Corporate Environmental Risk Exposure and Audit Fees[*]

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Abstract

Prior research shows that audit clients with higher perceived business risk, mostly litigation risk, incur higher audit fees. We extend the literature by examining the relation between audit fees and corporate environmental risk and we argue that corporate environmental risk represents a key source of business risk for companies in many industries. We hypothesize that auditors will increase audit efforts and charge a higher audit fee for clients with environmental risk exposure. We characterise corporate environmental risk exposure in different environmental risk areas and by the complexity of applicable environmental regulations our sample firms face. Using a longitudinal data from 2000 to 2012 and different proxies for corporate environmental risk exposure, we find that audit fees were higher for clients with environmental risk exposure. Further analyses indicate that the impact of individual environmental risk factors on audit fees is not linear and the complexity in the overall environmental regulations has a more direct impact on audit fees. The findings in this study provide direct evidence that corporate environmental risk exposure affects audit engagements. Auditors appear to exercise more efforts when auditing clients with environmental risk exposure and charge higher audit fees for those who have higher compliance risk with the applicable environmental regulations.

I. Introduction

Securities regulators and the accounting standard setters have been concerned about the impact of corporate environmental liability on the quality and reliability of financial statements for a long time (Securities Exchange Commission (SEC) 1993, Financial Accounting Standards Board (FASB) 2001, Government Accountability Office (GAO) 2004, Chadick et al 1993). Existing studies show that poor corporate environmental performance not only damages firms' reputation as good corporate citizens but also contributes to future operational risk and poor financial performance (Clarkson et al. 2011). Anecdotal evidence indicates that firms with high environmental risk exposure may face contingent environmental liability in future remediation and incur substantial capital outlays to comply with increasingly more stringent environmental regulations.[1] To respond to investors' concerns about material misstatements in financial reports due to corporate environmental risk exposure, the International Standards of Auditing (International Standard on Auditing (ISA) 240) requires auditors to identify risks associated with significant accrued environmental remediation liabilities. Auditors are also required to ensure that their clients are in compliance with environmental regulations that may be fundamental to the operating aspects of the business, to an entity's ability to continue its business, and/or to avoid material penalty due to violation (ISA 250). These mandates indicate that auditors must consider a wide range of corporate environmental risk factors and exercise more efforts when auditing clients with complex environmental compliance risk. There is scant empirical study that seeks to establish such direct evidence.

[1] As an example of how environmental risk exposure may impact a firm's financial reporting and future financial performance, Dairyland Power Cooperative disclosed that it reached an agreement with the EPA on June 29, 2012 that requires the company to invest approximately $150 million in pollution control technology. The company must also spend $5 million on environmental mitigation projects and pay a civil penalty of $950,000. The Company stated that the impact of mandated $150 million investment on future earnings remains uncertain until both the timing and successful implementation of the investment is determined in the future. It is conceivable that the auditor of the Company must assess the financial impact of this legal settlement in its future audit engagement.

On the other hand, the auditor's responsibility is limited to undertaking specified audit procedures to help identify non-compliance with those laws and regulations that may have a material effect on the financial statements (ISA 250). To ensure compliance with the existing environmental regulations, auditors must assess the client's aggregated compliance risk in the context of all applicable environmental risk factors. One could argue that auditors must exercise more efforts for clients that face more complex environmental regulations and the complexity of applicable environmental regulations for audit clients should affect the design of audit procedures and have a direct impact on audit engagements and audit fees. Thus, the mandate on auditors' responsibility to ensure compliance with applicable environmental regulations creates an interesting empirical setting to examine whether corporate environmental risk affects auditor behavior and if it does, how.

This study examines the following two related research questions: (1) Does corporate environmental risk exposure affect audit fees? (2) If it does, what contribute to the increase in audit fees; the complexity in the overall corporate environmental risk exposure or the level of individual toxic emissions and number of incidents of non-compliance with specific environmental regulations? The first research question explores the impact of corporate environmental risk exposure on auditor behavior in general. The second research question examines how auditors assess the aggregated compliance risk when clients face complex environmental regulations in multiple areas.

Using a large longitudinal sample of U.S. public companies from the 2000 to 2012, we find consistent evidence that corporate environmental risk exposure has a significant and positive impact on audit fee. We develop two sets of empirical measures of corporate environmental risk exposure that capture compliance with applicable environmental regulations in five different

areas: (1) the toxic chemicals released to the environment as reported to the Toxic Releases Inventory database (TRI), (2) Superfund liabilities identified in the National Priority List of Superfund Sites, (3) total CO_2 and CO_2 equivalent emissions, (4) total waste materials produced, and (5) estimated costs for all environment-related violations, including penalty, fines, lost court cases and future settlements. The first set of environmental risk measures capture the compliance risk with individual environmental regulations and the second set captures the overall complexity in clients' compliance risk with all applicable environmental regulations. Our empirical models control for other known factors that affect audit fees in the existing literature. The results indicate that auditors charge higher fees for firms with environmental risk exposure in each of the five environmental risk areas. Further analyses reveal a complex and non-linear relation between audit fees and individual environmental risk proxies. Specifically, we find that auditors charge higher audit fees for clients facing complex environmental regulations and with higher aggregated compliance risk. We also find that the complexity in corporate environmental risk exposure increases the likelihood of a going-concern opinion and bankruptcy risk. This finding enhances our argument that corporate environmental risk represents a key source of business risk and auditors consider corporate environmental risk exposure. As further corroborating evidence, we find that auditors increase audit fees for clients with significant environmental risk exposure in 2004, following the issuance of a GAO report calling for the SEC to improve the quality and transparency in corporate environmental disclosure in the U.S.. Finally, to assess the robustness of our findings in an international setting, and as a further control for omitted variables, we extend our analysis to a subset of non-US sample firms and our main results still hold. Overall, the findings in this study suggest that corporate environmental risk exposure affects auditor

behavior. Our results are robust and consistent with auditors increasing audit efforts for clients with more complex environmental risk exposure.

Our study makes the following contributions. First, we extend prior research on the relation between business risk and audit fees. Much of the existing research focuses on litigation risk, such as Bell et al. (2001), Francis (1984), Seetharaman et al. (2002), and Simunic and Stein (1996). More recent studies such as Lyon and Maher (2005) examine the impact of business risk on audit fees. We extend this literature by exploring the impact of environmental risk on audit fees. We characterize corporate environmental risk exposure based on firms' compliance with the existing applicable environmental regulations in five different areas using actual pollution and environmental compliance data. This characterization allows us to examine the impact of both individual environmental risk factors and aggregated compliance risk with the applicable environmental regulations on auditor efforts. It entails that corporate environmental risk captures an important aspect of business operations and that corporate environmental risk contributes to future business risk, hence audit fees.

Second, this study also contributes to the environmental accounting research. The existing literature in this area shows that non-financial environmental performance information can be value-relevant (Barth and McNichols 1994; Hughes 2000; Clarkson et al. 2004; Sharfman and Fernando 2008; Plumlee et al. 2009; etc.). Recent study shows that financial analysts impound corporate environmental risk exposure into their earnings forecasts and stock recommendations (De Franco et al. 2013). Since auditors also play a critical role in safeguarding the capital market institution, we would expect an increased assurance effort from auditors to protect investors from corporate environmental risk. Although clear mandates exist for auditors to exercise more efforts for clients with environmental risk as discussed earlier, to the best of our

knowledge, we are not aware of any studies that examine the relationship between auditor efforts and corporate environmental risk exposure. This study seeks to provide direct evidence that auditors increase audit efforts when auditing firms with environmental risk exposure, consistent with the requirements of the existing auditing standards.

The rest of the article is organized as follows. Section II reviews the existing literature and develops our hypotheses. Section III discusses the sample selection and key research design. Section IV presents our primary empirical results while V discusses additional analyses and the robustness checks. Section VI concludes.

