Firm's occupational health and safety and employees' accidents in the oil and gas industry

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April 2024

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Employee accidents' determinants and association with assurance: International evidence from the oil and gas industry

Synopsis

The research problem

Implementing an occupational health and safety (OHS) system can demonstrate a firms' commitment to employees' safety and the improvement of working conditions. We explore the practices of the international oil and gas industry, a hazardous industry, focusing on the association between the presence of an OHS system and (i) the level of employee accidents of a firm and (ii) the likelihood of a firm deciding to assure its sustainability report.

Motivation

Lack of an adequate OHS system can adversely affect employees' lives and lead to considerable costs for firms. Moreover, accidents in the oil and gas industry may have disastrous environmental consequences.

The hypotheses

We test whether the existence of an OHS system is negatively associated with the number of accidents that occur in a firm and whether the existence of an OHS system is positively associated with the assurance of the firm's sustainability report.

Target population

We analyze a large sample of oil and gas firms, which includes 659 yearly observations of oil and gas production firms from 2015 to 2019. The observations correspond to 158 unique firms with headquarters in 15 different countries.

Adopted methodology

We test the first hypothesis by using a pooled Poisson model. We start our tests of the second hypothesis using a pooled logit regression. To extend the analysis of H2, we performed a mediation analysis and an ordered logit.

Analyses

Most of the analyses are performed on the entire sample. To consider that firms from four countries comprise more than 75 percent of the sample, we run an additional analysis, estimating fixed effects models, and studying subsamples.

Findings

This study has two main findings. First, oil firms with an OHS system report a significantly lower number of employee accidents. Second, oil and gas firms with an OHS system are more likely to seek assurance for their sustainability reports. These findings are robust to several alternative specifications. Looking closer to the relationship between the existence of an OHS system and assurance, we find that (i) this association is stronger when firms have developed their own OHS system and (ii) OHS-related topics have been assured.

Keywords: Key performance indicator (KPI); environmental, social, and governance (ESG); Assurance; Health and safety (H&S); sustainability.

JEL Classification: M41, J28, C10.

1 Introduction

The importance of human safety has increased significantly in recent decades, as reflected in several policy papers and international guidelines and regulations. In the US, a report by the Sustainability Accounting Standards Board (SASB, 2014) suggested that a lack of adequate occupational health and safety (OHS) management could adversely affect employees' lives and lead to considerable costs for firms. In 2016, when the UK's population voted to leave the European Union (EU), one of the few policy areas earmarked for safeguarding in future years was human rights and social protection (Scottish Human Rights Commission, 2016). More recently, in 2022, the International Organization for Standardization (ISO) reviewed the ISO 45001 standard for occupational health and safety management systems, providing updated requirements and guidance.

The Deepwater Horizon oil rig disaster in 2010, which killed 11 workers and released almost five million barrels of oil into the Gulf of Mexico, is a sobering reminder of how accidents have serious effects on workers and their families, as well as their employers, government, and the wider society. Moreover, the fact that safety-related offenses represent half of all regulatory violations in the US since 2000 (Violation Tracker, 2024), indicates that safety matters are a significant problem for firms.[1]

Law firms' health and safety experts believe that "organizations cannot ignore the fact that public and political appetite to hold organizations to account for their safety and health failings continues to grow" (Pinsentmasons, 2021, p.2). In the UK, the Health and Safety Executive (HSE) estimated that the total cost of self-reported workplace injuries and ill

[1] Violation Tracker categorizes violations into nine categories. The number of safety-related offences, since 2000, was 313,921 (on 17th Apr 2024 - https://violationtracker.goodjobsfirst.org/)

health, for new cases of the year 2019/20, was £18.8 billion.[2] In the US, the National Safety Council (NSC) estimated that the cost of work-related injuries in 2021 was $167 billion.[3] Thus, it should not come as a surprise that, in many companies, the number of accidents reported is an important non-financial key performance indicator (KPI), and "safety and security" is the most common specific KPI related to environmental, social, and governance issues (ESG) included in executives' compensation (Cohen et al, 2023).[4]

Employees' health and safety are critical to a firm's sustainability strategy, since employees are one of the most important stakeholder groups and many view human capital as the "most important asset" of a business (Batish et al., 2021).[5] In this study, we explore the sustainability practices of the international oil and gas industry, focusing on the existence of an occupational health and safety system. Specifically, we examine whether the existence of an OHS system is associated with the number of employee accidents and firms' decisions to assure their sustainability reports. According to the international standard in place during the time of our analysis (Occupational Health and Safety Assessment Series - OHSAS 18001), an OHS system is a structured management system that "enables an organization to develop an OH&S policy, establish objectives and processes to achieve the policy commitments, take action as needed to improve its performance and demonstrate the conformity of the system to

[2] These costs include only new cases of work-related ill health and self-reported injuries, and exclude pre-existing cases, to represent the costs arising from current working conditions. This is reported at https://www.hse.gov.uk.

[3] A breakdown of this value is presented at https://injuryfacts.nsc.org/work/costs/work-injury-costs/.

[4] Cohen et al. (2023) report in their Table 2 that 10 percent of their observations include this KPI in their executive's compensation. The second most common KPI is "other environmental", and the third is "employee satisfaction and development". KPIs are measures used to assess the activities that an organization sees as important to the achievement of its strategic objectives (AICPA, 2013).

[5] Recognizing the importance of human capital, the Securities and Exchange Commission (in the US) mandated a new disclosure requirement for registrants to provide a description of human capital resources "to the extent such disclosures would be material to an understanding of the registrant's business" (SEC 2020, Item 101(c)). This was effective on November 9, 2020, and thus does not affect our analysis.

the requirements of this OHSAS Standard."[6] Thus, the goal of this system is to develop and implement an OHS policy and manage OHS risks.

Many firms report KPIs that are "specific to their industry or company" (Givoli et al., 2019). Although the importance of employee accidents is not restricted to the oil and gas industry, we contend that the potentially high-risk impact associated with this industry on employees' health and safety (PSE, 2016; NSC, 2019; HSE, 2020) makes it an ideal setting for our study. For example, after the Deepwater Horizon disaster in 2010, President Obama called for "better regulations, better safety standards, and better enforcement when it comes to offshore drilling" (Office of the Press Secretary, 2010).[7] According to a SASB report (2014), employees working for oil and gas firms suffer many occupational dangers, and the world's five deadliest offshore oil accidents claimed 546 lives, while the five most expensive accidents represented almost US$3 billion. Recently, Shell has been fined more than one million GBP after an offshore worker's feet were crushed on a gangway (BBC, 2023). Therefore, it is vital that oil and gas firms disclose OHS information in their reports. In Appendix A, we present some examples of these disclosures. Det Norske Veritas, one of the biggest assurance firms in oil and gas industry projects (2017, p.2), asserts that "there is regulatory concern globally over oil and gas major accident risks."

Given these circumstances, firms should focus on improving global safety standards and avoiding accidents, as these will affect their social performance. Moreover, fewer accidents should reduce financial costs, such as payment for damages, lost productivity, insurance premiums, wage differentials, and non-compliance fines, as well as non-financial

[6] In 2018 a new standard was issued (ISO 45001) by the International Organization for Standardization, and firms were given three years to transition. The main difference between the two standards is that "ISO 45001 concentrates on the interaction between an organization and its business environment while OHSAS 18001 was focused on managing OH&S hazards and other internal issues" (ISO, 2018)

[7] Later, investigations concluded that this disaster was avoidable and was caused by an overall lack of safety culture (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011, p. vii), and the evidence from the Commission indicated that BP suffered from a lack of ethical and safety standards.

costs, such as loss of reputation (Wei, 2007; Caskey & Ozel, 2017; Christensen et al., 2017; Johnson, 2020; Cohn et al., 2021). However, creating an OHS system and implementing its policies can be expensive, and may entail the recruitment and training of personnel, the development and maintenance of infrastructure, the monitoring of the correct application of the OHS system, and decreased productivity (Cohn & Wardlaw, 2016; Caskey & Ozel, 2017; Christensen et al., 2017; Cohn et al., 2021).[8] Moreover, oil companies extensively use insurance (Torraca & Fanzeres, 2021) and share resources to clean up oil spills (Dekel & Scotchmer, 1990). Both mechanisms reduce the financial cost of accidents and may reduce the incentives for firms to be (more) stringent with respect to the implementation of an OHS system. Thus, it is an empirical question which motivation dominates a firm's actions.

