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Linked opacities: how fragmented transparency regimes undermine accountability in the extractive sector

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ABSTRACT

Firms and governments navigate a global economy with diverse networks of suppliers and intricate economic relationships. Yet, transparency standards are designed to record financial events as singular rather than relational. While critical accounting research has pointed out the limitations of transparency, we bring forward an overlooked critique: transparency standards generate siloed data that does not make systemic interdependencies transparent. We suggest that many financial practices are 'linked opacities', where the significance of each event is only clear when considered in conjunction with related transactions, figures or counterparties. This implies that transparency improves accountability for these aspects only if reported data is linkable. Such integrated thinking at the system-level of reporting regimes could lead to emergent accountability. We analyse whether existing frameworks can address linked opacities in a critical illustrative case of the extractive industries. We find that the potential for new transparencies into emergent issues such as corporate tax avoidance remains unfulfilled: current reporting regimes provide all the required data points for tax avoidance detection, but only 2% of the data – equivalent to 27 firms – can be linked across datasets.

1. Introduction

Concerns with negative impacts of corporate behaviour has led transparency to become a dominant global norm (Gillies, 2010; Mehrpouya & Salles-Djelic, 2019). The merits and effectiveness of transparency continue to be an area of discussion. Critical accounting scholars have long noted the deficiencies of transparency initiatives (Moore, 2018; Power, 1997; Roberts, 2009), and raised the question of how transparency could be re-designed for accountability rather than mere data proliferation (Dillard & Vinnari, 2019). Indeed, despite increasing available data, issues such as corruption, tax avoidance or environmental degradation continue. These accountability failures persist even in sectors where transparency initiatives are numerous and longstanding, such as the extractives sector (Cortese & Andrew, 2020; Finér & Ylönen, 2017). The puzzle therefore continues regarding what is lacking in transparency to increase accountability.

Previous research has debated and documented numerous issues in transparency regimes, from the broader principles (Moore, 2018; Power, 1997; Roberts, 2009) to the exact implementation (Ejiogu et al., 2019; Sovacool et al., 2016). One aspect has been overlooked in this critique. While it has been argued that the backward-looking nature of reporting fails to capture new developments in how capital is structured or how firms behave (Strathern, 2000); the debate on transparency reporting has so far failed to

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acknowledge the relational and networked nature of modern capitalism (Dörry, 2025). Work in political economy and economic geography has emphasized how contemporary economic activity is organized dynamically across spatially dispersed production processes and highly mobile financial structures (Gereffi et al., 2005; Seabrooke & Wigan, 2022). These complex networks of production and finance (Coe et al., 2014; Henderson et al., 2002) constitute a challenge for transparency and reporting standards which are not designed for the relational nature of economic organization. There is a mismatch between economic activities being highly networked and relational, and transparency into economic activities being designed for isolated and independent events, which generates siloed disclosures that can not make systemic interdependencies transparent.

We argue that many of the economic activities that are subject to accountability failures are what we term 'linked opacities'. Linked opacities are phenomena in which transparency into one domain (e.g., tax payments) is insufficient without simultaneous visibility into related domains (e.g., profits, ownership structures, or contracting practices). Each domain may have its own reporting regime, but successful transparency requires seeing them together. When firms shift profits between subsidiaries, or when government officials and CEOs collude to engage in corrupt contracting practices that give rise to personal wealth and corporate rents, these activities cannot be scrutinized at the individual level but must be understood from a relational analysis. For transparency to be successful in leading to accountability, standards must be transformed in ways that make them more dynamic and able to respond to emergent concerns and the relational nature of modern production and finance.

We make several contributions. Theoretically, we connect critical accounting scholarship on transparency with political-economy and economic-geography accounts of relational, networked capitalism, arguing that the failure of disclosures to add up is a structural feature of standards designed for siloed events rather than relational activities. Conceptually, we introduce *linked opacities* to capture phenomena such as cross-border profit shifting or corrupt contracting where accountability requires linking disclosures across multiple domains. Empirically, we test this claim in the extractive sector, a site of several existing transparency initiatives, by attempting to combine three transparency regimes that should, in principle, support detection of profit shifting. We show the data cannot be meaningfully integrated, reflecting a fundamental lack in the transparency regime. As a normative response, we propose greater modularity and interoperability across regimes to enable *emergent accountability*. Unlike critiques that focus on selective visibility or strategic disclosure, our analysis shows that accountability can fail even when disclosures are accurate, public, and audited, when transparency infrastructures are not designed to be relational.

The paper continues as follows. Section 2 introduces the concept of linked opacities and its basis in critical debates on transparency and accountability integrated with political economy and economic geography accounts of relational and dynamic economic organisation, illustrating how data infrastructures produces silos when an integrated economy requires modularity. The section ends on providing an illustrative descriptive account of linked opacities and data infrastructure in the extractive industries. Section 3 outlines the research design, data sources and case selection, and explains the analytical approach used to assess the integration of existing transparency data. Section 4 presents the results of the empirical analysis, demonstrating that combining three sources with thousands of companies, only 2% of the data results in a combined firm-country-year match. The extensive reporting in the sector is therefore too siloed to be combined for new insights on emergent issues such as corporate tax avoidance. Section 5 reflects on the broader implications for accountability, transparency design and emergent uses of accounting data. Section 6 concludes.

2. Background

2.1. Linked opacities

Contemporary economic activity is organized dynamically across spatially dispersed production processes and highly mobile financial structures (Gereffi et al., 2005; Seabrooke & Wigan, 2022). Capital does not merely flow through linear, traceable pathways but circulates, often changing in response to new regulations, tax incentives, or opportunities for regulatory arbitrage. Firms operate within complex and adaptive configurations of suppliers, subcontractors and intermediaries that can be rapidly reorganised (Coe et al., 2014; Henderson et al., 2002). Yet, this dynamic and relational nature of economic organization is rarely reflected by transparency and reporting standards, which have been an increasingly widespread norm in global governance, in the hopes that increased information will lead to better accountability (Best, 2005; Gillies, 2010; Mehrpouya & Salles-Djelic, 2019). Transparency is a key part of corporate governance (Calland, 2007; Florini, 1998; Hood, 2006), but has its limits. Among other critiques, the backward-looking nature of reporting standards has been emphasized (Strathern, 2000). Even as policy concerns and capital forms develop, transparency standards, much like economic statistics, are 'sticky', meaning they do not evolve with the phenomena they were designed to capture (Ergen et al., 2023; Mügge, 2022).

The networked and dynamic nature of global production and finance challenges transparency regimes by generating what we term *linked opacities*. These are aspects of economic activities where transparency into one domain is not complete without simultaneous access to information about another domain. Linked opacities are often upheld by long ownership chains where individual corporate units are situated in different jurisdictions (Castro & Seabrooke, 2026). An example of linked opacity is the use of transfer pricing by multinational corporations to shift profits between subsidiaries from high-tax jurisdictions to low-tax jurisdictions (Sikka & Willmott, 2010). Through this mechanism, the company can seem less profitable or even loss-making in the higher tax country, and the resulting lower tax payment is in compliance with the law. Any investigation into the firm that focuses on the individual country level would therefore conclude that the low tax is simply due to low profits. However, when viewed in conjunction with extraordinary high profits in other locations – perhaps places where the economic activities are minimal – would reveal strategic profit shifting for tax minimization purposes (Murphy, 2003). Other examples of linked opacities include any type of collusion, such as bribery for political or economic gains, or any circular movement of capital to obtain financial advantages, such as round-tripping FDI (Aykut et al., 2017) or

VAT carousel fraud (Sergiou, 2012).

Our argument is that there is a mismatch between economic activities being highly networked and relational, and transparency into economic activities being designed for isolated and independent events. The literature on transparency already highlights its limits. One chief concern is that transparency is never complete and in the process of making certain things transparent others are obscured. Trust in transparency can preclude "any discussion of institutional openness as necessarily contingent and partial" (Moore, 2018, p. 424). The process of making transparent involves active or accidental decisions about what gets shown and what does not, such that by deciding what is relevant to be shown, transparency conceals and reveals at the same time (Roberts, 2009). It is furthermore highly unlikely that all risks can ever be calculated and quantified in complex economic settings (Best, 2010).

