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Advisor: Peter F. POPE

Co-Advisor: Annita FLOROU

PhD Thesis by

Claudio FERRANTINO

ID number: 1667013

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THESIS ABSTRACT

In the first chapter, I examine the audit consequences associated with financial misconduct by a firm within a strategic alliance. Core earnings restatements, which involve corrections to a firm's primary operational activities, such as revenues, cost of goods sold, and selling, general and administrative expenses, are particularly relevant to its alliance partners. I find evidence that audit fees increase for allied partners following a core earnings restatement. This increase does not appear to be driven by more audit effort but from an increased risk premium, to compensate for the higher perceived audit risk, and is concentrated on contractual alliances rather than joint ventures. Additional analyses indicate that this effect is not limited to core earnings restatements but extends to fraudulent restatements. Cross-sectional tests show that the spillover effect deriving from core earnings restatements is concentrated among firms with lower accruals quality, while, on the contrary, the spillover effect deriving from fraudulent restatements is concentrated among firms with better accruals quality. Overall, this study indicates that financial misconduct in one firm has detrimental consequences to allied partners' perceived audit risk, which translates into higher audit fees.

In the second chapter (co-authored with Hami Amiraslani, Annita Florou and Peter F. Pope) we examine the effects of a change in ESG scoring methodology by LSEG ESG (formerly Refinitiv ESG) on both the disclosure practices and policy adoption of rated firms. In 2020, LSEG ESG implemented two major modifications to its ESG scoring approach: (1) the "summing the percentile" methodology, which penalizes firms that selectively disclose quantitative data, and (2) the "default-value removal," which rewards firms that adopt more ESG-friendly policies. Our findings indicate an increase in quantitative data disclosure and policy adoption, particularly within the Environmental and Social pillars. Cross-sectional analysis reveals that this effect is more

pronounced among firms with higher levels of institutional ownership as of March 2020. Overall, this study suggests that changes in third-party rating methodologies can significantly influence firms' disclosure behaviors and real policy actions.

In the third chapter, I plan to explore how the presence of alliances within an industry influences the investment sensitivity of non-allied peer firms and the accuracy of financial analysts' capital expenditure (capex) forecasts. I intend to use a comprehensive dataset of alliances spanning multiple industries in the United States. I hypothesize that the presence of alliances will lead to a reduction in investment sensitivity for non-allied firms, a decline in the accuracy of analysts' capex forecasts for non-allied firms, and an improvement in the forecast accuracy for allied firms. I further anticipate that these effects will be more pronounced under specific conditions: when alliances involve increased private communication (e.g., through joint ventures), when they pertain to higher-risk projects (e.g., exploration alliances), in high-tech sectors, and in contexts with higher investment irreversibility. Additionally, I expect that the average number of forecasts provided by allied firms within an industry will reinforce the observed decrease in investment sensitivity among non-allied firms. To validate these findings, I plan to use a shock to alliances across seven U.S. states as a falsification test. This study aims to contribute to the literature on information transfers and their impact on peer firm investments, on financial analysts' capex forecasting, and provide insights, albeit to a lesser extent, into the management literature on strategic alliances.

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CHAPTER 1

Painted With the Same Brush? Audit Consequences of Allied Firms' Financial Misconduct

I. INTRODUCTION

I explore whether the financial misreporting of one firm in a strategic alliance leads to increased audit fees for its alliance partners. Strategic alliances are collaborations between two or more firms that combine resources to achieve common objectives (Gulati and Singh, 1998), aiming at diminishing each firm's dependence on external resources (Hillman et al., 2009), while increasing their interdependence on one another (Barnett and Hoffman, 2008). Alliances can take various forms, from equity-based joint ventures to contractual partnerships, such as R&D, marketing, and supply-chain agreements. To illustrate the scale and significance of strategic alliances, joint ventures alone account for over $5 trillion in annual investments (Bamford, 2017), and nearly 40% of U.S. public companies' revenues in 2010 were generated from alliances (Greve et al., 2014).

Given the strategic importance of alliances and the interdependencies they create, understanding how events occurring at one alliance partner may impact the other firms is crucial. This study focuses on accounting restatements as a key event that signals significant errors in a firm's financial statements and examines their consequences on the audit fees of the allied partners. Restatements, which correct prior misstatements in financial statements, are described by the SEC as "the most visible indicator of improper accounting and a source of new investigations."[1] Restatements represent a failure for both the restating company and the audit firm, undermining the restating firm's organizational legitimacy (Arthaud-Day Certo, Dalton and Dalton, 2017) and damaging the auditor's reputation (Liu, Raghunandan and Rama, 2009). Since alliances create

[1] The full article is available at: https://www.wsj.com/articles/SB994366683510250066.

interdependence between firms, the actions of one partner, such as a restatement, can have similar implications for the others. Therefore, one potential consequence is an increase in the perceived audit risk of allied firms, as the auditor's reputation is also at stake, and auditors charge fees in return for bearing such risk and for their effort (Florou, Morricone and Pope, 2020). Audit risk consists of client-specific risk (inherent and control risk) and detection risk (the risk that the auditor fails to detect a misstatement)[2]. Indeed, restatements often lead to negative stock market reactions, reputational damage and increased audit scrutiny not only for the restating firm (Palmrose and Scholz, 2004; Ettredge et al., 2010) but also for firms in the same sector firms (Guo et al., 2018) and firms connected through board interlocks (e.g., Ivanova and Prencipe, 2021; Li, Cai and Wang, 2023). While the direct effects of restatements on the restating firm's audit fees have been well-documented (e.g., Feldmann, Read and Abdolmohammadi, 2009; Lobo and Zhao, 2013), the potential spillover effects on the audit fees of alliance partners remain underexplored.

Strategic alliances represent a fundamentally different linkage mechanism from industry membership or board interlocks. Unlike industry peers, which share common market environments without formal coordination, or board interlocks, which arise from individuals serving on the boards of multiple firms without necessarily implying cooperation between those firms, strategic alliances involve formal and contractually defined relationships between specific firms. Alliances are characterized by frequent operational interactions, private information exchange and complex agreements governing the allocation of costs, revenues and risks. Moreover, strategic alliances often span firms across different industries, making the connection firm-specific rather than industry-based. In contrast, industry-based relationships are inherently competitive and lack any

[2] The American Institute of Certified Public Accountants (AICPA) defines "audit risk" as "the risk that the auditor expresses an inappropriate audit opinion when the financial statements are materially misstated" in AU-C Section 320.

collaborative structure, while board interlocks do not require formal agreements or joint operations. As a result, the flow of proprietary information and interfirm dependencies, inherent in strategic alliances, create a risk transmission channel that is absent in industry or governance-based linkages.

I focus on core earnings restatements, which involve corrections to a firm's primary operational activities, such as revenues, cost of goods sold (COGS), and selling, general and administrative (SG&A) expenses. These restatements are particularly significant in the context of strategic alliances. Core earnings restatements affect the fundamental components of a firm's financial health. They are more likely to signal ongoing operational weaknesses than non-core earnings restatements, which typically involve one-time or peripheral items such as tax adjustments or asset impairments (Penman, 2013). They are also associated with a higher frequency of bankruptcy and delisting, and more negative stock price reactions upon announcement (Palmrose and Scholz, 2004).

Allied firms are often deeply concerned about their partners' financial health, as the bankruptcy of a partner can have detrimental effects on their own operations, particularly by impacting their operating performance (Boone and Ivanov, 2012). In addition to financial health, alliance partners are concerned with the accounting quality of their counterparts (Ge, Ji and Louis 2021), which ties closely to the reliability of shared financial information. Furthermore, alliances typically engage in activities that share the risks, revenues and operating costs generated through their partnerships (e.g., Demirkan and Demirkan, 2014). Given that cost allocation can be challenging even among divisions within the same entity (Ray and Goldmanis, 2012), it becomes even more complex when multiple entities are involved, as in the case of a strategic alliance. As such, core earnings restatements may complicate these financial arrangements and exacerbate the

risks for all parties in the alliance. Therefore, the restatement of core earnings is likely to significantly impact both contagion risk and business risk within the alliance.

There are several reasons why the audit fees of allied firms may increase after a partner's restatement. First, a reputational spillover may occur. One firm's reputational damage associated with financial misconduct can spread to its alliance partners. Previous research has shown that investors and stakeholders often perceive alliances as signals of shared values, strategies, and organizational endorsements (Norheim-Hansen and Marchi, 2021; Stuart, Hoang and Hybels, 1999). Thus, if a firm in an alliance restates its financials, auditors may perceive increased audit risk for other firms in the same alliance and charge higher audit fees to compensate for this heightened risk. Second, the business risk of allied firms may also increase.[3] Prior studies have documented that restating firms experience negative market reactions (e.g., Palmrose, Richardson and Scholtz, 2004), which can impair their credibility and reduce the value created by the alliance (Gleason, Rahman and Stice, 2023; Galloway, Miller and Liu, 2021). This increase in business risk could raise concerns for the auditors of allied firms, leading to higher audit fees (Lyon and Maher, 2005). Third, auditors may respond to concerns about a contagion effect, where issues in the restating firm spread to its alliance partners, therefore increasing audit scrutiny and fees (Kedia, Koh and Rajgopal, 2015).

I use a sample of U.S. public firms that are covered by Compustat North America for financial statement data, Audit Analytics for data on audit fees and restatements and the Securities Data Company (SDC) Platinum database for information on strategic alliances. The sample period begins in 2000, the first year of audit fee disclosure in Audit Analytics, and extends through 2022

[3] AICPA defines business risk as the "risk resulting from significant conditions, events, circumstances, actions, or inactions that could adversely affect an entity's ability to achieve its objectives and execute its strategies or from the setting of inappropriate objectives and strategies" in AU-C Section 315.

to allow sufficient time to detect financial misstatements. I find evidence supporting the hypothesis that core earnings restatements by an allied partner are associated with a significant increase in audit fees for its allied firms. Specifically, the results show that when an alliance partner restates its core earnings, its alliance partners experience an increase in audit fees. This finding aligns with the theory that core earnings restatements, often signaling operational weaknesses, create spillover effects on allied firms. In response, auditors may increase their scrutiny of the non-restating firm's financial reporting or demand a higher risk premium to compensate for the increased perceived audit risk. I find that this effect is mainly driven by Contractual Alliances (CAs) rather than by Joint Ventures (JVs).

Additionally, I test whether other types of restatements, such as Big R restatements[4], fraudulent restatements, adverse restatements, income decreasing restatements and the number of restated items, are also positively associated with increases in audit fees for allied firms. I find that, beyond core earnings restatements, only fraud-related restatements at allied firms have a significant impact on audit fees. It means that severe forms of financial misconduct can affect perceived audit risk, even if they are less directly tied to the core operating activities of the allied firms. Rather, these restatements influence audit fees primarily through increased reputational and business risk, rather than through direct contagion effects. Also in this case, the effect is mainly driven by CAs.

In additional analyses, I find no evidence of an increase in audit effort, proxied by audit reporting lag (ARL; Knechel and Payne, 2001) following a core earnings restatement by an allied firm. This result suggests that the observed increase in audit fees is more likely attributable to a higher risk premium charged to the audited firm rather than an increase in audit effort.

[4] A Big R restatement is a "revision and publication of one or more of a company's previously released financial statements due to a material error" (e.g., Bartov et al., 2021).

In the cross-sectional analyses, I examine whether the spillover effect is more pronounced for firms with poorer or better accruals quality. Since one key driver of spillover effects is the possibility of contagion, allied firms with higher audit risk are expected to face greater penalties in terms of increased audit fees compared to firms with better accruals quality. To test this, I split the sample into two groups based on whether their accrual levels are higher than the sample median, using the accruals taxonomy proposed by Richardson et al. (2005). As expected, the positive effect of core earnings restatements by an allied firm on a partner's audit fees is concentrated in the subsample of firms with higher accruals or "less reliable" accruals. Conversely, the spillover effect from fraudulent restatements is significantly positive for firms with lower accruals or more reliable accruals. These findings suggest that firms already engaging in aggressive earnings management are more susceptible to spillover effects from their alliance partner's core earnings restatements. However, firms with higher-quality accruals appear more vulnerable to spillover effects from their alliance partner's fraudulent restatements.

This study makes several important contributions to audit fees, strategic alliances and financial reporting literature. First, I contribute to the emerging research on audit pricing in the context of strategic alliances. While prior studies have extensively documented how audit fees are influenced by client characteristics (e.g., Hay et al. 2006; Simunic 1980), prior audit fees (Kacer et al. 2018) and board interlocks (Ivanova and Prencipe 2021; Li, Cai and Wang 2023), relatively few studies have examined how strategic alliances affect the audit pricing of allied firms. Among the limited work in this area, Demirkan and Zhou (2016) provide evidence that firms entering into more strategic alliances tend to face higher audit fees, and that this effect is primarily driven by contractual rather than equity alliances. They attribute this to the incomplete contract nature of contractual alliances, which makes it difficult to anticipate and specify all potential contingencies.

I extend this line of research by showing that financial misreporting at one alliance partner (i.e., restatements of core earnings) can affect the audit fees of its allied partners. I attribute this finding to an increase in the perceived audit risk, rather than increased audit effort, of firms that are not directly involved in the misconduct but are connected through strategic alliances. Moreover, I find that the increase in audit fees is not limited to core earnings restatements but also extends to fraudulent restatements, and that these effects are mainly driven by contractual alliances, consistent with Demirkan and Zhou's findings, and are stronger among firms with less reliable accruals.

Secondly, this study contributes to the recent research on misconduct in strategic alliances. Recent research by Gleason, Rahman and Stice (2023) and Galloway, Miller, and Liu (2021) has shown evidence of stock market consequences for firms allied with partners that engaged in misconduct, including financial misreporting. These studies found that misconduct leads to various consequences, such as analyst forecast revisions and increased forecast accuracy for allied firms. However, none of these studies has examined the audit-related consequences for non-restating allied firms. My research aims to complement their findings by demonstrating that financial misconduct by an alliance partner can also have significant implications for audit fees, thereby broadening the understanding of how misconduct within alliances influences other financial outcomes.

Thirdly, I seek to extend the literature on the role of auditors in strategic alliances. Demirkan and Zhou (2016) found that firms engaged in more strategic alliances tend to pay higher audit fees, likely due to the increased complexity and risks associated with monitoring these alliances. Similarly, Gore et al. (2019) suggest that auditors may even specialize in auditing firms involved in alliances, recognizing the unique challenges these relationships pose. I aim to extend this literature by providing evidence that auditors consider financial misconduct outside their

client's immediate boundaries when determining audit fees, thereby pricing the audit to account for potential spillover risks from allied firms' misstatements. This result highlights the increasingly interdependent nature of modern businesses and the evolving role of auditors in assessing interconnected risks across firm networks.

Lastly, I aim to contribute to the growing literature that examines the importance of financial reporting quality in strategic alliances. Huang et al. (2023) demonstrate that the financial reporting quality of an alliance partner has a significant impact on the investment efficiency of allied firms, as the information provided by the partner aids investors in monitoring firm performance. Ge, Ji and Louis (2021) show that lower accounting quality in a firm leads to more governance provisions imposed within strategic alliance contracts. These studies indicate that poor financial reporting is recognized as a potential risk, prompting partners to establish more stringent oversight mechanisms. Similarly, Baxamusa, Jalal and Jha (2018) found that the readability of a firm's annual reports positively correlates with the value generated by the alliance, as clearer financial disclosure generates greater trust and confidence among investors and stakeholders. Thus, my study extends the focus on financial misconduct, an egregious signal of poor accounting quality, and its impact on allied firms' audit fees.

II. THEORETICAL BUILDING

1. Strategic Alliances and Accounting Quality

Strategic alliances, defined as collaborations where two or more firms pool property and strategic decision-making rights while maintaining independent ownership and control over their other assets, have become a fundamental component of modern business strategies (Gibbons and Roberts, 2013). Alliances often involve the exchange or joint development of products, technologies or services, allowing firms to achieve mutually beneficial objectives (Gulati and

Singh, 1998). For example, joint ventures, a common form of strategic alliance, involve firms committing resources (i.e., equity-based agreements) to form a separate legal entity dedicated to specific projects, with profits distributed proportionally according to the partners' equity stakes. Strategic alliances can also take the form of contractual agreements, including production alliances, marketing collaborations, R&D expense-sharing agreements, and supply-chain partnerships.

Strategic alliances differ from typical supplier relationships in several key respects. First, alliances tend to have longer durations, often averaging five years when the termination date is not disclosed (e.g., Gulati and Gargiulo, 1999; Sytch and Tatarynowicz, 2014; Kumar, Liu and Zaheer, 2022). Additionally, alliances feature more complex administrative structures and dispute resolution mechanisms. Alliance contracts frequently involve the exchange of firm-specific information and technical knowledge, which may not always be intended (Arrow, 1962; Phene and Tallman, 2014), and require joint decision-making. Moreover, strategic alliance contracts often include distinct payment terms, such as revenue- and cost-sharing mechanisms and specific payment timelines. In contrast, supply contracts tend to be shorter and focus primarily on transactional details, such as payment terms, quality specifications and delivery quantities. While sharing some similarities, alliance contracts are generally longer, more complex, and broader in scope (Mayer and Teece, 2008).

When selecting an alliance partner, firms must evaluate several factors, including technological capabilities, distribution channels and accounting quality. Ge et al. (2021) found that firms with higher accounting quality tend to have fewer governance provisions in their alliance contracts, such as less frequent written reports, fewer lawsuit clauses, and reduced arbitration provisions. This correlation likely stems from the understanding that allying with a financially unreliable partner diminishes the potential value of the collaboration. Further supporting this,

Huang et al. (2023) show that accounting quality positively influences the investment efficiency of allied firms. Accurate financial information enables capital providers to make better-informed decisions regarding a firm's growth prospects, benefiting the allied partner. Similarly, Baxamusa et al. (2018) found that the readability of a firm's annual report affects the value created by the alliance, as poor readability undermines investor trust and generates negative sentiment about the newly formed partnership.

Overall, strategic alliances inherently create interdependence between the firms involved, making the accounting quality of each party a matter of concern for their alliance partners. Prior research has documented various forms of spillover effects in other contexts, thereby suggesting that such alliances may similarly serve as a channel for spillover effects in areas such as audit fees.

2. Spillover Effects and Strategic Alliances

Spillover refers to the unintended impact of an event in a focal organization on the perceptions and decisions of other organizations within the same category or categories (i.e., peer organizations) and their respective stakeholders (e.g., Shi et al., 2022). When a stigmatizing event occurs, negative legitimacy spillovers often extend beyond immediate stakeholders, as investors and other observers may associate firms with their partners' misconduct. Stakeholders, such as creditors, employees or customer firms, may distance themselves from the organization to avoid stigmatization (Jensen, 2006). For example, when Enron filed for bankruptcy amid its scandal, JPMorgan was implicated in negative press coverage because it had provided $2.6 billion in financing to Enron (Atlas, 2002). As a result, the relationship between the two entities became a significant liability, threatening the legitimacy of Enron and JPMorgan. Prior research has extensively documented spillover effects among organizations, which can have positive or negative consequences for peer entities. In the context of accounting restatements, there is evidence of reputational penalties (i.e., negative market reactions) on peer firms that are connected

to the restating firms through board interlocks (Kang, 2008), as well as an increase in audit fees (Ivanova and Prencipe, 2021; Li, Cai and Wang, 2023). Furthermore, peer firms in the same industry, or those sharing the same auditor, often experience negative market reactions (Gleason et al., 2008). Evidence also shows that peer firms learn from restating firms and change their behavior accordingly, such as by decreasing their investment growth in the year following the competitor's restatement announcement (Durnev and Mangen, 2009), and increasing their investments during the fraud periods of high-profile firms (Beatty, Liao and Yu, 2013), or engage in financial misconduct as a response for rivals' bribery for benchmarking reasons (Marangoni, 2021).

In the context of strategic alliances, spillovers are typically driven by interorganizational proximity (i.e., frequent communication), which signals strategic alignment, shared orientations or values, and mutual endorsement (Stuart et al., 1999; Yu and Lester, 2008). Indeed, direct contacts between companies via alliances allow firms to reduce their public disclosure while increasing private communication (Kepler, 2021). When communication between two organizations is frequent, they are more likely to adopt similar orientations and values (Galaskiewicz and Burt, 1991). Thus, although strategic alliances can reduce firms' dependence on external resources (Hillman et al., 2009), they simultaneously increase reputational interdependence between partners (Barnett and Hoffman, 2008), making highly reputable firms more attractive for strategic alliance selection (Norheim-Hansen, 2015). For instance, Simonin and Ruth (1998) found that consumer attitudes toward one firm in an alliance could significantly influence perceptions of its allied partners. Thus, firms engaging in strategic alliances may be considered as "painted with the same brush". Since organizations tend to associate with others of

similar status (Podolny and Phillips, 1996), alliances serve as a conduit for firms to enhance their status and legitimacy in the market (Gulati and Higgins, 2003).

Given the interdependence of resources (including firms' reputation) between partnering firms, also negative events at one firm can impact its allied partners. In this vein, Boone and Ivanov (2012) documented that when an alliance partner files for bankruptcy, the non-bankruptcy partner experiences a negative stock price reaction around the filing announcement, followed by decreased profit margins and reduced investment levels over the subsequent two years, thereby supporting the rationale behind the introduction of more governance provisions in alliance contracts when a partner has poor accounting quality (Ge et al., 2021). While affiliations with reputable firms can confer legitimacy and provide access to critical resources, ties to a firm experiencing a negative event can also damage its allies, thereby making strategic alliances a double-edged sword.