In this study, we analyze a large sample of oil and gas firms, which includes 659 yearly observations of oil and gas production firms from 2015 to 2019. Our sampled firms have headquarters in 15 different countries, enabling us to obtain a worldwide perspective on the existence of OHS systems, assurance practices, and their connection to the disclosure of employee accidents.

Our initial results provide evidence of a significant and negative relationship between the reported number of employee accidents and having an OHS management system, suggesting a real benefit of implementing these systems. Descriptive evidence shows that the number of firms in our sample with an OHS system increased significantly during the study period, indicating that firms prefer to implement these systems to support the financial and reputational costs of having employee accidents.

[8] Furthermore, some evidence also suggests that investments in safety may take a long time to pay off, thus creating a short-term vs. long-term tradeoff (Bernstein & Sheen, 2016; Cohn & Wardlaw, 2016; Cohn et al., 2021; Raghunandan & Ruchti, 2022)

Next, we investigate whether the existence of an OHS system is associated with a firm's decision to seek assurance for its sustainability report. Our results indicate that the likelihood of assurance in firms with an OHS system is higher. Additional analyses allow us to better understand this association. First, we find that this association is direct and not mediated by the occurrence of accidents in a firm. Second, we provide evidence that this association is stronger when firms have developed their own OHS system, suggesting a greater need to increase the legitimacy of the information disclosed, given that the system was not acquired from a third party. Third, we find that this association is due to cases in which OHS-related topics have been assured. Finally, we provide evidence that this association is not present when the assurer is one of the Big4 firms, suggesting that firms concerned with OHS issues tend to hire more technically oriented assurers.

This study contributes to literature in at least three ways. First, we address the lack of international evidence on the determinants of employee accidents, an important non-financial KPI. Indeed, many have emphasized the need for further studies on issues related to OHS and employee accidents (e.g.: Campbell & Shang, 2022), and the literature often focuses on the US (e.g.: Caskey & Ozel, 2017; Christensen et al., 2017; Johnson, 2020; Shi et al., 2021). Second, to the best of our knowledge, no study has previously addressed the association between the presence of an OHS system and the assurance of sustainability reports (including which type of assurer is chosen by the firms). By addressing this gap, we extend the literature on the association between risk disclosures mandated by financial accounting standards and the characteristics of auditors (e.g.: Bozzolan & Miihkinen, 2021), to the area of non-financial disclosures and the use of auditors for the assurance of sustainability reports. Finally, we focus on an industry relevant to the topic we study, as peer benchmarking has the potential to help achieve ESG objectives (Leuz, 2023).

The findings of this study are of interest to employees, regulators, and socially responsible investors. For example, employees should verify the existence of adequate health and safety procedures to protect their safety and well-being before joining oil and gas firms. They may accomplish this by evaluating disclosures related to health and safety information in firms' non-financial reports. Looking at accidents is a way for stakeholders to focus on an issue that has clear externalities and is not probable to be used as a "red herring" in disclosure – these are two of the main criteria that Leuz (2023) mentions in his talk about how we can leverage transparency for the betterment of society.

The remainder of this paper is organized as follows. The next section presents an overview of the theoretical framework and proposes hypotheses related to the available literature. The methods used to test our hypotheses are described in Section 3. Section 4 describes the sample selection process and discusses the empirical findings. Finally, in Section 5, conclusions are presented.

2 Literature review and hypotheses development

In this section, we briefly outline stakeholder theory, which is the basis of our study, critically review the extant literature, and state our hypotheses.

2.1 Theoretical background

Stakeholder theory focuses on the relationship between firms and stakeholders (Gray et al., 1997; Roberts, 1992). Freeman (2010, p.46) described stakeholders as "any group or individual who can affect or is affected by the achievement of the organization's objectives." Thus, the term 'stakeholders' includes owners, shareholders, employees, customers, the supply chain, communities, and government bodies. Firms may act and disclose their non-

financial information, including OHS information, as a method for securing benefits for stakeholders who are affected by their actions.

According to stakeholder theory, the more that a firm acts 'responsibly' and engages in social and environmental protection activities, the greater their growth and profit are likely to be (Busch & Hoffmann, 2011). These potential consequences may explain the tendency of firms to disclose information about their OHS procedures as part of a communication strategy with stakeholders. Crucially, firms with a high level of visibility tend to be subject to more stakeholder scrutiny than others (Schreck & Raithel, 2018), and publicly available information, such as non-financial disclosures, as an initial point for engagement with diverse stakeholders (Dierkes & Antal, 1986).

The need for sustainability information is theoretically supported by Freeman's (2010) corporate policy model, which emphasizes the creation of acceptance among stakeholders, whose favorable opinion is required for the firm to continue as a going concern: the so-called 'license to operate'. Consequently, the duties of management should encompass an evaluation of stakeholder demands and needs (considering the firms' strategic goals), bearing in mind that the stronger the power, legitimacy, and urgency of stakeholders' demands (Mitchell et al., 1997), the greater the need for compliance with stakeholders' expectations.

Increased disclosure is required when stakeholder resources are critical for businesses. Ullmann's (1985) theoretical model considers (1) a stakeholder's control over resources required by the firm, (2) the firm's stance towards corporate social responsibility initiatives, and (3) the firm's historical and present economic performance. Applying Ullmann's (1985) theory experimentally, Roberts (1992) concluded that the greater the level of power possessed by stakeholders, the more an effective strategic approach toward stakeholders is needed, resulting in greater disclosure of non-financial information.

Accordingly, it is possible that oil and gas firms, subject to the influence of their stakeholders, attempt to reduce the number of employee accidents reported in their OHS disclosures by strengthening their OHS measures and providing the necessary training for their employees. Moreover, firms with an OHS system may desire to avoid stakeholder pressure and preserve a positive image by seeking external assurance for these disclosures. Our expectations are aligned with Ntim (2016), who argued that legitimacy is the central reason why firms in Sub-Saharan Africa may engage in and disclose information about their practices related to corporate health accounting.

2.2 Development of hypotheses

2.2.1 The association between OHS and employee accidents.

OHS is essential in assessing a firm's sustainability policy (Cadbury, 2006) and demonstrating a firm's commitment to the continual improvement of working conditions (Tsalis et al., 2018). Several issues can lead firms to implement an OHS: pressure from stakeholders, interest in having a good reputation, desire to avoid productivity losses (or production pauses), and lower payments to insurance companies, among others. On the other hand, OHS systems are expensive to implement and maintain, and may also lead to productivity losses (as workers receive training and implement new measures). While we can debate whether firms will decide to implement an OHS system, once they implement it, managers should only maintain it in place if they see its benefits.

Given the importance of employee accidents as a key performance indicator, we believe that managers will use this metric in their decisions. Numerous studies have shown that organizations with a stronger safety culture are less likely to disclose work-related injuries than those with a poorer culture (e.g.: Probst et al., 2008; Raghunandan & Ruchti, 2022). For example, Christensen et al. (2017) found that the introduction of mandatory safety

disclosures was associated with a 13 percent decrease in injuries in mines in the US. While it is possible that the reduction in accidents reported in these studies may be caused by firms withholding information, we believe that a stronger safety culture and the extra attention that comes with a regulatory intervention has led firms to implement measures that resulted in a reduction in accidents. We extend the literature on worker safety by focusing on a specific mechanism (not a disclosure requirement) that should increase this safety: the existence of an OHS system.

Specifically, we argue that when an OHS system is put in place, workers' safety should be enhanced and the number of employee accidents should be lower than in companies where such a system has not been implemented. However, one cannot ignore the high frequency of safety-related regulatory violations (e.g., in the US, these represent about half of all violations since 2000, according to the Violation Tracker). Therefore, it is possible that some firms' OHS systems are not well implemented or that these systems were created as a mechanism of social impression management (i.e., to convince stakeholders that health and safety are a real concern of the firm, when in fact that is not true). However, because we are not assessing disclosure (as in the case of greenwashing), but a system put in place, we believe that an impact on accidents should occur. Based on the above discussion, we propose our first hypothesis as follows:

H1: There is a negative association between the existence of an OHS system and the number of employee accidents in oil and gas firms.