Transparency is particularly ill suited to respond to a dynamic and rapidly changing global economy. Transparency is codified through pre-defined categories which agents need to report on or account for. These are pre-defined in the sense that transparency works backwards (Strathern, 2000), as we can only make transparent the 'known unknowns' – particularly in the case of numerical categories, though narrative reporting faces the tradeoff with comparison and aggregation. This is a weakness in any transparency regime, as these categories may be ill defined, wrongly chosen, or easy to manipulate. The concept of transparency projects an idea of everything being visible when in reality this is not the case (Roberts, 2009). Rather, what is being disclosed are specific and limited data points which will lead the discussion into exactly the areas they are designed to cover, reflecting negotiated interests and power structures (Cortese et al., 2010; Perry & Nölke, 2006). Moreover, these specific templates are not easily changed or updated, which makes transparency reporting standards 'sticky' once they are implemented, shaping potential courses of action as a form of infrastructure (Kurunmäki et al., 2019; Power, 2015; Star, 1999).

Our concern with linked opacities adds to the existing woes of transparency. Even if data quality and measurement is improved and correct, we point to the fact that context and connections between discrete figures is still lacking. Data which lack relevant context can make the economy *seem* more governable, but will ultimately prove more elusive (Kranke & Yarrow, 2019). Therefore it is important to critically evaluate the data and its usefulness, which has prompted recent research to debate the implementation and operationalisation of transparency standards (Smirnow & Cooper, 2026). In this paper, we build upon this concern with operationalization and point to the lack of integration between standards which suggests a missing aspect within the design or operationalization phase.

Transparency is often considered as a supply issue, neglecting to think about the demand-side: that is, everything that comes after reporting, including auditing and access to the data. As most transparency initiatives do not consider the accessibility and usability of the information produced (Moore, 2018), even areas with multiple reporting schemes will have very little effect on accountability when the data is never read, much less acted on (Heald, 2006; O'neill, 2006). The mere reporting of information is not enough to achieve a state of transparency (Holzner & Holzner, 2002). The recipients of the information need to be able to question the claims, as well as being able to use it or act on it (Heald, 2006; O'neill, 2006). Most transparency initiatives however do not consider these aspects of accessibility, intelligibility and usability of the information (Moore, 2018). Even if the data becomes accessible, this does not immediately make it actionable. The administrative capacity to enforce rules as well as acting upon data also varies across countries, with a risk of reporting standards becoming a 'box-ticking' exercise in low-capacity contexts (Tsingou, 2022). The information gained

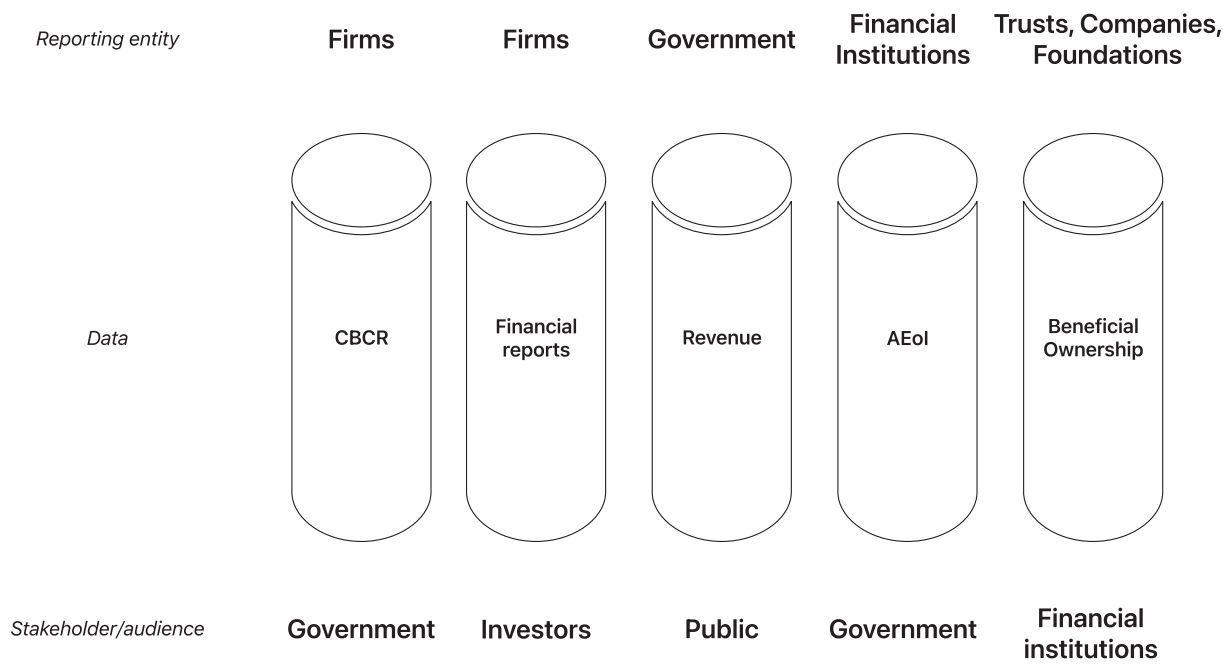

Fig. 1. Silos.
Source: Authors.

from transparency has no value if it is not put to use and should therefore be considered a necessary but not sufficient condition for accountability (Dillard & Vinnari, 2019).

Corporate tax avoidance, corruption, and other practices related to illicit financial flows using the 'offshore' finance system represents significant examples of linked opacities, as transparency into single units will not reveal systematic profit shifting or surprising transfers without systems-level scrutiny. At the same time, concerns with financial crime means that it is actually an area with a high degree of transparency, with many initiatives providing data. Fig. 1 summarizes in a stylized way the current transparency regime around tax avoidance and illicit financial flows. There are multiple standards where both firms and governments are reporting, with a clear directionality between reporting entities and stakeholders. Firms report country by country activities and tax payments, but only in certain sectors and above certain revenue thresholds. These reports are received by tax authorities but in most cases not made public. Firms also produce financial reports, which are public but implicitly addresses capital providers (Malsch, 2013). Governments publish budgets and reports indicating their tax revenue. Here, the public is the recipient and is meant to hold the government to account, which relies upon resources from civil society and media to use the data.

Concerns with the activities of firms, and what accountability is demanded for, changes over time. The strategies of capital evolve, and policy preferences change, leaving transparency and accountability to catch up. One example of an issue that has risen in salience is the tax avoidance by high net worth individuals and multinational corporations (Christensen & Hearson, 2019; Meehan, 2024). The phenomenon is particularly tied to the role of 'tax havens' and other 'offshore' spaces (Cobb, 1998; Fichtner, 2016; Hampton & Christensen, 2002; Ogle, 2017; Palan, 2006; Sharman, 2012), but also relates to accountants (Sikka & Willmott, 2010), multinational corporations (Otusanya, 2011), and corruption and money laundering (Compin, 2008; Sikka & Lehman, 2015). This has been discussed widely in accounting literature (Oats et al., 2025), including the role that transparency standards or voluntary disclosures may play in addressing these phenomena (Konovalova et al., 2023; Oats & Tuck, 2019; Ylönen & Laine, 2015).

This interest has led to new initiatives targeting tax avoidance. While some jurisdictions offering low taxes have been targeted through tax haven blacklists, this effectiveness has been questioned (Eggenberger, 2018; Stausholm & Garcia-Bernardo, 2024). Efforts have primarily concentrated on increasing transparency, with initiatives including beneficial ownership registration and automatic exchange of information, as well as country-by-country reporting (CbCR).

CbCR is a type of reporting that tries to address linked opacities by requiring comparable data across jurisdictions, enabling testing of whether transfer pricing is applied consistently or strategically used to increase profitability in low-tax jurisdictions. By requiring disclosure of key financial information for every country in which they operate, CbCR detects profit-shifting by making activity and reported profit in each jurisdiction readily comparable. In this way, CbCR is a relational transparency initiative, constructed so that the relative tax and profits in different jurisdictions can be compared. The OECD standard originated in 2015 explicitly states that "Taken together, these three documents (master file, local file and Country-by-Country Report) will require taxpayers to articulate consistent transfer pricing positions and will provide tax administrations with useful information to assess transfer pricing risk" (OECD, 2015, p. 9).

CbCR standards are becoming established, but far from all firms and sectors are subject to it, as application remains uneven (Chatzivgeri et al., 2020). Over time, these standards have gradually expanded in scope and coverage (Cobham et al., 2018), but they remain far from the maximalist vision originally proposed by Murphy (2003) (Crawford, 2017). In practice, most CbCR implementations are minimalist, disclosing only limited information and vary widely across jurisdictions and policy proposals (Wójcik, 2015), and with sectoral variation such as the very limited and partially voluntary standard for extractive industries originating through Publish What You Pay and EITI (Chatzivgeri et al., 2020; Lesage & Kaçar, 2013). Even when these initiatives have been incorporated into law, monitoring and compliance is lacking (European Commission DG FISMA et al., 2018).