In this spirit, negative spillover effects in alliances have also garnered attention in prior research when a regulative violation occurs. Regulative violation events provide information not only about the perpetrators but also about other firms connected to them (i.e., they can be seen as "guilt by association"; Suchman, 1995). For example, in 2008, the District of Columbia sued Bank of America for over $105 million for its involvement in the largest and longest-running embezzlement scheme in the city's history, known as the "Mother Harriette" fraud case (Southall, 2009). Harriette Walters, a tax manager, orchestrated a scheme issuing $48 million in fraudulent property tax refunds to herself, her family, friends and a bank manager over nearly two decades (Southall, 2009). Following the lawsuit's announcement, firms allied with Bank of America, such as HP, experienced negative market reactions. Prior research also found that firms accused of environmental misconduct can cause negative reputation spillovers to their alliance partners (Norheim-Hansen and Meschi, 2020), while Galloway, Miller and Liu (2021) found evidence of

negative stock market reactions for firms allied with companies engaging in misconduct, including accounting restatements. Similarly, Gleason et al. (2023) confirmed that non-restating allied firms experience negative market reactions and also found downward revisions in analyst forecasts and increased forecast accuracy following their alliance partner's restatement.

3. Audit Fees

Audit quality refers to the probability that an auditor will not only detect material misstatements in a client's financial statements but also report them accurately (DeAngelo, 1981). High audit quality is essential for maintaining public trust in financial reporting, as it ensures that stakeholders receive accurate and reliable financial information, not only so that financial statements comply with accounting standards, but also reflect the underlying economics of the firm (DeFond and Zhang, 2014). An audit failure takes place when an auditor issues an incorrect opinion on financial statements that are materially misstated, and audit firms earn audit fees for bearing such risk and for their audit effort (Florou, Morricone and Pope, 2020). Client engagement risk is made of three main components (e.g., DeFond, Lim and Zhang, 2016): client business risk (which is the "risk resulting from significant conditions, events, circumstances, actions, or inactions that could adversely affect an entity's ability to achieve its objectives and execute its strategies or from the setting of inappropriate objectives and strategies", according to AICPA), auditor business risk (which is the risk of reputational and litigation costs that the auditor may incur in case of audit failure), and audit risk (which is the risk of a material misstatement passing undetected by the auditor). Such audit risk, in turn, consists of three components: inherent risk, control risk, and detection risk. "Inherent risk" refers to the susceptibility of an assertion to a material misstatement assuming no related controls (i.e., the probability of environmental or client factors leading to a material misstatemet), "control risk" refers to the risk that a client's internal

controls will fail to prevent or detect a material misstatement, and "detection risk" is the risk that the auditors' procedures will not detect a material misstatement.[5]

When a client's risk profile changes, the auditor's perception of audit risk also changes. An increase in client risk, such as through financial instability or a significant restatement, typically leads to higher assessments of both inherent risk and control risk (i.e., risks over which the auditor has no direct control; Bell et al., 2001; Knechel and Salterio, 2016). In response to the identification or perception of higher risks, auditors must perform additional or more extensive audit procedures, which can be both time-consuming and costly. To mitigate detection risk, the risk over which auditors do exert control, auditors need to increase their audit effort (e.g., Bell et al., 2001). This increased effort aims to reduce the overall audit risk by compensating for the heightened client-specific risk. Such an increase in audit effort can either be through longer audit hours and/or an increase in the charged-out rate (i.e., charging a risk premium) to compensate for the increase in perceived audit risk and potential exposure associated with the client's elevated risk profile (e.g., DeFond and Zhang, 2014; Florou, Morricone and Pope, 2020).

4. Hypothesis

Considering the arguments outlined above, a restatement by a firm can have an impact on other allied peers' audit fees for the several reasons, as audit fees are jointly determined by auditor effort (e.g., audit hours and charge-out rates) and client-specific risk, which reflects the likelihood of undetected material misstatements or irregularities (Simunic, 1980).

First, a reputational spillover may occur. Strategic alliances create interdependence between firms through frequent interactions, which signal strategic alignment, shared values and mutual endorsement (Kepler, 2021; Stuart, Hoang and Hybels, 1999; Yu and Lester, 2008). While

[5] See: https://pcaobus.org/oversight/standards/archived-standards/pre-reorganized-auditing-standards-interpretations/details/auditing-standard-no-8_1838 or DeFond, Lim and Zhang (2016)

alliances can reduce dependence on external resources (Hillman, Withers and Collins, 2009), they simultaneously heighten reputational interdependence between partners (Barnett and Hoffman, 2008). Restatements are viewed as failures for both the restating company and its auditor (Arthaud-Day, Certo, Dalton and Dalton, 2017; Liu, Raghunandan and Rama, 2009), and firms with strong reputations are generally less likely to issue restatements, indicating higher accounting quality (Cao, Myers, Tice and Wang, 2012). Consequently, a restatement by an allied firm can impair the reputation of its partners. When auditors recognize this reputational impairment, they may perceive an increase in client-specific risk, resulting in higher audit fees.

Second, the business risk of allied firms may be affected following a partner's restatement. Allied firms are deeply concerned about the financial health of their partners, as a partner's bankruptcy can severely affect their own operations, particularly in terms of operating performance (Boone and Ivanov, 2012). Lower accounting quality in an alliance often leads to the inclusion of more governance provisions, as partners attempt to mitigate detrimental consequences and protect their relationship-specific investments (Ge, Ji and Louis, 2021). If a restatement signals increased business risk for allied peers as well, auditors may adjust audit fees upward in response to the heightened misstatement risk.

Third, a contagion effect is plausible in an alliance context. Alliances typically involve sharing risks, revenues, and operating costs (Mayer and Teece, 2008; Demirkan and Demirkan, 2014). Cost allocation among divisions within the same entity can be challenging (Ray and Goldmanis, 2012), and even more so when several allied parties are involved. Plus, accounting numbers manipulation by one partner can distort the financial information shared among participants. This increases the likelihood of misstatements in other allied firms. If auditors

perceive a contagion risk, they may increase audit fees to address the greater misstatement risk within the alliance.

These channels are especially relevant when core earnings restatements are involved. Core earnings restatements affect earnings from primary operating activities, as opposed to non-recurring items such as tax adjustments, impairments or mergers and acquisitions (Penman, 2013; Palmrose and Scholz, 2004). Core earnings restatements are particularly critical because they directly relate to the firm's ongoing operations and provide insights into its long-term viability and operational health (e.g., Ettredge, Scholz, Smith and Sun, 2010; Gleason, Jenkins and Johnson, 2008; Asante-Appiah, 2020). When a firm restates its core earnings, it signals potential instability in its operations and financial reporting. Such restatements can affect allied firms, especially if they rely on the restating firm's operations for projections, contracts or profitability. For instance, a misstatement of revenue (i.e., part of core earnings) in one company can undermine an allied firm's financial expectations, given that it could result in an incorrect allocation of revenues among the allied parties. Given the centrality of core earnings to operational stability, core earnings restatements may trigger spillover effects, increasing audit fees for allied firms. Auditors may either increase their audit effort, recognizing the need for more detailed scrutiny, or charge a risk premium to compensate for the elevated perceived risk in non-restating firms. Therefore, my main hypothesis is as follows:

HP*: Auditors charge higher audit fees for firms after their strategic alliance partners' core earnings restatements.*

However, the null hypothesis remains plausible for several reasons. First, auditors are responsible for ensuring the accuracy of the financial statements of the firms they audit, not for those of other related firms (such as allied firms). Misstatements or misconduct by allied firms can

thus be considered beyond the scope of the auditor's responsibilities. Second, given that audit fees tend to exhibit a certain "stickiness" and do not always react fully to changes in typical audit fee determinants (e.g., Chang et al., 2019; De Villiers et al., 2014), it is even more unlikely that audit fees would change in response to restatements by allied firms.

Third, because reputation is a key intangible asset for securing stakeholder trust, non-restating allied firms may proactively take steps to protect their reputation and mitigate potential audit fee increases. For example, they may enhance internal controls or increase oversight of their own financial reporting practices in response to a partner's restatement. By improving the quality of financial reporting ex ante, these firms can make the audit process more efficient and reduce the auditor's perceived risk. As a result, higher ex-ante reporting quality may translate into lower audit fees, since the engagement becomes less complex and requires fewer audit resources.

Fourth, following a negative event (e.g., a misstatement) that could harm the reputation of the allied peers, such firms may have stronger incentives to distance themselves from the allied partner that restates its core earnings. It may even consider terminating the alliance, despite the absence of conflicts between the partners (Bruyaka et al., 2018). Furthermore, given the inherent incompleteness of alliance agreements and the fact that "bargaining power matters not only at the alliance formation stage, but also throughout the alliance life cycle" (Lavie, 2007), the allied peer firm may be able to renegotiate more favorable terms. These new terms could allow the peer firm to capture a larger share of the value created by the alliance, thereby improving its economic outlook. As a result, this would reduce the firm's perceived business risk, potentially leading to lower audit fees.

Cross-sectional variation

I focus on whether the alliance takes the form of an equity-sharing agreement (i.e., a Joint Venture, JV) or a contractual agreement (i.e., a Contractual Alliance, CA), using this distinction as a proxy for a firm's reliance on its allied partner's financial statements. Alliances introduce additional complexity in managerial control. Given that cost allocation can be challenging even within divisions of the same entity (Ray and Goldmanis, 2012), this complexity is amplified when multiple alliance partners are involved. However, in the case of a JV, where a separate entity is formed, there is less dependence on contracts and subjective measurements compared to a CA (Demirkan and Demirkan, 2014). As a result, I expect that auditors charge higher audit fees for firms connected through CAs when a partner restates its core earnings, as the likelihood of financial contagion is greater in such cases.

III. DATA AND RESEARCH DESIGN

1. Sample selection

The sample consists of firms covered by Compustat North America, for financial statement information, and Audit Analytics for data on restatements and audit fees. I obtained information on alliances from Securities Data Company (SDC) Platinum's Alliances and Joint Ventures database. SDC Platinum is one of the leading databases on information on strategic alliances. In particular, it has the widest coverage in terms of sectors covered and has a very accurate coding of the information contained, though alliances' termination dates are largely missing.[6] The sample period begins in 2000, the first year of audit fee disclosure in Audit Analytics, and extends through 2022 to allow enough time for the detection of financial misstatements. I exclude firms operating in financial services and utility industries (SIC codes between 6000 and 6999, and between 4900

[6] For more information on SDC Platinum and other databases covering strategic alliances, see Schilling (2009)

and 4999) and drop observations with insufficient data on Compustat to compute the main financial statement variables. Table 1 presents the details of sample selection.

[INSERT TABLE 1]

2. Research Design

To test whether firms with at least one allied partner committing financial irregularities experience an increase in audit fees, I employ a panel ordinary least squares regression (OLS) approach with the following econometric model:

$$Ln\_Audit\_fees_{i,t} = \beta_0 + \beta_1 Res\_Core\_Earnings\_fy_{j,t} + Controls + \varepsilon_{i,t} \quad (1)$$

Where subscript *i* refers to the focal firm, and subscript *j* refers to the restating allied partner. The dependent variable, Ln_Audit_fees, is computed as the natural logarithm of total audit fees paid by firm i in year t. The main independent variable, Res_Core_Earnings_fy, is a dummy variable equal to 1 if firm j (an ally of firm i) restates any of its core earnings components. A firm is considered to have an active alliance with another firm if the restatement announcement falls within the period between the alliance announcement and its termination date. However, given that termination dates are often unavailable, prior research typically assumes an alliance duration of five years (e.g., Gulati and Gargiulo, 1999; Sytch and Tatarynowicz, 2014; Kumar, Liu, and Zaheer, 2022) or three years (e.g., Lavie et al., 2022; Lavie, 2007; Schilling and Phelps, 2007) when the termination date is not disclosed. For this analysis, I adopt a conservative approach by assuming a three-year alliance duration.[7] A restatement is considered to affect Core Earnings if it involves

[7] This approach is conservative because the occurrence of additional restatements from allied partners in the years following the third year after the alliance announcement could still increase audit fees in periods when my main variable of interest equals zero. This potential misclassification of exposure could make it more difficult to achieve statistical significance

misstatements related to revenues, cost of goods sold (COGS), or selling, general, and administrative (SG&A) costs, in the spirit of Palmrose and Scholz (2004).[8]

[INSERT FIGURE 1]

Consistent with prior research (e.g., DeFond and Zhang, 2014; Ivanova and Prencipe, 2020), I control for company-specific characteristics that are likely to impact affect both the level of auditor effort and the underlying audit risk. For instance, larger firms, less profitable and firms with higher leverage generally face higher audit fees (Simunic, 1980). Therefore, I control for firm size (using the natural logarithm of total assets, SIZE), profitability (ROA), market-to-book ratio (MTB), leverage (long-term debt to total assets, LEV), and previous financial distress (PLOSS). Additionally, non-cash assets such as inventory and receivables can increase audit complexity (Simunic, 1980). As such, I include INVREC, which combines inventory and receivables scaled by total assets. Firms that seek external financing tend to be perceived as riskier (Krishnan et al., 2013), so I include an indicator variable, DEBT_ISSUE, equal to 1 if the firm issued long-term debt during the year. Given that financially distressed firms may manipulate earnings to meet covenants, I also control for financial distress and liquidity using the Zmijewski (1984) score (ZSCORE), the quick ratio (QUICK_RATIO), and operating cash flows (OCF), following Ivanova and Prencipe (2021). Growth potential is another critical factor, as firms with higher growth may face increased audit scrutiny. Accordingly, I include sales growth (SALES_GROWTH) as a control variable. Moreover, because audit fees are often lower in the initial year of an audit engagement due to potential lowballing (DeAngelo, 1981), I include FIRST, a dummy variable set to 1 in the first year of an audit engagement. Extraordinary items, extraordinary events and the number of markets a firm serves can also increase audit complexity; thus, I include an indicator to

[8] In the analyses, I exclude clerical errors as they are unlikely to carry negative consequences (e.g., Hennes et al., 2008).

control for whether a firm has foreign operations (FOROPS), whether it has extraordinary items or discontinued operations (XDOPS), whether the firm was involved in merger or acquisition activities during the year (M&A), and the number of business and operating segments a company operates in (SQNUMSEGS2). The fact that a firm has multiple alliances may also influence audit fees (Demirkan and Zhou, 2016); thus, I control for the number of active alliances (ln_num_alliances), expressed as the natural logarithm, as this could increase audit complexity (Demirkan and Zhou, 2016) and affect the likelihood of a core earnings restatement by a partner firm.

In line with prior studies (e.g., DeFond and Zhang, 2014; Florou et al., 2020), I include firm and fiscal year fixed effects. The former allows each firm to serve as its own control, accounting for unobservable firm- (and industry-) specific effects, while the latter captures time-varying factors such as economic conditions. This approach increases confidence that the estimated coefficients for the main variables of interest accurately reflect changes in audit fees, conditional on core earnings restatements by allied peers. Standard errors are clustered at the firm level and all continuous variables are winsorized at the first and last percentile.[9]

In additional analyses, I test whether the audit pricing effects observed in response to core earnings restatements also extend to other types of restatements occurring at an allied firm. To do so, I re-estimate the econometric model from Equation (1), replacing the main independent variable with alternative indicators that capture different restatement characteristics, denoted collectively as *Res_Type_fy*. This variable varies in both label and value depending on the nature of the restatement. Specifically: (i) *Res_Big_R_fy* equals 1 if the restatement involves a reissuance of prior years' financial statements; (ii) *Res_Adverse_fy* equals 1 if the restatement has a negative

[9] This is particularly relevant given that the distribution of Audit Fees (in dollars) is positively skewed.

impact on either the balance sheet or the income statement; (iii) *Res_Fraud_fy* equals 1 if the restatement is associated with an SEC or DOJ investigation or is classified as fraudulent by Audit Analytics; (iv) *Res_NI_Decr_fy* equals 1 if the restated net income is lower than the originally reported figure; and (v) *Res_Issues_fy* is a count variable indicating the number of distinct accounting items affected by the restatement.

Further, I assess whether an allied firm's restatement not only increases audit fees (indicating increased perceived risk and audit effort) but also extends audit report lag (ARL). ARL is defined as the number of days between the fiscal year-end and the date of the signed audit opinion (Knechel and Payne, 2001). I use a similar set of control variables as in the primary model, but I also include additional factors following prior research (e.g., Knechel and Sharma, 2012; Asante-Appiah, 2020). These additional controls include AGE (as older firms are expected to report lower accruals) and AUDTEN (audit tenure), as longer audit tenure may reflect greater firm-specific knowledge, which can influence ARL. I also control for current period loss (CLOSS), as losses in the current period may lead to additional audit effort. The model is as follows:

$$ARL_{i,t} = \beta_0 + \beta_1 Res\_Type\_fy_{j,t} + Controls + \varepsilon_{i,t} \quad (2)$$

IV. RESULTS

1. Main Analyses

Table 2 presents the sample distribution across years (Panel A) and across the Fama-French 12 industry groups (Panel B). Columns 2 and 3 in Panel A display the firm-year observations for the entire sample, while columns 4 and 5 show the firm-years where at least one firm has an active alliance (based on the assumption of a three-year duration if the termination date is unavailable). Columns 6 and 7 provide the yearly distribution of firm-year observations where at least one allied partner restated its core earnings.

The same structure applies to Panel B. Columns 2 and 3 present the entire sample distribution, columns 4 and 5 show the distribution for firms with an active alliance, and columns 6 and 7 show the firm-years where a partner firm restated its core earnings. As expected, most of the firm-year observations with active alliances are concentrated in the Business Equipment, Healthcare, Manufacturing, and Other sectors, reflecting the industries with the highest alliance activity (Kepler, 2021). Furthermore, the majority of firm-year observations with a partner firm restating its core earnings belong to the Business Equipment sector.

[INSERT TABLE 2]

Table 3 presents the descriptive statistics of the sample. The natural logarithm of audit fees has a mean value of 13.629 (equivalent to $2,133,534), which is consistent with prior research (e.g., Ivanova and Prencipe, 2020; Asante-Appiah, 2020; Chakrabarty et al., 2024). In this sample, only 0.8% of firm-year observations involve an alliance partner restating its core earnings. This percentage is slightly lower than that of firm-year observations in which a partner restated its financial statements adversely.

[INSERT TABLE 3]

Table 4 provides the results of the main analysis, which addresses my hypothesis. Column 1 presents the baseline results without controls or fixed effects, while Column 2 shows the results of the full econometric specification based on Equation 1. Both regressions support the hypothesis, as the estimated coefficient for β_1 is significantly positive at standard significance levels. While the effect is weaker in the specification with control variables, firm and year fixed effects, it remains statistically significant (p-value = 2.5%) and economically relevant. Specifically, having an allied partner restating its core earnings leads to an approximately 3.7%[10] increase in audit fees

[10] Computed based on the antilog of the 0.036 estimate.

for non-restating firms. For instance, a firm that pays $2,133,534 in audit fees (the sample average) would incur an additional $78,206 after an allied partner restates its core earnings. Interestingly, distinguishing between firms connected through JVs and CAs reveals that the effect is primarily driven by firms connected through CAs rather than JVs. This finding aligns with Boone and Ivanov (2012), as JVs appear to provide a degree of protection against negative events affecting one allied partner, whereas CAs are more susceptible to negative spillovers. This supports the expectation that auditors charge higher fees for firms engaged in CAs compared to those in JVs.

Control variables exhibit expected relationships: larger firms, firms with more business segments, foreign operations, extraordinary items, audits by Big 4 auditors, lower liquidity, more strategic alliances and higher risk levels all correlate with higher audit fees. Conversely, more profitable firms with growth prospects and superior financial performance tend to pay lower audit fees. Including firm and year fixed effects naturally produces a high R-squared, consistent with prior studies using similar specifications (e.g., Florou et al., 2020). Although high R-squared values can signal multicollinearity, my VIF diagnostics show that all regressors have VIFs below 10, indicating no collinearity concerns.[11]

[INSERT TABLE 4]

2. Additional Analyses

Other restatements

Given the variety of restatement types, it is useful to examine whether other severe restatements from partner firms impact the audit fees of the focal firm. I focus on four types of restatements that could significantly increase audit fees, and on the number of restated accounts as an additional proxy of restatement pervasiveness. The four types of restatements I consider are the

[11] For a detailed assessment of multicollinearity, see Appendix B for the full VIF tables.

following: Big R restatements, fraudulent restatements, adverse restatements and income decreasing restatements.

Big R restatements, as defined by Bartov, Marra and Momentè (2021), refer to the correction of material misstatements in prior periods' financial statements. When a Big R restatement occurs, public companies must file SEC Form 8-K, Item 4.02, within four days, notifying investors not to rely on the previously issued financial statements. The company must also file amended 10-Q or 10-K reports to correct the misstatements. These restatements typically involve significant errors and necessitate a revised audit opinion, which includes an explanation of the restatement and a reference to the financial statement footnote detailing the error. My sample includes 305 firm-year observations classified as Big R restatements. In contrast, Little r restatements occur when immaterial errors accumulate over time, ultimately reaching a material level. If correcting these past-year errors in the current year alone would materially misstate the current year's financial statements, the company must revise prior-period information within the current period's financial statements. Unlike Big R restatements, Little r restatements do not require the company to amend previous 10-Q or 10-K filings, nor do they necessitate an SEC Form 8-K filing or withdrawal of the auditor's opinion. Instead, the correction is disclosed in a footnote in the current period's financial statements.