2.2.2 The association between OHS and assurance.

According to legitimacy theory, a 'social contract' exists between firms and the society in which they operate, which requires firms to be considered acceptable or appropriate within the context of a socially formed system of norms and values (Suchman,

1995). For this to happen, there must be sufficient information to fulfill external stakeholders' requirements regarding non-financial disclosures' accuracy and quality (O' Dwyer et al., 2011). Given that there is always the risk that firms use impression management techniques in their disclosures, especially when they are voluntary, to positively bias the perception of users (e.g.: Guillamon-Saorin et al., 2017), firms may assure their sustainability reports.

By hiring an external assurer, firms can increase social trust in their sustainability reports' integrity and obtain or maintain their legitimacy (Perego & Kolk, 2012; DeBeelde & Tuybens, 2015), as assurance providers' practices are expected to instill moral and cognitive validity in firms' reports. In this sense, assurance is a key strategy that firms may use to legitimize their behavior and influence societal opinions on where they operate (Smith et al., 2011). The process of assuring sustainability reports includes auditing the content of the reports, resulting in an assurance statement confirming the integrity and reliability of the data (Boiral et al., 2019). In addition, a restatement of the reported information may be required as part of the assurance process, which may increase the firms' perceived trustworthiness of sustainability disclosures (Michelon et al., 2019).

Affiliation with a particular industry affects sustainability assurance adoption practices (e.g.: Martínez-Ferrero & García-Sanchez, 2017). In fact, in the introduction of OHSAS 18001, it is stated that the standard "contains requirements that can be objectively audited". Thus, oil and gas firms that have implemented an OHS system may seek assurance of their sustainability reports, which contain health and safety information, to satisfy their stakeholders' demand for high-quality information on how the system has been put in place and the necessary actions to improve its performance have been taken. For example, in these sustainability reports, firms may address any accidents that have occurred and provide details on the measures taken to avoid future accidents. The assurance of sustainability reports

increases the credibility of OHS system disclosures and firms' legitimacy. This leads us to state our second hypothesis as follows.

H2: Firms with an OHS system are more likely to seek the assurance of their sustainability reports.

Next, we need to recognize that while the importance of assurance is generally accepted, the use of different types of assurers may result in differences in the assurance engagement process (Channuntapipat et al., 2019), and even affect stakeholders' perceptions and investors' decisions (Clarkson et al., 2019). Due to the size and reputation of Big 4 accounting firms, they are likely to be preferred by large and international firms (Audousset-Coulier, 2015). They may also be viewed as superior providers of non-financial assurance. Alsahali et al. (2023a) studied how the monitoring quality of the board of directors was associated with the choice of assurance providers and found that, overall, the board's monitoring quality was positively associated with the choice of a Big 4 assurer. Moreover, the findings of Alsahali et al. (2023b) indicate that most firms that assure their sustainability reports choose one of the Big 4 firms and that the probability of this choice increases with the ownership level of foreign investors. Therefore, as an additional analysis, we study how the choice of a Big 4 firm as an assurer is associated with the existence of an OHS system.

3 Methods and data

3.1 Models

First, we assess whether the existence of an OHS system in oil and gas firms is negatively associated with the number of employee accidents, to test H1. In Equation (1), the dependent variable is the number of employee accidents and the variable of interest is the

dummy *OHS system*, which indicates whether the firm has an OHS management system in place.[9]

$$\#Empl\_Accid = \beta_0 + \beta_1\, OHS\ system + \sum_{j=1}^{k} \gamma_j Control_j + \tau + \varepsilon \quad (1)$$

Prior studies have identified many firm-level variables that might influence firms' disclosure of OHS and employee accidents (e.g., Brown et al., 2000; Cohn & Wardlaw, 2016). These variables refer to the assets' conditions, financial characteristics, and institutional environment in which firms operate. Based on these studies and prior research on sustainability reporting, we control for the following firm-level variables: *New Assets*, the firm's net PP&E to gross PP&E ratio; *ROA* (return on assets); *Leverage;* a proxy for size, calculated as the natural logarithm of the number of employees, *ln(#Employees); UNGC*, an indicator variable coded as one if the firm follows the United Nations Global Compact and zero otherwise*; OECD*, an indicator variable coded as one if the firm follows OECD's guidelines for Multinational Enterprises and zero otherwise; *Dev_country*, an indicator variable coded as one when the firm is domiciled in a developed country and zero otherwise; and year fixed effects τ.

We do not have an expected sign on *New Assets* because, although newer assets can be safer, construction and maintenance are the activities that lead to most accidents (Hare & Johnson, 2009) and physical assets-intensive firms are more prone to injury risk (Cohn et al., 2021). We also do not predict the sign for *ln(#Employees)* because although larger firms should have proportionally fewer accidents, the number of employees should have a positive association with the number of accidents, and previous evidence on the size effect is mixed

[9] This variable takes into consideration two aspects: whether the reporting organization has an internal management system/framework in place to identify, assess and control workplace hazards, and whether the reporting organization complies with OHSA or has OHSAS 18001.

(Cohn & Wardlaw, 2016; Caskey & Ozel, 2017; Heese & Pérez-Cavazos, 2020; Shi et al., 2021). We expect the estimated coefficients for *ROA*, *UNGC, OECD,* and *Dev_country* to be negative and *Leverage* to be positive (Cohn & Wardlaw, 2016; Caskey & Ozel, 2017; Heese & Pérez-Cavazos, 2020; Shi et al., 2021). Appendix B provides a detailed description of all variables, as well as their sources.

To test H2, we assess whether firms with an OHS system are more likely to seek sustainability assurance using a logit model, estimating Equation (2). The indicator variable *Assurance* is coded as one when the firm decides to assure its sustainability report, regardless of who the assurer is, and zero otherwise.[10]

$$Assurance = \beta_0 + \beta_1 OHS\ system + \sum_{j=1}^{k} \gamma_j Control_j + \tau + \varepsilon \quad (2)$$

The control variables included in this model are the same as those in Equation (1) and are defined in Appendix B.

3.2 Data

All data used were obtained from the LSEG database, previously known as Refinitiv Datastream. We start by choosing all active equity securities classified as oil and gas producers; this is the industry group 501020 of Refinitiv's business classification. As this dataset contains several securities from the same firm, either dual-class shares or cross-listings, we follow Landis & Skouras's (2021) procedure to clean the data. This procedure led to the identification of 206 firms.

[10] When cleaning the data, we noticed that in 38 of our observations the variable *Assurance* was coded as zero, but the variable for Big 4 assurance was coded as one, which is an inconsistency. Thus, we corrected the data of the variable *Assurance* in these cases (i.e., we changed it to one).

To define the period of fiscal years 2015-2019, we identify two major international events that may significantly impact the disclosure of oil and gas firms' sustainability information, including OHS information, sustainability assurance, and possibly employee accidents. The events in question are the introduction of the EU Directive on non-financial information in 2014 (Al-Dosari et al., 2023) and the COVID-19 pandemic in 2020 (Takahashi & Yamada, 2021). From our initial sample of 1,236 firm-years, we lost 95 observations due to missing financial data and an additional 482 observations due to missing non-financial data. Thus, our final sample comprises 659 firm-years from 158 unique firms, as detailed in Panel A of Table 1. Panel B of Table 1 shows that firms from four countries comprise more than 75 percent of the sample, namely the US, Canada, the UK, and Australia. Panel C of Table 1 shows that the sample is well-distributed across years, with some increase over time.