While CbCR addresses the need for financial transparency across firm networks, it remains siloed away from other data, and often unobtainable to broader user bases. Data availability is a necessary component for accountability to wider stakeholders than the immediate recipient of the reporting. OECD CBCR is only shared with tax authorities of headquarter countries (Garcia-Bernardo & Janský, 2021), only some of which, such as the United States, are sharing their aggregated statistics with the public (Clausing, 2020; Garcia-Bernardo, Janský, & Tørsløv, 2021; Garcia-Bernardo, Janský, & Zucman, 2021) or exchanging them with other governments (Janský et al., 2021). In June 2021, the EU agreed that large MNCs would need to share their reports with the public, albeit only in an aggregated form and without a fully global country by country breakdown (Rusina, 2020), but compliance is uneven (European Court of Auditors, 2024; Monaghan, 2025). While some evidence points to positive effects of private CBCR (Joshi, 2020), Cobham et al. (2018) argue that fully public CBCR is essential to restoring transparency and accountability among multinational corporations. Even when publicized, 42% of reports fall short, with disclosures often restricted to the country of filing, restricted to EU-listed tax havens, or omitting key data such as profits (Fair Tax Foundation, 2026). Therefore, in practice, these initiatives may not reach their 'emancipatory' potential (Gallhofer & Haslam, 2019; Hackett & Janský, 2022).

Siloed and inaccessible data means that the challenge is inter-regime compatibility rather than (only) compliance within each standard. Dillard and Vinnari note that the typical approach to increasing accountability is to take current transparency and reporting frameworks and do 'a little bit more'. They argue that this is fundamentally not enough as accountability has to start with the question of accountability rather than be limited to existing frameworks, which come with a legacy of being addressed particularly to the interests of capital providers. However, we think there might be a scope for addressing new accountability questions and broadening the stakeholders addressed, by reorganizing current regimes in a way that integrates them rather than adds 'a little bit more'. This requires in particular thinking through the demand side and the actual data generated from transparency, ensuring data standards are practically designed to serve different analytical aims, while at the same time keeping the system flexible enough to allow incremental changes and new standards (Crawford, 2017).

2.2. Emergent accountability

The limits to transparency are especially important in that it undercuts the expected accountability. These concerns are exacerbated by the dynamics of a global economy where both power and accountability is more diffuse, without clarity on actionable sanctions on information (Grant & Keohane, 2005). Furthermore, in complex economic settings, there can be competing accountabilities (Moses et al., 2023). Dillard and Vinnari (2019) has pointed out the deficiencies in 'accounting-based accountability', in which financial stakeholders are prioritized and initiatives for increasing accountability is to just disclose 'a little bit more' within the same frameworks. The alternative they propose is accountability-based accounting, in which reporting frameworks are designed to meet the specific needs of a multitude of stakeholders in what they term a 'responsibility network' (Dillard & Vinnari, 2019). Such accountability is supposed to arise in dynamic ways, in response to emergent concerns.

Siloed disclosures, while useful for specific regulatory aims, cannot illuminate cross-cutting issues. Backward-looking static disclosures are also not useful for addressing emergent concerns that may arise in response to new policy preferences or changes in global economic patterns. However, by integrating information across domains and recognising how different opacities are connected in practice, transparency can become responsive to wider and arising accountability demands. We refer to this expanded, problem-driven orientation as *emergent accountability*: a form of transparency capable of addressing questions that arise not from predetermined reporting categories, but from the evolving concerns of diverse responsibility networks, using already existing data to address emergent issues and hold actors accountable. Changes to the infrastructure of reporting could improve accountability generally, as well as give opportunities for new insights.

New concerns continue to arise due to changes in policy preferences, new innovations in capital movements or shifting salience of economic activities. New concerns can be addressed through new initiatives, but these are costly, and produced with a time lag. Therefore we might think of ways that transparency can become more dynamic without sacrificing the stability and standardization that is core to the effectiveness of disclosures (Mügge & Stellinga, 2015; Parsons, 2019). Brunelli et al. (2021) underline the importance of integrated thinking for accountability. Just like the notion of integrated reporting recognizes the limitations of siloed reporting for organizations, we should think about the ways different transparency standards could feasibly complement each other at the macro scale. The reason why linking different opacities and integrating data across transparency regimes matters is that doing so enables transparency to respond to broader and emergent accountability questions. As Dillard and Vinnari (2019) argue, accountability increasingly arises from "responsibility networks" that extend beyond any single stakeholder, institution, or reporting mandate.

A more modular approach with combinable data across standards could increase accountability through the ability to generate emergent accountability: insights beyond what has already been designed for in siloed, sticky, backward-looking standards. This would enable existing reporting frameworks to speak to emergent issues based on concerns from diverse sets of stakeholders. Such usability of data is important for the value of transparency for end users, as also found by Smirnow and Cooper (2026). Fig. 2 illustrates how transparency data *could* form an integrated system if reporting regimes were designed using shared connectors that allow information to be combined across domains; an idea that we present metaphorically as Lego bricks. In this idealised representation, disclosures on tax payments, country-by-country reporting, contracts, beneficial ownership, financial statements, ESG, AML rules, and automatic exchange of information would interlock to create a coherent picture for firms, governments, investors, and the public. The point of the figure is not that current standards function this way, but that they *could*: if datasets were built with compatible identifiers,

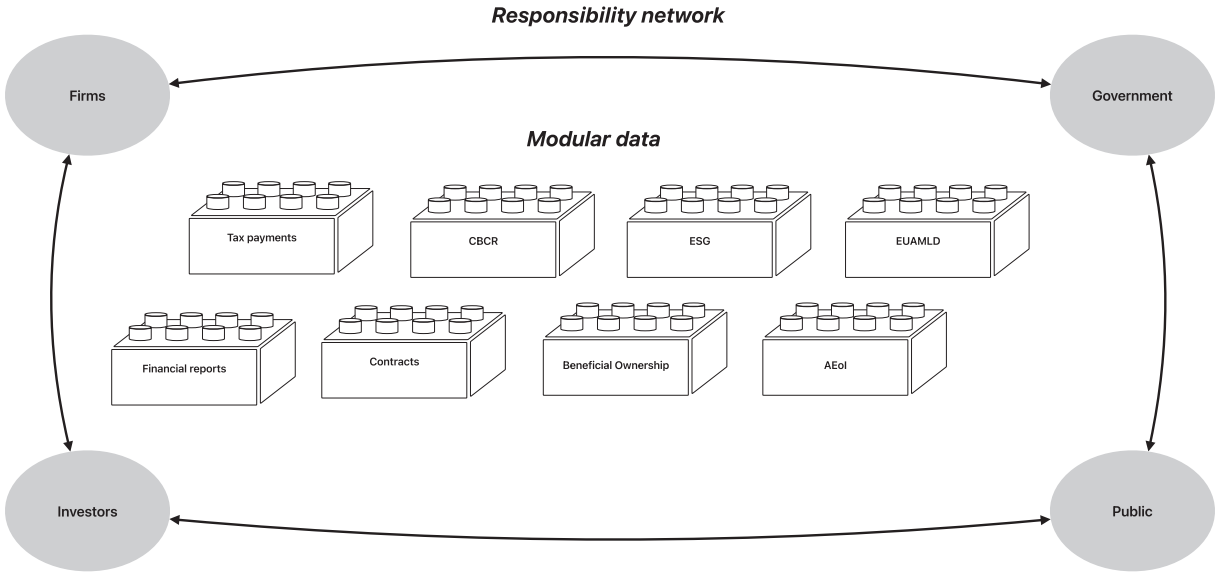

Fig. 2. Modular data for emergent accountability.
Source: Authors.

formats, and metadata, the pieces could be assembled into a more complete and relational view of economic actions and transactions. It visualises the potential of modular, interoperable design as an alternative to the present siloed landscape, with a higher potential of addressing linked opacities.