Fraudulent restatements occur when the original financial statements were intentionally falsified to deceive stakeholders. For a restatement to qualify as fraudulent, the financial statements must have been deliberately falsified, typically under the responsibility of top management, such as the CEO or CFO. Fraudulent restatements are less common but carry far more severe consequences, both legally and reputationally. I classify restatements as fraudulent if there is an

SEC or DOJ investigation or if it is classified as such by Audit Analytics. In my sample, there are 208 firm-year observations classified as fraudulent restatements.

A restatement is classified as adverse if it negatively impacts either the balance sheet or the income statement[12]. In my sample, there are 1,409 firm-year observations with restatements coded as adverse. In contrast, restatements that result in a positive impact are unlikely to affect the audit fees of a partner firm, as they could even improve the alliance's economic prospects. Indeed, untabulated tests show no significant effect for such positive restatements.

Income decreasing restatements are particularly critical due to their role as the primary indicator of a firm's performance and are supposed to elicit greater scrutiny than an income increasing restatement (e.g., Pittman and Zhao, 2021).

[INSERT TABLE 5]

Table 5 presents the results of Equation 1, where the main independent variable has been replaced with indicators equaling 1 when an allied partner firm issues a Big R restatement (Columns 1 and 2), an adverse restatement (Columns 3 and 4), a fraudulent restatement (Columns 5 and 6), an income-decreasing restatement (Columns 9 and 10), and the number of restated accounts (Columns 7 and 8).

The highest and most significant coefficient estimates are observed for fraudulent restatements (Columns 5 and 6). These restatements represent severe events, with substantial reputational consequences for both the restating firm and its allied peers. The magnitude of the coefficients is notably larger than those for core earnings restatements reported in Table 4. Specifically, when an allied partner restates its financials due to fraud, its allied partners experience

[12] From Pittman and Zhao (2021), adverse restatements include "reductions in net income, stockholders' equity, cash from operations, revenue (and expenses by the same amount so the overall effect on net income is zero), and total assets as well as increases in short-term or long-term debt ratios."

an approximate 8.2% increase in audit fees. For a firm with average audit fees of $2,133,534 (the sample mean), this corresponds to an additional cost of $175,386 (i.e., more than double the amount of the core earnings restatement case). Consistent with the findings in Table 4, the effect is concentrated among firms connected through Contractual Alliances (CAs) rather than Joint Ventures (JVs). Column 6 indicates no significant effect on JV-connected firms when a partner fraudulently restates its financial statements. In contrast, the effect is stronger for firms connected through CAs (8.6% increase in their audit fees). Interestingly, the adverse consequences of restatements on financial statements, their classification as Big R, or their pervasiveness do not appear to have a spillover effect on allied partners.

Dynamics of the effect

After showing that core earnings restatements and fraud restatements have detrimental effects on the audit fees of allied peers, I explore whether other types of restatements exhibit different temporal dynamics. Specifically, I test whether these restatements have no impact on the audit fees of allied partners, or if such effects are anticipated or occur with a delay. To examine this, I use a series of dummy variables: Lag_2, which equals one if the restatement occurred two years earlier; Lag_1, for one year earlier; Occurrence_Year, for the year the restatement is disclosed; Lead_1, for one year after; and Lead_2, for two years after. These variables allow to determine whether the effects of restatements take more time to be reflected in auditors' decisions or if they are anticipated. The suffices _JV and _CA distinguish between Joint Ventures and Contractual Alliances, respectively.

[INSERT TABLE 6]

Table 6 presents the results of the analysis. Column 1 focuses on Big R restatements, Column 2 on adverse restatements, Column 3 on the number of accounts restated, Column 4 on

income decreasing restatements. The pervasiveness of restatements appears to have no effect on the audit fees of allied partners as the Num_Issues column shows no significant coefficient estimates across all the leads and lags.

In contrast, Big R restatements are associated with higher audit fees for allied firms with a one-year lag. Specifically, the coefficient estimates for *Lag_2* and *Lag_1* are significantly higher than zero and around the same amount for JV alliances. Similarly, both adverse restatements and income-decreasing restatements are associated with increased audit fees for allied firms, also with a two-year lag, and the effects are primarily concentrated among CAs, with comparable effect sizes.

Notably, JVs do not shield allied firms from spillovers caused by Big R restatements, as they do with other types of restatements. This finding suggests that JVs may not protect against restatements involving multiple prior financial misstatements. One possible explanation is that auditors perceive the allied firm as riskier in terms of business risk, particularly if the JV formation was based on judgments derived from inaccurate financial information.

It is noteworthy that JVs do not shield against spillovers from Big R restatements, unlike other types of restatements. This finding suggests that JVs fail to protect against restatements involving multiple misstatements in prior financial statements, likely because auditors perceive the allied firm they audit as riskier. This increased risk perception may stem from the possibility that the firm based its decision to form the JV on incorrect information, leading to greater business risk.

Audit Report Lag

To better understand the mechanisms underlying the increase in audit fees following restatements by allied firms, I examine whether such restatements are also associated with longer audit report lags (that is, more days required to complete and sign the audit opinion). Since audit

fees may rise due to either increased audit effort or elevated perceived risk (which could result in a risk premium without additional work), this analysis helps disentangle these two explanations. Specifically, I test whether restatements of core earnings (and other types of restatements) by allied firms lead to an increase in the audit report lag. In other words, having established that auditors charge higher fees following a partner firm's restatement, I investigate whether this is accompanied by longer audit timelines, which would suggest greater audit effort, or whether the fee increase reflects a higher risk premium absent additional audit complexity. To test this, I estimate a panel OLS as specified in Equation (2) of the Research Design section. The dependent variable is the Audit Report Lag (ARL), measured as the natural logarithm of the number of days between the firm's fiscal year-end and the date of the signed audit opinion. The key independent variables are dummy indicators capturing the type of restatement issued by the allied firm or the number of restated accounts.

[INSERT TABLE 7]

The results of this analysis are presented in Table 7. The coefficient estimates for all independent variables are not significantly different from zero, except for Big R restatements. This finding suggests that auditors may charge higher fees to compensate for the increased perceived risk associated with firms allied to a partner that restates its core earnings or commits a fraudulent restatement. However, the financial statements of the audited firms themselves do not appear to require additional auditing time. Thus, while audit fees may reflect both increased effort and a higher risk premium, the results do not support the idea that higher fees are driven by increased audit effort. Instead, the findings indicate that the rise in fees is more likely attributed to an increased risk premium. The exception for Big R restatements suggests that these restatements may require auditors to spend more time forming their audit opinion, particularly when the partner

firm has restated multiple financial statements. However, these restatements do not consistently result in higher fees, except in the case of joint ventures with a one-year delay, as reported in Table 6.

Cross-sectional analysis

I next examine whether the spillover effects of allied firms' core earnings restatements or fraud restatements vary based on the client-specific risk of the audited firms. One potential concern for auditors is that non-restating firms allied with restating firms may share similar accounting practices, leading to a "contagion effect." This could increase the perceived risk that non-restating firms are also engaging in earnings management, such as inflating earnings or committing similar accounting errors. Consequently, I expect that the increase in audit fees is concentrated among firms with higher levels of accruals (i.e., those perceived as riskier due to poorer earnings management practices) compared to firms with lower levels of accruals, which are less risky and demonstrate better earnings management practices.

To test this, I partition the sample into two groups based on firms' accrual levels, using the sample median as the threshold. Following the accruals typology proposed by Richardson, Sloan, Soliman and Tuna (2005), I define accruals as the change in all non-cash assets minus the change in all liabilities.[13] These accruals are then decomposed as follows: and split firms according to their accruals, and decompose them as follows:

[13] Prior research employed various accrual measures, often involving two-step approaches to calculate abnormal accruals. These methods define abnormal accruals as the difference between actual accruals and expected (or "normal") accruals, typically benchmarking the focal firm against its industry peers in a given year. However, I have chosen to focus on total accruals for two primary reasons. Firstly, total accruals are a key area of concern for auditors (Lys and Watts, 1994), and audit procedures and adjustments focus predominantly on actual accruals rather than "abnormal" accruals (Nelson, Elliott, and Tarpley, 2002). Secondly, the two-step approaches used to compute abnormal accruals can introduce methodological issues, such as understated standard errors and thus bias results. Chen, Hribar, and Melessa (2018, 2023, 2024) provide an in-depth discussion of these limitations, underscoring the potential drawbacks of such methods. To ensure a more robust and comprehensive analysis, I have opted to use the total accrual measure and its decomposition.

$$T\_ACC = TOP\_ACC + FIN\_ACC = WC\_ACC + NCO\_ACC + FIN\_ACC \quad (3)$$

T_ACC represents total accruals, and it can be decomposed into total operating accruals (TOP_ACC) plus financial accruals (FIN_ACC). TOP_ACC can be further decomposed into working capital accruals (WC_ACC) plus non-current operating accruals (NCO_ACC). All these measures are scaled by the beginning-of-the-year total assets. These components of total accruals have different levels of reliability in their measurement. In particular, WC_ACC are more reliably measured than NCO_ACC, while FIN_ACC are more reliably measured than TOP_ACC. Thus, I expect that firms with higher levels of less reliable accruals are the ones that will get a higher increase in audit fees after a core earnings restatement or a fraudulent restatement by an allied firm. Analogously, I expect that the increase in audit fees will be weaker or indifferent for firms with high or low levels of highly reliable accruals (i.e., FIN_ACC).

[INSERT TABLE 8]

Table 8 presents the results of these cross-sectional analyses. In each panel, columns 1-2 and columns 5-6 display results for observations with high total accruals, while columns 3-4 and 7-8 show results for the low accruals subsample. Columns 1 to 4 focus on core earnings restatements, while Columns 5 to 8 examine fraudulent restatements.

In Panel A, firms are partitioned based on the sample median of T_ACC. As expected, the coefficient estimate for core earnings restatements by an allied partner has a significantly positive effect on audit fees for firms with higher total accruals (Column 1), whereas the effect is insignificantly positive for firms with lower accruals (Column 3). This finding suggests that auditors are particularly concerned that risky accounting practices may be adopted by firms already perceived as "risky" in terms of their accrual levels. Column 2 reveals that this effect is primarily driven by CAs, while JVs appear to have no significant spillover effect on allied partners. Column

4 confirms that, for the low-accruals subsample, the spillover effect is absent, regardless of whether the alliance is a JV or CA. Interestingly, Columns 5 to 8 reveal a different pattern regarding fraudulent restatements. Here, the firms most impacted by the negative spillover effect from allied partners' fraudulent restatements are those with low total accruals, firms typically considered less risky. Specifically, firms with low accruals experience a significant increase in audit fees following a partner's fraudulent restatement. A plausible explanation for this finding is the element of "surprise" for auditors when a firm perceived as reliable (due to its low accruals) is linked to a fraudulent partner. For high-accrual firms, auditors may already apply heightened scrutiny or charge a risk premium, so the severe nature of a fraudulent restatement by the allied partner does not fundamentally alter their perception. In contrast, when a firm with low accruals faces such negative news, auditors may react strongly, reflecting a reassessment of the firm's perceived reliability and charging a premium to account for the unexpected risk. This phenomenon aligns with prior literature documenting similar effects for firms with high Corporate Social Responsibility (CSR) performance. For instance, Bartov et al. (2021) show that firms with a strong CSR reputation that issue fraudulent financial restatements face more severe market reactions. Investors expect "good" firms to maintain ethical behavior, so violations of trust by such firms result in disproportionate punishment when expectations are not met.

Decomposing T_ACC into TOP_ACC and FIN_ACC can provide further insights into which accruals components are most negatively affected by the spillover effects of the two types of restatements. In Panel B, the partition is based on total operating accruals (TOP_ACC), which exclude financial accruals (that are the focus of Panel E) and are considered as "less reliably" measured than FIN_ACC. The results confirm that fraudulent restatements (Columns 5–8) predominantly impact firms with lower accrual levels, aligning with the findings in Panel A.

However, the coefficient magnitudes and statistical significance are somewhat weaker in Panel B, though the p-values remain below the 5% threshold. Columns 1–4 show that, for core earnings restatements, the only significant effect appears in the high TOP_ACC, without any significant difference between CA and JV. This "weak" effect can suggest a more nuanced result if the partition is made according to working capital accruals (WC_ACC, more reliable than NCO_ACC) and non-current operating accruals (less reliably measured than WC_ACC).

Indeed, comparing the first four columns in Panels C and D, the spillover effects from core earnings restatements are stronger for firms with higher NCO_ACC and those with lower levels of WC_ACC. NCO_ACC is less reliably measured than WC_ACC, thus firms with higher levels of NCO_ACC are perceived as riskier than firms with higher levels of WC_ACC. Columns 5-8 in Panel C further corroborate that the most "trustworthy" firms (i.e., those with lower WC_ACC) experience a more pronounced increase in audit fees following fraudulent restatements by allied firms. Conversely, firms with lower NCO_ACC (considered less reliable) exhibit only a weak impact, with p-values below the 10% threshold.

Lastly, Panel E focuses on FIN_ACC, which represents the most reliably measured accruals component. As expected, the spillover effect for core earnings restatements is similar in both magnitude and significance, suggesting that this type of accrual has a limited impact on auditors' risk assessments. However, firms that are considered as more reliable and "trustworthy" show a stronger effect on their audit fees when a partner restates fraudulent financial statements, with the effect being concentrated among firms connected through contractual alliances.

Overall, the analysis indicates that when a partner restates its core earnings, only firms connected through CAs experience an increase in audit fees. This outcome aligns with expectations, as firms in CAs are generally associated with higher risk, due to lower-quality financial statements

(i.e., as proxied by higher accrual levels). Interestingly, firms with lower total accruals that are connected through CAs experience an even greater increase in audit fees when an allied partner restates its (fraudulent) financial statement. This may occur because, for firms with higher-quality financial statements, a fraud committed by an allied partner is an unexpected event, prompting auditors to reassess and increase their risk evaluation. This effect is especially pronounced in Panel E, which divides the sample into high- and low-FIN_ACC accruals. These accruals are considered the most reliably measured, reinforcing the idea that fraudulent restatements by allied partners disproportionately affect firms with otherwise reliable financial reporting.

V. CONCLUDING REMARKS

This study provides new insights into the spillover effects of financial misconduct within strategic alliances, specifically focusing on how core earnings restatements by an allied firm can influence audit fees for non-restating partners. The findings demonstrate a significant association between a partner's restatement and an increase in the focal firm's audit fees, with an approximate 3.7% rise, likely due to increased perceived audit risk. This effect is not limited to core earnings restatements, but it is extended to fraudulent restatements as well. The study's cross-sectional analysis shows that firms with worse earnings quality suffer more from these spillover effects, with the audit fee increases concentrated among firms displaying ex ante more accruals. All these detrimental effects on audit fees appear to be mainly driven by firms connected through contractual alliances, rather than joint ventures.

Overall, this research contributes to several streams of literature, including the determinants of audit fees, the consequences of financial misconduct in strategic alliances, and the role of auditors in monitoring firms involved in complex inter-firm relationships. By showing that auditors consider external risks, such as the audit failures of alliance partners, this study

underscores the interconnected nature of modern business environments and highlights another type of negative consequence that may arise from having close business relationships with firms with poor accounting quality. Like any study, this research has some limitations. First, termination dates for alliances are rarely available, making it necessary, as with other studies on strategic alliances, to rely on assumptions about the duration of alliances when termination dates are not provided. Second, I use audit reporting lag as a proxy for audit effort, although access to direct data on audit hours would have been ideal. Future research could gain more precise insights by analyzing audit hours or the specific nature of audit procedures, offering a clearer understanding of how auditors respond to increased risk due to allied firms' financial misconduct.

Future analyses can consider additional tests to better investigate the mechanisms. In particular, I plan to test whether there is a similar effect when an allied partner receives a comment letter from the SEC expressing concerns on the financial statements of a firm. Plus, it is interesting to see whether the effects I find can be amplified or weakened when additional "spillover mechanisms" are analyzed at the same time. For example, the effects can be stronger when the allied firms share the same auditor or operate in the same industry. Furthermore, more comprehensive alliances (i.e., encompassing several different activities) can have a differential spillover impact on allied partners.

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VII. TABLES AND FIGURES

Table 1

This table shows the sample selection process.

	Observations	Unique firms
All firms with Audit Fees in Audit Analytics that can be connected to Compustat (from 2000 to 2022)	111,976	12,668
Less firms with missing control variables	84,543	9,764
Less firms operating in financial sector and regulated utilities (i.e., SIC codes 6000-6999 and 4900 to 4999)	77,844	9,073
Less firms with missing date (or multiple dates) of signature of opinion	72,469	8,859

Table 2
Sample distribution

This table presents the sample distribution by fiscal year (Panel A) and by industry, categorized using the Fama-French 12-industry classification (Panel B). Both panels display the observations divided into three groups: (1) all observations in the sample, (2) observations where firms have at least one active alliance, and (3) observations where firms have at least one active alliance with a partner that has restated its core earnings during the fiscal year.

***Panel A**: sample distribution by fiscal year*

	All Sample		Only Allied		Core Earnings Restatements	
Fiscal Year	N	Percent	N	Percent	N	Percent
2000	3,206	4.12	1,499	5.39	47	7.48
2001	3,732	4.79	1,595	5.74	46	7.32
2002	3,973	5.10	1,524	5.48	76	12.10
2003	3,915	5.03	1,432	5.15	48	7.64
2004	3,875	4.98	1,423	5.12	53	8.44
2005	3,777	4.85	1,418	5.10	47	7.48
2006	3,703	4.76	1,327	4.77	43	6.85
2007	3,601	4.63	1,329	4.78	33	5.25
2008	3,415	4.39	1,250	4.50	29	4.62
2009	3,302	4.24	1,087	3.91	12	1.91
2010	3,234	4.15	847	3.05	10	1.59
2011	3,165	4.07	666	2.40	8	1.27
2012	3,108	3.99	772	2.78	18	2.87
2013	3,142	4.04	894	3.22	15	2.39
2014	3,252	4.18	1,027	3.69	11	1.75
2015	3,175	4.08	861	3.10	6	0.96
2016	3,096	3.98	852	3.06	10	1.59
2017	3,089	3.97	1,056	3.80	18	2.87
2018	3,093	3.97	1,282	4.61	19	3.03
2019	3,113	4.00	1,408	5.06	29	4.62
2020	3,184	4.09	1,453	5.23	23	3.66
2021	3,550	4.56	1,589	5.71	14	2.23
2022	3,144	4.04	1,214	4.37	13	2.07
Total	77,844	100	27,805	100	628	100

***Panel B**: sample distribution by* industry (Fama-French 12-industry classification)

	All Sample		Only Allied		Core Earnings Restatements	
Fama-French industry code (12 industries)	Obs.	Percent	Obs.	Percent	Obs.	Percent
Consumer Non Durables	4,398	5.65	1,328	4.78	18	2.87
Consumer Durables	2,310	2.97	699	2.51	12	1.91
Manufacturing	8,949	11.50	2,348	8.44	32	5.10
Oil, Gas, and Coal Extraction and Products	4,482	5.76	1,178	4.24	18	2.87
Chemicals and Allied Products	2,360	3.03	851	3.06	5	0.80
Business Equipment	19,214	24.68	9,103	32.74	293	46.66
Telephone and Television Transmission	2,978	3.83	1,284	4.62	58	9.24
Wholesale, Retail, and Some Services	8,604	11.05	1,995	7.17	45	7.17
Healthcare, Medical Equipment, and Drugs	12,482	16.03	5,463	19.65	94	14.97
Other	12,067	15.50	3,556	12.79	53	8.44
Total	77,844	100	27,805	100	596	100.00

Table 3
Descriptive Statistics

This table presents the distribution of the variables used in my analyses. All variables are defined in Appendix A. The sample period is 2000-2022. All continuous variables are winsorized at the 1% and 99% levels.

