013)	(0.013)
Observations	5,402	5,402	5,402	5,402	5,402
R^2	0.91119	0.91204	0.91210	0.92264	0.92269
MNE-Country fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓		
MNE-Year fixed effects				✓	✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on corporate income taxes accrued in each country. The outcome variable is the log of taxes accrued. Standard errors are clustered at the MNE level.

C Robustness

Table B12: Winsorized and Balanced Sample

	Winsorized Profits (log)		Profits (log)	
	(1)	(2)	(3)	(4)
$P_{g(p)t}$ (log)	0.432**	0.042	0.412**	-0.013
	(0.214)	(0.212)	(0.194)	(0.183)
$P_{g(p)t}$ (log) × $\text{Extract}_{g(p)i}$		1.34***		1.35***
		(0.254)		(0.254)
$P_{g(p)t}$ (log) × Haven_i		0.516**		0.691***
		(0.198)		(0.165)
Employees (IHS)	0.237***	0.237***	0.292***	0.292***
	(0.061)	(0.061)	(0.062)	(0.062)
Tang Assets (IHS)	0.076***	0.079***	0.045**	0.049**
	(0.028)	(0.028)	(0.021)	(0.020)
Observations	5,754	5,754	4,631	4,631
R^2	0.92622	0.92736	0.92400	0.92548
MNE-Country fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on profits at the country level. The outcome variable is the log of profits. Standard errors are clustered at the MNE level.

Table B13: Triple Difference-in-Difference with Weighted Average Prices

	Profits (log)				
	(1)	(2)	(3)	(4)	(5)
$P_{g,t}$	0.519**	0.133	0.123		
	(0.220)	(0.232)	(0.231)		
$P_{g,t}$ × $\text{Extract}_{g(p)i}$		1.36***	1.38***	1.30***	1.33***
		(0.241)	(0.250)	(0.281)	(0.294)
$P_{g,t}$ × Haven_i		0.458**	0.497**	0.516**	0.546***
		(0.215)	(0.211)	(0.206)	(0.206)
$P_{g,t}$ × $\text{Extract}_{g(p)i}$ × Haven_i			-0.758		-0.560
			(0.492)		(0.517)
Employees (IHS)	0.237***	0.237***	0.237***	0.241***	0.241***
	(0.062)	(0.062)	(0.062)	(0.057)	(0.057)
Tang Assets (IHS)	0.076***	0.080***	0.080***	0.060***	0.060***
	(0.028)	(0.028)	(0.028)	(0.016)	(0.016)
Observations	5,717	5,717	5,717	5,717	5,717
R^2	0.92626	0.92743	0.92745	0.93842	0.93843
MNE-Country fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓		
MNE-Year fixed effects				✓	✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on profits at the country level. The outcome variable is the log of profits. Standard errors are clustered at the MNE level.

Table B14: Instrumental Variable - Second Stage Results - Weighted Price Index

	Profits			Share in Profits			
	Tax Havens (1)	Extractive (2)	Other (3)	Tax Havens (4)	Extractive (5)	Other (6)	Tax Havens Non-Extrac. (7)
Conso. Profits	0.188***	0.909***	-0.079				
	(0.068)	(0.073)	(0.059)				
Conso. Profits (log)				0.147	-0.067	-0.069	0.416
				(0.090)	(0.092)	(0.104)	(0.255)
F-test (1st stage), Conso. Profits	22.205	22.205	22.205				
F-test (1st stage), Conso. Profits (log)				6.6243	6.6243	6.6243	7.0352
Observations	265	265	265	209	209	209	196
MNE fixed effects	✓	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓	✓