<Table 1 about here>

4 Results and discussion

4.1 Descriptive statistics

Panel A of Table 2 presents the descriptive statistics. Continuous variables *#Empl. accid.*, *New assets*, *ROA*, *Leverage*, and *ln(#Employees)* are winsorized at the 1 and 99 percentiles. In our sample, about two-thirds of the observations have an OHS, most observations are from firm-years without accidents, and firms assured their sustainability reports in about one-third of the cases. Panel B of Table 2 shows descriptive statistics by country, indicating that the mean firm characteristics differ considerably across countries. In seven countries, all observations are from firm-years with an OHS system, indicating the presence of country-level effects. The other variables showed more variation. For example, the average number of accidents of firms in Brazil and France is higher than 50, whereas the mean of this variable is zero in the Netherlands. Panel C of Table 2 suggests that on average,

these characteristics change over time. There seems to be a trend in the adoption of OHS systems, with more sustainability assurance overall but less reliance on Big 4 firms as assurers. This may be caused by firms focusing more on audit partner characteristics than on the firm they work for, as argued by Bozzolan & Miihkinen (2021).

<Table 2 about here>

Untabulated univariate tests indicate that the percentage of firms with an OHS system is significantly lower in the first year (p-value of the two-sided test is 0.054) than in the other years, and that the mean of OHS is also different from its mean in 2019 (p-value of the two-sided test is 0.08). Moreover, a change analysis reveals that this increase in the presence of OHS systems is related to 27 firms that went from not having such a system in place to implementing it. Finally, we also observe that three firms that had an OHS system stopped having it.

The correlations in Table 3 are on the lower side, with most exhibiting magnitudes below 0.5. Therefore, we do not anticipate multicollinearity issues in our estimates. Interestingly, having an OHS system has a low but positive and significant correlation with the number of accidents, which is not consistent with H1 and needs to be further investigated in a multivariate analysis. We find some initial evidence that supports H2, as *Assurance* is positively correlated with the existence of an OHS system. Moreover, the use of a Big 4 assurer is positively correlated with the existence of an OHS system.

<Table 3 about here>

4.2 Testing the association between an OHS system and accidents.

4.2.1 Initial estimation

First, we assess whether the existence of an OHS system in a firm is negatively associated with the number of employee accidents (to test H1). A concern that arises from

using OLS to estimate Equation (1) is that the dependent variable *#Empl. accid.* is a count variable and, therefore, is always non-negative. Thus, we use a pooled Poisson estimator. According to Cameron and Trivedi (2022), the Poisson estimator consistency does not require that the data are Poisson distributed. However, in this case, one should use robust standard errors to avoid incorrect inferences (Cameron & Trivedi, 2022, p. 1174-1175).[11]

Table 4 presents the results of estimating Equation (1). The results suggest that having an OHS system reduces the number of accidents, thus supporting H1. We complement prior studies on OHS practices by providing international quantitative evidence that firms' adoption of an OHS system is associated with a significant reduction in employee accidents, securing benefits for the firms' stakeholders.

Regarding the control variables, we observe that five variables are positively and significantly associated with the number of accidents reported: *New assets*, *Leverage*, *ln(#Employees)*, *OECD*, and *Dev_country*. We did not have a directional prediction for *New Assets* and *ln(#Employees).* Their positive associations with the number of accidents suggest that building new assets can be a risky process, and that the "more employees, more accidents" effect dominates the "larger companies are safer" effect. The result for *Leverage* supports the idea that financial constraints limit investment in workplace safety and is consistent with the findings of Cohn & Wardlaw (2016). Interestingly, both *OECD* and *Dev_country* have positive associations with the dependent variable. This may be due to the existence of better reporting systems in these countries where all accidents have been reported. Moreover, this can be the result of institutional pressures in the countries in which firms operate. For example, Safe Work Australia issued a report on OHS-related metrics that

[11] Besides the theoretical justification for using a Poisson estimator, previous research in a similar context has also used it extensively (e.g., Cohn et al., 2016; Caskey & Ozel, 2017; Christensen et al. 2017; Cohn et al., 2021; Campbell & Shang, 2022).

firms should disclose in annual reports (O'Neill & Wolfe, 2017). Given that we do not have data on unreported accidents, future qualitative research should investigate this possibility.

<Table 4 about here>

4.2.2 Robustness tests

Next, we re-estimate our Poisson model with an entropy-balanced sample, the method used by Shroff et al. (2017), where we use the existence of an OHS system to balance the sample. The untabulated results of this analysis show that the presence of an OHS system maintains its association with fewer accidents, as the coefficient for *OHS system* is -0.509 (z-stat = -3.683).[12] Moreover, we re-estimate our model using a pooled OLS. This new set of results also provides evidence of a significant negative association between the presence of an OHS system and the number of accidents that occur in a firm (the estimated coefficient is -4.532 with a t-stat of -3.103). Considering the variation in the number of accidents that occur and the possibility of an impact of outliers, we also re-estimate our model after winsorizing this variable (for the top and bottom and 5 percent of observations). The untabulated results are consistent with those in Table 4 (the estimated coefficient is -0.341 and the t-stat is 2.063).[13]

A possible concern when considering the estimates from Table 4 is that firms from four countries comprise more than 75 percent of the sample: the US (39.5%), Canada (23.8%), the UK (7.6%), and Australia (5.5%). This sample distribution and country-specific regulations regarding OHS may bias our results. Therefore, we run the robustness tests listed

[12] Entropy balancing reweights the control observations, so that the mean, variance, and skewness of this subsample is similar to its counterpart in the treatment subsample. The lack of significance (at the usual levels) of the interaction effect may be caused by the reduced size of our sample, as "you need four times the sample size to estimate an interaction that is the same size as the main effect" (Gelman et al., 2020).

[13] Christensen et al. (2017) state "We do not truncate the incidence rates in the Poisson specification because it is essentially a log-linear model, which can effectively deal with outliers without truncation". Therefore, the chance of outliers in this variable affecting our results was small, by default.

in Table 5. The results in Column (1) are for an extended version of Equation (1), where we include indicator variables for these four countries.[14] In the estimation of column (2), we exclude the US, which dominates the sample and could be driving the results. The results in this table are consistent with those in Table 4, thus providing additional support for H1. In conjunction, the results of Tables 4 and 5 suggest that having an OHS system in place helps to avoid accidents.

<Table 5 about here>

4.3 Testing the association between accidents and assurance

4.3.1 Initial estimation

We now assess whether having an OHS system in place is associated with oil and gas firms seeking sustainability assurance (H2). Column (1) of Table 6 presents the results of estimating Equation (2) using *Assurance* as the dependent variable of interest. The results indicate that firms with an OHS system are more likely to assure their sustainability reports, which is consistent with our expectations. Specifically, if a firm has an OHS system, the probability of assurance is 10 percentage points higher (see the average marginal effects in column 2). This evidence supports our second hypothesis.

Regarding the control variables, we observe that three of them are positively associated with a firm's decision to assure its sustainability report. This indicates that there is a size effect (*ln(#Employees)*) as well as an effect of a firm observing sets of international

[14] The International Labour Organization has country profiles, when it comes to occupational safety, and health, on its webpage: https://www.ilo.org/safework/countries/lang--en/index.htm. The profile for the US states that the OSH Act permits individual states to run their own programmes if approved by the federal Occupational Safety and Health Administration (OSHA), and that 17 states have State OSH Plans. Thus, even within the US, there is a variety of requirements. There is also variation in Canada, where OSH laws and regulations fall under provincial and territorial jurisdictions, although several aspects are common to most. Thus, we recognize the introduction of indicator variables for countries is not a very precise control for the existing regulations. The existing variation also prevents us from running a before versus after analysis of the implementation of country-level regulations.

good practices (*UNCG* and *OECD*). Firms that sign the UNGC are expected to adopt sustainable and socially responsible policies and report on the implementation of these policies. Logically, these firms are more likely to have their sustainability reports assured to signal that they provide high-quality information about their sustainability and social responsibility initiatives. The same reasoning applies to firms that follow OECD guidelines.

<Table 6 about here>

As discussed, oil and gas firms with employee accidents may seek assurance of their sustainability reports to satisfy their stakeholders' demand for high-quality information on how those accidents were addressed and on what measures were taken to avoid future accidents. Thus, we extend our analysis to assess whether the occurrence of accidents mediates the association between the presence of an OHS system and assurance. Unlike an interaction effect, a mediation effect implies a causal sequence among the variables of interest. This is important for us, as we want to test whether the existence of an OHS system influences the occurrence of accidents and whether the occurrence of accidents influences the likelihood of assurance. Table 7 presents two alternative versions of this analysis: column (1) corresponds to a linear structural equation model and column (2) corresponds to a generalized structural equation model. Both estimations confirm our previous result that the presence of an OHS system is associated with a lower level of accidents and a higher probability of assurance. Moreover, the results show that accidents are not associated with assurance (Column 1) or are negatively associated with assurance, but only marginally significant (Column 2). Thus, we find no robust evidence of a mediation effect.