Variable	Obs.	Mean	Standard Deviation	P25	Median	P75
Ln(Audit_fees)	77,844	13.629	1.361	12.631	13.647	14.538
Audit_fees($)	77,844	2,133,534.09	4,415,628.62	305,867.50	844,700.00	2,060,000.00
ARL	72,432	4.144	0.382	3.989	4.127	4.331
Res_Big_R_fy	77,844	0.004	0.062	0.000	0.000	0.000
Res_Core_Earnings_fy	77,844	0.008	0.089	0.000	0.000	0.000
Res_Adverse_fy	77,844	0.018	0.133	0.000	0.000	0.000
Res_Fraud_fy	77,844	0.003	0.052	0.000	0.000	0.000
Res_NI_Decrease_fy	77,844	0.011	0.106	0.000	0.000	0.000
Res_Issues_fy	77,844	0.064	0.512	0.000	0.000	0.000
SIZE	77,844	6.244	2.141	4.681	6.171	7.709
ROA	77,844	-0.057	0.296	-0.079	0.026	0.080
MTB	77,844	3.168	5.948	1.137	2.065	3.803
LEV	77,844	0.193	0.249	0.002	0.128	0.303
PLOSS	77,844	0.387	0.487	0.000	0.000	1.000
INVREC	77,844	0.232	0.180	0.084	0.198	0.340
DEBT_ISSUE	77,844	0.542	0.498	0.000	1.000	1.000
ZSCORE	77,844	-1.111	2.261	-2.540	-1.436	-0.275
OCF	77,844	0.010	0.530	-0.001	0.072	0.127
SALES_GROWTH	77,844	0.208	0.748	-0.038	0.075	0.233
WEAK	77,844	0.034	0.182	0.000	0.000	0.000
DEFIC	77,844	0.000	0.017	0.000	0.000	0.000
RESTAT	77,844	0.112	0.315	0.000	0.000	0.000
FOROPS	77,844	0.602	0.489	0.000	1.000	1.000
XDOPS	77,844	0.165	0.371	0.000	0.000	0.000
QUICK_RATIO	77,844	2.429	2.767	0.956	1.506	2.698
M&A	77,844	0.185	0.388	0.000	0.000	0.000
BIG	77,844	0.745	0.436	0.000	1.000	1.000
FIRST	77,844	0.056	0.229	0.000	0.000	0.000
FYEDEC	77,844	0.719	0.450	0.000	1.000	1.000
SqNumSegs2	77,844	1.183	0.305	1.000	1.000	1.414
CLOSS	72,432	0.387	0.487	0.000	0.000	1.000
AGE	72,432	18.869	15.425	7.000	14.000	26.000
AUDTEN	72,432	9.467	6.865	4.000	8.000	13.000
ln_non_audit_fees	72,432	10.485	4.242	10.067	11.644	12.972
ln_num_alliances	77,844	0.417	0.668	0.000	0.000	0.693
Obs.	77,844					

Table 4
Main analysis

This table presents the coefficient estimates based on Equation (1):

$$Ln\_Audit\_fees_{i,t} = \beta_0 + \beta_1 Res\_CoreEarn\_fy_{j,t} + Controls + \varepsilon_{i,t}$$

*The sample includes all firm-year observations as shown in Table 1. The dependent variable is the natural logarithm of Audit Fees. Res_CoreEarn_fy is a dummy variable equal to 1 if an allied partner restated its core earnings during the fiscal year. In Model 3, I partition the observations where an allied partner restated its core earnings into two subsets, according to whether the alliance is a Contractual Alliance (CA) or a Joint Venture (JV). All continuous variables are winsorized at the 1% and 99% levels. Models 2 and 3 include firm and year fixed effects. Standard errors, shown in parentheses, are clustered by firm. ***, **, * Denote significance at 1 percent, 5 percent, and 10 percent, respectively.*

	Audit Fees		
VARIABLES	(1)	(2)	(3)
Res_Core_Earnings_fy	1.045***	0.036**	
	(0.095)	(0.016)	
Res_Core_Earnings_JV_fy			0.060
			(0.050)
Res_Core_Earnings_CA_fy			0.033*
			(0.017)
SIZE		0.384***	0.384***
		(0.006)	(0.006)
ROA		-0.055***	-0.055***
		(0.014)	(0.014)
MTB		-0.000	-0.000
		(0.000)	(0.000)
LEV		-0.068***	-0.068***
		(0.019)	(0.019)
PLOSS		0.041***	0.041***
		(0.005)	(0.005)
INVREC		0.259***	0.259***
		(0.035)	(0.035)
DEBT_ISSUE		0.018***	0.018***
		(0.004)	(0.004)
ZSCORE		0.029***	0.029***
		(0.002)	(0.002)
OCF		-0.017***	-0.017***
		(0.003)	(0.003)
SALES_GROWTH		-0.011***	-0.011***
		(0.003)	(0.003)
WEAK		0.314***	0.314***
		(0.012)	(0.012)
DEFIC		0.001	0.001
		(0.081)	(0.081)

RESTAT		0.086***	0.086***
		(0.005)	(0.005)
FOROPS		0.048***	0.048***
		(0.007)	(0.007)
XDOPS		0.054***	0.054***
		(0.005)	(0.005)
QUICK_RATIO		-0.017***	-0.017***
		(0.001)	(0.001)
M&A		0.023***	0.023***
		(0.004)	(0.004)
BIG		0.264***	0.264***
		(0.011)	(0.011)
FIRST		-0.024***	-0.024***
		(0.008)	(0.008)
FYEDEC		0.071*	0.071*
		(0.041)	(0.041)
SqNumSegs2		0.112***	0.112***
		(0.015)	(0.015)
ln_num_alliances		0.009*	0.009*
		(0.005)	(0.005)
Observations	77,844	77,844	77,844
R-squared	0.005	0.946	0.946
Controls	NO	YES	YES
Year FE	NO	YES	YES
Firm FE	NO	YES	YES

Table 5

The effects of other restatements

This table presents the coefficient estimates based on Equation (1), but includes other types of restatements in place of Core Earnings restatements:

$$Ln\_Audit\_fees_{i,t} = \beta_0 + \beta_1 Res\_Type\_fy_{j,t} + Controls + \varepsilon_{i,t}$$

*The sample includes all firm-year observations as shown in Table 1. The dependent variable is the natural logarithm of Audit Fees. Res_Type_fy is a dummy variable equal to 1 if an allied partner restated its earnings during the fiscal year, according to the type of restatement that has been made (i.e., Big R, Adverse, Fraudulent, Issues, Net income decreasing), as explained in Appendix A. In even-numbered Models, I partition the observations where an allied partner restated its earnings into two subsets, according to whether the alliance is a Contractual Alliance (CA) or a Joint Venture (JV). All continuous variables are winsorized at the 1% and 99% levels. Standard errors, shown in parentheses, are clustered by firm. ***, **, * Denote significance at 1 percent, 5 percent, and 10 percent, respectively.*

	Audit Fees									
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Res_Big_R_fy	0.024									
	(0.022)									
Res_Big_R_JV_fy		0.033								
		(0.093)								
Res_Big_R_CA_fy		0.024								
		(0.023)								
Res_Adverse_fy			0.011							
			(0.011)							
Res_Adverse_JV_fy				0.012						
				(0.027)						
Res_Adverse_CA_fy				0.011						
				(0.012)						
Res_Fraud_fy					0.079***					
					(0.028)					
Res_Fraud_JV_fy						0.052				
						(0.081)				
Res_Fraud_CA_fy						0.083***				
						(0.031)				
Res_Issues_fy							0.002			
							(0.003)			
Res_Issues_JV_fy								0.004		
								(0.007)		
Res_Issues_CA_fy								0.002		
								(0.003)		
Res_NI_Decr_fy									0.016	
									(0.013)	
Res_NI_Decr_JV_fy										0.029
										(0.031)
Res_NI_Decr_CA_fy										0.013
										(0.014)
Observations	77,844	77,844	77,844	77,844	77,844	77,844	77,844	77,844	77,844	77,844
R-squared	0.946	0.946	0.946	0.946	0.946	0.946	0.946	0.946	0.946	0.946
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 6

Time dynamics of the effects of other restatements

*This table presents the coefficient estimates based on Equation (1) but examines the time dynamics of various types of restatements. Each column in the table focuses on a specific type of restatement: Big R restatements, adverse restatements, the number of accounts restated and net income-decreasing restatements. The dependent variable remains the natural logarithm of audit fees. The main independent variable of interest has been replaced by a series of lead and lagged dummy variables, each corresponding to a specific restatement type. These variables are defined as follows: lag_2-: Dummy variables equal to 1 if an allied partner restated its earnings two years before. lag_1-: Dummy variables equal to 1 if an allied partner restated its earnings in the previous year. Occurrence_year-: Dummy variables equal to 1 if an allied partner restated its earnings during the current fiscal year. lead_1-: Dummy variables equal to 1 if an allied partner restated its earnings in the following year. lead_2-: Dummy variables equal to 1 if an allied partner restated its earnings two years later. Additionally, dummy variables with the suffix -JV or -CA differentiate between whether the firms are connected through Joint Ventures (JV) or Contractual Alliances (CA), respectively. All continuous variables are winsorized at the 1% and 99% levels. Standard errors, shown in parentheses, are clustered by firm. ***, **, * Denote significance at 1 percent, 5 percent, and 10 percent, respectively.*

	Audit Fees			
Restatement Types:	Big R	Adverse	Num_Issues	NI_Decrease
Lag_2_JV	0.127**	0.025	0.004	0.013
	(0.055)	(0.027)	(0.010)	(0.037)
Lag_1_JV	0.129**	0.032	0.004	0.055
	(0.065)	(0.027)	(0.009)	(0.036)
Occurrence_Year_JV	-0.000	0.008	-0.000	0.007
	(0.104)	(0.028)	(0.011)	(0.037)
Lead_1_JV	-0.013	-0.009	-0.001	-0.012
	(0.131)	(0.025)	(0.011)	(0.032)
Lead_2_JV	-0.134	-0.009	-0.011	-0.013
	(0.105)	(0.026)	(0.011)	(0.035)
Lag_2_CA	0.028	0.030**	0.004	0.031**
	(0.023)	(0.013)	(0.003)	(0.016)
Lag_1_CA	0.004	0.001	0.000	-0.003
	(0.025)	(0.014)	(0.004)	(0.017)
Occurrence_Year_CA	0.001	-0.008	-0.004	-0.008
	(0.025)	(0.013)	(0.003)	(0.017)
Lead_1_CA	-0.015	0.014	0.003	0.020
	(0.028)	(0.014)	(0.004)	(0.019)
Lead_2_CA	-0.017	0.018	0.001	0.006
	(0.025)	(0.015)	(0.004)	(0.020)
Observations	45,772	45,772	45,772	45,772
R-squared	0.954	0.954	0.954	0.954
Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Controls	YES	YES	YES	YES

Table 7
Audit Reporting Lag

This table presents the coefficient estimates based on Equation (2):

$$ARL_{i,t} = \beta_0 + \beta_1 Res\_Type\_fy_{j,t} + Controls + \varepsilon_{i,t}$$

*The sample includes all firm-year observations as shown in Table 1. The dependent variable is the natural logarithm of the number of days between the fiscal year-end and the signature date of the audit opinion. Res_Type_fy is a dummy variable equal to 1 if an allied partner restated its earnings during the fiscal year, according to the type of restatement that has been made (i.e., Core earnings, Big R, Adverse, Fraudulent, number of issues, Net income decreasing), as explained in Appendix A. All continuous variables are winsorized at the 1% and 99% levels. Standard errors, shown in parentheses, are clustered by firm. ***, **, * Denote significance at 1 percent, 5 percent, and 10 percent, respectively.*

	Audit Reporting Lag					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Res_Core_Earnings_fy	0.002					
	(0.018)					
Res_Big_R_fy		0.074***				
		(0.018)				
Res_Adverse_fy			0.004			
			(0.009)			
Res_Fraud_fy				0.023		
				(0.034)		
Res_Issues_fy					0.004	
					(0.003)	
Res_NI_Decr_fy						0.015
						(0.012)
SIZE	-0.032***	-0.032***	-0.032***	-0.032***	-0.032***	-0.032***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
CLOSS	0.029***	0.029***	0.029***	0.029***	0.029***	0.029***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ZSCORE	0.016***	0.016***	0.016***	0.016***	0.016***	0.016***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SqNumSegs2	0.036***	0.036***	0.036***	0.036***	0.036***	0.036***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
M&A	0.020***	0.020***	0.020***	0.020***	0.020***	0.020***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
FOROPS	0.015***	0.015***	0.015***	0.015***	0.015***	0.015***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
ROA	-0.018**	-0.018**	-0.018**	-0.018**	-0.018**	-0.018**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
LEV	-0.063***	-0.063***	-0.063***	-0.063***	-0.063***	-0.063***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
MTB	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DEBT_ISSUE	0.008***	0.009***	0.008***	0.008***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)

AGE	-0.016	-0.016	-0.016	-0.016	-0.016	-0.016
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
WEAK	0.206***	0.206***	0.206***	0.206***	0.206***	0.206***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
DEFIC	0.009	0.009	0.009	0.009	0.009	0.009
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
AUDTEN	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RESTAT	0.030***	0.029***	0.030***	0.030***	0.029***	0.029***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
BIG	0.031***	0.031***	0.031***	0.031***	0.031***	0.031***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
FYEDEC	-0.042	-0.042	-0.042	-0.042	-0.042	-0.042
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
ln_non_audit_fees	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln_num_alliances	-0.006	-0.006*	-0.006*	-0.006*	-0.006*	-0.006*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	72,432	72,432	72,432	72,432	72,432	72,432
R-squared	0.629	0.629	0.629	0.629	0.629	0.629
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES

Table 8
Cross-sectional analysis

This table presents the coefficient estimates based on Equation (1):

$$Ln_{Audit_{fees_{i,t}}} = \beta_0 + \beta_1 ResType_{j,t} + Controls + \varepsilon_{i,t}$$

*I partition the sample based on whether the firm-year observation has accrual levels above or below the median, following the accruals taxonomy proposed by Richardson et al. (2005) and outlined in Equation (3). In Panel A, I partition the sample according to whether the firm has total accruals (T_ACC) above the median. In Panel B, the partition is based on whether the firm has total operating accruals (TOP_ACC) above the median. In Panel C, the focus is on whether the firm has working capital accruals (WC_ACC) above the median. In Panel D, the partition is based on whether the firm has non-current operating accruals (NCO_ACC) above the median. Finally, in Panel E, the sample is partitioned according to whether the firm has financial accruals (FIN_ACC) above the median. All continuous variables are winsorized at the 1% and 99% levels. Standard errors, shown in parentheses, are clustered by firm. ***, **, * Denote significance at 1 percent, 5 percent, and 10 percent, respectively.*

Panel A*: cross-sectional analysis*

	Audit Fees							
Subsample:	*High T_ACC*		*Low T_ACC*		*High T_ACC*		*Low T_ACC*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Res_Core_Earnings_fy	0.064**		0.001					
	(0.025)		(0.021)					
Res_Core_Earnings_JV_fy		0.074		0.011				
		(0.075)		(0.076)				
Res_Core_Earnings_CA_fy		0.062**		-0.000				
		(0.027)		(0.021)				
Res_Fraud_fy					0.005		0.108***	
					(0.042)		(0.038)	
Res_Fraud_JV_fy						-0.043		0.122
						(0.114)		(0.125)
Res_Fraud_CA_fy						0.012		0.107***
						(0.045)		(0.040)
Observations	38,597	38,597	38,596	38,596	38,597	38,597	38,596	38,596
R-squared	0.948	0.948	0.956	0.956	0.948	0.948	0.956	0.956
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES

Panel B: *Cross-sectional analysis*

	Audit Fees							
Subsample:	*High TOP_ACC*		*Low TOP_ACC*		*High TOP_ACC*		*Low TOP_ACC*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Res_Core_Earnings_fy	0.047*		0.001					
	(0.025)		(0.021)					
Res_Core_Earnings_JV_fy		0.085		0.001				
		(0.069)		(0.087)				
Res_Core_Earnings_CA_fy		0.040		0.001				
		(0.026)		(0.022)				
Res_Fraud_fy					0.000		0.096**	
					(0.042)		(0.038)	
Res_Fraud_JV_fy						-0.030		0.112
						(0.102)		(0.151)
Res_Fraud_CA_fy						0.006		0.095**
						(0.046)		(0.039)
Observations	38,597	38,597	38,596	38,596	38,597	38,597	38,596	38,596
R-squared	0.948	0.948	0.956	0.956	0.948	0.948	0.956	0.956
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES

Panel C*: Cross-sectional analysis*

	Audit Fees							
Subsample:	*High WC_ACC*		*Low WC_ACC*		*High WC_ACC*		*Low WC_ACC*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Res_Core_Earnings_fy	0.025		0.048**					
	(0.023)		(0.022)					
Res_Core_Earnings_JV_fy		0.094		0.081				
		(0.075)		(0.061)				
Res_Core_Earnings_CA_fy		0.017		0.044*				
		(0.025)		(0.024)				
Res_Fraud_fy					0.018		0.116***	
					(0.042)		(0.041)	
Res_Fraud_JV_fy						-0.024		0.147
						(0.096)		(0.137)
Res_Fraud_CA_fy						0.024		0.112**
						(0.047)		(0.044)
Observations	38,616	38,616	38,577	38,577	38,616	38,616	38,577	38,577
R-squared	0.950	0.950	0.953	0.953	0.950	0.950	0.953	0.953
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES

Panel D*: Cross-sectional analysis*

	Audit Fees							
Subsample:	*High NCO_ACC*		*Low NCO_ACC*		*High NCO_ACC*		*Low NCO_ACC*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Res_Core_Earnings_fy	0.053**		-0.005					
	(0.023)		(0.022)					
Res_Core_Earnings_JV_fy		0.075		0.025				
		(0.075)		(0.085)				
Res_Core_Earnings_CA_fy		0.049**		-0.008				
		(0.024)		(0.023)				
Res_Fraud_fy					0.038		0.069*	
					(0.040)		(0.041)	
Res_Fraud_JV_fy						-0.018		0.135
						(0.096)		(0.153)
Res_Fraud_CA_fy						0.047		0.063
						(0.043)		(0.042)
Observations	38,596	38,596	38,597	38,597	38,596	38,596	38,597	38,597
R-squared	0.949	0.949	0.955	0.955	0.949	0.949	0.955	0.955
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES

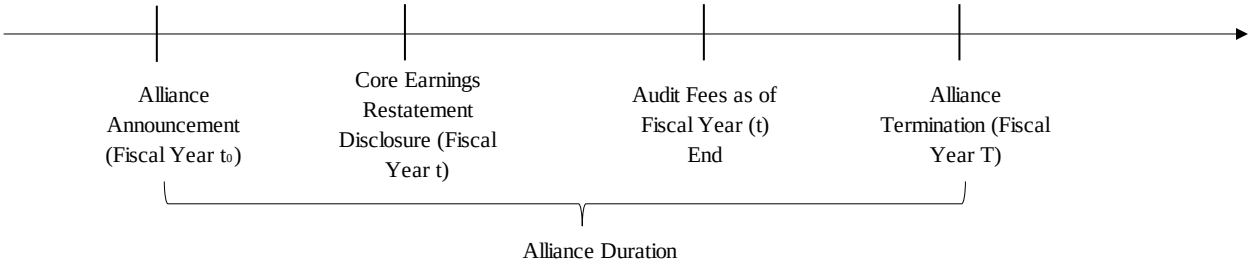
Panel E*: Cross sectional analysis*

	Audit Fees							
Subsample:	*High FIN_ACC*		*Low FIN_ACC*		*High FIN_ACC*		*Low FIN_ACC*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Res_Core_Earnings_fy	0.046*		0.042*					
	(0.023)		(0.023)					
Res_Core_Earnings_JV_fy		0.137		0.059				
		(0.090)		(0.060)				
Res_Core_Earnings_CA_fy		0.038		0.039				
		(0.024)		(0.025)				
Res_Fraud_fy					0.052		0.111***	
					(0.041)		(0.037)	
Res_Fraud_JV_fy						-0.003		0.097
						(0.109)		(0.110)
Res_Fraud_CA_fy						0.056		0.113***
						(0.044)		(0.038)
Observations	39,886	39,886	37,307	37,307	39,886	39,886	37,307	37,307
R-squared	0.948	0.948	0.955	0.955	0.948	0.948	0.955	0.955
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES

Figure 1

Time dynamics of the main independent variables

This figure shows the time dynamics involved in constructing the main independent variables. Specifically, the dummy variable Res_CoreEarn_fy is equal to 1 if, during the alliance duration period (i.e., the time between the alliance announcement and its termination), a core earnings restatement is disclosed by an alliance partner. In my analyses, I test whether such restatements affect audit fees for the same fiscal year-end, with the exception of Table 6, where the time dynamics follow a different approach. Other restatement-type variables are constructed using the same logic as core earnings restatements.



APPENDIX

Appendix A

Variable Definitions

Variables	Description	Data source
Main variables		
Audit_Fees	Natural logarithm of total audit fees.	Audit Analytics
Res_Core_Earnings_fy	Indicator variable = 1 if a restatement by an allied firm involves its core earnings, and 0 otherwise.	Audit Analytics
Res_Fraud_fy	Indicator variable = 1 if a restatement by an allied firm involves fraud, as identified by Audit Analytics, or involves an SEC or DOJ investigation and 0 otherwise.	Audit Analytics
Res_Adverse_fy	Indicator variable = 1 if a restatement by an allied firm negatively impacts its financial statements, as identified by Audit Analytics, and 0 otherwise.	Audit Analytics
Res_Big_R_fy	Indicator variable = 1 if an allied firm restates its earnings due to incorrect classification of revenues during the fiscal year, and 0 otherwise.	Audit Analytics
Res_NI_Decr_fy	Indicator variable = 1 if a restatement by an allied firm negatively impacts its net income, as identified by Audit Analytics, and 0 otherwise.	Audit Analytics
Res_Issues_fy	The number of restated accounts.	Audit Analytics
ARL	Natural logarithm of the difference in days between a firm's fiscal year-end and the signature date of the audit report.	Audit Analytics, Compustat
Control variables		
SIZE	Natural logarithm of total assets.	Compustat
ROA	Income before extraordinary items divided by lagged total assets.	Compustat
INVREC	Sum of inventory and receivables scaled by total assets.	Compustat
LEV	Long-term debt scaled by total assets.	Compustat
PLOSS	Indicator variable = 1 if income before extraordinary items was negative during the previous fiscal year.	Compustat
MTB	Market-to-book ratio; market value divided by book value.	Compustat
DEBT_ISSUE	Indicator variable = 1 if the firm issues long-term debt during the fiscal year.	Compustat
ZSCORE	Zmijewski score: -4.336 - 4.513 * (net income/total assets) + 5.679 * (long-term debt/total assets) + 0.004 * (current assets/current liabilities).	Compustat
OCF	Operating cash flows scaled by total assets.	Compustat
SALES_GROWTH	Annual sales growth; (current sales - previous sales) divided by previous sales.	Compustat
WEAK	Indicator variable = 1 if there was a material weakness in a firm's internal controls over financial reporting.	Compustat
DEFIC	Significant Deficiency in Internal Controls (1 if the audit opinion is deficient, 0 otherwise).	Compustat

RESTAT	Indicator variable = 1 if the firm restates its financial statements in the current year, and 0 otherwise.	Audit Analytics
FOROPS	Foreign Operations Indicator (1 if tax on foreign operations is greater than 0, and 0 otherwise).	Compustat
XDOPS	Indicator variable = 1 if the firm reports extraordinary items or discontinued operations.	Compustat
QUICK_RATIO	Quick ratio; (current assets - inventory) divided by current liabilities.	Compustat
MnA	Indicator variable = 1 if the firm was involved in merger and acquisition activity during the year, and 0 otherwise.	Compustat
BIG	Indicator variable = 1 if the firm's financial statements are audited by a Big four auditor.	Compustat
FIRST	Auditor change (1 if audit tenure is less than or equal to 1 year, and 0 otherwise).	Compustat
FYEDEC	Indicator variable = 1 if the firm's fiscal year-end is December 31.	Compustat
SQNUMSEGS2	Squared number of different business and operating segments a company operates in.	Compustat
ln_num_alliances	Natural logarithm of the number of different alliances a firm is involved in.	SDC Platinum
CLOSS	Indicator variable = 1 if income before extraordinary items was negative during the current fiscal year.	Compustat
AGE	Number of years a company has been covered by Compustat.	Compustat
AUDTEN	Number of fiscal years audited by the same auditor.	Compustat
ln_non_audit_fees	Natural logarithm of total non-audit fees.	Audit Analytics

Appendix B

Variance Inflation Factors (VIFs) analysis

This table reports the VIFs and Tolerance values for the regressors used in the audit fee models from previous tables. The column headings reference the corresponding models from previous tables. Specifically, Columns 2 and 3 present the VIFs and Tolerance values for the regression in Table 4, Model 2, while Columns 4 and 5 correspond to Table 4, Model 3. Similarly, Columns 6 and 7 report the VIFs and Tolerance values for Table 5, Model 5.