II. Literature Review and Hypothesis Developments

This study relates to the two strands of research literature, the environmental accounting literature and the audit fee literature. The existing literature in environmental accounting finds that corporate environmental performance affects firm valuation, future financial performance, and the cost of capital (Cormier et al. 1993, Barth and McNicholes 1994, Cormier and Magnan 1997, Hughes 2000, and Clarkson et al. 2004, Connors and Silva-Gao 2009, Dhaliwal et al. 2011, Clarkson et al. 2011, Schneider 2011). Recent studies indicate that corporate environmental performance also affect firms' capital expenditures, the design and strength of corporate governance, credit risk, earnings volatility, and analyst behavior (Schneider 2011, De Franco et al. 2013, Lam and Li 2013). This line of research implies that corporate environmental risk exposure increases future operational uncertainty and default risk and analysts impound corporate environmental risk into their earnings forecasts and stock recommendations.[2]

[2] As an example of environmental risk exposure contributing to operating uncertainty, see the Wall Street Journal article on Oct 31, 2013 titled "Barrick Gold Puts South American Project on Hold." Barrick Gold decided to suspend the construction of its massive $8.5 billion Pascua-Lama mine mainly because of the uncertainty over legal

Interestingly, there is no study that examines the role of auditor assurance with respect to corporate environmental risk exposure. To the extent that environmental risk can adversely impact future financial performance and operational uncertainty, auditors ought to ensure that the financial impact of corporate environmental risk is properly recognized and communicated to investors. This study fills the void in the literature and examines the role of auditors in safeguarding investors from corporate environmental risk exposure. Specifically, we examine whether auditors exercise increased efforts when auditing firms facing complex environmental regulations. We use audit fees to proxy for auditor efforts because in a competitive equilibrium, audit fees should reflect the expected costs of auditing hours and implied business risk (Bell et al. 2001). To the extent that environmental regulations create compliance risk and increased future spending, companies facing complex environmental regulations will have higher inherent risk and control risk. Auditors must increase audit efforts and complexity in audit engagements to ensure an acceptable level of audit risk.[3] We argue and expect that auditors will increase audit efforts and charge a higher fee accordingly for clients with environmental risk exposure than for those without environmental risk exposure.

Simunic (1980) pioneers the empirical research on audit fees. He presents a production view of the audit process and shows that audit fees are affected by client size, operating complexity, and client risk. Subsequent research provides consistent evidence supporting the effect of these determinants on audit fees (Hay et al. 2006, DeFond and Zhang 2013). Existing research in auditing also shows that audit clients with higher perceived business risk, mostly litigation risk, incur higher audit fees (Palmrose 1988, Simunic and Stein 1996, Seetharaman et

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and other environmental regulatory requirements and poor outlook for metal prices. http://online.wsj.com/news/articles/SB10001424052702303843104579169342595551968

[3] Audit risk refers to the likelihood of a material misstatement in the financial report that is not discovered in an audit engagement. We use audit engagements to refer the complete auditing process broadly, including audit planning, testing of controls, substantiation or fieldwork, exit or finalization, etc..

al. 2002). The business risk of audit clients refers to the client's continued survival and well-being (Lyon and Maher 2005). It contributes directly to audit risk (the risk of an audit failure). The auditor is paid a fee to attest to the assertions contained in the client's financial statements, and presumably the fee reflects the works the auditor must perform to reduce the audit risk to an acceptable level. In a competitive equilibrium, audit fees should reflect the expected costs of auditor's effort and future litigation risk as a result of an audit failure (Bell et al. 2001). This study extends the existing auditing literature and explores whether corporate environmental risk affects audit fees. We argue that corporate environmental risk contributes to business risk in industries with high pollution propensity. We hypothesize that rational auditors should increase audit efforts to mitigate the increased inherent risk and control risk associated with compliance with the existing environmental regulations, resulting a higher audit fee for audit clients facing more complex environmental regulations.

There are also institutional factors that motivate our hypothesis about the relation between corporate environmental risk exposure and audit fees. As discussed earlier, the ISA (240) requires auditors to identify risk associated with significant accrued environmental remediation liabilities. For firms operating in the natural resources and other high polluting sectors, Financial Accounting Standards Board (FASB) 143 mandates companies to estimate future site reclamation liability and formally recognize such estimates on the balance sheet as Asset Retirement Obligations (ARO).[4] For US firms named as a potentially responsible party in the National Priority List of Superfund Sites by the U. S. Environment Protection Agency (EPA), they must provide either provisions for estimated future cleanup liability or proper footnote disclosure of such contingent liabilities (Barth and McNichols 1994, Barth et al. 1997). To

[4] International Accounting Standards (37) contains similar requirements for the recognition of future environmental cleanup obligations.

provide assurance services against material misstatements arising from future environmental liabilities as discussed above, auditors must possess knowledge about the applicable environmental regulations and industry expertise to evaluate such liabilities and must put more hours into the auditing process to ensure environmental liabilities not being misreported. In addition, firms operating in high polluting sectors face a wide range of environmental regulations with compliance obligations that can significantly impact their future operations and financial health. For example, under the Emergency Planning and Community Right-to-Know Act (EPCRA), the EPA requires U.S. facilities with more than ten employees to track over 650 toxic chemicals that pose a threat to human health and the environment. Companies that manufacture, process, or otherwise use these chemicals above established levels must keep track of and report annually to the EPA how much each chemical is released to the environment or managed through recycling, energy recovery and treatment.[5] To ensure full compliance with the TRI reporting requirement, auditors need to ensure that company's environmental management systems can track and monitor the flow of these chemicals in the production process reliably and accurately.

Modern corporations also face a plethora of environmental regulations and violations of existing environmental regulations may trigger enforcement activities that could either endanger the existing business operations or result in significant future compliance obligations and penalty.[6] ISA (250) mandates auditors to ensure that their clients are in compliance with

[5] The information submitted by facilities to the EPA becomes a publically available database called the Toxics Release Inventory or TRI. Further information about the TRI program can be obtained from the following EPA web site http://www2.epa.gov/toxics-release-inventory-tri-program

[6] The enforcement activity may create earnings shocks for firms with high environmental risk exposure. For example, the EPA and the U.S. Department of Justice announced on August 20, 2012 that they fined Sinclair Oil Corporation $3.8 million for violations of air pollution limits at refineries in Casper and Sinclair, Wyoming. The company must also spend approximately $10.5 million on additional pollution control equipment to reduce emissions of nitrogen oxides (NOX) by approximately 24 tons per year, sulfur dioxide (SO2) by approximately 385 tons per year, and particulate matter by approximately 59 tons per year. See footnote 1 for another example of

environmental regulations that may be fundamental to the operating aspects of the business, to an entity's ability to continue its business, or to avoid material penalty due to violations. This assurance mandate implies that audit engagements with clients facing environmental regulations will be more complex and require more knowledge about the relevant environmental regulations and firm-specific environmental risk factors. In addition to validating managers' estimates for future cleanup obligations as discussed above, auditors must also ensure that their clients implement appropriate internal environmental risk management control systems to avoid future violations that may trigger material compliance costs. Failure to identify material mistakes in firms' future environmental liability estimates and material weakness in firms' environmental risk control mechanisms will increase the audit risk. The above institutional details suggest that auditors may charge a higher fee for clients with environmental risk to compensate for increased auditor efforts. Our first hypothesis, stated in the alternate form, is stated below:[7]

H1: there is a positive association between audit fees and corporate environmental risk exposure.

Kim et al (2012) argue that audit complexity will increase audit fees. Specifically, they show that the IFRS adoption in European Union countries increases audit fees there because of the resulting increase in audit complexity following the adoption. They argue that since IFRS is fair-value oriented, implementing IFRS requires accountants and auditors to make more complex estimates and more professional judgments (Kim et al. 2012 p. 2066). Other studies also show that the number of subsidiaries or business segments will affect audit complexity and audit fees (Hackenbrack and Knechel 1997, Francis et al. 2005, Spencer et al. 2014). Following the same

material compliance obligations with environmental regulations.

[7] A counter argument would be that corporate environmental risk exposure has no material impact on audit engagements either because it does not affect audit risk or because such risk can be easily accommodated in existing audit engagements without increasing auditor efforts.

logic, we argue that the complexity in corporate environmental regulations increases the clients' compliance risk. To comply with the IAS (250), auditors must implement complex audit procedures to audit clients facing complex environmental regulations, which will lead to a higher audit fee. Auditors must assess the aggregated compliance risk the clients face by considering the overall complexity of environmental regulations, not just individual environmental risk factors. For example, a firm facing both Superfund liability and TRI reporting requirement has a more complex environmental risk exposure than a firm with Superfund liability alone. Auditors must apply a more complex auditing process to the first firm to ensure that it reports its Superfund liability in the financial statements properly and it has an effective environmental management system to track the flow of toxic chemicals in the production process in order to comply with the TRI reporting requirement. Thus, our second hypothesis explores the impact of the complexity in client's environmental exposure on audit fees.