<Table 7 about here>

Now that we have established that the association between the existence of an OHS system and the likelihood of assurance of the sustainability report is a direct effect, we look closer to this issue. Specifically, we consider that the assurance provided may be limited and not cover any OHS aspects. If this is the case, we would expect the documented association to be weaker. However, we would expect a stronger association in cases where assurance covers the OHS information disclosed in the sustainability report. To test if this is the case, we hand-collect information from firms' sustainability reports and run a multinomial logit model. In this model, the base outcome is "no assurance", followed by the cases where assurance does not cover the OHS information (other_assurance), which is less desirable than the cases where the OHS information is assured (OHS_assurance). Table 8 presents the results of the analysis. Our findings indicate that whether the assurance covers the occupational health and safety (OHS) system (or topics) is indeed relevant to our study. This is because only one of the two estimated coefficients for the OHS system is positive and statistically significant, specifically, the coefficient for OHS_assurance. A test of whether the two coefficients are equal (reported at the bottom of the table) provides further evidence of the difference between the two cases, as the probability of this being true is extremely small (p-value=0.000). This is further evidence of the importance of an OHS system for assurance and indicates that the results in Table 6 are driven by cases in which assurance covers OHS topics.

<Table 8 about here>

4.3.2 Robustness tests

As we did in the case of our tests of H1, we now consider the fact that firms from four countries comprise more than 75 percent of the sample. This issue is particularly important when assessing assurance, as Alsahali et al. (2023a) present evidence that companies operating in countries with strong economic, legal, and social environments are more likely to engage in external assurance. The untabulated results corroborate our main findings, as they indicate that in firms where an OHS system is in place the likelihood of firms assuring their sustainability reports is higher, even when we include indicator variables for those four countries. In this case, the estimated coefficient is 0.756 (t = 2.475). Furthermore, when we restrict our analysis to a subsample (where we exclude firms from the US), the untabulated results also indicate that in firms where an OHS system is in place the likelihood of firms assuring their sustainability reports is higher. In this case, the estimated coefficient is 0.940 (t = 2.908).

As discussed before, because of the size and reputation of the Big 4 accounting firms, they are likely to be preferred as assurer firms. Thus, we expect some of the oil and gas firms in our sample to hire a Big 4 assurer when they must report employee accidents, enhance their image, and increase legitimacy. As an additional analysis, we re-test H2, replacing *Assurance* with *Big4* as the dependent variable of interest. The untabulated results of this analysis indicate that firms with an OHS system are not likely to hire the Big 4 as an assurer. In this case, the estimated coefficient is 0.224 (t = 0.690). This suggests that firms with a focus on OHS look for an assurer with expertise in areas other than accounting and consulting, such as an engineering firm or an individual expert on OHS.

4.4 Additional analyses

Thus far, we have considered all OHS systems to be similar, given that we have used an indicator variable to signal their presence. We now consider the nature of the OHS systems. Specifically, we assess whether they have been developed by a third party (off-the-shelf solutions) or by the firm (in-house development) and whether this distinction is relevant to our analyses. For this, we once again manually collected information. Of the 275 sustainability reports we were able to find, 52 firms (171 firm-years) disclosed that they developed their own systems. Thus, it is possible that these systems are not comparable to other systems. To test this, we re-estimate our main models with one variation: instead of the indicator variable for the existence of an OHS system, we now have two indicator variables: (i) Third-party OHS and (ii) In-house OHS. The results in the first column of Table 9 indicate that this distinction between the two types of OHS systems is not relevant when it comes to the association between the presence of an OHS system and the number of accidents (Poisson model). This is because we find that both estimated coefficients are negative and statistically significant, but the first coefficient is not statistically different from the second (the p-value of this test is 0.417, as reported at the bottom of the table). However, the distinction between the two types of OHS systems is relevant when it comes to our analysis of the likelihood of assurance, as we find that the coefficient estimated for in-house OHS is statistically higher than that estimated for Third-party OHS (the p-value of this test is 0.017). This may reflect the need for firms to validate the systems that they develop (via assurance).

<Table 9 about here>

Notably, some firms are involved in ethical controversies. According to the BBC (2021), Chevron, ExxonMobil, BP, and Shell are among the fossil fuel firms recently sued by 21 US states because of 'greenwashing' and participating in a long-standing 'misinformation

campaign' concerning the impacts of climate change, although the firms refute the allegations. Given the current focus on climate change and the evidence that media coverage of corporate social irresponsibility, by providing conditions that increase the potential for stakeholder sanctions, is positively associated with financial risk (Kolbel et al., 2017), firms involved in ethical controversies may use impression management techniques to provide a favorable image of their employees' health and safety. This leads us to examine whether the OHS system associations we study differ when firms are involved in ethical controversies. Thus, we explore whether a firm's involvement in ethical controversies moderates the relationship between the existence of an OHS system and the number of accidents as well as the relationship between the existence of an OHS system and assurance.

To examine whether these firms have more employee accidents and whether, for this subsample of firms, the association between the number of employee accidents and the existence of an OHS system is different, we extend our first model by including the indicator variable *Controversial* plus an interaction between *OHS system* and *Controversial*. This new variable is coded as one if the firm has been involved in controversies related to ethical issues, and zero otherwise.[15] In the untabulated results, we find that (i) the coefficient for the OHS system is no longer significant at usual levels, (ii) the *Controversial* coefficient is significantly positive, and (iii) the coefficient of the interaction *OHS system*Controversial* is significantly negative. These findings suggest a plausible positive relationship between *Controversial* and number of accidents, indicating that firms involved in ethical controversies have a larger number of accidents. These firms have some ethical issues uncovered; the issue may have surfaced because of accidents or may be related to the causes of accidents. Moreover, the findings indicate that in firms involved in ethical controversies, the presence of

[15] We acknowledge that *Controversial* is an imperfect measure, since it relies on a controversy being disclosed. However, most likely it underestimates the effect we aim to capture, as it does not reflect issues that were never disclosed.

an OHS system alleviates issues related to accidents, offsetting the effect of being controversial. In fact, a test of the sum of the coefficients (0.874-0.640) shows that the resulting value is not significantly different from zero (p-value is 0.26). Thus, the offset is complete.[16]

To explore whether the association between the assurance of a firm's sustainability report and the presence of an OHS system is different when firms are involved in ethical controversies, we extend our second model by including two variables: the indicator variable *Controversial* and the interaction between it and *OHS system.* The untabulated results show that the association between assurance and the presence of an OHS system is robust to the inclusion of these variables (the estimated coefficient is 0.79, and its t-stat is 2.848). Moreover, we find that whether a firm is involved in ethical controversies is not associated with the likelihood of assurance, as both the coefficient estimated for the indicator variable and the interaction are not statistically different from zero. This lack of statistical significance may be because of the relatively small percentage of firms classified as controversial.

5 Conclusion

Given the importance of employees' health and safety in a firm's sustainability strategy, we examine whether the existence of an OHS system is associated with the number of employee accidents and firms' decisions to assure their sustainability reports. We focus on the oil and gas industry due to the potentially high-risk impact associated with this industry on employees' health and safety and study 158 oil and gas producers from 15 countries.

[16] An F-test on the sum of the three coefficients (OHS system, Controversies, and interaction term) provides consistent results, as it indicates this sum is not significantly different from zero (p-value is 0.815).

We find that employees working in oil and gas firms with an OHS system have fewer accidents on average. Moreover, oil and gas firms with an OHS system are more likely to seek assurance for their sustainability reports. These findings are robust to several alternative specifications. Looking closer to the relationship between the existence of an OHS system and assurance, we find that (i) this association is stronger when firms have developed their own OHS system and (ii) OHS-related topics have been assured.