	Table 4 (model 2)		Table 4 (model 3)		Table 5 (model 5)		Table 5 (model 6)	
VARIABLES	VIF (2)	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance
Res_Core_Earnings_fy	1.050	0.953						
Res_Core_Earnings_JV_fy			1.010	0.994				
Res_Core_Earnings_CA_fy			1.040	0.957				
Res_Fraud_fy					1.020	0.981		
Res_Fraud_JV_fy							1.000	0.997
Res_Fraud_CA_fy							1.020	0.984
SIZE	5.230	0.191	2.440	0.411	2.430	0.411	2.430	0.411
ROA	2.520	0.397	2.510	0.398	2.510	0.398	2.510	0.398
MTB	1.030	0.972	1.020	0.976	1.020	0.976	1.020	0.976
LEV	1.880	0.532	1.870	0.534	1.870	0.534	1.870	0.534
PLOSS	1.490	0.671	1.480	0.675	1.480	0.675	1.480	0.675
INVREC	1.340	0.746	1.320	0.755	1.320	0.755	1.320	0.755
DEBT_ISSUE	1.360	0.737	1.350	0.740	1.350	0.740	1.350	0.740
ZSCORE	3.070	0.326	3.020	0.331	3.020	0.331	3.020	0.331
OCF	1.210	0.825	1.210	0.826	1.210	0.826	1.210	0.826
SALES_GROWTH	1.090	0.921	1.080	0.923	1.080	0.923	1.080	0.923
WEAK	1.040	0.958	1.020	0.979	1.020	0.979	1.020	0.979
DEFIC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
RESTAT	1.040	0.959	1.030	0.975	1.030	0.975	1.030	0.975
FOROPS	1.270	0.784	1.230	0.813	1.230	0.813	1.230	0.813
XDOPS	1.050	0.952	1.050	0.953	1.050	0.953	1.050	0.953
QUICK_RATIO	1.560	0.642	1.560	0.642	1.560	0.642	1.560	0.642
M&A	1.060	0.943	1.060	0.946	1.060	0.946	1.060	0.946
BIG	1.330	0.751	1.310	0.764	1.310	0.763	1.310	0.763
FIRST	1.020	0.977	1.020	0.979	1.020	0.979	1.020	0.979
FYEDEC	1.060	0.941	1.060	0.942	1.060	0.942	1.060	0.942
SqNumSegs2	1.180	0.848	1.180	0.850	1.180	0.850	1.180	0.850
ln_num_alliances	1.210	0.827	1.240	0.808	1.210	0.828	1.210	0.828
Mean VIF	1.640		1.380		1.390		1.380	

Appendix C

Robustness test for Table 7

This table reports the same econometric model of Table 7 but includes the natural logarithm of audit fees as a control variable.

	Audit Reporting Lag					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Res_Core_Earnings_fy	-0.002					
	(0.017)					
Res_Big_R_fy		0.070***				
		(0.017)				
Res_Adverse_fy			0.002			
			(0.009)			
Res_Fraud_fy				0.015		
				(0.033)		
Res_Issues_fy					0.004	
					(0.003)	
Res_NI_Decr_fy						0.014
						(0.012)
SIZE	-0.072***	-0.072***	-0.072***	-0.072***	-0.072***	-0.072***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
CLOSS	0.026***	0.026***	0.026***	0.026***	0.026***	0.026***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ZSCORE	0.011***	0.011***	0.011***	0.011***	0.011***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SqNumSegs2	0.024**	0.023**	0.024**	0.024**	0.024**	0.024**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
M&A	0.018***	0.018***	0.018***	0.018***	0.018***	0.018***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
FOROPS	0.009*	0.009*	0.009*	0.009*	0.009*	0.009*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
ROA	-0.019**	-0.019**	-0.019**	-0.019**	-0.019**	-0.019**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
LEV	-0.051***	-0.051***	-0.051***	-0.051***	-0.051***	-0.051***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
MTB	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DEBT_ISSUE	0.006*	0.006*	0.006*	0.006*	0.006*	0.006*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)

AGE	-0.023	-0.022	-0.023	-0.023	-0.023	-0.023
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
WEAK	0.171***	0.171***	0.171***	0.171***	0.171***	0.171***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
DEFIC	0.007	0.007	0.007	0.007	0.006	0.006
	(0.028)	(0.028)	(0.028)	(0.028)	(0.027)	(0.027)
AUDTEN	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RESTAT	0.020***	0.020***	0.020***	0.020***	0.020***	0.020***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
BIG	0.004	0.004	0.004	0.004	0.004	0.004
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
FYEDEC	-0.054*	-0.054*	-0.054*	-0.054*	-0.054*	-0.054*
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
ln_non_audit_fees	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln_audit_fees	0.107***	0.106***	0.107***	0.107***	0.107***	0.107***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
ln_num_alliances	-0.007*	-0.007**	-0.007*	-0.007*	-0.007**	-0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Observations	72,432	72,432	72,432	72,432	72,432	72,432
R-squared	0.637	0.637	0.637	0.637	0.637	0.637
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES

CHAPTER 2

Does "rewriting history" affect the future? ESG re-scoring and firms' reaction

I. INTRODUCTION

The past decade has seen a growing trend in the integration of Environmental, Social and Governance (ESG) criteria, particularly ESG ratings, into investment decisions. A survey conducted by Natixis Investment Managers in 2019 revealed that nearly two-thirds of institutional investors believe that ESG factors will become a standard in the industry within the next five years. ESG ratings are the most common source of information for evaluating ESG performance, with 70% of survey respondents using this information[14]. Refinitiv (formerly known as Asset 4). provides ESG ratings to the world's largest asset manager, BlackRock, which incorporates ESG criteria into its investment decisions[15]. A recent survey conducted by BlackRock[16] on its clients found that 48% of the respondents would prioritize firms with the highest ESG scores in their investment strategy. The importance of ESG ratings has been confirmed in academic research as a significant source of information for investors (e.g., Hartzmark and Sussman, 2019) and for supply-chain relationships (Darendeli, et al., 2022). Rated firms have also recognized the significance of ESG ratings, as being rated for the first time triggers a response from the firm, and firms with poor CSR ratings exhibit more improvement in their subsequent ratings than their better-rated counterparts (Cheng, et al., 2013; Chatterji, and Toffel, 2010).

ESG ratings are widely recognized as important indicators of a company's sustainability. However, there is a high degree of disagreement among ESG scores. A recent Wall Street Journal article[17] highlighted the difficulty in defining ESG criteria and "quantifying" sustainability, with

[14] https://www.im.natixis.com/us/resources/esg-investing-survey-2019
[15] https://www.responsible-investor.com/blackrock-taps-asset4/
[16] BlackRock, 2020. Global sustainable investing survey
[17] https://www.wsj.com/articles/why-its-so-hard-to-be-an-ethical-investor-1535799601

little overlap on how different ESG rating agencies evaluate companies in the S&P500. Although ESG rating agencies allow rating users an easy comparison among covered firms in a similar way to credit rating agencies, there are some key differences between ESG rating providers and credit rating providers that can explain the (sometimes large) discrepancies among ESG scores.

Firstly, the definition of ESG performance lacks the clarity of default probability, which is well established and less “vague”. Secondly, ESG reporting is replete with different standards that companies may adopt for their disclosure, thereby granting them more discretion compared to standard financial reports. This flexibility is confirmed by academic studies, including Berg et al. (2022), that documented rating divergence among six ESG rating agencies (KLD, Sustainalytics, Moody's ESG, S&P Global, Refinitiv, and MSCI). They found that most of the divergence comes from "measurement divergence," wherein rating agencies measure the same attribute using different indicators, rather than "scope” (i.e., different rating agencies rely on different sets of attributes for scoring) or "weight" (i.e., different rating agencies give different relevance to the same attributes). As a consequence, assessing ESG performance and determining an ESG rating is more subjective than evaluating creditworthiness, with the measurement of these scores being the most crucial point of differentiation among raters. Thirdly, credit ratings typically require firms to meet specific thresholds based on precise and standardized criteria, as outlined earlier. This process does not involve relative evaluation. In contrast, ESG ratings generally require benchmarking, meaning that if one organization improves its ESG score, it can result in another organization within the same benchmark group having a worse ESG score (Gioia and Corley, 2002).

This divergence in ESG ratings, and therefore different rating methodologies, have consequences. Indeed, they can confuse market participants, as demonstrated by Rzeznik et al. (2022), who found that a change in scoring methodology by Sustainalytics generated abnormal

returns for firms experiencing a decline in their ESG score that was not due a "real" change of their ESG performance. This change involves two main adjustments. Firstly, there is a scale-inversion of the ESG score, where it now measures the ESG-related risk of the company rather than its ESG-performance. In other words, a higher ESG risk value now signifies poorer ESG performance. Secondly, there is a shift in benchmarking from industry comparison to universe comparison. This means that a firm is now compared against all others covered by the rating agency, rather than just those within the same industry. The lower abnormal returns that they find suggest that less sophisticated investors rely too heavily on ESG scores. However, despite many studies on the importance of ESG ratings and the drivers and consequences of ESG ratings disagreement, how firms react to a change in the scoring methodology by a leading rating agency is an open question.

Refinitiv, a leading ESG rating agency, has implemented two significant methodological changes in measuring the ESG performance of the firms it covers. In 2017, Refinitiv transitioned from the old Asset4 nomenclature to Refinitiv ESG and reorganized its scoring methodology. The most notable changes involved the "benchmark" groups used for score computation, shifting from a comparison against the entire universe of covered firms to an industry-specific benchmarking approach, which contrasts with the approach taken by Sustainalytics. Additionally, the overall ESG Scores were reorganized, including the removal of the Economic category (reducing the pillars from four to three), changes in the raw measures employed for ESG scores, and the introduction of new scores, such as a separate measure for ESG controversies.

The second major change occurred at the beginning of 2020 and aimed specifically at enhancing transparency in firms' ESG disclosures. This change had two main features: the "*Default-value removal*" and the "*Adoption of the Summing the Percentile Methodology*." To

compute ESG scores, Refinitiv converts each raw variable into a numerical value, even when the variable itself is not numerical (i.e., variables that can only take "YES" or "NO" values if they are not missing, referred to as "Boolean" KPIs, as opposed to numerical variables labeled as "Float" KPIs; we adopt this nomenclature throughout this paper). Under the Refinitiv 1.0 regime, a default value of 0.5 was given when the answer to a Boolean KPI was negative, thereby mitigating the negative impact on the ESG scores. Under the new Refinitiv 2.0 methodology, this default value has been removed, thereby more severely "punishing" firms with negative responses to Boolean KPIs (or, equivalently, "rewarding" firms with positive responses to Boolean KPIs). The second feature, the "*Adoption of the Summing the Percentile Methodology*" in place of the "*Averaging the Percentile*" methodology, affects how KPIs are aggregated to compute ESG scores. Under the old methodology, Refinitiv computed ESG scores by averaging the values attached to the relevant KPIs (i.e., the percentile scores), favoring firms that disclosed fewer KPIs in which they performed better (e.g., by disclosing only one KPI in which the firm performs very well, the score would be very high) and penalizing firms that were more transparent by disclosing KPIs in which they performed worse. Under the new methodology, scores are aggregated by summing the scores attached to the KPIs, thereby favoring companies that disclosed more, even if their performance was not particularly strong.

We leverage this recent change in Refinitiv's scoring methodology in 2020, and aim at answering the following question: is there a relationship between an ESG-rating agency's scoring methodology and a firm's ESG-related behavior? Put differently, do penalties in ESG ratings for non-disclosure influence firms' disclosure decisions and/or real actions?

To answer this research question, we employ a sample of US incorporated firms from 2017 to 2021, to mitigate potential heterogeneity stemming from disclosure laws and country-specific

effects, as well as to avoid the potential impact of an additional methodological change by the same rating agency (the passage from Asset4 to Refinitiv 1.0), our study hypothesizes and subsequently finds that firms under Refinitiv's coverage increased their ESG disclosure after the 2020 methodological change, encompassing both Boolean and Float KPIs. This surge is particularly pronounced in the Environmental and Social pillars, albeit somewhat less so in Governance. Additionally, we employ an ESG disclosure quantity proxy from Bloomberg, and further find that the increasing trend of disclosure, mainly in the Environmental and Social pillars, while failing to reject the null hypothesis concerning the Governance pillar. Finally, through a cross-sectional examination, we provide evidence that firms with a higher percentage of institutional ownership responded to this methodological change by increasing their ESG disclosures.

Furthermore, we employ a Difference-in-Differences (DiD) analysis to test whether the two groups of firms most affected by the two major methodological changes (namely, the removal of the default value and the adoption of the summing-the-percentile methodology for score computation) exhibited an increase in both their reporting of "YES" responses to Boolean KPIs and their disclosure of Float KPIs. Specifically, for the first treatment group, we find that the effect is significantly positive across all pillars when considering Boolean KPIs. However, this effect is not significant for Bloomberg Disclosure Scores, likely because these scores are more influenced by quantitative disclosures than by Boolean information. The second treatment group (i.e., firms that under-disclosed Float KPIs in the pre-period) shows an increase in both the Environmental and Social Disclosure Scores by Bloomberg, as well as in the overall ESG Disclosure Score, but only shows an increase in Social and Governance Float KPIs when considering Refinitiv's metrics. Additionally, we confirm these results by employing a continuous treatment variable, allowing for

variation in the intensity of the treatment across the two groups. To further mitigate potential bias due to covariate imbalances, we apply an entropy balancing matching technique.

Firstly, we contribute to the literature examining the impact of third-party ratings. Prior research has documented that evaluated actors tend to change their behavior to align with the criteria used in evaluations in various settings, including colleges and universities (Espeland and Sauder, 2016), law schools (Sauder and Espeland, 2009), and hospitals (Pope, 2009). Actors subject to third-party evaluations perceive them as a form of control (Espeland and Sauder, 2016; Brandtner, 2017; Kornberger, Pflueger, and Mouritsen, 2017). As third-party evaluations can influence actors' ability to obtain resources and recognition from their primary audiences, actors are likely to internalize evaluation criteria and alter their behavior to conform to those standards (Sauder and Espeland, 2009). However, none of these studies have examined a setting where a change in ESG scoring methodology impacts firms' behavior and disclosure. In a corporate context, we extend previous literature on the consequences of being rated for the first time, such as improving sustainability performance (Chatterji, and Toffel, 2010), access to finance (Cheng, et al., 2013), and stakeholder decision-making (Darendeli, et al., 2022). Particularly, we provide novel insights on how firms respond to a *change* in scoring methodology rather than *being* rated for the first time. Therefore, we aim to demonstrate that ESG ratings can shape firms' decision-making not only by simply *rating*, but also by *how* they rate.

Secondly, this study contributes to the literature on the properties of ESG ratings. Previous research has documented ESG rating disagreements among six well-established rating providers, including KLD and Asset 4 (Chatterji et al., 2016). It has also identified the sources of such disagreements, in terms of measurement, scope, and weight divergences (Berg et al., 2022), and the drivers behind these disagreements, such as firms' disclosure practices (Christensen et al.,

2022). Additionally, prior studies have explored the stock market consequences of these disagreements, including impacts on stock returns (Gibson et al., 2021) and financing (Christensen et al., 2022), as well as business consequences, such as effects on supply-chain contracting (Darendeli et al., 2022). In this study, we provide novel insights into how other business decisions (specifically, ESG disclosure and real actions or firms' ESG policies) can vary in response to changes in ESG scoring methodology, i.e., how ESG performance is measured. Closely related to our research, Cornaggia, and Cornaggia (2023, WP) found that firms respond to changes in ESG scoring methodology by Sustainalytics by "adjusting their reported ESG behavior in the same month". However, these changes pertain changes in the "weight" that is given to certain criteria and are solicited by the rating agency itself: indeed, Sustanalytics demands for companies' feedback during the rating process, thereby incorporating private communication with firms into their scoring process. Conversely, in our email correspondence with Refinitiv, the support service highlighted that they rely upon public disclosure only[18]. Moreover, the methodological change we are testing pertains more closely to overall disclosure and transparency. Therefore, we further corroborate the importance of the measurement system employed by ESG rating agencies and demonstrate that firms may dynamically adjust their behavior publicly according to the rating criteria, and not only privately.

[18] From our correspondence: "The ESG data is collected from company's website and its publicly available documents. We prioritize all the documents from the respective company website." They also specify that they incorporate Carbon Disclosure Project reports only if it is reported on the company website.

II. THEORETICAL BUILDING

1. The Effects of Third-Party Ratings

In general, ratings and rankings compare firms against each other, creating a "hierarchy" among competing firms (Rindova and Fombrun, 1999) by providing a numerical assessment of their performance. A firm's ranking is relevant for its image or reputation, as firms increasingly compete based on their intangible assets (e.g., Rao, 1994; Martins, 2005). Past research has shown that a good reputation and better ranking performance allow firms to demand higher prices (e.g., Fombrun, 1996), achieve better financial performance (Srivastava et al., 1997), and have better chances of survival (Rao, 1994), since rankings influence external stakeholders who provide access to key resources. Therefore, ratings can elicit corporate reactions to conform to ranking criteria, exerting a form of "normative control" and conferring "relative competitive advantage" over competitors (Fombrun and Shanley, 1990).

Espeland and Sauder (2007) propose two main mechanisms that can push organizations to conform to ranking criteria: self-fulfilling prophecies and commensuration. Self-fulfilling prophecies are defined as "processes by which reactions to social measures confirm the expectations or predictions embedded in those measures, thereby increasing their validity by encouraging behavior that conforms to them." Rankings create expectations about organizations, which in turn adjust their behavior accordingly. Commensuration operates by transforming quality into quantities, allowing the measurement of characteristics that rankings consider when evaluating organizations. Essentially, commensuration simplifies and aggregates information, making "certain dimensions of quality salient" while "deflecting attention from others" (Clementino and Perkins, 2021), and establishes relationships and hierarchical orders among covered organizations. Numerical evaluations can amplify even small differences as long as those

differences are considered among the criteria used by the rater. These evaluations also provide organizations with common metrics upon which they can compete.

Indeed, "targets that seem measurable" can "become enticing tools for improvement" (Strathern, 1997) and function as "aspiration levels." Firms can compare themselves to their competitors or their own past performance in a "performance feedback" loop, where performance below a certain threshold gains management's attention (Greve, 2003) and increases the anxiety produced by metrics (Espeland and Sauder, 2016; Slager et al., 2021).

Similar to third-party rankings, ESG ratings are "evaluations of a company based on a comparative assessment of their quality, standard, or performance on ESG issues" (Sustainalytics, 2020). These ratings compare firms' ESG practices and performance within their benchmark group, whether it be the universe of firms covered by the ESG rating agency or peers in the same industry. Although ESG performance is an abstract concept, similar to the reputation derived from third-party rankings, the ESG ratings that firms receive can act as a "summary measure of nonfinancial performance, analogous to how net income is a summary measure of financial performance covering a variety of heterogeneous areas" (Christensen et al., 2022).

Past research has shown that favorable ESG scores facilitate firms' access to finance (Cheng et al., 2013), provide useful information for investors (e.g., Hartzmark and Sussman, 2019), major asset managers, and enhance supply chain relationships (Darendeli et al., 2022). Sustainable investing is growing rapidly, and mutual funds that invest based on ESG ratings experience sizable inflows (Hartzmark and Sussman, 2019). As a result, more investors rely on ESG ratings for a third-party assessment of corporations' ESG performance. Given the increasing importance of sustainable practices and the integration of ESG principles in investment behavior, the need to simplify and aggregate sparse information (i.e., commensuration) regarding firms' ESG practices

has made ESG rating agencies significant information intermediaries in capital markets (e.g., Christensen et al., 2022).