H2: there is a positive association between audit fees and the complexity in corporate environmental regulations.

Although both H1 and H2 examine the impact of corporate environmental risk exposure on audit fees, H2 focuses on how auditors assess the aggregated compliance risk in audit engagements for clients facing multiple environmental risk factors. H2 implies that auditors must ensure that complex auditing processes are employed to deal with complex environmental risk exposure. To the extent that auditors are not directly responsible for the financial consequences of violating individual environmental regulations, the impact of individual environmental risk factor should not be linear on audit effort and audit fees. Auditors should be more concerned about the complexity (or dimensionality) in applicable environmental regulations. We characterize the complexity (or dimensionality) in firm's environmental risk exposure by the

number of different environmental risk factors the sample firms face. H2 captures the essence of this argument to explore the connection between audit efforts and the complexity in environmental regulations in this study. The findings will shed light on the mechanism by which corporate environmental risk exposure affects audit engagements and contributes to the understanding of the relationship between audit complexity and audit fees. We will discuss our empirical proxy for the complexity in environmental risk exposure further later.

III. Sample selection and research design

Data and empirical proxies for corporate environmental risk

We employ a longitudinal sample of U.S. public companies to test our hypothesis. Our sample consists of companies covered both in the Audit Analytics and Compustat North America database since we require audit fees, audit opinion, and financial data for controls. A merge of the two databases generates 83,027 observations for the period of 2000 to 2012. 42,477 observations remain after deleting firms with missing control variables.

One important feature in this study is that we assess corporate environmental risk in five different areas. This is an important research design issue in this study for a few reasons. First, firms in different industries may face different environmental regulations and it is unlikely that environmental performance in one area will capture environmental risk exposure for firms in different industries. Second, firms differ in pollution propensity, emissions types, environmental performance relative to their industry peers, and compliance status with the existing environmental regulations. Thus, assessing the overall compliance risk with existing environmental regulations must consider all applicable environmental regulations and risk factors. For these two reasons, we assess corporate environmental risk in five different areas,

both individually and in aggregate, to ensure the empirical validity of our measures for individual environmental risk factors and the overall complexity in applicable environmental regulations. Finally, as in the existing literature, our audit fee model may suffer from omitted variables and our results could be driven by a correlation between our environmental risk proxy and any potential omitted variables. Using five different environmental risk proxies mitigates the concern that our results are driven by omitted variables.

We develop our environmental risk exposure proxies from three different data sources: the Superfund liability data, the TRI data, and the ASSET4 data. Specifically, we consider corporate environmental compliance risk in the following five areas: Superfund liability, TRI emissions, CO_2 emissions, total waste produced, and fines and penalties from environmental violations. For firms without data in all five areas, we assume they have zero compliance risk relative to other firms in our sample. Finally, we exclude observations with student-t value greater than 3 to avoid the impact of outliers. All independent variables are winsorized to the 1 percentile level in both ends. The sample size may vary somewhat in different regressions when different environmental risk exposure proxies are used. For example, the Superfund data covers the period from 2000 to 2012, TRI from 2000 to 2009, but the ASSET4 database covers the period from 2002 to 2012. When we use environmental risk proxies from all three different databases in one regression or use the complexity measure, the sample covers the period from 2002 to 2009 only. This sample has 30, 436 observations and consists of 6,122 firms from 72 different industries.

Empirical model specifications

To test the relation between environmental risk exposure and audit fees (H1 and H2), we develop an audit fee model based on prior research (Simunic 1980; Francis 1984; Choi et al. 2009). We employ five different environmental risk proxies from three separate data sources as discussed earlier. Our treatment variable *Env* is the environmental risk proxy developed from these databases and we replace *Env* with different environmental risk proxies in different regressions. For example, one of our environmental risk proxies is *TRI_RANK* which is a rank variable defined as aggregated total toxics releases in year *t*, scaled by total sales to control for difference in the production scale, and then ranked within industry peers with the same two-digit SIC number.[8] A high *TRI_RANK* value corresponds to a high relative environmental risk exposure because it indicates a higher toxic emissions amount per thousand dollars of sales relative to the firm's industry peers with the same two-digit SIC code. Our empirical model is specified as follows:

$$\begin{aligned} LnFee = {} & \alpha_0 + \alpha_1 Env + \alpha_2 LnAssets + \alpha_3 NBS + \alpha_4 NGS + \alpha_5 Inv + \alpha_6 QRatio \\ & + \alpha_7 ETD + \alpha_8 ROA + \alpha_9 Loss + \alpha_{10} Opinion + \alpha_{11} Big + \varepsilon, \end{aligned} \tag{1}$$

where $LnFee =$ the natural logarithm of audit fees;

Control variables:

$LnAssets =$ the natural logarithm of total assets;

$NBS =$ number of business segments;

$NGS =$ number of geographic segments;

$Inv =$ ratio of total inventory to total assets;

$QRatio =$ the difference between current assets and inventory divided by current liabilities;

$ETD =$ equity to debt ratio;

[8] This relative environmental risk exposure measure within industry peers is consistent with the existing literature (see Clarkson et al. 2004, Clarkson et al. 2013). All five environmental risk proxies are defined in the Appendix.

$ROA =$ return on assets;

$Loss =$ an indicator variable that equals one if the company reports a loss, and zero otherwise;

$Opinion =$ an indicator variable that equals one if a going-concern is issued, and zero otherwise;

$Big =$ an indicator variable that equals one if the company was audited by a Big4/5 auditor, and zero otherwise.

A significant and positive α_1 is consistent with corporate environmental risk exposure (higher relative toxic emissions per thousand dollars of sales in the case of *TRI_RANK*) being associated with higher audit fees.

We also develop a set of environmental risk proxies based on firms' Superfund liabilities. Specifically, we replace *Env* in equation (1) with *SUPF_DUM*, with *SUPF_DUM* equal to 1 for firms with the Superfund liability and zero otherwise. Our second Superfund based environmental risk proxy is *SUPF_ASSETW* which is as asset-weighted net worth of total Superfund liabilities as reported in the Decision of Order issued by the EPA (see Barth and McNichols 1994 for more details). We also use CO_2 equivalents emissions, the total waste produced, and environmental fines and penalties from the ASSET4 database to proxy for corporate environmental risk. Finally, we create a new variable, *COMPLEXITY*, as our proxy for the complexity in applicable environmental regulations by summing up the dummy variables in each of the five areas. This variable is our proxy measure for the overall complexity in the applicable environmental regulations and it should capture the aggregated compliance risk in five different areas as discussed earlier. We test H2 by replacing *Env* in equation (1) with this *COMPLEXITY* proxy.

Control variables

We follow the existing audit fee literature and control for a variety of factors that are known to affect audit fees from previous studies such as Dao et al. (2012), Francis and Yu (2009), Fung et al. (2012), Hay et al. (2006), Numan and Willekens (2012), and Simunic (1980). Specifically, we control for client size (*LnAssets*), operating complexity (*NBS*, *NGS*, *Inv*), and financial risk (*QRatio*, *ETD*, *ROA*, *Loss*). The coefficients of *LnAssets*, *NBS*, *NGS*, *Inv*, and *LOSS* are expected to be positive and the coefficients of *QRatio*, *ETD*, and *ROA* are expected to be negative. We include going concern opinion (*Opinion*) as a control variable because more investigative efforts are usually required in such circumstances, which may lead to higher audit fees (Francis et al. 2005, Fung et al. 2012). Extant literature has shown that Big audit firms may charge a fee premium (Hay et al. 2006) and thus we also control for Big audit firms (*BIG*) in the regression. We expect the coefficients for *Opinion* and *BIG* to be positive. Finally, we control for the year and industry fixed-effects with indictor variables as appropriate. The definitions for all variables are provided in the Appendix.