Our findings should be interpreted with caution and certain limitations must be considered. First, this study focuses on the oil and gas industry. Therefore, the generalizability of these results to other industries may be limited. Second, the number of employee accidents used in this study is reported by the firms and thus may not reflect the actual number of accidents that occurred. Moreover, while we examine whether the presence of an OHS system has an impact on the frequency of accidents, we must recognize that a reverse relationship may exist, as the occurrence of accidents may influence the adoption of an OHS system, possibly owing to external pressures arising from a high accident rate. However, there was not enough variation in our dataset to empirically test this. Lastly, it is possible that some firms have an OHS system in place but do not disclose that information. In these cases, we classify firms incorrectly. These limitations offer potential opportunities for future research, perhaps in the areas of qualitative research and/or case studies.

Acknowledgements: The authors appreciate the valuable feedback and suggestions provided by Ricardo Malagueno, Maria Rykaczewski, Christine Liu, and Xi Ai, as well as those received from reviewers and participants of the 6th Journal of Accounting, Auditing and Finance India Symposium 2022; the British Accounting and Finance Association annual meeting 2022; the Journal of International Accounting Research annual meeting 2022; the American Accounting Association annual meeting 2022; the Journal of Accounting, Auditing and Finance conference 2023; and the IAS mid-year meeting 2024. We also acknowledge the valuable research assistance of Catarina Proença, Maria Santana, and Tomás Santos.

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Appendix A: Examples - Disclosures on health and safety

BP chairman's letter in the 2019 annual report mentions **"**Our commitment to safe and reliable operations will remain paramount. BP's safety performance has seen near continuous improvement since 2010, and we must continue to learn and improve." The corporate governance structure of the firm also reflects the importance of this issue, as there is a committee for safety, environment, and security assurance. The topic "Safety and Security" is further discussed in the strategic report of the annual report. The firm uses several mechanisms to manage the safety of its operations, and states "our approach builds on our experience, including learning from incidents, operations audits, annual risk reviews and sharing lessons learned with our industry peers." A group-wide framework has been implemented to manage operating risks and several safety indicators are disclosed. For example, a graph on the number of process safety events shows that while these had been declining from 2015 to 2018, they increase in 2019 (from 72 to 98). Moreover, two fatalities occurred. On the other hand, data on recordable injury frequency (calculated as workforce incidents per 200,000 hours worked) shows a declining trend of this measure.

Total Energies, in its 2018 registration document, has a section dedicated to the prevention of occupational accidents, where disclosures include the following: "The Group's personal safety policy covers three main areas: preventing occupational accidents, preventing transport accidents, and preventing accidents linked to technological risks, such as fires and explosions... In addition to its aim of zero fatalities in the exercise of its activities, the Group has set the target of continuously reducing the TRIR and, for 2018, of keeping it below 0.9 for

all personnel (Group and External Contractors)."[17] Moreover, the group has a framework (One MAESTRO), that "aims to strengthen the Group's safety culture and create a new drive to improve safety results" and a document entitled "Safety at Work: TOTAL's Twelve Golden Rules".[18] However, Total reports, in 2018, three accidents resulted in the death of four employees working for external contractors.

Marathon Petroleum discusses the firm's five values on page 17 of its 2019 annual report. The first is "Safety and environmental stewardship", described as follows: "Protecting our people and the world we all share has been and remains a priority for MPC. We aim for an accident free, incident-free workplace to ensure everyone goes home safely, every day. We are committed to safe and environmentally responsible operations to protect the health and safety of our employees, contractors, and communities." Moreover, the firm also states that they use "a rigorous, independently audited management system, RC14001®:2015", and that their "Refining organization achieved an Occupational Safety and Health Administration recordable incident rate of 0.28 per 200,000 man-hours worked, significantly better than the industry average."

[17] TRIR: Total Recordable Injury Rate – calculated as number of recorded injuries per million hours worked.

[18] The application of the occupational safety procedures is verified through site visits and internal audits. The Stop Card system enables any employee of the Group or an external contractor to intervene if any of the Golden Rules is not being followed.

and safety of our employees,
contractors and communities.

Appendix B: Variable definitions

Variable	Definition
#Empl. accid.	Number of injuries and fatalities reported for employees while working for the firm. We assumed missing data meant zero accidents. [SOHSDP029]
OHS system	Dummy indicating if the firm has a health and safety management system, like the OHSAS 18001 (Occupational Health & Safety Management System). [SOHSDP014]
New assets	A firm's asset "newness", defined as net PP&E divided by gross PP&E [WC02501 / WC02301]
ROA	Return on Assets, defined as net income before extraordinary items divided by total assets. [WC01551 / WC02999]
Leverage	Leverage, defined as total debt divided by total assets. [WC03255 / WC02999]
ln(#Employees)	The natural logarithm of the number of employees. [ln(WC07011)]
UNGC	Dummy indicating if the firm signed the United Nations Global Compact. [CGVSDP020]
OECD	Dummy indicating if the firm claims to follow the Organisation for Economic Co-operation and Development (OECD) guidelines for Multinational Enterprises. [SOCODP013]
Dev_country	Dummy indicating if the firm is from a developed country. [CODOM]
Assurance	Dummy indicating if the sustainability report is assured. [CGVSDP030]
Assurance coverage	Indicator variable valued 0 for no assurance, 1 for only other parts other than OHS assured, and 2 for OHS part assured.
OHS type	Indicator variable valued 0 for no OHS system, 1 for third-party OHS system, and 2 for developed in-house OHS system.
Big4	Dummy indicating if the sustainability report is assured by a Big 4. [CGVSDP033]
Controversial	Dummy indicating if the firm has controversies published in the media linked to business ethics in general, political contributions or bribery and corruption. [SOCODP058]

Notes: Definitions for all variables. The Datastream mnemonics used to obtain the data are between square brackets.

Table 1: Sample

Panel A: sample			
Item		Firm-years	Unique firms
Oil and Gas producers (Refinitiv DataStream)		1,236	206
Missing financial data		-95	-8
Missing non-financial data		-482	-40
Final sample – number of firms		659	158
Panel B: sample by country			
Country	Firm-years	%	Cum. %
United States	260	39.5	39.5
Canada	157	23.8	63.3
United Kingdom	50	7.6	70.9
Australia	36	5.5	76.3
Russian Federation	35	5.3	81.6
Japan	22	3.3	85.0
Thailand	20	3.0	88.0
China	16	2.4	90.4
France	14	2.1	92.6
Norway	13	2.0	94.5
Brazil	11	1.7	96.2
Italy	10	1.5	97.7
Austria	5	0.8	98.5
Netherlands	5	0.8	99.2
Spain	5	0.8	100.0
Total	659	100.0	
Panel C: sample by year			
Year	Firm-years	%	
2015	115	17.5	
2016	122	18.5	
2017	130	19.7	
2018	142	21.5	
2019	150	22.8	
Total	659	100.0	

Table 2: Descriptive statistics

Panel A: Descriptive statistics									
Variable	Mean	SD	Min	P1	P25	Median	P75	P99	Max
#Empl. accid.	11.778	31.848	0.000	0.000	0.000	0.000	6.000	175.000	175.000
OHS system	0.660	0.474	0.000	0.000	0.000	1.000	1.000	1.000	1.000
New assets	0.566	0.204	0.087	0.088	0.431	0.582	0.711	0.985	0.996
ROA	-0.034	0.210	-1.681	-1.219	-0.046	0.011	0.048	0.352	0.497
Leverage	0.287	0.196	0.000	0.000	0.173	0.260	0.352	1.214	1.551
ln(#Employees)	6.980	2.469	1.792	2.197	5.170	6.653	8.312	13.052	13.052
UNGC	0.184	0.387	0.000	0.000	0.000	0.000	0.000	1.000	1.000
OECD	0.047	0.212	0.000	0.000	0.000	0.000	0.000	1.000	1.000
Dev. country	0.876	0.330	0.000	0.000	1.000	1.000	1.000	1.000	1.000
Assurance	0.340	0.474	0.000	0.000	0.000	0.000	1.000	1.000	1.000
Assurance coverage	0.396	0.654	0.000	0.000	0.000	0.000	1.000	2.000	2.000
OHS type	0.921	0.772	0.000	0.000	0.000	1.000	2.000	2.000	2.000
Big4	0.200	0.401	0.000	0.000	0.000	0.000	0.000	1.000	1.000
Controversial	0.065	0.247	0.000	0.000	0.000	0.000	0.000	1.000	1.000
N	659								