Firms recognize the importance of ESG ratings. Previous research indicates that when firms receive their initial poor ESG scores, they improve their ESG performance in subsequent ratings (Chatterji and Toffel, 2010; Cheng et al., 2013), suggesting that they conform to ESG criteria to avoid the negative consequences associated with poor ratings.

2. Refinitiv's Scoring Methodology

We leverage the plausibly exogenous shock of a change in the scoring methodology by Refinitiv, one of the leading ESG-rating agencies. On March 6, 2020, Refinitiv announced the introduction of several changes to its ESG scoring methodology, referred to as Refinitiv 2.0 going forward, to replace the previous scoring system, Refinitiv 1.0, starting the following month. The stated objective was to increase transparency, meaning more disclosure, among the firms being rated. Refinitiv[19], like other rating agencies, provides overall ESG scores that are based on scores specific to each of the "pillars" (*Environment*, *Social*, and *Governance*). These pillar scores, in turn, are based on "category" scores, with examples such as *Emission Reduction* being a category within the *Environment* pillar. These category scores, in general, are based on several metrics, referred to as Key Performance Indicators (KPIs), which can be either binary (Yes/No), referred to as "Booleans" going forward, or numerical variables, referred to "Floats" going forward. In order to compute both "category" and "pillar" scores, Refinitiv applies a particular methodology: each KPI is transformed into a "percentile score" based on the KPI's value for the firm being rated and how it compares against other firms within the same benchmark group. In particular, there are

[19] Although Berg et al. (2020, WP) documented that there is an ongoing data rewriting process taking place.

two benchmark groups in Refinitiv that are utilized for scoring: the first one is an industry group[20] benchmarking, according to which a firm is compared against peer firms within the same TRBC industry group, and is used for Environmental and Social categories and pillars' scores; the second one is a country-of-incorporation benchmarking, according to which a firm is compared against all firms incorporated in the same country, and is used for Governance categories and pillar's scores. After having ranked the value of a KPI within the focal benchmark group peers, the following formula is used to compute the *percentile score* of that KPI:

$$KPI_{Percentile\_score} = \frac{Number\ of\ firms\ with\ lower\ value + \frac{number\ of\ firms\ with\ same\ value}{2}}{number\ of\ firms\ with\ a\ value}$$

To illustrate with an example, consider the KPI *ENERDP068* which assesses whether a company reports its participation in any emissions trading initiative. This KPI is a Boolean variable where a "YES" response is viewed as more sustainable (for ease of explanation, Boolean KPIs will be assumed to have a positive polarity[21] throughout the paper). If the answer is "YES", the company is assigned a value of 1 for that KPI. Then, within the same Thomson Reuters industry group-year[22], the number of companies with a lower value (i.e., "NO" or missing value), and the number of companies with the same value (i.e., "YES") are determined and used in the formula mentioned earlier. The two main differences between Refinitiv 1.0 and Refinitiv 2.0 relate to the default value that is given to a company that reports a "NO" or does not report to a Boolean KPI

[20] The Refinitiv Business Classifications (TRBC – Industry Group) is a Refinitiv-specific industry classification that classifies firms into one of their 61 TRBC industry groups. This is the industry classification that Refinitiv uses for ESG scoring (i.e., they follow an industry-benchmarking) related to environmental and social pillars, and for controversies scores (Refinitiv, 2022).

[21] Refinitiv defines *polarity* as follows: "Each measure has a polarity indicating whether a higher value is positive or negative. For instance, having an emissions reduction policy is positive, but having environmental controversies is negative."

[22] The only exception relates to Governance-specific KPIs, which are compared against country of incorporation (before April 2020, they were compared against country of headquarters) and not against industry groups.

and how individual KPI scores are combined to generate category scores. The next paragraphs elaborate on these differences, followed by a summary of the changes, considerations, and formal hypotheses to be tested.

1. Default-Value Removal for Boolean KPIs

Under Refinitiv 1.0, a firm that reports "NO" for a Boolean KPI (or does not provide information on that regard) would receive a score of 0.5 out of 1 and the percentile score formula would be applied to compute the KPI's percentile score (i.e., half of the number of firms with a value of 0.5 divided by the total number of firms with a value). However, in Refinitiv 2.0, the same firm would receive a value of 0, and the formula would not be applied for firms that do not report their participation in a KPI. Regarding the KPI *ENERDP068* in the previous example, if a company chooses not to disclose its engagement in an emission trading initiative, which implies responding negatively ("NO"), or if it fails to provide any information on this subject, resulting in a missing value for the KPI, the company will obtain a percentile score of 0 (the percentile score formula will not be applied for the ENERDP068 KPI for that company).

[INSERT TABLE 1]

Refinitiv claims that the change from version 1.0 to 2.0 is meant to encourage firms to disclose more information, but in reality, the penalty for not disclosing is applied equally to firms that report a "NO" for a given KPI and those that do not provide any information at all. As a result, this change may have more impact on firms' real actions or policy adoptions rather than their "simple" disclosure behavior. In other words, disclosing a "YES" for any Boolean KPI now results in a higher score compared to Refinitiv 1.0, while reporting a "NO" or not providing any information at all is now costlier in terms of the KPI's percentile score. This means that the difference in percentile scores between reporting a "YES" and reporting a "NO" (or not disclosing

at all) for any Boolean KPI has increased under Refinitiv 2.0. In other words, the cost of not disclosing positive information has increased.

To express this with a numerical example, let's assume that *x* denotes the number of firms reporting a "NO" for a KPI, while y denotes the number of firms reporting a "YES" (assuming that the KPI has positive polarity). Under the previous Refinitiv 1.0 methodology, the difference in percentile scores between a firm having a "YES" and another firm having a "NO" is independent of the number of firms having "YES" or "NO" and remains constant at 0.5. Numerically:

$$Refinitiv_{1.0}: \ KPI_{Yes\_score} - KPI_{No\_score} = \frac{x + \frac{y}{2}}{x + y} - \frac{\frac{x}{2}}{x + y} = \frac{2x + y - x}{2(x + y)} = \frac{1}{2} = 0.5$$

Under the new Refinitiv 2.0 methodology, however, the difference in percentile scores depends on the number of firms responding "YES" or "NO". Numerically:

$$Refinitiv_{2.0}: \ KPI_{Yes\_score} - KPI_{No\_score} = \frac{x + \frac{y}{2}}{x + y} - 0 = \frac{2x + y}{2(x + y)}$$

Therefore, the cost of not disclosing a Boolean KPI is greater under the new Refinitiv 2.0 methodology, and this effect increases when only a small number of firms report a "YES" for a particular KPI. At the other extreme, where almost all firms report a "YES" for a given KPI, the percentile score difference for that KPI is slightly higher than 0.5. This change in methodology, however, does not affect Float KPIs since the percentile scores for Floats are calculated by directly applying the previous formula to the value of the Float variables, which do not require a default value to be quantified.

2. Adoption of the "Summing the Percentile" Methodology

While the previous change affects only Boolean KPIs, the adoption of the *summing the percentile* methodology in place of the *averaging the percentile* methodology affects both Float and Boolean KPIs. These methodologies regard the way KPIs' percentile scores are aggregated to

compute the focal category score. As mentioned in the previous paragraph, in both Refinitiv 1.0 and 2.0, each firm's relevant KPI is compared against its industry group peers to compute a "percentile score" based on how "it ranks" against them. In Refinitiv 1.0, an *averaging the percentile* methodology was applied, thereby all the percentile scores of the KPIs within a category were averaged, so that it was possible to apply the percentile score formula again. This category percentile score is, indeed, the final score for the category. In Refinitiv 2.0, the *averaging the percentile* methodology has been substituted by the *summing the percentile* methodology. Therefore, all the percentile scores of the KPIs within a category were summed up, so that it is possible to apply the percentile score formula again on these summed-up scores. As a result. under the Refinitiv 1.0 regime and keeping all else constant, firms which disclosed only Float KPIs where they had a very good percentile score were advantaged compared to firms disclosing more Float KPIs where they were performing worse. Hence, under Refinitiv 1.0, it was convenient for any firm to selectively disclose Float KPIs in which it performed better, from an ESG-score perspective. Under Refinitiv 2.0, instead, even if firms performed worse on a particular Float KPI, they get a higher summed-up score, which is turned into a higher category score after applying the formula outlined above. However, while all Boolean KPIs are given a default value of 0 (0.5) under Refinitiv 2.0 (Refinitiv 1.0), thereby all firms in an industry group contribute to the final score calculation, it is worth noting that Float KPIs are considered in such calculations only when they are available. In other words, a firm is not assigned any value if it does not disclose a particular Float KPI, and consequently it does not get any percentile score for that KPI. At the same time, it does not contribute to the number of firms with a worse value nor to the total number of firms with a value in the above formula. Hence, it is convenient for any firm to disclose all Float KPIs, even the ones in which it performed worse, from Refinitiv's ESG scoring perspective. For example, if

a firm has a very "bad" value for a Float KPI (e.g., it emits a high level of CO2) compared to its industry group, this turns into a low *percentile score* for this particular KPI. Therefore, when computing the relevant category score (in this case, the emission score), the fact that a firm has disclosed its (very bad) level of CO2 emissions penalizes the firm under Refinitiv 1.0. Conversely, the opposite is true under Refinitiv 2.0 (i.e., disclosing a very high level of CO2 emissions increases the percentile score).

3. Hypotheses Development

According to Refinitiv, the purpose of the two changes to their scoring methodology is to encourage companies to disclose more information related to their ESG performance. The removal of default values for Boolean KPIs is likely intended to incentivize companies to take actions or adopt policies rather than just reporting their behavior (e.g., by declaring that the firm does not have a particular policy nor has taken a particular action), as the only way to receive a positive score is by reporting a "YES" for a Boolean KPI. Therefore, our first hypothesis is:

HP 1: Companies included in Refinitiv's coverage will report more "YES" for Refinitiv's Boolean KPIs after the 2020 scoring methodology change.

This increase in ESG-related disclosure can be achieved in two ways. Following the first of the two components of the Refinitv 2.0's major change (i.e., default-value removal), companies have more incentives to report a "YES" for Boolean KPIs rather than simply disclosing a "NO", or not disclosing it at all, given that the benefit of disclosing a "YES" is higher than in Refinitiv 1.0. The second component of the Refinitv 2.0's major change (i.e., the adoption of the "summing the percentile" methodology) penalizes firms that selectively disclose Float KPIs for which they show more positive values (or "less negative", according to the KPI's polarity), and, at the same

time, rewards more transparent firms that disclose more Float KPIs for which they may have less positive values (or "more negative").

Analogously, for Float KPIs:

HP 2: Companies included in Refinitiv's coverage will disclose more values for Refinitiv's Float KPIs after the 2020 scoring methodology change.

We expect that our hypothesis is supported as ESG ratings by rating agencies, and Refinitiv in particular, are important to the key recipients of this information. ESG scores that are favorable can enable companies to obtain improved access to finance (Cheng et al., 2013), provide useful information for investors (e.g., Hartzmark and Sussman, 2019), major asset managers, and supply chain relationships (Darendeli et al., 2022). Additionally, companies typically disclose more information when there are penalties for failing to disclose (Friedman et al., 2022).

III. RESEARCH DESIGN

1. Sample construction

To test our predictions, we use two samples of firms covered by Refinitiv 1.0 and Refinitiv 2.0 during two periods: 2017-2018, which we refer to as the historical dataset (downloaded in early 2020), and 2019-2020-2021, which we refer to as the current dataset. For the former, we obtained a bulk download of Key Performance Indicators (KPIs) from Refinitiv 1.0[23], treating it as if Refinitiv 2.0 had never been introduced. This is the latest backup of data we have before the introduction of Refinitiv 2.0 in April 2020. We chose not to consider years prior to 2017 due to another methodology change (from Asset4 z-scores to Refinitiv 1.0). Also, we cannot use year 2019 from the historical dataset because it contains too few observations[24].

[23] This bulk download refers to data as of March 2020, though it has been downloaded afterwards
[24] It is not surprising, given that our historical data have been downloaded in February 2020.

The second sample consists of firms with the same ISINs and was downloaded when Refinitiv 2.0 had already been implemented, at the end of February 2024.

We chose to use two samples to prevent firms from requesting Refinitiv to "backfill" their KPIs after the scoring methodology change. Refinitiv has a cut-off period of five years, meaning that they do not typically alter data beyond that period, even if a firm requests a correction or restatement through Refinitiv's Help Desk. This concern is supported by research by Berg et al. (2020, WP), which revealed that Refinitiv can modify a firm's KPIs historically. Table 2 presents the details of the sample selection process.

[INSERT TABLE 2]

We start from the historical sample of firms as of 2020, containing 8,662 different Datastream company identifiers, and we dropped duplicate ISINs. We downloaded all firms' country of incorporation in order to focus on firms that are still covered by Refinitiv 2.0, are still incorporated in the United States to avoid potential confounding effects (e.g., different disclosure legislation around the world). Given that the historical dataset contains the entire time series of firms starting from 2002 onwards, irrespective of when Refinitiv started covering them, we dropped firms that have both missing ESG Score, and miss all the KPIs from the historical dataset. Additionally, Refinitiv implemented a change in September 2020 that added seven new industry groups, potentially impacting the behaviour of firms within previously existing groups because their benchmark group has been altered. To avoid any confounding effects that may have arisen from this change, we have both excluded the seven new industry groups, and the three industry groups that mostly contributed to the creation of the new groups[25], resulting in a sample of 51 industry groups rather than the previous 54. This yields to the sample that we use for descriptive

[25] For more information on all industry groups, including the ones we have excluded thanks to our email correspondence with Refinitiv, please see Appendix D.

statistics and t-tests in our analyses, composed by 2,121 different ISINs, and 9,771 firm-year observations. Panel A of Table 3 presents this sample distribution by year. For the empirical analyses with OLS, the sample is smaller due to missing control variables and yields to 8,585 firm-year observations for 1,849 different firms, and its yearly distribution is shown in Panel B.

[INSERT TABLE 3]

The distribution of firm-year observations across TRBC Industry Groups is shown in Table 4, while more detailed information on the Industry Groups can be found in Appendix D.

[INSERT TABLE 4]

2. Specification

In order to provide empirical evidence for our first hypotheses, we employ a combination of descriptive statistics and t-tests, as well as a pre-post research design, a difference in differences analysis, an entropy balancing approach and cross-sectional test. Specifically, we investigate whether firms increased their reporting of "YES" for Boolean KPIs, whether there has been an increase in the number of disclosed Float KPIs, and whether firms increased their ESG disclosure after the change in scoring methodology. To accomplish this, firstly, we show the yearly distribution of the average proportion of the number of relevant KPIs that are missing over the total number of relevant KPIs for each firm. Secondly, we use difference in means t-tests to compare the average number of disclosed KPIs within each category. This involves calculating the percentage of missing KPIs (both Booleans and Floats) in each year of the pre-period and in the post-period, relative to the total number of relevant KPIs[26] within each category and perform t-

[26] Not all the KPIs are relevant for all industry groups. Therefore, we will be referring to the list of relevant KPIs as per April 2020. The only exception relates to Governance-specific KPIs, which are relevant for all industries. For detailed information on the relevant KPIs we consider in our analyses for all TRBC industry groups, please refer to Appendix C.

tests to compare if the percentage of missing KPIs is significantly different between the pre and post period. We consider as ore-period the years 2017 to 2019 because the change has been announced in March 2020 and adopted at the beginning of April, so that the first effects of such change can take place at the end of 2020. Consequently, our post-period is composed by the years 2020 and 2021. In order to ensure the cleanliness of our dataset, we opted for including only the KPIs that are common to both Refinitiv 1.0 and Refinitiv 2.0[27] in all our analyses. Thirdly, in our pre-post research design, we use the following model:

$$Disclosure\_Percentage_{i,t} = \beta_0 + \beta_1 Post_t + \beta_2 Controls_{i,t} + \varepsilon_{i,t} \quad (1)$$

The variables in our study are denoted by subscripts *i* and *t*, indicating the firm and year, respectively. The dependent variable, $Disclosure\_Percentage$, refers to the percentage of disclosed KPIs over the number of relevant KPIs in each pillar for each firm. However, given the low number of missing Boolean KPIs for the current dataset (i.e., the one that has been downloaded in 2024), and given that missing values and "NO" values are treated equally in the scoring process, we opted for a conservative approach by considering as disclosed only "YES" values for Boolean KPIs. Given that there are eleven different categories across the three pillars, we opted for a general approach thereby aggregating the *Disclosure_Percentage* across the three pillars (*Environment_ryp*, *Social_ryp*, and *Governance_ryp*), by Environment and Social pillars (*ES_ryp*), and by all pillars at once (*ESG_ryp*). For example, if company A discloses 3 Float KPIs out of ten relevant KPIs for the Social pillar, its *Social_Ryp_Float* is equal to 3/10. The same applies for the other pillars and for Boolean variables. To distinguish between Boolean and Float

[27] The KPIs that are common to both Refinitiv 1.0 and Refinitiv 2.0 are 172. However, 8 of them are not available in our pre-period dataset. Another KPI, SOCODP066, is a "string" type variable that "indicates countries where the company has been involved in a controversy for operating in a country with human rights violation". Given the different nature of this variable and the fact that none of the firms in our dataset has a non-missing value for it in both periods, we excluded it. Hence, we focus on 163 KPIs in total.

KPIs, the disclosure percentage variables are labeled with a suffix *_Float* or *_Boolean* indicate the percentage of disclosed KPIs out of the total number of relevant KPIs, focusing solely on Float KPIs and Boolean KPIs, respectively. As an additional outcome variable, we draw from (among others) Grewal, et al. (2019) and use the Bloomberg ESG disclosure scores to proxy for the extent of firms' ESG-related disclosures. These variables serve as metrics employed by industry practitioners to gauge a company's transparency in reporting ESG-related information. Bloomberg provides both an overall ESG Disclosure score and a more detailed breakdown on the three pillars, Environment, Social, and Governance. It is important to note that these scores do not assess the "quality" of the disclosure, defined as whether the company attains a specific performance level. Instead, Bloomberg aggregates all publicly available information on ESG topics disclosed by a firm, recording whether the firm discloses all the data points that Bloomberg considers relevant for the firm's sector. Although these scores account for both Boolean and Float metrics similar to Refinitiv, Bloomberg specifies that "quantitative fields are weighted more heavily than binary fields." Therefore, it is likely that these scores align more closely with our Float disclosure measure than with the percentage of "YES" responses for Boolean KPIs. These scores range from 0.1 (for a firm that discloses the minimum amount of ESG-related information) to 100 (for a firm that discloses all the data points collected by Bloomberg). We have rescaled these scores so that 1 is the new maximum score achievable to facilitate comparison across tables.

The independent variable, *Post,* is an indicator equal to one for the years 2020 and 2021, and zero otherwise. Our pre-post analysis does not distinguish between a treatment and control group; therefore, the β1 coefficient captures the time effect on the entire (treated) sample.

To control for the different propensity of firms to disclose ESG-related information, we incorporate firm-specific control variables in the spirit of Christensen, et al. (2022). These

variables include *Size* (measured as natural logarithm of total assets), *ROA*, *Book-to-Market*, *Leverage*, Analyst_following, *Return_volatility*, *Board_size*, *Board_independence*, *Board_gender_ratio*, Institutional Ownership Ratio (*IOR*) and *Average_tenure* of board members, as defined in Appendix A, and continuous variables are winsorized at the first and last percentile, while *IOR* is capped a 100%. We also employ firm fixed effects to capture unobservable time-invariant firm characteristics and employ year dummies in alternative specifications to observe the magnitude of year-specific coefficients. We cluster standard-errors at the TRBC Industry Group level.

To improve our identification strategy, we also adopt a difference-in-differences analysis. Following prior literature (e.g.: Ma and Thomas, 2024; Qiu and Ronen, 2019; Chatterjee, 2021; Li et al., 2024), firms are assigned to the treatment and control groups based on the potential impact of the two scoring methodology changes, leading to two different treatment groups, one for each methodological change.

The model specification for the Difference-in-Differences (DiD) approach is as follows:

$$Disclosure\_Percentage_{i,t} = \beta_0 + \beta_1 ESG\_Treat_i \times Post + \beta_2 Controls_{i,t} + \varepsilon_{i,t} \quad (2)$$

The outcome variables and controls are the same as in Equation 1. Equation 2 includes both firm and year fixed effects, while standard errors are clustered by TRBC Industry Groups.

The first treatment group (*ESG_Treat_Boolean*) consists of firms expected to react more to the "default-value removal" for Boolean KPIs. The treatment dummy is set to 1 if a firm reported a percentage of "YES" responses (or "NO" responses for negative polarity KPIs) below the median in 2018, which is the last pre-period year. Similarly, the second treatment group (*ESG_Treat_Float*) consists of firms expected to react more to the adoption of the "summing the

percentile" methodology, therefore the treatment dummy is set to 1 if a firm reported a percentage of Float KPIs (out of the total number of relevant Float KPIs) below the median in 2018.

Data on 2019 were not available in our latest historical download (February 2020), and current 2019 data could have been affected by the announcement of the methodological change in March 2020, as some firms might have already started altering their reporting of "YES" responses or disclosure of Float KPIs. To avoid this concern and ensure a cleaner analysis, we exclude 2019.