IV. Empirical Results and Discussion

Descriptive Statistics

Panel A in Table 1 reports the descriptive statistics of audit fees, various environmental risk proxies based on Superfund, TRI, and Asset4 database, and other key control variables. As shown in the table, audit fees are on average $1.6 million. About 8% of our sample firms have the Superfund liability and the mean TRI per thousand dollars of sales is 0.031 pound. The mean of CO_2 equivalents emissions is about 1.322 ton per million dollars of net sales and mean environmental fines and penalties are $1.39 per million dollar sales. Panel B in Table 1 shows the correlations among all variables with no clear indication for multi-co-linearity among

independent variables. It is interesting to observe that most environmental risk proxies are positively associated with audit fees.

Results using Superfund data to proxy for environmental risk

Table 2 presents the regression results on the association between audit fees and corporate environmental risk as proxied by firms' Superfund liabilities for the period of 2000 to 2012. Column (1) presents the results when a dummy variable *SUPF_DUMMY* is used to indicate whether a firm has Superfund liabilities or not. The estimated coefficient for *SUPF_DUMMY* is 0.227 and it is significantly positive at the 1 percent level. This result suggests that firms with Superfund liabilities on average would pay about 25% higher audit fees than firms without Superfund liabilities, all else being equal.[9] Column (2) presents the regression results when environmental risk is proxied by the net worth of total Superfund liability weighted by the total assets of all firms identified as potentially responsible for the site cleanup cost (i.e., *SUPF_ASSETW*).[10] Column (3) presents regression results when environmental risk is proxied by the net worth of total Superfund liability weighted by the number of firms who are potentially responsible for the site cleanup cost and scaled by the sales revenue of this firm (i.e., *SUPF_EQUALW*).[11] Both variables have significantly positive coefficients, consistent with our hypothesis one. Regarding control variables, the coefficients are all significant at the 1 percent level with signs consistent with the existing literature. Specifically, larger and more complex firms paid higher audit fees and more profitable firms paid lower audit fees. Firms audited by Big 4 auditors and firms that receive a going-concern opinion also paid higher fees.

[9] Note that 25% = exp (0.227)-1
[10] This proxy is based on the notion that bigger firms may assume a higher portion of the total cleanup costs due to their "deeper pockets."
[11] This proxy is based on the notion that all identified responsible firms share the future cleanup liability equally.

Results using TRI data to proxy environmental risk

Table 3 reports the results for the regressions using TRI data to proxy for corporate environmental risk for the period of 2000 to 2009. Column (1) shows the impact of the *TRI_DUMMY*, indicating whether a firm released toxics chemicals to the environment or not, on audit fees. The estimated coefficient is 0.180 and statistically significant at 1% level. To interpret our coefficient estimates, firms with toxics releases would pay 20% higher audit fees, all else being equal. Columns (2) and (3) present the regression results using *TRI_RANK* (TRI per thousand dollar sales ranked within the industry peers) and *TRI_SALES* (TRI per thousand dollars sales) to proxy for corporate environmental risk e, respectively. Additionally, scaling TRI by cost of goods sold generates similar results but not reported for the sake of brevity. Consistently with our hypothesis, both proxies have significantly positive coefficients. Regarding control variables, the coefficients are all significant at the 1 percent level and they bear signs consistent with prior studies.

Results using Asset 4 data to proxy for environmental risk

Table 4 presents the regression results using environmental risk proxies obtained from Asset4 database for the period of 2002 to 2012. Specifically, *CO2_SALES* is the total CO_2 and CO_2 equivalents emissions in tons, *WASTE_SALES* is total waste generated by the sample firms in tons, and *VIOLATIONS* is environmental fines and penalties. All three variables are scaled by net sales in millions of dollars to control for variation in production scale. *CO2_DUMMY*, *WASTE_DUMMY*, and *VIOLATIONS_DUMMY* are dummy variables indicating whether a company has CO_2 emission, or industrial waste production, or environmental violations or not.

The regression results indicate that all six proxies have a significantly positive impact on audit fees, consistent with H1. The coefficients of all control variables are significant at either 5 percent or 1 percent level and bear signs consistent with prior studies. The results from Tables 2, 3, and 4 together indicate that each of our five environmental risk proxies capture some aspect of corporate environmental risk exposure and they all have a positive impact on audit fees. Overall, these results are consistent with H1.

Complexity in applicable environmental regulations and audit fees

H2 explores the impact of the complexity in applicable environmental regulations on audit fees. To test H2, we create a new variable *COMPLEXITY* to proxy for the aggregated environmental risk exposure in five different compliance areas. Specifically, the variable *COMPLEXITY* is the sum of *SUPF_DUMMY*, *TRI_DUMMY*, *CO2_DUMMY*, *WASTE_DUMMY*, and *VIOLATIONS_DUMMY*. The construction of the *COMPLEXITY* variable is based on the assumption that each of the five environmental risk dummy variables represents one aspect (dimension) of the compliance with the applicable environmental regulations. Thus, this *COMPLEXITY* variable captures the overall environmental risk exposure each sample firm faces. We argue that auditors must increase audit efforts and complexity as the dimension of audit clients' environmental risk exposure increases in these five areas. Since this variable requires data from all three data sources, the sample period is intersection of the periods for all data sources, i.e., 2002 to 2009. We estimate regression model (1) with this *COMPLEXITY* proxy and the results are reported in Table 5. Column (1) in Table 5 presents the regression results when *COMPLEXITY* is used in the regression. To further assess the combined impact of individual environmental risk proxies used in Tables 2, 3 and 4, we replicate model (1) by including all five

continuous environmental risk proxies (*TRI_SALES*, *SUPF_EQUALW*, *CO2_SALES*, *WASTE_SALES*, and *VIOLATIONS*) and the results are presented in Column (2). The coefficient of *COMPLEXITY* is 0.106 and significant at 1% level, consistent with H2, indicating an increase in *COMPLEXITY* by one will lead to an 11% increase in audit fees Column (2) shows that *TRI_SALES*, *SUPF_EQUALW*, *CO2_SALES* remain significant while *WASTE_SALES*, and *VIOLATIONS* become insignificant. The results in Table 5 indicate that each of our environmental risk proxies may capture a new dimension in corporate environmental risk exposure. Although our continuous environmental risk proxies in each area may reflect the magnitude of future compliance costs in that area, they do not impact auditor effort and audit complexity in a linear fashion. It appears that auditors are more concerned about the dimension of the overall environmental risk exposure in these five different areas and will increase their effort and audit complexity when the complexity in applicable environmental regulations increases along these five areas. The results in Table 5 support our argument that *COMPLEXITY* can better capture the impact of aggregated compliance risk on audit fees than individual continuous environmental risk proxies.

As further evidence in support of H2, we also investigate the impact of a change in *COMPLEXITY* on audit fees and the results are presented in Table 6. Column (1) in Table 6 shows that the coefficient of the *COMPLEXITY_CHANGE* is 0.027 and significant at 5% level for a signed one tail test, indicating that changes in *COMPLEXITY* have a significant and positive impact on audit fees, while changes in all five continuous environmental risk proxies are not significant as shown in Column (2). The results in Table 6 provide further support that auditors are more concerned about the dimensionality of the overall environmental risk exposure than the incremental changes in the magnitude of individual environmental risk factors.

Overall, the regression analyses so far indicate that firms with environmental risk exposure appear to pay higher audit fees, consistent with auditors exercising more audit efforts for firms with environmental risk exposure. Our results also suggest that auditors are more concerned about the overall complexity in the applicable environmental regulations, less so about the magnitude of individual environmental risk factors.

V. Additional Analyses

We conduct a number of additional analyses in this section to check the robustness of the results in Section IV and to provide further corroborating evidence in support of our hypotheses.