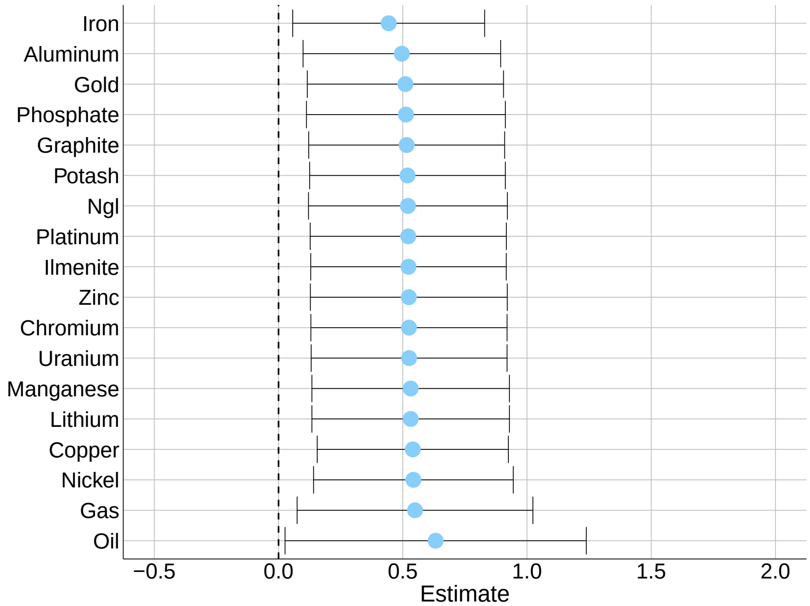
Notes: This table summarizes our estimates of the effects of an increase in consolidated profits instrumented by weighted commodity prices on the amounts of profits booked in tax havens, extractive and other subgroups (columns 1 to 3), and on the share of each category in total positive profits of the MNE (columns 4 to 6). Column 7 displays the share of tax havens in non-extractive profits. The data is aggregated at the MNE and subgroup level. It displays the result of an instrumental variable regression where the first stage is a regression of the amounts of consolidated profits (columns 1-3) or the log of consolidated profits (columns 4-7) on the log of the price of the commodity in which the MNE specializes in. Standard errors are clustered at the MNE level.

Table B15: Robustness, Lag of Price and HQ location

	Profits (log)		
	(1)	(2)	(3)
$P_{g(p)t}$ (log)	0.424**	0.072	0.070
	(0.200)	(0.169)	(0.210)
$P_{g(p)t}$ (log) $\times$ $Extract_{g(p)i}$		1.24***	1.31***
		(0.259)	(0.262)
$P_{g(p)t}$ (log) $\times$ $Haven_i$		0.554***	0.518**
		(0.191)	(0.197)
$P_{g(p)t-1}$ (log)	-0.105	-0.118	
	(0.137)	(0.149)	
$P_{g(p)t-1}$ (log) $\times$ $Extract_{g(p)i}$		-0.057	
		(0.120)	
$P_{g(p)t-1}$ (log) $\times$ $Haven_i$		0.158	
		(0.217)	
$P_{g(p)t}$ (log) $\times$ HQ_{gi}			0.007
			(0.066)
Employees (IHS)	0.260***	0.263***	0.235***
	(0.082)	(0.082)	(0.062)
Tang Assets (IHS)	0.063***	0.064***	0.080***
	(0.021)	(0.021)	(0.028)
Observations	4,241	4,241	5,738
R^2	0.94128	0.94219	0.92713
MNE-Country fixed effects	✓	✓	✓
Year fixed effects	✓	✓	✓

Notes: Standard errors are clustered at the MNE level.

Figure B5: Robustness, Leave-one-out



Notes: This graph shows our coefficient of interest (commodity prices interacted with a tax haven dummy) when removing commodities one after the other. The x-axis labels indicate which commodity is removed.

Table B16: Triple Difference-in-Difference, PPML

	Profits				
	(1)	(2)	(3)	(4)	(5)
$P_{g(p)t}$ (log)	0.866***	0.353	0.108		
	(0.201)	(0.309)	(0.313)		
$P_{g(p)t}$ (log) × $\text{Extract}_{g(p)i}$		0.555**	0.812***	0.598*	1.10***
		(0.232)	(0.306)	(0.332)	(0.312)
$P_{g(p)t}$ (log) × Haven_i		0.602	0.980**	0.334	0.992***
		(0.478)	(0.394)	(0.547)	(0.377)
$P_{g(p)t}$ (log) × $\text{Extract}_{g(p)i}$ × Haven_i			-1.51**		-2.34***
			(0.742)		(0.574)
Employees (IHS)	-0.024	-0.025	-0.026	0.041	0.042
	(0.039)	(0.039)	(0.039)	(0.082)	(0.083)
Tang Assets (IHS)	0.080**	0.081**	0.082**	0.058**	0.060**
	(0.034)	(0.034)	(0.034)	(0.025)	(0.025)
Observations	5,977	5,977	5,977	5,977	5,977
Pseudo R^2	0.93678	0.93708	0.93736	0.95847	0.95904
MNE-Country fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓		
MNE-Year fixed effects				✓	✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on profits. The outcome variable is profits. Standard errors are clustered at the MNE level.