Additionally, given that treatment intensity may vary depending on how many "YES" responses firms reported or how many Float KPIs they disclosed, we substitute the binary treatment variable (ESG_Treat) in Equation 2 with a continuous treatment variable (ESG_Continuous_Treat), as there is no available untreated comparison group (Callaway, Goodman-Bacon, and Sant'Anna, 2021). Therefore, for each firm, we compute the average percentage of "YES" responses for Boolean KPIs and the average percentage of disclosed Float KPIs during the pre-period (i.e., 2017 and 2018), and subtract these values from 1. Thus, the higher the value of this treatment variable, the fewer "YES" responses or disclosed Float KPIs, indicating a higher expected intensity of the treatment.

A potential concern is that firms in the treatment group may not be comparable to those in the control group due to observable factors. To address this concern, we employ an entropy balancing matching technique to balance the first three moments of the control group across all control variables (i.e., Size, ROA, BTM, Leverage, Analyst Following, Return Volatility, Board Size, Board Independence, Average Tenure, IOR) and TRBC Industry Group membership, and rerun the DiD baseline analysis using sampling weights.

IV. **RESULTS**

1. Descriptives and T-Tests

In order to test our hypothesis, which posits that firms disclose more ESG-related information after the 2020 scoring methodology change by Refinitiv, in the sense that they report more numerical values for Float KPIs, and undertake more real actions or commit to policies by reporting "YES" values for Boolean KPIs, after the 2020 scoring methodology change, we start by showing the average number of disclosed KPIs by each firm with respect to the total number of relevant KPI for that firm in each category and pillar. Regarding Boolean variables, we treat "NO" as missing values for KPIs with positive polarity (and "YES" as missing values for KPIs with negative polarity). This decision stems from our correspondence with Refinitiv, where they assured us that when a KPI is missing, it returns no value in Datastream or "NULL" in Refinitiv Workspace. However, it appears that both platforms actually report a "NO" rather than a missing value or a "NULL." Therefore, we adopted a conservative approach and considered "NO" as a missing value as well for all our analyses. This is also consistent with our first hypothesis that posits that firms will report more "YES" values for Boolean KPIs. For reference to the table considering "NO" as a non-missing value, please see Appendix B.

[INSERT TABLE 5]

Panel A of Table 5 displays the ratio of missing KPIs to the total number of relevant KPIs, encompassing both Boolean and Float KPIs, for each firm. Overall, it seems that there is a trend increased disclosure among firms, as evidenced by a decrease in the percentage of missing values over the years. For instance, in the *Innovation* category, the table shows that in 2017 firms, on average, disclosed the 13.4%[28] of their relevant KPIs, compared to over 30% in 2021. The most

[28] i.e., 100% - 86.6%

significant increase in disclosure (or decrease in missing values) is observed in the Environmental and Social pillars, which rose from 14.3% and 28.4% of average disclosed KPIs to 33.2% and 49.1%, respectively. The categories most affected by this trend are Community and Human Rights, which saw a decrease in their average number of missing values by approximately 30%.

Panel B of Table 5 indicates that the most significant reduction in missing values occurred in the Environmental and Social pillars for both Boolean and Float KPIs. However, the decline in missing values for the Social pillar predominantly involves Boolean KPIs (approximately 20%) compared to Float KPIs (around 10%). Interestingly, there was not a notable decrease in missing values for Float KPIs in the Innovation category. This is likely because Refinitiv only considers a few Float KPIs relevant for this category. Consequently, the number of firm-year observations with relevant KPIs in this category is relatively low (around 400 for the 5 years under consideration) and not many of them reported values for such KPIs. Regarding the Governance pillar, there is a decline in missing values for Boolean KPIs across all its categories, particularly in CSR Strategy. However, the missing values for its Float KPIs have remained consistently low throughout the five years of our analysis. For almost all 5 years, the average percentage of missing values is lower than 10%.

Panel C is devoted to irrelevant KPIs, with the third column representing the percentage of missing value KPIs over the total number of irrelevant KPIs. It demonstrates consistent trends in missing values across various categories: while there has been a slight increase in the average number of missing values for irrelevant KPIs in the Environmental pillar, the Social pillar shows a slight decrease[29]. Overall, most categories exhibit a high percentage of average missing values, except for the first two years of the innovation category, which display a ratio lower than 95%.

[29] All KPIs in the Governance pillar are relevant across all industry groups

Henceforth, our analysis will focus on relevant KPIs only, rather than irrelevant ones. This decision is based on consistent descriptive evidence suggesting that the methodology change had little to no impact on the disclosure of irrelevant KPIs.

[INSERT TABLE 6]

Table 6 presents the results of t-tests comparing the average number of disclosed values for relevant KPIs in the pre-period versus the post-period (i.e., 2017 to 2019 and 2020 to 2021). However, for ease of interpretation, we opted to display the disclosure percentage rather than the missing-value percentage (i.e., 1 minus the missing value percentage). This disclosure percentage will be referenced throughout the following analyses. Panel A focuses on Boolean KPIs, while Panel B on Float KPIs[30] categories. Panel A shows that there has been an increase in Boolean KPIs in the Community category, rather than Float KPIs. Specifically, the averages move from 47.8% to 82% for Boolean KPIs and from 15.3% to 29% for Float KPIs. Similarly, the Governance pillar also exhibits an increase in the average disclosure percentage, although to a lesser extent compared to the Environment and Social pillars. This trend aligns with the higher increase in the disclosure percentage mean for the Environment and Social pillars combined (for Boolean KPIs: from 24.9% to 45.5%; for Float KPIs: from 19.6% to 31.8%) compared to the ESG pillars combined (for Boolean KPIs: from 37.9% to 54%; for Float KPIs: from 50.3% to 60.3%).

The disclosure percentage for the Environment and Social pillars increases by more than 20% and more than 12% for Boolean and Float KPIs, respectively. In contrast, for all ESG pillars combined, the increase is 16.2% for Boolean KPIs and 10% for Float KPIs. To address concerns that historical data (i.e., years 2017 and 2018) may be influencing the significance of these results, Appendix E presents the same t-tests comparing a different pre-period involving only the year

[30] The categories Human Rights and CSR Strategy do not contain any Float KPI.

2019 versus 2020 and 2021. This analysis also supports the difference in means, although the magnitude of the difference between the post and pre-periods is smaller. The only notable exception is observed in the Governance pillar. While Panel A of Appendix E shows that the Governance pillar had, on average, more disclosed values in the post-period than in the pre-period, Panels B and C reveal that the Shareholders category significantly increased its average number of disclosed Boolean KPIs only, while it decreased the number of disclosed Float KPIs in the post-period. Consequently, this decrease in disclosure for the Shareholders category also results in an insignificant difference in means for the Governance pillar regarding Float KPIs.

Overall, the descriptive statistics presented above and the t-tests support our prediction that firms covered by Refinitiv have increased their disclosure of ESG-related information following the 2020 scoring methodological change for Float KPIs, and increased the number of policies (or real actions) that they adopt (Boolean KPIs). While we refrain from claiming causal evidence in our previous analyses, we observe a consistent trend of increasing disclosure from 2017 to 2021. However, it is noteworthy that Table 5 did not demonstrate an increase in disclosure in 2018 compared to 2017. In fact, Panel A indicates that all categories experienced a decrease in disclosure (i.e., more missing values on average) rather than an increase in 2018. Nonetheless, starting from 2019 (i.e., the first year of our analysis utilizing current data rather than historical data), there has been a rise in disclosure and adoption of policies compared to the previous two years, and this trend continues into 2020 and 2021. The Governance pillar appears to be the least affected by the methodological change. Furthermore, the results remain robust even when considering a different pre-period consisting only of current data from 2019 onwards.

2. OLS Results

The pre-post research design outlined above aims to demonstrate the time effects on disclosure percentage variables while controlling for time-varying factors that have been found to be correlated with ESG disclosure, in the spirit of Christensen et al. (2022). However, due to missing control variables, the sample size is smaller, as indicated in Table 3.

[INSERT TABLE 7]

Table 7 displays the descriptive statistics of the sample used in our empirical analyses. It is notable that, on average, our disclosure percentage measures (i.e., *Environment_Ryp_Float*, *Social_Ryp_Float*, and *Governance_Ryp_Float*) appear to be quite similar to the average Bloomberg Disclosure measures[31]. Specifically, information regarding the environmental performance of firms seems to be the least disclosed among the firms in our sample, with an average disclosure percentage of 12.9% and 24.5% for Float and Boolean KPIs, respectively, and an average environmental disclosure of around 14.8% according to Bloomberg. Conversely, information regarding the Social pillar appears to be more disclosed among firms in our sample, with around 28.2% of the *Social_Ryp_Float* measure and 38.8% for the *Social_Ryp_Boolean*, compared to around 2% of the disclosure measure provided by Bloomberg. Notably, governance information appears to be the most disclosed overall.

[INSERT TABLE 8]

The initial set of results of the OLS is presented in Table 8. In this table, the dependent variables are the disclosure percentage measures for Boolean KPIs. The post-period indicator equals 1 from 2020 to 2021 in odd columns, while year dummies are included in even columns.

[31] A comparison between the *Ryp_Float* variables and Bloomberg Disclosure scores must be taken cum grano salis, given that the former are raw ratios of disclosed values to the total disclosable Float KPIs, while the latter are scores that necessarily entail more calculations than a simple raw ratio.

The findings suggest that firms have, on average, disclosed more "YES" for Boolean KPIs related to all pillars from 2020 onwards, consistently with our first hypothesis and with the descriptive analysis in the previous paragraph. Specifically, the Environmental and Social pillars are the most affected, with firms disclosing, on average, 10.9% and 19.1% more KPIs in 2020 and 2021 compared to the period from 2017 to 2019, respectively. Conversely, the Governance pillar appears to be the least affected, with firms disclosing only 6.4% more relevant KPIs in the post-period compared to the pre-period. The combined effect on both Environmental and Social pillars is an average increase of 15.5% in disclosed KPIs, while for all pillars combined, it is 11.9%.

Examining even columns with 2017 as the baseline year provides further insights into the time trend. In 2018, firms disclosed fewer Boolean KPIs on average compared to 2017, except for the Environment pillar, which showed a slight increase. However, a clear increasing trend emerges from 2019 onwards. Particularly in 2020, firms disclosed 15.8%, 22.7%, and 8.3% more relevant KPIs compared to 2017 for the three pillars, Environment, Social and Governance, respectively. These coefficients are significantly higher than those in 2019 (the p-values for the equality of the coefficients are less than 1% for all specifications with year dummies), indicating that firms disclosed 5.2%, 5.2%, and 2.2% more relevant KPIs compared to 2019. The trend appears to continue in 2021, albeit with a smaller magnitude, as the difference between the estimated coefficients in 2021 and 2020 is smaller than that between the coefficients in 2020 and 2019. Therefore, the results in Table 8 support hypothesis 1.

[INSERT TABLE 9]

Table 9 focuses on the disclosure percentage variables considering only Float KPIs. There is a notable increase in the disclosure percentage for all pillars, with the Governance pillar experiencing a slightly lower growth of 3.8% in the post-period. Interestingly, when comparing

the coefficients for Environmental and Social pillars between Table 8 and Table 9, it appears that Environmental Float KPIs have been disclosed more in the post-period than Environmental Boolean KPIs, while the opposite trend is observed for the Social Pillar disclosure. When considering Environmental and Social pillars together, it appears that the 2020 methodological change affected more the reporting of "YES" for Boolean KPIs than the disclosure of Float KPIs.

Additionally, in the case of Float KPIs, the time effect of 2020 is significantly higher than that of 2019 for the Environment and Social pillars, while it does not significantly differ for the Governance pillar. However, when comparing the difference in the time effect observed in 2020 for Boolean KPIs against that for Float KPIs, their difference is never found significantly different (i.e., the p-value for the difference between the year 2020 coefficient in Table 8 and year 2020 coefficient in Table 9 is higher than 10%[32]).

Overall, Tables 8 to 9 support our hypotheses, indicating an increasing trend in disclosure for Float KPIs and undertaking real actions (i.e., by reporting "YES" values) for Boolean KPIs across all years in our panel, with the exception of 2018. The upward trend started in 2019, the first year not sourced from our historical dataset, likely driven by firms' efforts to rectify reported KPIs with Refinitiv via the dedicated online platform in a bid to boost their ESG Scores. However, this upward disclosure trend intensified notably in 2020 and 2021, surpassing the time effect observed in 2019 for both Boolean and Float KPIs. The only exception is observed in Governance pillar Float KPIs, as highlighted especially n Table 9. Moreover, it appears that most of the effect of methodological change affected more Float KPIs concerning the Environment Pillar, whereas most of the "YES" for Boolean KPIs concern the Social Pillar. In contrast, the Governance pillar

[32] The p-values have been obtained using *suest* command in Stata

exhibits a consistent disclosure trend over the years, albeit not as pronounced as the Environment and Social pillars and demonstrates no significant difference between Boolean and Float KPIs.

[INSERT TABLE 10]

Table 10 displays the impact of time on Bloomberg Disclosure scores, serving as a proxy for the quantity of ESG disclosure by firms. It reveals that firms have increased their disclosure quantity in the post-period compared to the pre-period across all pillars. Consistent with earlier findings, it seems that Governance disclosure experienced a modest increase in the post-period, although the coefficient estimate significantly differs from zero. On average, firms augmented their governance disclosure by 0.6 points after 2020, a notably smaller increase compared to the Environment and Social pillars, which saw increments of 4.5 points and 3.4 points in the post-period, respectively.

Examining the year-specific effects in the even columns, it is evident that there has been a consistent upward trend in disclosure, as previously observed. However, the magnitude of all coefficient estimates appears relatively stable over the years, with no sudden spikes. Nevertheless, similar to prior tables, the increase in disclosure during 2020 is significantly higher than that in 2019 for all three pillars individually, as well as when considering all three pillars together. Although the coefficient for 2018 is significantly positive, unlike the 2018 coefficient in Table 9, its magnitude is much weaker compared to the coefficient estimates from 2019 onwards.

3. Cross-sectional Analysis

In a cross-sectional test, we expect that certain firms may respond differently to the change in scoring methodology based on their characteristics. Among these traits, firms with higher institutional ownership might exhibit a more pronounced reaction to changes in ESG scoring methodology compared to others. This prediction is supported by both anecdotal evidence

presented in the introduction of this study and academic research highlighting the impact of institutional ownership on ESG ratings.

Anecdotal evidence, such as surveys conducted by Natixis Investment Managers and BlackRock, indicates that nearly two-thirds of institutional investors believe ESG factors will become increasingly important in the coming years. Additionally, about half of BlackRock's clients incorporate ESG ratings into their investment criteria, suggesting that institutional investors tend to be more cognizant of ESG rating dynamics. Similarly, academic research has shown that institutional investors are interested in ESG ratings (e.g., Hartzmark and Sussman, 2019), strive to enhance the sustainability performance of their invested firms (Chen, Dong, and Lin, 2020), and are more likely to be knowledgeable about ESG rating methodologies (Rzeźnik, Hanley, and Pelizzon, 2022). Notably, the latter study indicates that institutional investors were not misled by Sustainalytics' methodological change and were able to integrate this change into their investment decisions. Thus, we expect that firms with higher institutional ownership will similarly be more responsive to Refinitiv's methodological change.

To run this cross-sectional test, we employ the model described in Equation 1 and split the sample according to the IOR level at the end of March 2020 (i.e., the closest date for institutional ownership data to the Refinitiv methodology change). Specifically, a firm is included in the *High_IOR* subsample if its *IOR* is higher than the sample median as of March 2020[33], and in the *Low_IOR* subsample otherwise. We incorporate the same controls as in Equation 1 (excluding *IOR*). Additionally, we employ firm fixed effects and cluster standard errors by TRBC Industry Groups. The dependent variables are those specified earlier. To test whether the coefficient estimates for the *Post* variable are significantly higher in the *High_IOR* subsample than in the

[33] Firms without IOR data on March 2020 have been excluded from this analysis.

Low_IOR subsample, a series of t-tests are computed on the interactions between a *High_IOR* dummy and the *Post* dummy in a fully-interacted model.

[INSERT TABLE 11]

Panel A of Table 11 shows that the disclosure of Boolean KPIs for all three pillars (Environmental, Social, and Governance) has increased in the post-period for both firms with higher and lower levels of institutional ownership. For all three pillars, firms in the High_IOR subsample have shown a significantly greater increase in reporting "YES" to Boolean KPIs, though the magnitude of this difference is smaller for the Governance pillar. Specifically, firms in the High_IOR subsample have shown an increase of 13.3% against an increase of 8.9% for the Environment pillar, with a 4.4% differential effect between the two subsamples. Similarly, for the Social pillar, the increase for the High_IOR subsample has been 20.1%, compared to an increase of 18% for the Low_IOR subsample, with a 2.1% difference between the subsamples. Regarding the Governance pillar, the High_IOR subsample shows an increase of 6.6%, which is only 0.6% higher than the Low_IOR subsample. The differential impact for the E&S pillars combined is 2.9% more for the High_IOR subsample and 1.8% when considering all three pillars. Thus, Panel A supports our prediction that firms with higher institutional ownership increased their reporting of "YES" for Boolean KPIs more significantly.

In Panel B of Table 11, we investigate the impact of the Post indicator on the disclosure percentage of Float KPIs. Once again, we observe that the increase in disclosure is stronger for the High_IOR subsample for both the Environment and Social pillars. In particular, the differential impact of the Post dummy for the Environmental pillar is nearly 1% in favor of the High_IOR subsample (i.e., 12.6% vs. 11.7%), while for the Social pillar the difference is almost 2% (8.6% vs. 6.8%). However, the effect for the Governance pillar is opposite to what has been found in

Panel A, as the Low_IOR subsample shows a significantly higher increase of 0.4%. Although the difference is not as pronounced as for the other pillars, it appears that the results for the Governance pillar differ according to the nature of the outcome variable.

Panel C further corroborates the results from Panels A and B, showing that the High_IOR subsample exhibits a significantly higher increase in disclosure scores for both Environmental and Social pillars compared to the Low_IOR subsample. Specifically, the differential impact is 2.5% for the Environment pillar (5.8% vs. 3.3%) and 0.8% for the Social pillar (3.8% vs. 3%). Overall, these cross-sectional results suggest that firms with higher institutional ownership in March 2020 increased their E&S disclosure (both in terms of policies and quantitative information) more than the Low_IOR subsample, while results for the Governance pillar appear to be mixed. These findings further underscore the importance of distinguishing between E&S pillars and Governance.

4. Difference-in-Differences Analysis

Table 12[34] shows the results of our baseline DiD analysis using the model outlined in Equation 2. Panel A includes two types of outcome variables: columns 1 through 5 present the percentage of "YES" responses from the total number of relevant Boolean KPIs, categorized by pillar. In contrast, columns 6 through 9 use the Bloomberg Disclosure Scores as the outcome variable to measure disclosure quantity.

[INSERT TABLE 12]

The results in Panel A indicate that firms most penalized by the "default-value removal" (i.e., firms reporting fewer "YES" responses during the most recent year available in the historical dataset before the change) show a greater increase in reporting "YES" across all pillars,

[34] The number of observations in the following tables is lower compared to the previous ones because data on 2019 have been excluded from the analysis, and some observations have been dropped because of missing Refinitiv data on 2018.

particularly for the Environment pillar. However, these firms do not show any significant increase in the Bloomberg Disclosure Scores. One potential explanation is that Bloomberg Disclosure Scores give greater weight to Float metrics than to Boolean metrics. Thus, except for the Bloomberg Disclosure Scores, Panel A supports our first hypothesis.

Panel B, analogous to Panel A, presents the percentage of disclosed Float KPIs from the total number of relevant Float KPIs as the dependent variable in columns 1 through 5, categorized by pillar. In columns 6 through 9, the outcome variable is again the Bloomberg Disclosure Scores. The results from this panel, particularly in columns 1 through 5, show that firms most penalized by the "summing the percentile" methodology (i.e., firms reporting fewer Float KPIs during the latest available year in the historical dataset before the change) have increased their disclosure of both Social and Governance Float KPIs. Notably, the effect is positive for both the E&S pillars combined and the ESG pillars overall, but it is slightly negatively significant in column 1, suggesting that firms that disclosed less in the pre-period disclose even less after the change in 2020. However, focusing on columns 6 through 9, firms that under-disclosed in the pre-period increased their disclosure for both Environment and Social pillars, but not for Governance. The difference in results between the Environment_Ryp_Float outcome variable from Refinitiv and the Environmental Disclosure variable from Bloomberg may be due to the fact that Bloomberg accounts for Boolean metrics when computing the Environmental Disclosure score, whereas Environment_Ryp_Float considers only Float variables. Although Bloomberg weights Boolean metrics less than quantitative information, such Boolean data are still factored into the scoring and may drive the positive coefficient for the interaction ESG_Treat_FloatXpost.

[INSERT TABLE 13]

Table 13 presents the results for our Equation 2 model, but using a continuous treatment group rather than a dichotomous one to allow for variation in treatment intensity. Panel A focuses on the treatment computed from Boolean KPIs, while Panel B focuses on the treatment computed from Float KPIs in 2017 and 2018. Panel A confirms the positive effect on "YES" responses to Boolean KPIs by firms that were most penalized by the "default-value removal" across all three pillars. However, consistent with the results of Panel A in Table 12, there is no significant effect on the Bloomberg Disclosure Scores. In Panel B, firms most affected by the "summing the percentile" methodology show consistent increases in both Social and Governance Float KPIs. However, confirming the weak effect on the Environment Float KPIs in Table 12, the interaction of the treatment and the post indicator is not significant for Environment_Ryp_Float. Nevertheless, the Bloomberg Disclosure Score outcome variables show significant improvement in both Environmental and Social scores. The magnitude of the coefficients is larger than in Table 12, which can be attributed to the different interpretation of coefficients due to treatment effect heterogeneity (Callaway et al., 2024).