Impact of environmental risk on going-concern opinion and default risk

To validate our argument that corporate environmental risk contributes to the business risk and to provide further evidence that auditors consider corporate environmental risk exposure in audit engagements, we analyze the impact of corporate environmental risk on auditor's going-concern opinion and on the default risk of audit clients. Specifically, we analyze whether corporate environmental risk exposure affects the likelihood of auditor issuing a going-concern opinion and the likelihood of clients going bankrupt. This set of analyses is based on the notion that auditors ought to care about audit client's environmental risk if such risk increases the clients' default risk and business risk to the extent that auditors may issue a going-concern opinion. Table 7 presents the results of two additional analyses. Column (1) in Table 7 shows the results of our analysis of the impact of *COMPLEXITY* on auditors' propensity to issue a going-concern opinion while Column (2) presents the results of the impact of *COMPLEXITY* on the bankruptcy risk for the sample firms. The results indicate that auditors are more likely to issue a

going concern opinion for firms facing complex environmental regulations. Following the existing literature, we measure audit clients' bankruptcy risk by Z-score (Altman 1968). *COMPLEXITY* has a negative and significant coefficient estimate on the Z-score, consistent with environmental risk increasing audit client's bankruptcy risk.[12] Overall, the results in Table 7 suggest that corporate environmental risk exposure contributes to business risk to the extent that it increases the likelihood of a going-concern opinion and default risk. These results provide corroborating evidence that corporate environmental risk exposure should affect auditor behavior and audit fees.

Corporate governance and audit fees

Previous studies suggest that corporate governance may also affect audit fees. One could argue that firms with stronger corporate governance mechanisms may have better internal control and lower environmental risk exposure (Lam and Li 2013). To ensure that our regression analysis does not suffer from this omitted variable, we implement an additional analysis to control for corporate governance strength. Specifically, we identify a subsample of firms in the ASSET4 dataset with both corporate governance strength score and the environmental risk data (*CO2_SALES, WASTE_SALES, VIOLATIONS*) and we include a new variable (*LnCG*) in the regression to control for cross-sectional variation in corporate governance strength. *LnCG* is the natural logarithm of the corporate governance pillar score from Asset 4 database and the number of observations drops to 4,336 (or 4,337) due to the requirement for this variable. The results for this analysis are shown in Table 8. The coefficients on all four environmental risk exposure

[12] Please note that the higher the Z-score is, the lower is the bankruptcy risk. See the Appendix for the definition of Z-score.

proxies remain significantly positive, indicating that corporate governance strength does not drive our results.

Regulatory impact on auditor behavior in Year 2004

To provide further evidence that auditors increase their efforts for clients facing environmental risk exposure, we explore the impact of a regulatory event that should affect auditor efforts. Specifically, the GAO issued a comprehensive report calling for improved corporate environmental disclosure in 2004. The report urges the SEC and other related regulators and policy makers to explore ways to improve the reliability and transparency of corporate environmental disclosure. One could argue that this report will increase the awareness of corporate environmental risk among investors and other related stakeholder groups, including securities and accounting regulators. In addition, the release of the report may trigger enhanced enforcement action by the SEC with respect to the quality and reliability in corporate environmental risk disclosure in corporate legal filings such as 10-Ks. If corporate environmental exposure affects auditor efforts and audit fees, we would expect that such impact will be more pronounced in 2004. Rational auditors may increase auditor efforts and audit complexity in response to anticipated future enforcement activities by the SEC following the release of the GAO report. To test this conjecture, we create a year dummy *Y04* equal one for fiscal year 2004 and zero otherwise. We interact this variable with our corporate environmental risk exposure proxy *COMPLEXITY* (*COMPLEXITY_Y04 = Y04*COMPLEXITY*). We replicate regression model (1) with this additional interaction variable and the results are presented in Table 9. As expected, the coefficient of *COMPLEXITY_Y04* is 0.079 and significant at 1% level. The coefficient of *COMPLEXITY* is 0.099 and is also significant at 1% level. These results are

consistent with auditors increasing audit effort and charging a higher audit fee for companies facing environmental risk exposure in 2004. These results provide further corroborating evidence that corporate environmental risk exposure affects audit fees and auditor behaviors.

International evidence

The sample firms in the previous analyses are drawn from Compustat North America and Audit Analytics database. Thus, they are mainly public securities registrants in the U.S.. In addition, two of our five environmental risk exposure proxies are based on the US environmental regulations (Superfund liability and TRI). One might argue that the environmental regulations and SEC enforcement actions in the US are more stringent than those in other jurisdictions in the world and the findings in Section IV may only apply to the US regulatory setting. To check whether our findings still hold in non-US environmental and securities regulations regimes, we replicate our analyses using non-US listed companies only. Specifically, we identify a group of non-US companies with environmental risk data from the Asset4 database which covers more than 3,500 global companies up to 9 years of historical data. We also extract audit fees, total assets, quick ratio, inventory, net income, and audit opinion from this database. However, it is difficult to calculate number of business segments and geographic segments from ASSET4 database. Thus, we are not able to control for these two factors in the regression model in this part of the analysis. Since Superfund liability and TRI data are only applicable to the US registrants, our environmental risk complexity measure in this section does not include them. We create a new variable *COMPLEXITY_NEW* to measure the complexity in environmental risk exposure for the international sample firms. Specifically, *COMPLEXITY_NEW* is the sum of *CO2_DUMMY*, *WASTE_DUMMY*, and *VIOLATIONS_DUMMY* for the international sample

firms. Table 10 presents the regression results using the international sample firms. Column (1) in Table 10 shows that *COMPLEXITY_NEW* has a positive coefficient estimate and significant at 10% level for a one tail test, consistent with the environmental risk exposure increasing audit fees. Column (2) shows the impact of three individual environmental risk factors on audit fees, CO_2 emissions (*CO2_SALES*), total waste (*WASTE_SALES*), and environmental violations (*VIOLATIONS*). *WASTE_SALES* has a significant and positive impact on audit fees, and *CO2_SALES* and *VIOLATIONS* do not. In sum, the results in Table 10 indicate that the positive relationship between audit fees and corporate environmental risk exposure is not restricted to the US environmental and securities regulation regime. It appears that auditors in non-US legal regimes also consider the complexity in corporate environmental risk exposure in the auditing process.

VI. Conclusions

This study examines the impact of corporate environmental risk exposure on audit efforts and audit fees. We argue that corporate environmental risk increases firms' business risk and auditors must increase audit efforts for firms with environmental risk in order to reduce audit risk. Furthermore, the existing auditing standards require auditors to identify risk in financial misreporting when auditing clients with significant accrued environmental remediation liabilities and to ensure compliance with environmental regulations that may have a material impact on future operations and on an entity's ability to continue its business, or to avoid material penalty due to violation (ISA 240, 250). This mandate for auditors to ensure compliance with the applicable environmental regulations implies that auditors must design more complex auditing process to deal with clients facing more environmental risk factors and complex environmental

compliance issues. These arguments lead to our predictions that corporate environmental risk exposure affects audit fees and auditors will employ more complex audit process for clients with more complex environmental risk exposure. Using a large longitudinal sample of U.S. public companies from the 2000 to 2012 and five different proxies for corporate environmental risk exposure, we find direct evidence that corporate environmental risk exposure has a significant and positive impact on audit fees. Our findings are robust to controls of other factors that are known to affect audit fees in the existing literature. Further analyses indicate that the impact of client's environmental risk exposure on audit fees is not linear and that the dimension (complexity) in corporate environmental risk exposure has a more direct impact on audit fees. Overall, the findings in this study suggest that auditors exercise more efforts when auditing clients with environmental risk exposure, as mandated by the existing auditing standards and auditors appear to charge a higher audit fee for clients with more complex environmental compliance issues. These findings are consistent with auditors employing complex audit process for clients facing complex environmental risk exposure. Overall, our findings are consistent with auditors exercising increased audit efforts when auditing firms with environmental risk exposure and the level of increased auditor efforts are consistent with the complexity in corporate environmental risk exposure.