Panel B: Mean values by country							
	Firm-years	#Empl. acc.	OHS sys.	ln(#Employees)	Assur.	Big4	Controv.
Australia	36	2.639	0.639	5.163	0.250	0.083	0.000
Austria	5	31.400	1.000	9.973	1.000	1.000	0.200
Brazil	11	55.091	1.000	9.876	0.455	0.455	0.455
Canada	157	2.261	0.554	5.591	0.287	0.185	0.006
China	16	21.500	0.938	11.700	0.625	0.625	0.250
France	14	61.643	1.000	8.805	1.000	0.357	0.286
Italy	10	17.600	1.000	8.957	1.000	1.000	0.400
Japan	22	6.545	1.000	8.780	0.909	0.455	0.000
Netherlands	5	0.000	0.600	6.777	0.400	0.000	0.000
Norway	13	34.692	0.231	8.161	0.385	0.385	0.154
Russia	35	26.771	0.857	11.490	0.800	0.714	0.114
Spain	5	9.800	1.000	10.107	1.000	1.000	0.000
Thailand	20	4.650	1.000	8.451	0.950	0.500	0.050
United Kingdom	50	13.580	0.860	5.997	0.320	0.100	0.120
United States	260	10.819	0.554	6.626	0.119	0.019	0.042
N	659						

Panel C: Mean values by year							
	Firm-years	#Empl. acc.	OHS sys.	ln(#Employees)	Assur.	Big4	Controv.
2015	115	12.026	0.583	7.280	0.357	0.226	0.052
2016	122	12.189	0.639	7.085	0.344	0.221	0.074
2017	130	10.508	0.677	6.935	0.331	0.200	0.062
2018	142	12.451	0.697	6.866	0.331	0.183	0.063
2019	150	11.720	0.687	6.809	0.340	0.180	0.073
N	659						

Notes: *#Empl. accid.* is the number of injuries and fatalities reported for employees; *OHS system* is a dummy indicating if the firm has a health and safety management system in place; *New assets* is net PP&E divided by gross PP&E; *ROA* is net income before extraordinary items divided by total assets; *Leverage* is total debt divided by total assets; *ln(#Employees)* is the natural logarithm of the number of employees; *UNGC* is a dummy indicating if the firm signed the United Nations Global Compact; *OECD* is a dummy indicating if the firm claims to follow the OECD guidelines for Multinational Enterprises*; Dev Country* is a dummy indicating if the firm is from a developed country; *Assurance* is a dummy indicating if the sustainability report is assured; *Assurance coverage* is 0 for no assurance, 1 for other parts assured, and 2 for OHS

assured; OHS type is 0 for no OHS system, 1 for third-party OHS system, and 2 for in-house OHS system; *Big4* is a dummy indicating if the sustainability report is assured by a Big 4; *Controversial* is a dummy indicating if the firm has controversies published in the media.

Table 3: Correlations

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) #Empl. accid.	1.000													
(2) OHS system	0.162	1.000												
(3) New assets	-0.037	-0.086	1.000											
(4) ROA	0.094	0.149	0.143	1.000										
(5) Leverage	-0.068	-0.039	-0.342	-0.313	1.000									
(6) ln(#Employees)	0.526	0.395	-0.141	0.212	-0.046	1.000								
(7) UNGC	0.218	0.224	-0.147	0.060	0.001	0.410	1.000							
(8) OECD	0.313	0.129	-0.085	0.041	-0.046	0.218	0.265	1.000						
(9) Dev. country	-0.147	-0.212	-0.045	-0.172	0.080	-0.549	-0.356	0.019	1.000					
(10) Assurance	0.268	0.319	-0.088	0.139	-0.086	0.525	0.545	0.264	-0.331	1.000				
(11) Assurance cov.	0.282	0.293	-0.123	0.091	-0.038	0.450	0.384	0.172	-0.264	0.717	1.000			
(12) OHS type	0.196	0.857	-0.101	0.155	-0.073	0.465	0.298	0.134	-0.277	0.414	0.417	1.000		
(13) Big4	0.249	0.207	-0.052	0.141	-0.098	0.455	0.478	0.354	-0.386	0.697	0.439	0.218	1.000	
(14) Controversies	0.440	0.138	-0.097	0.072	-0.072	0.383	0.224	0.232	-0.161	0.277	0.216	0.186	0.252	1.000
Observations	659													

Notes: Correlations in bold are significant (at 5% confidence level). *#Empl. accid.* is the number of injuries and fatalities reported for employees; *OHS system* is a dummy indicating if the firm has a health and safety management system in place; *New assets* is net PP&E divided by gross PP&E; *ROA* is net income before extraordinary items divided by total assets; *Leverage* is total debt divided by total assets; *ln(#Employees)* is the natural logarithm of the number of employees; *UNGC* is a dummy indicating if the firm signed the United Nations Global Compact; *OECD* is a dummy indicating if the firm claims to follow the OECD guidelines for Multinational Enterprises*; Dev_Country* is a dummy indicating if the firm is from a developed country; *Assurance* is a dummy indicating if the sustainability report is assured; *Assurance coverage* is 0 for no assurance, 1 for other parts assured, and 2 for OHS assured; OHS type is 0 for no OHS system, 1 for third-party OHS system, and 2 for in-house OHS system; *Big4* is a dummy indicating if the sustainability report is assured by a Big 4; *Controversial* is a dummy indicating if the firm has controversies published in the media.

Table 4: Accidents and Health & Safety

Variables	Z-stat (p-value)
OHS system	**-0.375****
	(-2.098)
New assets	1.571***
	(3.157)
ROA	0.855
	(1.234)
Leverage	2.389***
	(3.125)
ln(#Employees)	0.922***
	(22.829)
UNGC	-0.179
	(-1.076)
OECD	0.285*
	(1.869)
Dev_country	2.118***
	(8.475)
Year FE	Yes
Constant	Yes
Observations	659
Pseudo R^2	0.672

Notes: Pooled Poisson regressions with robust standard errors on the relationship between the number of accidents and health and safety management system. The z-statistics are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The dependent variable is *#Empl. Accid*, the number of injuries and fatalities reported for employees; *OHS system* is a dummy indicating whether the firm has a health and safety management system in place; *New assets* is net PP&E divided by gross PP&E; *ROA* is net income before extraordinary items divided by total assets; *Leverage* is total debt divided by total assets; *ln(#Employees)* is the natural logarithm of the number of employees; *UNGC* is a dummy indicating whether the firm signed the United Nations Global Compact; *OECD* is a dummy indicating whether the firm claims to follow the OECD guidelines for Multinational Enterprises*; Dev_country* is a dummy indicating whether the firm is from a developed country.

Table 5: Accidents and Health & Safety – robustness tests

Variables	(1) Dummies for top 4 countries	(2) Excluding US
OHS system	-0.461**	-0.719***
	(-2.330)	(-3.744)
New assets	1.322***	0.541
	(2.884)	(0.668)
ROA	1.050*	2.570**
	(1.704)	(2.406)
Leverage	2.304***	4.088***
	(3.281)	(3.010)
ln(#Employees)	0.889***	0.820***
	(22.195)	(12.293)
UNGC	-0.056	0.101
	(-0.275)	(0.492)
OECD	0.693***	0.527**
	(3.283)	(2.489)
Dev_country	1.571***	1.444***
	(5.547)	(3.724)
Firm from US	0.651**	
	(2.360)	
Firm from CN	0.094	
	(0.320)	
Firm from UK	0.799***	
	(3.039)	
Firm from AU	0.681**	
	(2.037)	
Year FE	Yes	Yes
Constant	Yes	Yes
Observations	659	399
Pseudo R^2	0.683	0.634

Notes: Pooled Poisson regressions with robust standard errors on the relationship between the number of accidents and health and safety management system. The z-statistics are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Columns (1) and (2) include dummies for the top four most representative countries in the sample, while Columns (3) and (4) drop the most representative country, the US. The dependent variable is *#Empl. accid*, the number of injuries and fatalities reported for employees; *OHS system* is a dummy indicating whether the firm has a health and safety management system in place; *New assets* is net PP&E divided by gross PP&E; *ROA* is net income before extraordinary items divided by total assets; *Leverage* is total debt divided by total assets; *ln(#Employees)* is the natural logarithm of the number of employees; *UNGC* is a dummy indicating whether the firm signed the United Nations Global Compact; *OECD* is a dummy indicating whether the firm claims to follow the OECD guidelines for Multinational Enterprises; *Dev_country* is a dummy indicating whether the firm is from a developed country; *Firm from XX* is a dummy indicating whether the firm is from country XX (US = United States, CN = Canada, UK = United Kingdom, AU = Australia).