Achieving fully integrated reporting at the macro level would ideally require multilateral coordination and shared standards across jurisdictions, an ambitious and often unrealistic expectation. A more flexible path lies in improving the accessibility and modularity of existing data so that it can be combined and reused across different contexts. In such a model, primary reporting regimes can remain heterogeneous, with diverse standard setters and enforcement arrangements, while secondary initiatives focus on aggregating, cleaning, and publishing the data in more usable forms. This division of labour allows for meaningful integration without requiring uniformity at the level of reporting standards themselves. Practically, it is worth thinking through how technology and existing progress on data integration works in other private and public initiatives such as the register data of the Northern European countries, the EU initiatives for public sector data integration, and the private companies working with data integration for AI training purposes.

2.3. Illustration: linked opacities in the extractive sector

As a case of a sector with a wide number of transparency regimes, yet recurring accountability failures, we take the example of the extractive sector. Accountability is an acute concern here, as the high value of natural resources notoriously has been linked to enriching international and national elites through illicit financial flows while impoverishing local societies (Brugger et al., 2024; Leite & Weidmann, 1999; Mehlum et al., 2006; Sala-i-Martin & Subramanian, 2003). The concerning financial practices in the sector range from government corruption and embezzlement (O'Higgins, 2006; Sharman, 2017b) to corporate tax avoidance (Finér & Ylönen, 2017). The sector has a large number of transparency initiatives that address multiple constituents (Cortese & Andrew, 2020). In the following, we provide an illustrative mapping of three types of linked opacities in the sector, with salient cases drawn from investigative reporting used to exemplify mechanisms. We outline the linked opacities that are risked at different stages of the extractive sector life cycle; bribery and collusion for corporate rents, government misappropriation and embezzlement, and international corporate profit shifting.

2.3.1. Bribery and collusion for corporate rents

Mining contracts are negotiated between the firm and the government on a discretionary basis, with ample room for individual concessions for each mining company (Katz-Lavigne, 2017; Sayne et al., 2017). The discretionary and often secretive nature of these negotiations mean there is low accountability toward the public, and both government officials and mining firms may benefit. This can for example be through a vastly underprized mining license as in the case of the company Beny Steinmetz Group Resources (BSGR) and their acquisition of rights to exploit part of the Simandou mine in Guinea (I.C.I.J., n.d.). Also in the Democratic Republic of Congo (DRC), a number of offshore companies bought mining rights for at times less than 5% of the market valuation. The companies or assets were then purchased by Eurasian Natural Resources Corporation (ENRC) at a much higher price, which cost the DRC greatly and enriched those behind the deals (Ross, 2012). Alternatively, the terms of the contract can be settled with favourable fiscal conditions.

As these examples show, the negotiation of the contract may give rise to rents to the firm and provides a setting where corruption can occur. While government officials may grant favorable conditions simply on the basis of the perception of their necessity for investment (Bell & Hindmoor, 2014; Jaakkola et al., 2023), personal motives may also play a role. A prominent example of these practices is the case of Isabel dos Santos, daughter of the Angolan autocrat, who got handed public contracts, amongst others diamond-mining rights. She and her husband and business partners siphoned off the profits through shell companies and enriched themselves to the detriment of the country and its population largely living in poverty (Freedberg et al., 2020).

The deferral of mining rights is a case of linked opacities, as the actions of both the corporations and what conditions they have received, and the potential benefits that have accrued to government officials as a direct part of that process, are sensitive to conditions of secrecy. It is a two-sided negotiation, where the changed legal conditions and illicit finances may occur together, and are in fact inseparable.

The transparency regime offers only limited insight into either side of this linked opacity and no efforts are made to consider them together. While it is currently a requirement in the EITI framework, many contracts are still not made publicly available. A recent evaluation report found that 65% of EITI implementing countries do not disclose their contracts at all or only partially disclose them. Only 18% of countries provide a full list of contracts in their EITI reports, and most do not regularly provide information about contract amendments (Pitman & Menard, 2023).

If government officials have for example taken a bribe in the process of granting these concessions, these illicit funds require ways to launder and hide the money. This can be achieved for example through an offshore trust, shell company or real estate purchases abroad (Sharman, 2017a). Such kleptocratic officials are challenged by transparency initiatives in their ability to hide illicit financial flows offshore. Automatic exchange of information between authorities through the CRS and beneficial ownership identification and declaration through implementation of the FATF recommendations have made it harder to hide money offshore. Of course, if the officials hiding funds have leverage over the tax authority, even if information is received about their offshore accounts, no action might be taken. In terms of reducing cross-border deposits in offshore financial centres, studies have found that the CRS has been fairly effective (Ahrens et al., 2020; Ahrens & Bothner, 2020; Beer et al., 2019; Casi et al., 2020), though responses vary across jurisdictions (Crasnic, 2022). Here it must be emphasized that not all countries, and in particular not all resource rich countries are signatories of the CRS or have information exchange agreements with the most important partner countries (e.g. financial centres) in place. They hence might not benefit from this increased transparency.

2.3.2. Government misappropriation of funds

When the company pays the relevant taxes and fees to government as agreed in the contract, there are examples of these funds being misappropriated and used for personal wealth gain rather than it entering public budgets. One case of this is the DRC where NGO Global Witness reported that at least $750 million of the income the government received from mining companies between 2013 and 2015 disappeared due to corruption and mismanagement. These funds were meant to be used for public services but were used to enrich political elites and their allies instead (Jazeera, 2017).

The transparency regime for extractives has a long legacy of recognizing this as a linked opacity, as there are two sides to tax payment: the payment and the receipt. The EITI reporting framework therefore consists of independent reporting of the payment figure from firms and governments. The link to accountability through such linked revenue transparency becomes problematic as it hinges upon power and resources of civil society to use this information: "The concept of revenue transparency is simple: if citizens know how much their government gets paid for the extraction of the country's natural resources, it becomes much easier to monitor how the revenue is spent." (Oranje & Parham, 2009, p. 21). Whether the EITI limits corruption in member countries has been investigated with diverging results (Kasekende et al., 2016; Rustad et al., 2017). The EITI further only focuses on revenue collection and does not cover other corruption-prone areas such as contracting/procurement and expenditure (Kolstad & Wiig, 2009), though there has recently been a higher focus on contracts.

While the transparency standard here recognizes the relational nature of this domain in one instance, it only goes so far. The government receipt and the firm payment are two sides, but the next link in the chain is left unscrutinized. On one side, for kleptocratic officials, the next link in the chain may be the use of offshore financial services, with the accompanying issues of beneficial ownership and automatic exchange of information. As discussed above, these are not only a separate silo of data, but have limited implementation in many natural resource rich countries. On the other side, the tax payment by the extractive firms is not scrutinized. As an accountability mechanism, it is assumed that the firm payment is 'correct' and that any discrepancy is on the government side. However, it is impossible for observers to verify whether the company paid the correct amount of tax in the first place without access to the contractually agreed fiscal regime as well as the context of wider financial statements across the firms operations.

2.3.3. Profit shifting

During the operational time of an extraction project, profits accruing to the company may be shifted outside the mining country in order to minimize taxation. This occurs for example through transfer pricing, when a company uses prices in intra-group transactions to its strategic advantage (Ylönen & Teivainen, 2018). A landmark case in this regard was the Zambian Revenue Authority's case against Mopani Copper Mining plc, a Glencore-owned mining company. In May 2020 the Zambian Supreme Court ruled that the company must pay an extra tax of $13 million for abuse of transfer pricing rules. The Revenue Authority was able to prove that Mopani under-priced the copper sold to Glencore in order to reduce its taxable income in Zambia (Mvula et al., 2020). Under-reporting volumes would be an alternative way to extract additional wealth from a working mining operation. Evidence shows that tax havens together with local elites and professionals facilitate both tax evasion and avoidance (Otusanya, 2011).

Profit shifting through transfer pricing is a clear instance of linked opacities, as it is only possible to do *between* units. Transfer pricing refers to the prices multinational companies set for goods, services, or assets traded between their own subsidiaries. Because these internal prices can be adjusted within the firm, they can be used to shift profits into low-tax jurisdictions and costs into high-tax ones, reducing the overall tax bill without changing the underlying economic activity.

Profit shifting has traditionally been of little concern in the transparency regime for the extractive sector, as initiatives have focused on corruption concerns instead. However, profit shifting and tax avoidance issues have emerged as a concern for policymakers in recent years, not least after the highly publicized Panama Papers and other large scale leaks, which has led to new reporting standards for multinational enterprises through the OECD BEPS process. For extractive sector companies that surpass the revenue threshold in the OECD BEPS framework, they will need to report CBCR on a wide range of indicators, though these remain non-public. The tax payment for all other companies is recorded in accordance with EITI requirement 4 (or the equivalent standards implemented in law in for example the EU), but the tax paid is not enough of a data point to analyse whether the company is strategically minimizing taxes.