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APPENDIX Variable Definitions

SUPF_DUMMY	=	1 if the company has superfund liability and zero otherwise.
SUPF_ASSETW	=	Asset weighted net worth of total Superfund liability in dollars, scaled by sales in thousands of dollars.
SUPF_EQUALW	=	Equal weighted net worth of total Superfund liability in dollars, scaled by sales in thousands of dollars.
TRI_SALES	=	The toxics releases (in pounds) scaled by the sales revenue (in $ thousands). The toxics releases is calculated based on data obtained from the U.S. Environmental Protection Agency's (EPA) Toxics Release Inventory (TRI) database and is the sum of all chemicals (in pounds) released to air, water and land by firm *i* in year *t*.
TRI_RANK	=	A proxy for pollution propensity relative to industry peers, measured as the intra-industry (two digit SIC code) decile rank of TRI_SALES in year t.
TRI_DUMMY	=	1 if the company has TRI emissions in year t and zero otherwise.
CO2_SALES	=	Total CO2 and CO2 equivalents emission in tons divided by sales in millions of dollars.
CO2_DUMMY	=	1 if the company has CO2 emission and zero otherwise.
WASTE_SALES	=	Total amount of waste produced in tons divided by net sales in millions of dollars.
WASTE_DUMMY	=	1 if the company has waste produced and zero otherwise.
VIOLATIONS	=	Environmental violations, measured as penalties, fines, settlements or cases not yet settled regarding environmental controversies divided by net sales in millions of dollars.
VIOLATIONS_DUMMY	=	1 if the company has a non-zero environmental violation cost and zero otherwise.
COMPLEXITY	=	Sum of SUPF_DUMMY, TRI_DUMMY, CO2_DUMMY, WASTE_DUMMY and VIOLATIONS_DUMMY.
COMPLEXITY_NEW	=	Sum of CO2_DUMMY, WASTE_DUMMY and VIOLATIONS_DUMMY.
COMPLEXITY_CHANGE	=	Current COMPLEXITY minus last year's COMPLEXITY.
Y04	=	1 if fiscal year is 2004 and zero otherwise.
COMPLEXITY_Y04	=	COMPLEXITY times Y04.
LnFee	=	The natural log of audit fees in dollars.
LnAssets	=	The natural log of assets in millions of dollars.
NBS	=	Number of business segments.
NGS	=	Number of geographic segments.
QRatio	=	The difference between current assets and inventory divided by current liabilities.
Inv	=	Ratio of total inventory to total assets.
ETD	=	Equity to debt ratio.
ROA	=	Return on assets.
Loss	=	Indicator variable that equals one if the company reports a loss this year, and zero otherwise.
Opinion	=	Indicator variable that equals one if going-concern is issued, and zero otherwise.
Big	=	Indicator variable that equals one if the company was audited by a Big4/5 auditor, and zero otherwise.
LnCG	=	The natural log of corporate governance pillar score from Asset4 database.
Z-Score	=	Z-Score = A * 3.3 + B * 0.99 + C * 0.6 + D * 1.2 + E * 1.4, where A=EBIT/Total Assets; B=Net Sales /Total Assets; C=Market Value of Equity / Total Liabilities; D=Working Capital/Total Assets; E=Retained Earnings /Total Assets Common interpretation of Z Score: > 3.0 - safe based on these financial figures only. 2.7 to 2.99 - On Alert. 1.8 to 2.7 - Good chances of going bankrupt within 2 years. < 1.80 - Probability of Financial distress is very high The higher the score, the lower the default risks.

Table 1 Descriptive Statistics and Correlation Matrix

Panel A: Descriptive Statistics

Variable	Mean	Std Dev	Minimum	Median	Maximum
AUDIT_FEES	1,567,276	3,797,433	1,500	537,000	90,200,000
LnFee	13.171	1.478	7.313	13.194	18.318
COMPLEXITY	0.307	0.730	0	0	5
SUPF_DUMMY	0.076	0.264	0	0	1
TRI_DUMMY	0.165	0.371	0	0	1
CO2_DUMMY	0.026	0.159	0	0	1
WASTE_DUMMY	0.013	0.115	0	0	1
VIOLATIONS_DUMMY	0.027	0.162	0	0	1
SUPF_ASSETW	0.053	0.358	0	0	3.221
SUPF_ EQUALW	0.375	2.129	0	0	17.375
TRI_RANK	0.144	0.323	0	0	1.000
TRI_SALES	0.031	0.174	0	0	2.215
CO2_SALES	1.322	8.160	0	0	66.160
WASTE_SALES	0.720	6.240	0	0	62.090
VIOLATIONS	1.390	8.366	0	0	66.160
LnAssets	5.601	2.386	-0.470	5.638	10.917
NBS	2.163	1.569	1	1	7
NGS	2.658	2.095	1	2	11
QRatio	2.230	2.698	0.064	1.376	17.888
Inv	0.104	0.127	0.000	0.056	0.582
ETD	2.065	3.237	-0.795	0.997	21.152
ROA	-0.107	0.504	-3.622	0.025	0.363
Loss	0.382	0.486	0	0	1
Opinion	0.076	0.265	0	0	1
Big	0.732	0.443	0	1	1

Number of observations: 30,436 in the period of Year 2002 to 2009.

Panel B: Pearson Correlation Matrix

		lnFee	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	COMPLEXITY	**0.410**	1.000																					
2	SUPF_DUM	**0.262**	**0.701**	1.000																				
3	TRI_DUM	**0.348**	**0.767**	**0.427**	1.000																			
4	CO2_DUM	**0.257**	**0.637**	**0.216**	**0.186**	1.000																		
5	WASTE_DUMMY	**0.189**	**0.536**	**0.186**	**0.155**	**0.618**	1.000																	
6	VIOLATIONS_DUMMY	**0.239**	**0.602**	**0.205**	**0.174**	**0.676**	**0.446**	1.000																
7	SUPF_ASSETW	**0.167**	**0.411**	**0.522**	**0.248**	**0.164**	**0.135**	**0.174**	1.000															
8	SUPF_EQUALW	**0.061**	**0.361**	**0.616**	**0.217**	**0.045**	**0.039**	**0.053**	**0.632**	1.000														
9	TRI_RANK	**0.339**	**0.753**	**0.418**	**0.975**	**0.188**	**0.159**	**0.178**	**0.251**	**0.218**	1.000													
10	TRI_SALES	**0.115**	**0.309**	**0.166**	**0.406**	**0.083**	**0.051**	**0.072**	**0.117**	**0.090**	**0.461**	1.000												
11	CO2_SALES	**0.257**	**0.636**	**0.219**	**0.184**	**0.996**	**0.621**	**0.673**	**0.164**	**0.045**	**0.187**	**0.080**	1.000											
12	WASTE_SALES	**0.189**	**0.534**	**0.189**	**0.155**	**0.615**	**0.993**	**0.442**	**0.136**	**0.040**	**0.159**	**0.049**	**0.619**	1.000										
13	VIOLATIONS	**0.238**	**0.601**	**0.207**	**0.174**	**0.672**	**0.447**	**0.997**	**0.175**	**0.053**	**0.177**	**0.069**	**0.673**	**0.443**	1.000									
14	LnAssets	**0.842**	**0.393**	**0.243**	**0.330**	**0.259**	**0.180**	**0.239**	**0.166**	**0.051**	**0.323**	**0.127**	**0.258**	**0.180**	**0.238**	1.000								
15	NBS	**0.411**	**0.347**	**0.244**	**0.338**	**0.169**	**0.111**	**0.147**	**0.153**	**0.085**	**0.331**	**0.154**	**0.168**	**0.111**	**0.146**	**0.415**	1.000							
16	NGS	**0.328**	**0.228**	**0.145**	**0.234**	**0.095**	**0.090**	**0.100**	**0.107**	**0.059**	**0.229**	**0.043**	**0.095**	**0.090**	**0.100**	**0.237**	**0.195**	1.000						
17	QRatio	**-0.167**	**-0.109**	**-0.082**	**-0.108**	**-0.053**	**-0.031**	**-0.038**	**-0.041**	**-0.030**	**-0.105**	**-0.061**	**-0.052**	**-0.031**	**-0.038**	**-0.158**	**-0.152**	**0.019**	1.000					
18	Inv	**-0.065**	**0.067**	**0.048**	**0.129**	**-0.032**	*-0.014*	**-0.030**	0.007	**0.064**	**0.121**	**0.047**	**-0.032**	*-0.013*	**-0.029**	**-0.087**	-0.003	**0.065**	**-0.184**	1.000				
19	ETD	**-0.207**	**-0.113**	**-0.082**	**-0.112**	**-0.057**	**-0.037**	**-0.039**	**-0.039**	**-0.023**	**-0.109**	**-0.062**	**-0.056**	**-0.036**	**-0.038**	**-0.179**	**-0.153**	*0.013*	**0.797**	**-0.087**	1.000			
20	ROA	**0.282**	**0.115**	**0.076**	**0.112**	**0.053**	**0.041**	**0.058**	**0.040**	**0.037**	**0.111**	**0.038**	**0.053**	**0.040**	**0.058**	**0.432**	**0.152**	**0.095**	**0.062**	**0.055**	**0.096**	1.000		
21	Loss	**-0.251**	**-0.148**	**-0.094**	**-0.127**	**-0.091**	**-0.060**	**-0.092**	**-0.056**	**-0.030**	**-0.126**	**-0.036**	**-0.091**	**-0.060**	**-0.092**	**-0.374**	**-0.180**	**-0.037**	**0.068**	**-0.060**	**0.022**	**-0.465**	1.000	
22	Opinion	**-0.281**	**-0.091**	**-0.055**	**-0.089**	**-0.046**	**-0.033**	**-0.046**	**-0.029**	**-0.021**	**-0.088**	**-0.025**	**-0.046**	**-0.033**	**-0.046**	**-0.379**	**-0.123**	**-0.095**	**-0.117**	**-0.017**	**-0.106**	**-0.523**	**0.297**	1.000
23	Big	**0.525**	**0.189**	**0.116**	**0.185**	**0.097**	**0.069**	**0.096**	**0.062**	**0.028**	**0.180**	**0.069**	**0.096**	**0.068**	**0.096**	**0.571**	**0.189**	**0.175**	-0.007	**-0.080**	**-0.053**	**0.239**	**-0.194**	**-0.279**