Table B17: Alternative List of Tax Havens

	Profits (log)		
	(1)	(2)	(3)
$P_{g(p)t}$ (log)	0.457**	0.147	
	(0.212)	(0.195)	
$P_{g(p)t}$ (log) × $\text{Extract}_{g(p)i}$		1.24***	1.17***
		(0.250)	(0.304)
$P_{g(p)t}$ (log) × Haven_i		0.152	0.243
		(0.220)	(0.229)
Employees (IHS)	0.236***	0.236***	0.241***
	(0.061)	(0.061)	(0.057)
Tang Assets (IHS)	0.076***	0.079***	0.059***
	(0.028)	(0.028)	(0.016)
Observations	5,754	5,747	5,747
R^2	0.92644	0.92739	0.93837
Within R^2	0.07344	0.08552	0.06819
MNE-Country fixed effects	✓	✓	✓
Year fixed effects	✓	✓	
MNE-Year fixed effects			✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on corporate income taxes paid in each country. The outcome variable is the log of taxes accrued. Standard errors are clustered at the MNE level.

Table B18: Winsorized and Balanced Sample

	Winsorized Profits (log)		Profits (log)	
	(1)	(2)	(3)	(4)
$P_{g(p)t}$ (log)	0.432**	0.042	0.412**	-0.013
	(0.214)	(0.212)	(0.194)	(0.183)
$P_{g(p)t}$ (log) × $\text{Extract}_{g(p)i}$		1.34***		1.35***
		(0.254)		(0.254)
$P_{g(p)t}$ (log) × Haven_i		0.516**		0.691***
		(0.198)		(0.165)
Employees (IHS)	0.237***	0.237***	0.292***	0.292***
	(0.061)	(0.061)	(0.062)	(0.062)
Tang Assets (IHS)	0.076***	0.079***	0.045**	0.049**
	(0.028)	(0.028)	(0.021)	(0.020)
Observations	5,754	5,754	4,631	4,631
R^2	0.92622	0.92736	0.92400	0.92548
MNE-Country fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓

Notes: This table summarizes our estimates of the effects of an increase in commodity prices on profits at the country level. The outcome variable is the log of profits. Standard errors are clustered at the MNE level.

D Data Appendix

Cleaning of double counting in CbCRs data

Due to the initial unclear guidance of the OECD between 2016 and 2020, intra-firm payments of dividends are not always eliminated from country-by-country reports. As an illustration, income from a subsidiary located in Germany that is distributed to a holding company in Switzerland could be counted both in the profit measures of the German and the Swiss subsidiaries. This double-counting of dividends can distort key indicators of profit shifting, artificially inflating reported profits and leading to underestimations of effective tax rates, as dividends are generally not taxed under corporate income tax. Therefore, it is crucial to correct this double-counting of equity income, which might be particularly salient for fiscal years prior to 2020 (Delpeuch et al., 2019; Horst and Curatolo, 2020; Blouin and Robinson, 2023). We correct our data by matching CbCRs data to consolidated financial statements from Orbis and Compustat. The amount of double-counted profits is then defined as the difference between profits reported in CbCRs and consolidated data for each MNE. Table C1 shows the number of MNEs we correct each year and the amounts involved.

To allocate double-counting within MNEs, we use the information they disclose on the business activities of their subsidiaries. From this data, we know where MNEs locate their holding companies, and hence where dividends are susceptible to being sent. For each MNE, we select countries in which MNEs have a holding company as well as the headquarter countries, where dividends are usually repatriated, and remove a share of double-counted dividends for each MNE $\times$ country equal to the share of profits in this country in all profits of all countries having a holding company or hosting the headquarters.

Table C1: Double Counting per Year

Year	MNEs (Nb)	Intra-Group Dividends ($bn)	Uncorrected Profits ($bn)	Corrected Profits ($bn)	Dividends/Uncorrected Positive Profits (%)
2016	7	39.4	38.5	-0.9	21.7
2017	17	53.7	217.2	163.5	18.5
2018	11	67.4	278.4	211.0	21.3
2019	8	48.1	175.2	127.1	19.1

Notes: This table shows the total amounts of double-counted profits per year that we correct in the data. The procedure to treat double-counting is detailed in Section D. Firms don't report double counted profits in their public country-by-country reports, so there is no double counting post 2019.
Lecture: In 2016, 7 MNEs double-counted part of their profits, representing 39.4$bn of double-counted profits in total, or 21.7% of positive profits.