While the EU and OECD have recently implemented CBCR standards to ensure linked transparency between subsidiaries, the extractive sector was explicitly not targeted despite already having a tax reporting framework established through the EITI. The CBCR standard for the banking sector and the OECD CBCR standard for large multinationals are focused on detecting international profit shifting, targeting the firm, but the transparency standards for the extractives sector focuses on detecting government embezzlement and corruption, targeting the government. The EU CBCR standard for the financial sector originated in 2013 "to understand whether taxes are being paid where the actual business activity takes place" (Parliament & European Union, 2013, p. 18). In contrast, the EU extractives CBCR standard's objective was to "provide civil society in resource-rich countries with the information needed to hold governments to account for any income made through the exploitation of natural resources" (European Commission, 2013, p. 2). This illustrates the 'sticky' nature of standards, as the CBCR applied to the extractive sector mirrored the concerns from the earlier 'Publish What You Pay' (PWYP) and the Extractive Industries Transparency Initiative (EITI) voluntary CBCR disclosure for extractives companies and governments (Lesage & Kaçar, 2013). Even as tax avoidance rose on the agenda and policymakers became increasingly focused on this (Christensen & Hearson, 2019), this existing standard was not amended to include this new policy goal, and in fact frowned upon when civil society actors attempted to use these reports to target tax planning of MNCs, with the EU calling such attempts unintended consequences (European Commission DG FISMA et al., 2018).

As CbCR in the extractives industry, in contrast to banking, was not aimed at detecting profit shifting, and has not been updated to accommodate it, tax avoidance in the extractives sector is now not detectable. In the following, we test the extent to which these can be combined to generate bottom-up transparency into profit shifting.

3. Methodology

3.1. Case selection

The extractive industries are selected as a critical case due to the coexistence of extensive transparency requirements and persistent accountability failures (Cortese & Andrew, 2020; Finér & Ylönen, 2017). The sector is characterised by complex contractual arrangements, multinational corporate structures, and cross-border financial flows, while also being subject to multiple reporting initiatives targeting corruption, revenue management, and corporate conduct. This makes the sector particularly suitable for illustrating the prevalence of linked opacities and examining whether existing transparency initiatives can be meaningfully integrated.

We focus on tax avoidance detection as one linked opacity that is not addressed in the current transparency regime for extractive industries, despite its rise in political salience. We test whether the singular initiatives can be integrated in their current formats to obtain transparency into tax avoidance. We gather three forms of data and test whether these can be combined.

3.2. Research design

The argument in this paper is that siloed data structures lead to accountability failures for linked opacities, because these effectively fall outside of the transparency regime even in dense reporting contexts. One such example is tax avoidance: profit shifting between subsidiaries in high and low tax jurisdictions is a relational phenomenon which requires insights into multiple contexts to be detectable. In some settings, all of this data is in principle already available. The analysis therefore evaluates transparency regimes by testing whether the data they produce can be recombined to address accountability questions that emerge beyond the original design of individual reporting standards.

The empirical exercise operationalises our argument by testing the potential for integrating across three data sets, the combination of which would in principle provide information on the linked opacity of tax avoidance. The detection of tax avoidance requires triangulation of financial data with tax payments to calculate effective tax rate, and legal regime, to compare with the statutory tax rate. In the extractives sector there is no single regime that captures all three, but there are different initiatives which ensure transparency into all three of them, illustrative of the fragmented data landscape. The matching exercise tests whether the existing transparency infrastructure can supply that linkage in practice. The size of the resulting intersection is diagnostic of fragmentation, and a direct empirical test of the claim that transparency without linkage delivers visibility into some opacities, but not into the linked opacities that require multiple accounts.

3.3. Data sources

The empirical analysis of potential data integration draws on three primary categories of data. These data sources correspond to three distinct transparency regimes with different accountability targets and disclosure logics. Tax payment data, obtained from the EITI Complete Summary Data Table, compiles company-level and project-level payments reported under EITI requirements across multiple countries and years. Fiscal regime data, derived from publicly available extractive contracts collected in the ResourceContracts.org database, provides information on contractual fiscal terms. Corporate financial data provides information on profits and financial performance.

Corporate financial reporting also contains textual disclosures which would be available to researchers or stakeholders interested in the individual firm level. These narrative elements can provide important context for interpreting firm-level finances or structures, but they cannot resolve linked opacities that require linkage across entities/jurisdictions. Furthermore, such information remains difficult to integrate across datasets at scale. Consequently, while textual disclosures may enable detailed firm-level investigations, they do not readily support the cross-country and cross-firm matching required to address linked opacities at the systemic level. Our empirical exercise therefore focuses on structured financial data.

Taxes paid are covered by several initiatives, including the EITI (under requirement 4.1). The EITI web page provides this data for more than 50 countries. The EITI data provides an overview of company and project name, recipient country, type of payment (eg. royalties, corporate income tax) and value of payment in local currency and dollars. We obtain a summary database of payments reported under EITI for the period 1999–2017 from resourcedata.org (EITI Complete Summary Data Table, 2021). The database contains data on government revenues per revenue stream and company and includes payments of companies operating in 50 countries. It is generated from the EITI Application Programming Interface (API).

As the fiscal regime in the extractive sector is often determined not only by statutory law but also by discretionary arrangements anchored in contracts, details of these contracts are crucial. Statutory regimes can be found from analyzing the mining, investment and tax codes of countries. Not all contracts are publicly available, but they are increasingly becoming public as EITI requires this from member governments and firms (under requirement 2.4). These are collected in the data repository resourcecontracts.org. The fiscal regime for mining and extractive projects is not systematically collected in a comparable manner, though one project has provided a database of a subset of 21 countries and 104 contracts (IGF, 2019). In order to cast the widest net possible, we therefore focus just on whether contracts are available, though fuller analysis entail a secondary step of analyzing the fiscal regime in each contract. For contract availability, we use the resourcecontracts.org database (Resource Contracts 2021) as a source of information about fiscal regimes relating to transactions covered by the EITI database. The database contained 2590 contracts from 97 countries at the moment of our access (2021).

Information about profits is as a minimum needed within the country to calculate the domestic effective tax rate, but preferably

across all countries such that it may be determined whether profit shifting has occurred. All public companies are required to file annual reports of financial data to share with shareholders. Profit and income statements from these are collected by various sources, such as opencorporates.com and the Orbis database by Bureau van Dijk (recently acquired by Moodys). Both profits and tax payments would also be covered by the BEPS framework, but only if the firm is within the target group (having consolidated revenues of 750 million EUR or above), and the data has been made publicly available by the firm or a government. We use the Orbis database. We test what Orbis covers as a proxy for what an analyst could realistically obtain at scale, when manually compiling annual reports is infeasible.

3.4. Data integration and matching procedure

To assess the feasibility of integrating transparency data across regimes, we conducted a structured matching exercise aimed at linking tax payments to contract-level fiscal regimes and corporate profit data. Matching was conducted at the company level for each country, eliminating accidental matches when companies operate in multiple countries. Firms are matched across datasets when they share both country and either a name or a tax identifier number, or both; giving some flexibility to fuzziness in matching on names. Our aim was to provide the largest match rate as possible, while avoiding double counting.

The matching exercise practically consisted of the following steps. First, country names were harmonized, re-assigning country labels to ensure identical spelling (ie, Côte d'Ivoire/Ivory Coast). Countries that were in one dataset but not the other was dropped. Secondly, the company names in the contract data were split into separate company names, when joint ventures meant several companies were parties to the contracts. The third step consisted of cleaning these company names to lower case, removal of punctuation and spaces, removing legal suffixes (llp, ltd and similar). The fourth step removed accents from characters. Finally, the cleaned company names were reduced to distinct firm-country pairs, collapsing duplicates with several instances of the same firm in the same country into one single instance, so that a firm with operations in two different countries appears as two distinct firm-country observations.

The datasets also include legal identifier codes, though in different formats and conventions, such as national tax identifier codes versus OpenCorporates ID. These identifiers were cleaned: removing apostrophes, removing placeholder strings that would otherwise match different firms to each other (ie. 'Not Available'), and discarding strings shorter than four characters. Allowing matching when legal identifier matched but the name was not identical handles cases where a company has changed names or made typographic errors. Companies with same legal identifier but differently spelled names were collapsed into a single entity to avoid double counting. The resulting data consists of unique firm-country pairs in each of the two datasets on contracts and payments.