The bold fonts indicate significant at 1% level, italic fonts indicate statistical significance at the 5% level, and the normal fonts are insignificant. All variables are defined in the Appendix.

TABLE 2
Audit Fees and Superfund Liabilities

This table examines the association between audit fees and environmental risk, as proxied by Superfund liabilities. Year- and industry-fixed effects are included. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in the Appendix.

Multivariate Analysis (Dependent Variable = LnFee)

	(1)	(2)	(3)
SUPF_DUMMY	0.227***		
	(19.91)		
SUPF_ASSETW		0.063***	
		(7.79)	
SUPF_EQUALW			0.007***
			(5.43)
LnAssets	0.488***	0.492***	0.494***
	(247.45)	(249.91)	(252.13)
NBS	0.053***	0.057***	0.058***
	(25.36)	(27.43)	(27.73)
NGS	0.050***	0.050***	0.050***
	(31.66)	(31.62)	(31.82)
QRatio	-0.009***	-0.009***	-0.010***
	(-4.79)	(-5.09)	(-5.24)
Inv	0.162***	0.172***	0.165***
	(5.13)	(5.43)	(5.20)
ETD	-0.021***	-0.022***	-0.021***
	(-14.21)	(-14.35)	(-14.16)
ROA	-0.169***	-0.170***	-0.172***
	(-22.85)	(-22.99)	(-23.24)
Loss	0.133***	0.131***	0.131***
	(19.29)	(18.87)	(18.82)
Opinion	0.110***	0.113***	0.115***
	(8.30)	(8.49)	(8.62)
Big	0.321***	0.317***	0.315***
	(38.99)	(38.45)	(38.20)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
No. of Observations	42,089	42,088	42,090
Adjusted R^2 (%)	83.94	83.83	83.81

TABLE 3
Audit Fees and TRI Emissions

This table examines the association between audit fees and environmental risk, as proxied by TRI_DUMMY, TRI industry ranking (TRI_RANK), and TRI scaled by sales (*TRI_SALES*). Year- and industry-fixed effects are included. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in the Appendix.

Multivariate Analysis (Dependent Variable = LnFee)

	(1)	(2)	(3)
TRI_DUMMY	0.180***		
	(17.24)		
TRI_RANK		0.189***	
		(16.16)	
TRI_SALES			0.081***
			(4.37)
LnAssets	0.487***	0.488***	0.495***
	(219.50)	(220.14)	(226.81)
NBS	0.052***	0.053***	0.059***
	(22.28)	(22.40)	(25.14)
NGS	0.053***	0.053***	0.054***
	(29.45)	(29.44)	(29.89)
QRatio	-0.011***	-0.011***	-0.012***
	(-5.47)	(-5.45)	(-5.67)
Inv	0.119***	0.120***	0.149***
	(3.42)	(3.43)	(4.23)
ETD	-0.020***	-0.020***	-0.021***
	(-12.15)	(-12.20)	(-12.69)
ROA	-0.171***	-0.172***	-0.174***
	(-21.01)	(-21.04)	(-21.29)
Loss	0.139***	0.138***	0.134***
	(18.14)	(18.06)	(17.43)
Opinion	0.121***	0.121***	0.126***
	(8.28)	(8.30)	(8.62)
Big	0.301***	0.300***	0.298***
	(32.60)	(32.47)	(32.20)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
No. of Observations	35,272	35,273	35,276
Adjusted R^2 (%)	83.30	83.30	83.16

TABLE 4
Audit Fees and Environmental Risk Variables from Asset4

This table examines the association between audit fees and environmental risk, as proxied variables obtained from Asset4 database. Year- and industry-fixed effects are included. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in the Appendix.

Multivariate Analysis (Dependent Variable = LnFee)

	(1)	(2)	(3)	(4)	(5)	(6)
CO2_DUMMY	0.129***					
	(7.30)					
CO2_SALES		0.003***				
		(7.37)				
WASTE_DUMMY			0.132***			
			(5.41)			
WASTE_SALES				0.002***		
				(5.55)		
VIOLATIONS_DUMMY					0.102***	
					(5.89)	
VIOLATIONS						0.002***
						(5.97)
LnAssets	0.497***	0.497***	0.499***	0.499***	0.498***	0.498***
	(229.63)	(229.60)	(232.87)	(232.86)	(230.54)	(230.51)
NBS	0.056***	0.056***	0.057***	0.057***	0.057***	0.057***
	(25.30)	(25.30)	(25.51)	(25.50)	(25.45)	(25.45)
NGS	0.049***	0.049***	0.049***	0.049***	0.049***	0.049***
	(29.35)	(29.35)	(29.32)	(29.32)	(29.35)	(29.35)
QRatio	-0.005**	-0.005**	-0.005**	-0.005**	-0.005**	-0.005**
	(-2.39)	(-2.39)	(-2.47)	(-2.47)	(-2.38)	(-2.38)
Inv	0.163***	0.163***	0.164***	0.164***	0.165***	0.165***
	(4.77)	(4.77)	(4.79)	(4.78)	(4.81)	(4.81)
ETD	-0.022***	-0.022***	-0.022***	-0.022***	-0.022***	-0.022***
	(-13.54)	(-13.54)	(-13.38)	(-13.38)	(-13.56)	(-13.56)
ROA	-0.170***	-0.170***	-0.173***	-0.173***	-0.171***	-0.171***
	(-21.16)	(-21.16)	(-21.45)	(-21.45)	(-21.27)	(-21.26)
Loss	0.141***	0.141***	0.141***	0.141***	0.141***	0.141***
	(18.75)	(18.76)	(18.68)	(18.69)	(18.76)	(18.76)
Opinion	0.104***	0.104***	0.105***	0.105***	0.104***	0.104***
	(7.14)	(7.13)	(7.19)	(7.19)	(7.19)	(7.18)
Big	0.326***	0.326***	0.325***	0.325***	0.325***	0.325***
	(37.08)	(37.08)	(36.90)	(36.91)	(36.96)	(36.96)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	36,971	36,971	36,973	36,973	36,971	36,971
Adjusted R^2 (%)	83.67	83.67	83.65	83.65	83.66	83.66

TABLE 5
Audit Fees and Complexity of Corporate Environmental Risk Exposure

This table examines the association between audit fees and the complexity of environmental risk (sum of dummy variables from all data sources) and the association between audit fees and the continuous variables obtained from all three data sources. Year- and industry-fixed effects are included. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in the Appendix.