Table 6: Assurance and OHS system

	(1) Base model	(2) Average Marginal Effect
OHS system	0.816***	0.100***
	(2.966)	(3.082)
New assets	0.014	0.002
	(0.024)	(0.024)
ROA	0.494	0.061
	(0.646)	(0.647)
Leverage	-1.208	-0.150
	(-1.529)	(-1.563)
ln(#Employees)	0.438***	0.054***
	(7.116)	(8.092)
UNGC	2.832***	0.351***
	(7.397)	(10.092)
OECD	2.249***	0.279***
	(4.184)	(4.184)
Dev. country	0.435	0.054
	(1.209)	(1.196)
Year FE	Yes	Yes
Constant	Yes	No
Observations	659	659
Adjusted R^2		
Pseudo R^2	0.385	

Notes: Pooled Logit regression with robust standard errors on the relationship between assurance and the OHS system. The z-statistics are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The dependent variable is *Assurance*, a dummy variable indicating whether the sustainability report is assured. *OHS system* is a dummy variable indicating whether the firm has a health and safety management system in place. *Accident* is a dummy indicating whether the firm has at least one accident; *New assets* is net PP&E divided by gross PP&E; *ROA* is net income before extraordinary items divided by total assets; *Leverage* is total debt divided by total assets; *ln(#Employees)* is the natural logarithm of the number of employees; *UNGC* is a dummy indicating whether the firm signed the United Nations Global Compact; *OECD* is a dummy indicating whether the firm claims to follow OECD guidelines for Multinational Enterprises*; Dev_country* is a dummy indicating whether the firm is from a developed country.

Table 7: Mediation Analysis

	(1) SEM	(2) GSEM
#Empl. accid.		
OHS system	-4.532***	-0.375**
	(-3.132)	(-2.098)
New assets	10.080**	1.571***
	(2.542)	(3.157)
ROA	-5.961**	0.855
	(-2.129)	(1.234)
Leverage	-5.687	2.389***
	(-1.265)	(3.125)
ln(#Employees)	8.116***	0.922***
	(9.498)	(22.829)
UNGC	0.336	-0.179
	(0.081)	(-1.076)
OECD	27.889***	0.285*
	(2.607)	(1.869)
Dev. country	17.450***	2.118***
	(2.718)	(8.475)
Assurance		
OHS system	0.095***	0.812***
	(3.109)	(2.898)
#Empl. accid	-0.001	-0.007*
	(-1.018)	(-1.860)
New assets	0.013	0.122
	(0.175)	(0.201)
ROA	0.035	0.439
	(0.613)	(0.568)
Leverage	-0.145*	-1.243
	(-1.934)	(-1.548)
ln(#Employees)	0.063***	0.504***
	(7.679)	(6.986)
UNGC	0.458***	2.856***
	(10.114)	(7.351)
OECD	0.199***	2.356***
	(3.233)	(4.591)
Dev. country	0.007	0.593
	(0.119)	(1.612)
Year FE	Yes	Yes
Constant	Yes	Yes
Observations	659	659
Indirect effect	0.002	0.003
(p-value)	0.331	0.162
Total effect	0.098	0.814
(p-value)	0.001	0.004

Notes: Linear SEM – model (1) or Generalized SEM – model (2) – using logit for #Empl. Accid. estimation and Poisson for Assurance estimation. All models use robust standard errors, *t* or z-statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. #Empl. accid is the number of injuries and fatalities reported for employees; the OHS system is a dummy indicating whether the firm has a health and safety management system in place; New assets is net PP&E divided by gross PP&E; ROA is net income before extraordinary items divided by total assets; Leverage is total debt divided by total assets; ln(#Employees) is the natural logarithm of the number of employees; UNGC is a dummy indicating whether the firm signed the United Nations Global Compact; OECD is a dummy indicating whether the firm claims to follow the OECD guidelines for Multinational Enterprises; Dev_country is a dummy indicating whether the firm is from a developed country.

Table 8: Assurance of OHS information

Variables	(1)
Other_assurance	
OHS system	0.266
	(1.043)
Accident	-0.005
	(-1.165)
New assets	0.600
	(0.920)
ROA	0.123
	(0.211)
Leverage	0.299
	(0.433)
ln(#Employees)	0.351***
	(4.713)
UNGC	1.725***
	(5.831)
OECD	1.396***
	(2.585)
Dev. country	0.683*
	(1.749)
OHS_assurance	
OHS system	15.006***
	(65.181)
Accident	0.004
	(0.900)
New assets	-2.637***
	(-3.276)
ROA	-0.163
	(-0.163)
Leverage	-1.035
	(-1.093)
ln(#Employees)	0.413***
	(4.089)
UNGC	1.113***
	(2.807)
OECD	-0.220
	(-0.277)
Dev. country	0.124
	(0.264)
Year FE	Yes
Constant	Yes
Observations	659
Pseudo R^2	0.233
OHS coeff. is equal (p-value)	0.000

Notes: Multinomial Logit regression with robust standard errors on the relationship between assurance by type (0 = no assurance (base outcome), 1 = other assurance, 2 = OHS assurance) and OHS system. The z-statistics are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. OHS system is a dummy indicating whether the firm has a health and safety management system in place; New assets is net PP&E divided by gross PP&E; ROA is net income before extraordinary items divided by total assets; Leverage is total debt divided by total assets; ln(#Employees) is the natural logarithm of the number of employees; UNGC is a dummy indicating whether the firm signed the United Nations Global Compact; OECD is a dummy indicating whether the firm claims to follow the OECD guidelines for Multinational Enterprises; Dev_country is a dummy indicating whether the firm is from a developed country.

Table 9: Type of OHS system

Variables	(1) Accidents	(2) Assurance
Third-party OHS	-0.324*	0.573*
	(-1.768)	(1.960)
In-house OHS	-0.436**	1.230***
	(-2.162)	(3.850)
New assets	1.518***	0.110
	(3.219)	(0.177)
ROA	0.810	0.603
	(1.146)	(0.731)
Leverage	2.303***	-1.046
	(2.869)	(-1.272)
ln(#Employees)	0.926***	0.409***
	(22.729)	(6.479)
UNGC	-0.190	2.722***
	(-1.156)	(7.054)
OECD	0.267*	1.941***
	(1.659)	(3.746)
Dev. country	2.097***	0.450
	(8.659)	(1.209)
Year FE	Yes	Yes
Constant	Yes	Yes
Observations	659	659
Adjusted R^2		
Pseudo R^2	0.673	0.392
Dif. coeff. OHS	0.112	-0.656
(p-value)	0.417	0.017

Notes: Poisson regression on the relationship between the number of accidents and type of OHS system – model (1) or logit regression on the relationship between assurance and type of OHS system – model (2). All models use robust standard errors, and the z-statistics are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. #Empl. accid is the number of injuries and fatalities reported for employees; Third-party/In-house OHS are dummies indicating whether the firm has a third party/developed in-house health and safety management system in place; New assets is net PP&E divided by gross PP&E; ROA is net income before extraordinary items divided by total assets; Leverage is total debt divided by total assets; ln(#Employees) is the natural logarithm of the number of employees; UNGC is a dummy indicating whether the firm signed the United Nations Global Compact; OECD is a dummy indicating whether the firm claims to follow the OECD guidelines for Multinational Enterprises; Dev_country is a dummy indicating whether the firm is from a developed country.