The matching was then done on these firm-country pairs, and counts as matching if a firm within the same country across the two files shares either a (cleaned) name or a legal identifier code, or both. Temporal consistency was ensured by verifying that reported payments occurred after the relevant contract was signed, dropping matches when all the payment data fell before the available contract was signed. The link between contract and payment is therefore assumed to hold when companies who pay taxes share a (cleaned) name or a legal identification number with a company that is party to a contract in a preceding year in the same country.

After completing matching between the tax payments data and the contracts, we check data availability for all matched firms in the Orbis database, by uploading a list of company names, country, and company legal identification number (when available). Orbis then

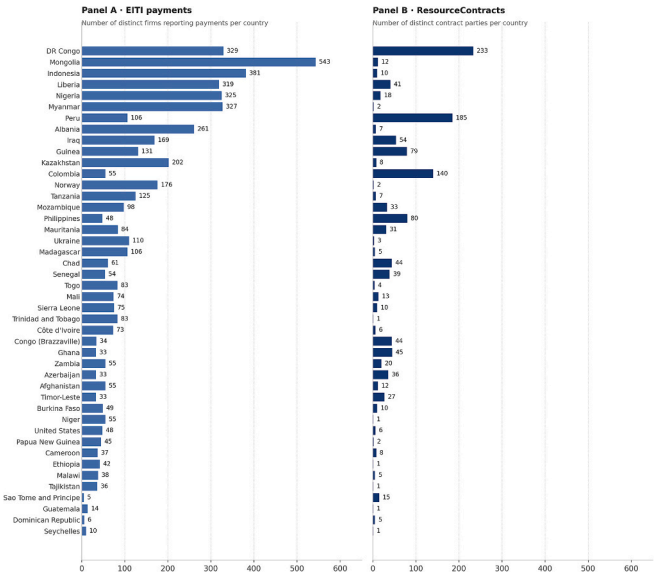

Fig. 3. Firm-country pairs in the EITI and ResourceContracts databases.
Source: Authors analysis based on EITI and ResourceContracts.

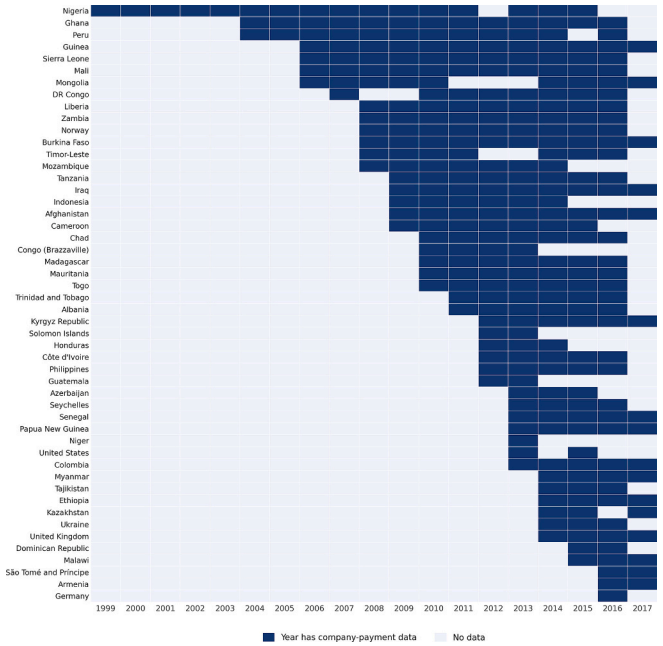

Fig. 4. Tax payments coverage of the EITI database.
Note: Dark cells represent years for which data from EITI are available for a given country.
Source: Authors' construction based on EITI Complete Summary Data Table (accessed 2021).

returned search results in the format of either exact matches, no matches, or a list of near matches in some cases. For the companies with near matches we manually chose the company name that was closest and was within the same country. If none were found or none was close, no match was recorded.

In the following, we report the results of the matching between the different databases.

4. Findings

As described above, tax avoidance has been a rising concern for policy makers but has not been explicitly integrated into existing transparency initiatives in the extractives sector despite the legacy infrastructure of tax payments reporting already in place in the sector. The existing transparency regime in extractive industries includes several stand-alone initiatives which provide access to all of the data points that are relevant to understanding and detecting corporate tax avoidance – a linked opacity which requires multiple data points. The data is reported in different formats from different sources, but firm and country names along with years should make them combinable. We evaluate whether such recombination is already feasible for the extractives sector by examining the existing multitude of reporting systems and data sources and assessing the extent to which they form a workable data ecology. We test the extent to which existing transparency between tax payments and contracts enable an overlap that can be held together with annual financial reports to generate systematic evidence of profit shifting.

First, we map the coverage of the tax payments database from EITI and the contracts database. In total the tax payments dataset covers 65,393 transactions between companies and government entities classified according to the Government Finance Statistics coding system. This is equivalent to 5343 firm-country pairs after data cleaning, 5026 of which are in countries also covered by the Resourcecontracts database. The Resourcecontracts database contained 2590 contracts from 97 countries at the moment of our access. Of these, 44 countries are also covered by the EITI database. This leaves 1745 potentially relevant contracts. This corresponds to 1307 unique firm-country pairs, as a small number of firms have a substantial number of contracts within the same countries. Fig. 3 outlines the data coverage by country.

As extractives projects can often take a decade of development before being profitable, it is necessary to have several years of data to get a good idea of the tax behaviour of the companies. The contract data provides a date for when the contract was entered into, and the relevant payment and financial data would be the data that falls after that date. The EITI data however has significant gaps in annual data. Fig. 4 folds out panel A of Fig. 3 to illustrate the country-year coverage of the database: dark cells mean that data are available. Data availability has clearly improved over time as data are becoming available for more and more countries, but it is still not comprehensive and, for many of the countries covered, data for specific years are missing. It is a challenge to tax avoidance detection that the mean number of payment years is only 2.37. In fact, 44.5% of firm-country pairs are only observed for a single year.

In the next step, we connect the contract and payments databases to identify matches. Combining the EITI and resourceontracts.org databases results in a low degree of overlap: Matching on company name, company identification number or both, results in 187 matches. This is equivalent to 3.7% of the available payment data and 14.3% of the available contracts. Fig. 5 shows the match rate by

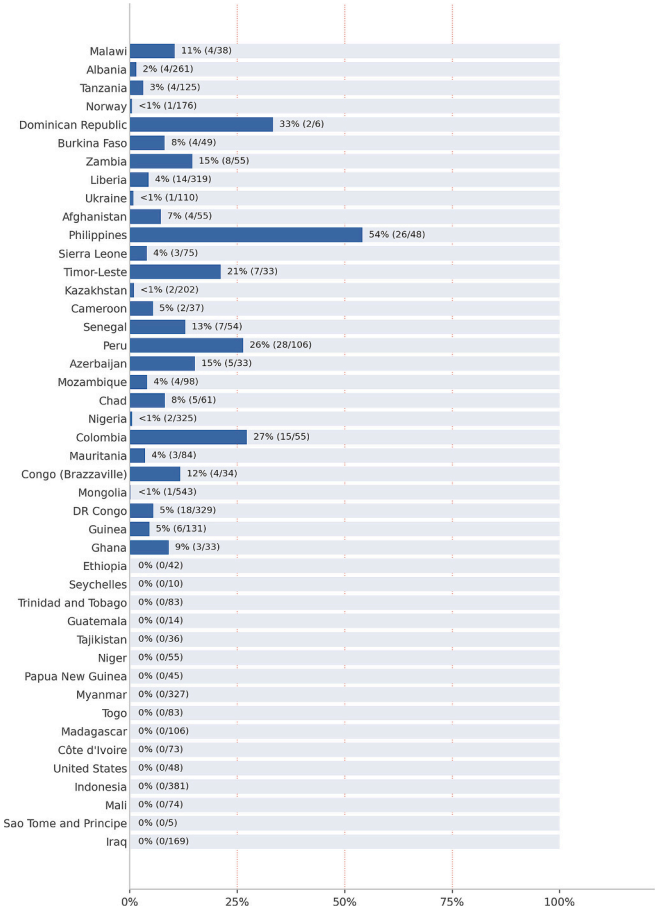

Fig. 5. Match between tax payments data and fiscal regime data by country.
Source: Authors' construction based on EITI Complete Summary Data Table (1999–2017, accessed 2021) and Resource Contracts (2021). Data shows how many of the firms in the EITI data is matched to a firm in the contracts data.

country, which makes clear that several countries fall out of the analysis at this point.