Multivariate Analysis (Dependent Variable = LnFee)	(1)	(2)
COMPLEXITY	0.106***	
	(18.66)	
TRI_SALES		0.085***
		(4.05)
SUPF_EQUALW		0.008***
		(4.60)
CO2_SALES		0.002***
		(2.91)
WASTE_SALES		0.001
		(1.39)
VIOLATIONS		0.000
		(0.68)
LnAssets	0.491***	0.501***
	(197.81)	(203.59)
NBS	0.051***	0.056***
	(19.78)	(22.10)
NGS	0.052***	0.053***
	(26.66)	(27.04)
QRatio	-0.005**	-0.006***
	(-2.11)	(-2.60)
Inv	0.131***	0.140***
	(3.40)	(3.60)
ETD	-0.022***	-0.021***
	(-11.74)	(-11.63)
ROA	-0.167***	-0.173***
	(-18.24)	(-18.81)
Loss	0.153***	0.148***
	(18.15)	(17.46)
Opinion	0.106***	0.111***
	(6.56)	(6.81)
Big	0.317***	0.312***
	(31.68)	(31.05)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
No. of Observations	30,158	30,166
Adjusted R^2 (%)	83.13	82.96

TABLE 6
Audit Fees and Changes in the Complexity of Environmental Risk Exposure

This panel examines the association between audit fees and changes in complexity of environmental risk, as proxied by COMPLEXITY_CHANGE. Year- and industry-fixed effects are included. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. *TRI_SALES_CHANGE* is current year's *TRI_SALES* minus last year's *TRI_SALES*. *SUPF_EQUALW_CHANGE* is current year's *SUPF_EQUALW* minus last year's *SUPF_EQUALW*. *CO2_SALES_CHANGE* is current year's *CO2_SALES* minus last year's *CO2_SALES*. *WASTE_SALES_CHANGE* is current year's *WASTE_SALES* minus last year's *WASTE_SALES*. *VIOLATIONS_CHANGE* is current year's *VIOLATIONS* minus last year's *VIOLATIONS*. The rest variables are defined in the Appendix.

Dependent Variable = LnFee		
	(1)	(2)
COMPLEXITY_CHANGE	0.027*	
	(1.77)	
TRI_SALES_CHANGE		-0.036
		(-1.07)
SUPF_EQUALW_CHANGE		-0.008
		(-0.80)
CO2_SALES_CHANGE		0.001
		(1.64)
WASTE_SALES_CHANGE		0.001
		(1.13)
VIOLATIONS_CHANGE		0.000
		(-0.10)
LnAssets	0.512***	0.511***
	(191.40)	(191.11)
NBS	0.057***	0.057***
	(20.77)	(20.70)
NGS	0.051***	0.051***
	(24.25)	(24.25)
QRatio	-0.006**	-0.006**
	(-2.44)	(-2.44)
Inv	0.115***	0.115***
	(2.79)	(2.78)
ETD	-0.019***	-0.019***
	(-9.32)	(-9.31)
ROA	-0.187***	-0.187***
	(-17.44)	(-17.44)
Loss	0.153***	0.153***
	(16.29)	(16.27)
Opinion	0.132***	0.131***
	(7.09)	(7.07)
Big	0.314***	0.315***
	(28.85)	(28.88)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
No. of Observations	24,099	24,098
Adjusted R^2 (%)	83.26	83.26

TABLE 7

Going-Concern, Default Risk and Environmental Risk Complexity

This panel examines the association between default risk and environmental risk, as proxied by COMPLEXITY. Year- and industry-fixed effects are included. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in the Appendix.

	(1) ***Dependent Variable*** Going_concern	(2) **Dependent Variable** Z-score
COMPLEXITY	0.237***	-0.20***
	(11.22)	(-3.88)
LnAssets	-0.455***	0.38***
	(542.85)	(18.60)
NBS	-0.017	-0.04
	(0.45)	(-1.53)
NGS	-0.007	-0.05***
	(0.19)	(-2.61)
QRatio	-0.323***	0.22***
	(151.80)	(10.80)
Inv	-0.991***	1.67***
	(23.19)	(4.99)
ETD	-0.012	1.39***
	(0.54)	(82.81)
ROA	-0.825***	11.46***
	(262.18)	(115.36)
Loss	1.435***	
	(351.72)	
Opinion		-2.27***
		(-15.40)
Big	-0.415***	
	(36.00)	
Year fixed effects	Yes	Yes
Industry fixed effects	N/A	Yes
No. of Observations	30,436	25,213
Likelihood Ratio or Adjusted R^2 (%)	6,809	68.65

Table 8
Audit Fees, Environmental Risk Exposure and Corporate Governance

This table examines the association between audit fees and environmental risk, as proxied by variables obtained from Asset4 database, after controlling corporate governance. Year- and industry-fixed effects are included. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in the Appendix.

Dependent Variable = LnFee				
	(1)	(2)	(3)	(4)
COMPLEXITY_NEW	0.021**			
	(2.53)			
CO2_SALES		0.001*		
		(1.85)		
WASTE_SALES			0.001**	
			(2.16)	
VIOLATIONS				0.001**
				(2.56)
LnCG	0.004	0.005	0.007	0.005
	(0.30)	(0.36)	(0.52)	(0.34)
LnAssets	0.566***	0.568***	0.569***	0.567***
	(69.15)	(69.62)	(72.05)	(71.17)
NBS	0.063***	0.064***	0.064***	0.063***
	(13.61)	(13.66)	(13.72)	(13.60)
NGS	0.032***	0.032***	0.032***	0.032***
	(8.40)	(8.47)	(8.55)	(8.39)
QRatio	-0.011	-0.011	-0.011	-0.011
	(-1.50)	(-1.51)	(-1.51)	(-1.44)
Inv	0.883***	0.881***	0.876***	0.886***
	(6.89)	(6.87)	(6.84)	(6.91)
ETD	-0.041***	-0.041***	-0.041***	-0.042***
	(-6.61)	(-6.59)	(-6.57)	(-6.67)
ROA	-0.457***	-0.445***	-0.450***	-0.459***
	(-5.23)	(-5.10)	(-5.15)	(-5.24)
Loss	0.052*	0.050*	0.049*	0.052*
	(1.82)	(1.74)	(1.72)	(1.83)
Opinion	0.127	0.128	0.134	0.124
	(0.95)	(0.96)	(1.01)	(0.93)
Big	0.074	0.072	0.073	0.077
	(1.10)	(1.08)	(1.09)	(1.15)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
No. of Observations	4,337	4,336	4,336	4,337
Adjusted R^2 (%)	75.75	75.78	76.79	75.75

Table 9

The Impact of Policy Enhancement on the Association between Audit Fees and Complexity of Environmental Risk

This table examines the association between audit fees and environmental risk in Year 2004 versus other years. Year- and industry-fixed effects are included. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in the Appendix.

Dependent Variable = LnFee	(1)
COMPLEXITY	0.099***
	(16.73)
COMPLEXITY_Y04	0.079***
	(5.10)
Y04	-0.245***
	(-16.63)
LnAssets	0.491***
	(197.83)
NBS	0.050***
	(19.68)
NGS	0.052***
	(26.71)
QRatio	-0.005**
	(-2.07)
Inv	0.130***
	(3.39)
ETD	-0.022***
	(-11.75)
ROA	-0.167***
	(-18.23)
Loss	0.154***
	(18.19)
Opinion	0.106***
	(6.57)
Big	0.317***
	(31.67)
Year fixed effects	Yes
Industry fixed effects	Yes
No. of Observations	30,161
Adjusted R^2 (%)	83.13

TABLE 10
International Analysis: Audit Fees and Complexity of Environmental Risk

This table examines the association between audit fees and the complexity of environmental risk (the sum of CO2_DUMMY, WASTE_DUMMY, and VIOLATIONS_DUMMY) of a sample of international companies other than those in Compustat North America. Year- and industry-fixed effects are included. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in the Appendix.

Multivariate Analysis (Dependent Variable = LnFee)	(1)	(2)
COMPLEXITY_NEW	0.373*	
	(1.64)	
CO2_SALES		0.019
		(0.35)
WASTE_SALES		0.010***
		(3.57)
VIOLATIONS		0.015
		(0.28)
LnAssets	0.787***	0.789***
	(81.07)	(81.96)
QRatio	0.019*	0.019*
	(1.72)	(1.80)
Inv	0.000	-0.000
	(-0.33)	(-0.51)
ROA	0.125	0.262
	(0.29)	(0.62)
Loss	0.366***	0.382***
	(4.33)	(4.55)
Opinion	2.507***	2.506***
	(3.77)	(3.80)
Year fixed effects	Yes	Yes
No. of Observations	2,590	2,588
Adjusted R^2 (%)	75.79	76.24