For these 187 companies, annual reports can be used to find measures of profits made. These are in principle available for all the companies but are not necessarily easily collected, since reporting formats differ, and the databases which compile them (e.g. Orbis) do not always have a comprehensive coverage of companies, particularly outside high-income jurisdictions and listed firms (Bajgar et al.,

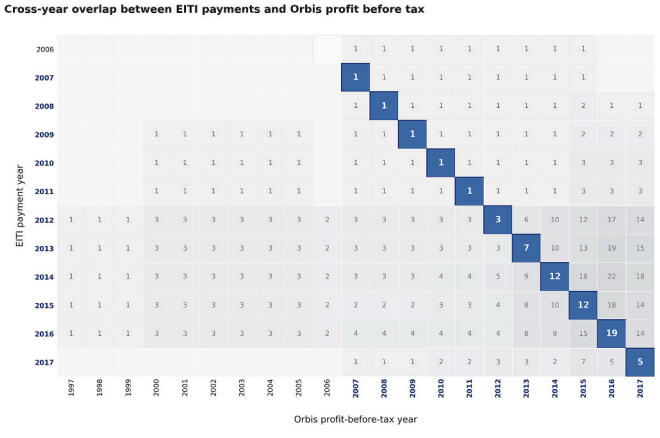

Fig. 6. Alignment of annual data in EITI tax payment data and Orbis profit data.
Source: Authors based on EITI and Orbis. The chart includes the firms that are present in EITI, Orbis, and in ResourceContracts.

2018). Searching for the matched companies on Orbis results in an immediate match for 107 companies, which we increase to 142 through manual checks. For these companies, we check the availability of financial data in Orbis. The data point needed to estimate profit shifting is profit before tax. 45 of the companies have data for at least one year. We check whether the data for profits is present for the same years as tax payment data (thereby matching not just on firm-country but on firm-country-year across the three data sources). The challenge there is that gaps in both datasets mean they do not necessarily align. Fig. 6 outlines the overlap between years available in the two data sources for the companies that overlap. Only 27 firms have any year where both an EITI post-contract payment and an Orbis profit figure are observed, and only 8 firms have overlapping data for three or more years. Two firms have an overlap of five years, and one firm has an overlap of 8 years. Fully estimating tax avoidance through profit shifting would also require data on these firms' foreign subsidiaries, to track whether profits had been channelled to other jurisdictions. The match rate at this stage, however, is already so low that the scope for extending the analysis further is limited.

In sum, even though transparency initiatives have led to a lot of data being available, including figures relevant to corporate tax avoidance in the extractives sector, the data is not sufficient to arrive at emergent accountability through modular transparency into tax avoidance. Starting from large datasets, the scope for large scale analysis was quickly reduced. First, identifying distinct firms in the contracts data reduced 2590 contracts to 1307 firm-country pairs within EITI countries. Of these, only 187 matched with the 5026 EITI payments firm-country pairs. Of these 187, only 27 companies had profit data covered in Orbis for matching years. Any analysis that would use all three sources to triangulate whether tax avoidance had occurred by comparing effective tax rate (taxes paid divided by profits) to statutory tax rate (in contract) could only find a sample of 27 firms, and only three firms, if at least five years of data should be required. The final match of 27 firms is equivalent to 2% of the largest potential match of 1307.

Despite existing standards holding data on thousands of companies, only very few remained in the overlap after matching. The significant lack of overlap is mainly because there are gaps in the data available and the different initiatives are not actively aligned. This underlines the sticky nature of transparency and reporting standards: once they are in place they may not be updated to fit new priorities, and because they are designed and governed by different bodies they do not match in ways that allows for flexibility and transferability across what they could potentially help monitor.

Our empirical section produces a diagnostic test of infrastructural failure. Matching is made harder by lacks in shared identifiers, but the primary reason behind the low match is simply missing data. Better implementation of the standards with higher reporting volumes in each initiative could provide a higher match rate in itself. However, it is worth noting that these would still require finding data from three different sources – not all free – and put in significant work to clean and match the data. If accountability rests upon transparency data actually being used, and on being combined in new ways to address emergent concerns such as tax avoidance, the existing fragmented framework is lacking. Even though more disclosure is available today than at any previous moment, the fragmentation of reporting regimes means the additional information increases complexity rather than generating clarity. This underscores that accountability through transparency depends not only on *more* data, but on *usable* and *linkable* data.

5. Discussion

By bringing insights from economic geography and political economy (Coe et al., 2014; Gereffi et al., 2005; Henderson et al., 2002; Seabrooke & Wigan, 2022) into debates on transparency in critical accounting, we can understand a previously overlooked limitation to transparency: The dynamic and relational nature of economic organization is rarely reflected by transparency and reporting standards, causing the problem of *linked opacities* – issues where transparency into one domain is insufficient without simultaneous visibility into related domains. While transparency initiatives such as the move towards CbCR is starting to recognize the relational nature of markets, most initiatives are designed to work in isolation. Moreover, despite high salience and political concern with the area of tax avoidance by multinational enterprises, CbCR for tax avoidance transparency has not been implemented in the extractive sector, even though there was already a legacy initiative for companies to report tax payments. This sector is already dense in transparency initiatives, which *should* provide the needed data to establish the extent of tax avoidance, but fail to do so. Our empirical test of the intersection between data sources shows that fragmentation is high, as only 2% of the data can be linked on firm-country-year basis. The current transparency without linkages drives visibility into some opacities, but not into the linked opacities that require multiple accounts.

Our paper follows in the line of many evaluations which have featured criticism of transparency initiatives generally and in the mining sector specifically, especially EITI. Ejiogu et al. (2019) suggest that EITI in some cases hinders further action on more effective accountability measures. Sovacool et al. (2016, p. 180) explain the standard's shortcomings with "the EITI's limited mandate, its voluntary nature, resistance by key stakeholders, and the absence of strong civil society actors in host countries." It is not the goal of this paper to reevaluate these efforts, but rather to point to a wider perspective on how accountability modes can be understood as interlinked, and how this informs the deficiencies of transparency regimes.

Dillard and Vinnari's (2019) question of how to design accountability systems that reflect the needs of relevant constituencies remains essential, as 'responsibility networks' shift over time as the dynamics of capital change and new forms of value extraction emerge (Gereffi et al., 2005; Seabrooke & Wigan, 2022). This temporal dimension requires transparency systems capable of responding to evolving users and concerns. Although accountability mechanisms differ, they all depend on data that are accessible, useful, and dynamically combinable across domains - particularly when the underlying problems involve linked opacities that transcend existing reporting boundaries (Dillard & Vinnari, 2019; Grant & Keohane, 2005; Rached, 2016). While dialogical accountability-based accounting remains a compelling normative ideal, it is difficult to enact given entrenched power asymmetries. We therefore propose a complementary, more feasible approach grounded in data modularity, which builds on existing accounting infrastructures but enables far more expansive uses of the information they generate. In this way, our proposal sits between accounting-based accountability and

accountability-based accounting, retaining the informational grounding of the former while enabling the more adaptive, constituency-responsive oversight envisioned by the latter. While accountability-based accounting as an objective means taking a starting point in the *issue* to be addressed, one could also imagine emergent concerns being met with new analysis of existing data rather than necessitate new reporting standards.

Modularity directly addresses linked opacities because it lets analysts cross the very domain boundaries that produce them. Although reporting standards tend to be "sticky," the proliferation of disclosure initiatives creates the possibility of treating reporting data as modular components. If data from different standards can be connected, linked, or recombined, then the absence of continuous regulatory updating becomes less constraining. What matters is not only the completeness of any single standard, but the availability of many interoperable pieces that diverse actors can assemble into new forms of insight. Such flexible data use could enable what we term emergent accountability. When responsibility networks change composition or new concerns rise in salience, modular data enables new insights before new regulation. In the extractives sector, better coverage and linkability in the existing transparency standards would have provided the potential to analyze profit shifting in this sector, even before a political consensus emerges on generating an accounting standard specifically for that purpose. This illustrates the ability of dynamic data to be used to address emergent issues, which may be increasingly important if multilateral politics is constrained in support.

The empirical fragmentation we observe reflects not merely technical incompatibility but the political–economic conditions under which these standards were developed and adopted (Botzem, 2014; Perry & Nölke, 2006). Public-sector data infrastructure has been a site of efforts toward interoperability. Initiatives such as EU's Data Act (2023) and Data Governance Act (2022), the cross-linked register data in Northern European countries (Connelly et al., 2016) and the Estonian ecosystem X-road (X-Road, 2024) may serve as frameworks for how interoperability can be achieved. Public sector data infrastructure is motivated by a coherent constituency with claims on legibility, whereas the users of private-sector accounting data are diffuse, and often without standing to demand integration. Public administrations also gain efficiency from interoperability, whereas the firms producing accounting data do not benefit from shared infrastructure.

Geopolitical tensions and shifting global power relations further reinforce the need for transparency systems that produce dynamic, relational insights. As states confront issues such as sanctions enforcement, evasion of trade restrictions, foreign control of strategic assets and the security of critical minerals, the ability to trace transactions across jurisdictions and organisational boundaries becomes essential. These developments also bring new accountability constituencies into focus, including security agencies, competition authorities and foreign policy actors, each of whom requires information that can link ownership, contracting, financial flows and corporate structures in ways that traditional siloed disclosures cannot support. Geopolitics therefore both amplifies and challenges the need for broad-based, modular data systems that can provide the relational visibility needed for accountability in an increasingly contested and interconnected global environment.

This also raises concerns about the political economy of data access. While data access does not necessarily need to arise from a multilateral effort, it remains important that data is made available to all potential stakeholders in diverse and shifting 'responsibility networks'. In that light, it is problematic that data is either reserved to governments and in a few cases, researchers, as with CBCR data. Still more problematic, a lot of important data is best accessed through private, for-profit companies such as Bureau van Dijks' Orbis database (recently acquired by Moody's). As discussed by Arndt (2023), this not only restricts many potential stakeholders from insight, but also generates a disincentive from the database owners to acknowledge shortcomings of the data, even when these are substantial (Heemskerk et al., 2018).

Data that should be a public good, and where greater availability would increase accountability, it is currently sitting behind paywalls. There is a strong case that this consolidation should instead be treated as a global public good, provisioned through the UN, OECD or EU, although any such initiative would itself face the political-economy pressures we have identified. The corporate capture concern also applies to considerations of using novel technologies to increase modularity of data or enhance the cross-comparability of textual elements in financial accounts. Experiments with blockchain based registries, distributed ledgers and digital identity frameworks suggest that technical infrastructures could, in principle, support the creation of shared identifiers, verifiable transaction trails and consistent reporting formats (De Silva et al., 2025; Lodhia et al., 2025). However, their actual potential remains uncertain and depends on political, institutional and governance choices rather than technological capacity alone. Evaluating these technologies in depth is beyond the scope of this paper, but we recognize that there are reasons to be sceptical about the potential for these tools to lead to increased accountability (Bernards et al., 2022).

It is tempting to respond to accountability failures in the extractive sector - and elsewhere - by calling for more data, whether through broader coverage or new indicators. Yet additional disclosure introduced into a fragmented system still produces fragmentation; more data without integration simply adds complexity, and complexity can obscure accountability just as effectively as opacity. A natural reaction is to imagine a single comprehensive mega-standard, but such harmonisation is neither realistic nor necessarily desirable, as smaller, issue-specific initiatives can bring agility and innovation without requiring global consensus, for example through incremental changes (Crawford, 2017). What we argue for instead is a model that allows new initiatives and indicators to emerge, while ensuring that all data are produced in consistent, modular formats with linkable identifiers and metadata. This would still be open to new social movement based initiatives shaping the ecosystem of transparency data (Crawford, 2017). This also works better against path dependence which would otherwise discourage updating regimes as political priorities shift. The extractive sector's reporting history illustrates this clearly. Even as tax avoidance became a central policy concern, the EU's extractives reporting framework remained frozen in its original mandate to monitor government behaviour, rather than redesigned to address the linked opacities between corporate units.

Modular data does not resolve the deeper political questions surrounding transparency itself. A broader concern here is not only the blank 'patches' in the transparency framework, but the lack of progress in regulating beyond transparency. Partial transparency risks

being worse than no transparency at all, if the existence of these initiatives shuts down consideration of alternative approaches (Le Billon & Spiegel, 2022). It is beyond the scope of this paper to evaluate whether this is a likely risk, but others such as Webb (2004) and Hakelberg (2020) have argued that transparency standards are a compromise constituting the lowest common denominator between business and political interests, when more comprehensive reforms fail. We can also note that transparency initiatives come with costs in terms of developing, maintaining, collecting, auditing and publishing data, which means it risks crowding out other use of those resources. Accountability also does not follow automatically from transparency even if standards are made interoperable and available to users. Accountability will still reflect power dynamics and rely upon the resources and sanction power available to constituents in responsibility networks. Just as individual standards may be subject to capture by political interests, there may also be pushback against initiatives to widen the usability of reported data (Perry & Nölke, 2006; Richardson, 2009).

Taken together, these reflections point to a common conclusion: accountability in complex and evolving political economies cannot be achieved through ever more data in siloed transparency regimes. Even if new regulation or market developments lead to more compliance and higher data quality within each standard, the inter-regime compatibility needs to be addressed. The problems we identify stem from the linked opacities that cut across contracting, ownership, financial reporting and taxation, and from the incompatibilities between the datasets meant to illuminate them. A modular approach to transparency, built on consistent identifiers and linkable formats, offers a practical way to support the shifting needs of diverse accountability constituencies while enabling new forms of insight to emerge as political, economic and geopolitical conditions change. Such an approach does not resolve every accountability challenge, but it creates the informational conditions under which multiple accountability pathways can function and adapt.

6. Conclusion

Economic activities are fundamentally relational, embedded in networks of subsidiaries, suppliers, financial intermediaries and ownership structures. Yet most reporting standards continue to render these relations invisible by organising disclosures around isolated entities, issues or accountability targets. Newer initiatives such as country-by-country reporting recognise the relational dimensions of profit shifting by requiring comparable data across affiliates, but such approaches remain unevenly implemented, sector-specific and inaccessible to many stakeholder constituencies. Meanwhile, legacy standards, such as the ones we evaluate, continue to generate incompatible datasets that cannot be integrated.

Our analysis started from three transparency datasets that together cover more than 600 million firms, 65,000 transactions and 2590 contracts. After matching firms across them and requiring overlap at the firm-country-year level, only 27 firms remained, of which three had five or more years of overlapping data. This collapse shows fragmented transparency in the extractive sector: Even with multiple long-standing transparency regimes in place, the sector's reporting infrastructure is insufficient to support cross-domain analysis. Our empirical illustration is in a transparency-rich sector, but one whose firms operate in jurisdictions that are underrepresented in commercial databases such as Orbis (Bajgar et al., 2018), and based on a 2021 vintage of the underlying data. Updating the analysis to a more recent year, or extending it to higher-income jurisdictions, would presumably yield a higher match rate. The point, however, is that linking these disclosures should not require this degree of manual reconciliation in the first place: if transparency is to be useful to stakeholders, the design must take users into account, enabling navigation of the data both within and across standards so it can be applied to emerging questions – also in low-income jurisdictions.

In this paper, we take the limits of transparency seriously while arguing that its usefulness can still be substantially improved. The concept of *linked opacities* clarifies why accountability routinely fails when domains are regulated, disclosed and audited separately. The empirical exercise shows that this fragmentation is real and persists in transparency-rich sectors. By framing modular, linkable data infrastructures as the response, we contribute a constructive pathway toward *emergent accountability* as a mode of oversight that can keep pace with shifting public concerns and evolving forms of capital movement. In doing so, it broadens how we understand both the limits and the future potential of transparency.

Accountability requires not just data, but rather informational conditions under which varied accountability mechanisms can function and adapt as economic practices and political concerns evolve. By reorienting transparency toward relationality, modularity and usability, it becomes possible to move beyond the limitations of existing regimes and support more effective and responsive forms of accountability. Linked opacities are a feature of a relational economy and understanding them is the precondition for any transparency regime that can keep pace with the political-economic conditions it claims to illuminate.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the authors used the AI tool 'Claude' (Opus 4.7) to check our code, identify problems in grammar and language, and to produce graphs (Figs. 3–6) based on data provided and checked by the authors. AI did not generate or edit the text, and the authors take full responsibility for the content of the article.

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Declaration of competing interest

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Data availability

Data will be made available on request.

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