[INSERT TABLE 14]

Table 14 shows the results of the baseline DiD analysis with entropy balancing. Panel A presents the results for the first treatment group, which are analogous to Panel A of Table 12. Indeed, the ESG_Treat_BooleanXpost coefficient is significantly positive in the first 5 columns (i.e., the percentage of "YES" out of the total number of Boolean KPIs across the pillars), supporting our first hypothesis. Panel B focuses on the second treatment group and shows that these firms increased their disclosure of Float KPIs for both Social and Governance pillars, as in Panel B of Table 12. Notably, after balancing, the negative effect of the ESG_Treat_BooleanXpost interaction on Environment_Ryp_Float becomes insignificant, confirming that this effect was

weak. Regarding the Bloomberg Disclosure Score variables, similar to the findings in Table 12 Panel B, the coefficient estimate of the interaction is significantly positive for both the E&S and overall ESG Disclosure scores, but not for the Governance pillar. Overall, the results from Tables 12 through 14 provide support for both our hypotheses: after the scoring methodology change in 2020, firms most impacted by this change increased their reporting of "YES" and their disclosure of Float KPIs. A more fine-grained analysis shows that while the reporting of "YES" was easier to achieve for all three pillars, the Bloomberg Disclosure Score was not significantly affected, likely due to its focus on quantitative disclosures rather than binary information (e.g., whether a policy is adopted or not). Moreover, the disclosure of Float KPIs increased for the Social pillar, Governance pillar, E&S combined, and ESG overall. Additionally, firms in the second treatment group improved their Bloomberg Disclosure scores for both the Environmental and Social pillars and ESG overall, but not for the Governance pillar. It is also noteworthy that the effect appears more pronounced for Boolean-type information compared to quantitative information outcomes, as evidenced by comparing Panel A and Panel B of Table 14. This is likely because it is easier to modify an "input" (i.e., the efforts a company makes to achieve a desired outcome) than an "output" (i.e., performance outcomes, typically the results of a policy or effort). Indeed, of the 163 KPIs considered in our analyses, 110 are Boolean KPIs, and of these, only 12 can be classified as output rather than input, according to our internal classification, aligned with the approach of Christensen et al. (2022).

[INSERT TABLE 15]

In Table 15, we test the parallel trends assumption by regressing the outcome variables of the previous tables on the treatment group interacted with year dummies (including controls and

fixed effects), keeping year 2017 as baseline year. In Panel A, we focus on the first treatment group, and it appears that there has been a slightly negative trend in 2018 on both the Environment and Governance pillar, and ESG overall, and all the Bloomberg Disclosure score outcome variables. Although the parallel trends assumption in not "perfect", we can safely assume that it is unlikely that the trend we observe from 2020 onwards is driven by an already-existing trend that goes, indeed, in the opposite direction. In Panel B, the parallel trends assumption holds for the Social and Governance Disclosure variables in columns 7 and 8, and the overall ESG Disclosure in column 9, while the trend appears negative for Social, Governance, E&S and ESG overall using Ryp_Float outcome variables. Therefore, although there is not a "perfect" parallel trends for all our outcome variables, it is unlikely that the trend in 2018 drove our results in Table 12.

V. **CONCLUSION**

In this paper, we examine the impact of a leading ESG rating agency's revision in scoring methodology on the disclosure behavior of covered firms, distinguishing between Boolean and Float Key Performance Indicators (KPIs). We hypothesize that this methodological shift encourages covered firms to disclose more ESG-related information in terms of more Float KPIs and undertake more real actions or policies regarding Boolean KPIs, and we provide descriptive evidence supporting this hypothesis. We test it using a pre-post research design that controls for various factors, conduct a cross-sectional analysis, a Difference-in-Differences with binary and continuous treatment, and a DiD after entropy balancing.

Utilizing the most recent backup of Refinitiv 1.0 from February 2020 and a dataset of US firms spanning from 2017 to 2018, along with data from 2019 to 2021, we observe a trend of increasing disclosure over the sample period. Descriptive statistics and t-tests reveal that in the

post-period (2020-2021), firms exhibit fewer missing values for relevant KPIs across all pillars compared to the pre-period (2017-2019).

Although Refinitiv tracks potential disclosure for irrelevant KPIs, this increase in disclosure does not appear to have impacted these irrelevant KPIs, as they consistently exhibit a very high percentage of missing values (over 95%). Employing a pre-post research design, we empirically investigate these findings while controlling for other time-variant factors. Our analysis reveals that the increase in disclosure is primarily driven by Boolean KPIs for the Social Pillar (i.e., firms adopt more Socially oriented real actions or policies) and by Float KPIs for the Environment Pillar. However, the increase in disclosure for Governance Float KPIs in 2020 is not significantly higher than that in 2019. While our research indicates an uptick in disclosure for Governance pillar KPIs in the pre-post design, the magnitude is lower compared to that for Environment or Social pillars.

Utilizing an alternative proxy for ESG disclosure quantity from Bloomberg, drawn from Grewal et al. (2019), we confirm that firms enhance their ESG disclosure concerning the Environment and Social pillars, whereas the increase for the Governance pillar is minimal. In a cross-sectional analysis, we provide additional evidence that firms with higher institutional ownership on March 2020 responded by disclosing more ESG information following Refinitiv's methodological change, both in terms of policy adoption (i.e., more "YES" to Boolean metrics) and quantitative disclosure (i.e., more disclosed Float metrics) than firms with less institutional ownership.

Our DiD analysis confirms that the two groups of firms most impacted by the two major methodological changes (i.e., the default-value removal and the adoption of the summing the percentile methodology for score computation) exhibited an increase in both their reporting of

"YES" responses to Boolean KPIs and their disclosure of Float KPIs. Specifically, for the first treatment group, the effect is significantly positive across all pillars when considering Boolean KPIs. However, it is not significant for Bloomberg Disclosure Scores, likely because these scores are more influenced by quantitative disclosure than by Boolean information. The second treatment group (i.e., firms that under-disclosed Float KPIs in the pre-period) shows an increase in both the Environmental and Social Disclosure Scores by Bloomberg (and in the overall ESG Disclosure Score), but only shows an increase in Social and Governance Float KPIs when considering Refinitiv's metrics.

Overall, we provide consistent evidence that the scoring methodology change announced and implemented by Refinitiv in 2020 prompted firms to disclose more ESG-related information. However, this effect appears to be driven more by Boolean-type information rather than quantitative information. This is likely due to the fact that it is easier to modify an "input" (i.e., efforts that a company is making to achieve a desired outcome) than an "output" (i.e., performance outcomes, typically the results of a policy or effort). Indeed, of the 163 KPIs considered in our analyses, 110 are Boolean KPIs, and of these, only 12 can be classified as output rather than input, according to our internal classification, in line with the approach of Christensen et al. (2022).

As with any study, this research is not without its limitations. Although we employ descriptive evidence, a DiD research design, and entropy balancing, the parallel trends assumption does not hold perfectly. While we can reasonably exclude the possibility that the decreasing trend observed in 2018 continues into the post-period and drives our results, we cannot entirely rule out the possibility that such trends may actually reverse over time.

Future research could explore additional interesting questions, perhaps focusing on other outcomes of the scoring methodology change. For example, it would be worthwhile to investigate

whether firms that were most penalized by this scoring methodology change faced penalties from other stakeholders, such as retail investors. Additionally, examining the potential benefits that an increase in scores—attributable to this change—might have conferred on firms could provide further insights. Other promising avenues for research may involve identifying contexts in which this scoring methodology change elicited stronger reactions from firms.

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VII. **TABLES AND FIGURES**

Table 1

This table shows the default values assigned by Refinitiv ESG for Boolean KPIs, comparing Refinitiv 1.0 and Refinitiv 2.0 regimes.

	Default-Value for Boolean KPIs	
Value for a Boolean KPI with Positive Polarity (i.e., a "YES" is more sustainable than a "NO")	**Refinitiv 1.0**	**Refinitiv 2.0**
Yes	1	1
No	0.5	0
Missing Value	0.5	0

Table 2

Sample selection process.

This table shows the sample selection process regarding the ESG Scores and KPIs availability in Refinitiv 1.0 and 2.0

	Observations	Unique ISINs
All firms included in the universe of Refinitiv 1.0 database (from 2002 to 2018). The number of observations is not applicable, since they keep all firms since 2002, even though that company was not covered by the rating agency yet (i.e., it has all missing values before it has been covered).	-	8,662
Less firms not incorporated in the US, and currently unavailable on Refinitiv 2.0 (i.e., we keep all firms with ISINs that are still existing and refer to firms incorporate in the US)	-	2,383
We remove observations with both missing ESG Score (code: TRESGS) in Refinitiv 2.0, and with all missing-value KPIs in the historical (Refinitiv 1.0) database, including only observations from 2017 to 2021 (unfortunately, there is no TRESGS score in our Refinitiv 1.0 database).	10,928	2,383
We remove firms belonging to new industry groups (codes: "573010", "571070", "611010", "621010", "631010", "631020", "631030"), and firms belonging to industry groups which have been contributing the most to the creation of the new industry groups (codes: "572010", "571060", "542010", as indicated in **Appendix D**). This is the sample we use for descriptive statistics related to KPIs disclosure, and for t-tests.	9,771	2,121
Less firms with missing control variables (e.g., CRSP, Compustat, BoardEx), and with singletons (i.e., only year 2017). This is the sample we use for empirical analyses.	8,585	1,849

Table 3

Sample distribution per year.

Panel A: This table shows the yearly distribution of firms across 2017 to 2021. This is the sample we use for descriptive statistics related to KPIs disclosure, and for t-tests.

Date	Historical or Current	Period	Freq.	Percent	Cum.
2017	Historical (Refinitiv 1.0)	Pre-period	2,117	21.67	21.67
2018	Historical (Refinitiv 1.0)	Pre-period	2,116	21.66	43.32
2019	Current (Refinitiv 2.0)	Pre-period	1,944	19.90	63.22
2020	Current (Refinitiv 2.0)	Post-period	1,855	18.98	82.20
2021	Current (Refinitiv 2.0)	Post-period	1,739	17.80[35]	100.00
Total			9,771	100.00	

Panel B: This table shows the yearly distribution of firms across 2017 to 2021. This is the sample we use for empirical analyses.

Date	Freq.	Percent	Cum.
2017	1,770	20.62	20.62
2018	1,829	21.30	41.92
2019	1,740	20.27	62.19
2020	1,669	19.44	81.63
2021	1,577	18.37	100
Total	8,585	100	

[35] The decrease in observations from 2018 to 2021, amounting to 3.86% (21.66% - 17.8%), is similar to the decline seen in the CRSP-Compustat Merged database when excluding firms added to the database from 2019 onwards (3.46%).

Table 4

***Panel A**: Firm-year observations distribution by TRBC Industry Group*

Industry Group	Freq.	Percent	Cum.
Coal	15	0.15	0.15
Oil & Gas	289	2.96	3.11
Oil & Gas Related Equipment and Services	195	2	5.11
Renewable Energy	57	0.58	5.69
Chemicals	206	2.11	7.8
Metals & Mining	143	1.46	9.26
Construction Materials	38	0.39	9.65
Paper & Forest Products	21	0.21	9.87
Containers & Packaging	86	0.88	10.75
Aerospace & Defense	171	1.75	12.5
Machinery, Tools, Heavy Vehicles, Trains & Ships	524	5.36	17.86
Construction & Engineering	102	1.04	18.9
Diversified Industrial Goods Wholesale	4	0.04	18.94
Professional & Commercial Services	447	4.57	23.52
Freight & Logistics Services	170	1.74	25.26
Passenger Transportation Services	59	0.6	25.86
Transport Infrastructure	5	0.05	25.91
Automobiles & Auto Parts	153	1.57	27.48
Textiles & Apparel	110	1.13	28.61
Homebuilding & Construction Supplies	213	2.18	30.78
Household Goods	77	0.79	31.57
Leisure Products	99	1.01	32.59
Hotels & Entertainment Services	343	3.51	36.1
Media & Publishing	171	1.75	37.85
Diversified Retail	93	0.95	38.8
Specialty Retailers	337	3.45	42.25
Beverages	59	0.6	42.85
Food & Tobacco	225	2.3	45.15
Food & Drug Retailing	93	0.95	46.11
Consumer Goods Conglomerates	27	0.28	46.38
Banking Services	1,136	11.63	58.01
Investment Banking & Investment Services	273	2.79	60.8
Insurance	340	3.48	64.28
Collective Investments	11	0.11	64.39
Investment Holding Companies	15	0.15	64.55
Healthcare Equipment & Supplies	498	5.1	69.64
Healthcare Providers & Services	195	2	71.64
Pharmaceuticals	272	2.78	74.42
Biotechnology & Medical Research	637	6.52	80.94
Semiconductors & Semiconductor Equipment	254	2.6	83.54
Communications & Networking	140	1.43	84.98
Electronic Equipment & Parts	114	1.17	86.14
Office Equipment	20	0.2	86.35
Telecommunications Services	123	1.26	87.61
Electric Utilities & IPPs	175	1.79	89.4
Natural Gas Utilities	58	0.59	89.99
Water & Related Utilities	31	0.32	90.31
Multiline Utilities	59	0.6	90.91
Real Estate Operations	65	0.67	91.58
Residential & Commercial REITs	823	8.42	100
Total	9,771	100	

Table 5

Panel A*: This table shows the average number of relevant KPIs with missing values in relation to the total number of relevant KPIs, categorized by Boolean or Float type. Only "YES" values for Boolean KPIs are considered as non-missing values.*

Pillar	Category	Relevant Missing KPIs / Relevant KPIs	Total KPIs considered for each Category or Pillar	Number of Observations	Year	Historical or Current data
Environment	Innovation	0.866	18	1931 [36]	2017	Historical
		0.87	18	1931	2018	Historical
		0.754	18	1777	2019	Current
		0.721	18	1702	2020	Current
		0.692	18	1598	2021	Current
	Emissions	0.89	18	2117	2017	Historical
		0.897	18	2116	2018	Historical
		0.793	18	1944	2019	Current
		0.749	18	1855	2020	Current
		0.705	18	1739	2021	Current
	Resource Use	0.823	18	2114	2017	Historical
		0.826	18	2113	2018	Historical
		0.729	18	1942	2019	Current
		0.677	18	1853	2020	Current
		0.629	18	1738	2021	Current
	Total	0.857	54	2117	2017	Historical
		0.862	54	2116	2018	Historical
		0.76	54	1944	2019	Current
		0.713	54	1855	2020	Current
		0.668	54	1739	2021	Current
Social	Workforce	0.747	28	2117	2017	Historical
		0.827	28	2116	2018	Historical
		0.667	28	1944	2019	Current
		0.616	28	1855	2020	Current
		0.576	28	1739	2021	Current
	Community	0.528	13	2117	2017	Historical
		0.864	13	2116	2018	Historical
		0.288	13	1944	2019	Current
		0.263	13	1855	2020	Current
		0.244	13	1739	2021	Current
	Product Responsibility	0.735	10	2117	2017	Historical
		0.942	10	2116	2018	Historical
		0.651	10	1944	2019	Current
		0.629	10	1855	2020	Current
		0.612	10	1739	2021	Current
	Human Rights	0.84	8	2117	2017	Historical

[36] The reduced number of observations in the Innovation category is because certain firms lack relevant KPIs among the ones we consider for our analyses. For instance, TRBC Industry Group 561020 does not have any relevant KPIs. For additional information, please refer to Appendix C.

		0.988	8	2116	2018	Historical
		0.693	8	1944	2019	Current
		0.622	8	1855	2020	Current
		0.55	8	1739	2021	Current
		0.716	59	2117	2017	Historical
		0.871	59	2116	2018	Historical
	Total	0.593	59	1944	2019	Current
		0.548	59	1855	2020	Current
		0.509	59	1739	2021	Current
		0.155	11	2117	2017	Historical
		0.23	11	2116	2018	Historical
	Shareholders	0.064	11	1944	2019	Current
		0.066	11	1855	2020	Current
		0.065	11	1739	2021	Current
		0.234	31	2117	2017	Historical
		0.301	31	2116	2018	Historical
	Management	0.179	31	1944	2019	Current
		0.17	31	1855	2020	Current
		0.162	31	1739	2021	Current
Governance		0.875	8	2117	2017	Historical
		0.895	8	2116	2018	Historical
	CSR Strategy	0.778	8	1944	2019	Current
		0.714	8	1855	2020	Current
		0.647	8	1739	2021	Current
		0.319	50	2117	2017	Historical
		0.38	50	2116	2018	Historical
	Total	0.25	50	1944	2019	Current
		0.234	50	1855	2020	Current
		0.219	50	1739	2021	Current

***Panel B**: This table shows the average number of relevant KPIs with missing values in relation to the total number of relevant KPIs, categorized by Boolean or Float type. Only "YES" and "NO" are considered as non-missing values. Column (a) shows the proportion of Relevant Missing KPIs on Relevant KPIs, considering only Boolean KPIs, while column (b) shows the proportion of Relevant Missing KPIs / Relevant KPIs, considering only Float KPIs. Columns (c) and (d) show the total (i.e., across all industry groups) number of Boolean and Float KPIs, respectively. Columns (e) and (f) show the number of observations that have been used to compute the proportions in columns (a) and (b).*

Pillar	Category	(a)	(b)	(c)	(d)	(e)	(f)	Year
Environment	Innovation	0.854	0.995	12	6	1931	439	2017
		0.86	1	12	6	1931	439	2018
		0.729	0.928	12	6	1777	417	2019
		0.693	0.93	12	6	1702	402	2020
		0.664	0.925	12	6	1598	378	2021
	Emissions	0.856	0.987	12	6	2117	1971	2017
		0.865	0.985	12	6	2116	1970	2018
		0.769	0.849	12	6	1944	1815	2019
		0.718	0.823	12	6	1855	1737	2020
		0.668	0.799	12	6	1739	1630	2021
	Resource Use	0.791	1	14	4	2114	1971	2017
		0.794	1	14	4	2113	1970	2018
		0.728	0.721	14	4	1942	1815	2019
		0.675	0.676	14	4	1853	1737	2020
		0.625	0.64	14	4	1738	1630	2021
	Total	0.825	0.992	38	16	2117	1971	2017
		0.831	0.991	38	16	2116	1970	2018
		0.745	0.808	38	16	1944	1815	2019
		0.694	0.777	38	16	1855	1737	2020
		0.646	0.749	38	16	1739	1630	2021
Social	Workforce	0.752	0.744	12	16	2117	2117	2017
		0.891	0.785	12	16	2116	2116	2018
		0.646	0.682	12	16	1944	1944	2019
		0.575	0.644	12	16	1855	1855	2020
		0.519	0.615	12	16	1739	1739	2021
	Community	0.473	0.863	11	2	2117	2117	2017
		0.858	0.893	11	2	2116	2116	2018
		0.21	0.778	11	2	1944	1944	2019
		0.187	0.733	11	2	1855	1855	2020

		0.173	0.686	11	2	1739	1739	2021
	Product Responsibility	0.663	0.94	8	2	2117	1812	2017
		0.934	0.965	8	2	2116	1811	2018
		0.552	0.941	8	2	1944	1666	2019
		0.528	0.93	8	2	1855	1595	2020
		0.508	0.926	8	2	1739	1494	2021
	Human Rights	0.84	0	8	0	2117	0	2017
		0.988	0	8	0	2116	0	2018
		0.693	0	8	0	1944	0	2019
		0.622	0	8	0	1855	0	2020
		0.55	0	8	0	1739	0	2021
	Total	0.685	0.766	39	20	2117	2117	2017
		0.911	0.805	39	20	2116	2116	2018
		0.525	0.707	39	20	1944	1944	2019
		0.474	0.671	39	20	1855	1855	2020
		0.43	0.642	39	20	1739	1739	2021
Governance	Shareholders	0.134	0.191	7	4	2117	2117	2017
		0.214	0.259	7	4	2116	2116	2018
		0.089	0.021	7	4	1944	1944	2019
		0.081	0.038	7	4	1855	1855	2020
		0.079	0.041	7	4	1739	1739	2021
	Management	0.353	0.069	18	13	2117	2117	2017
		0.409	0.152	18	13	2116	2116	2018
		0.286	0.032	18	13	1944	1944	2019
		0.27	0.03	18	13	1855	1855	2020
		0.261	0.026	18	13	1739	1739	2021
	CSR Strategy	0.875	0	8	0	2117	0	2017
		0.895	0	8	0	2116	0	2018
		0.778	0	8	0	1944	0	2019
		0.714	0	8	0	1855	0	2020
		0.647	0	8	0	1739	0	2021
	Total	0.433	0.097	33	17	2117	2117	2017
		0.485	0.177	33	17	2116	2116	2018
		0.363	0.03	33	17	1944	1,944	2019

	0.338	0.032	33	17	1855	1,855	2020
	0.316	0.029	33	17	1739	1,739	2021

***Panel C**: This table shows the average number of **irrelevant** KPIs with missing values in relation to the total number of **irrelevant** KPIs. Only "YES" values for Boolean type variables are considered as "non-missing" values.*

Pillar	Category	Irrelevant Missing KPIs / Irrelevant KPIs	Total KPIs considered for each Category or Pillar	Number of Observations	Year	Historical or Current data
Environment	Innovation	0.938	18	2,117	2017	Historical
		0.94	18	2,116	2018	Historical
		0.995	18	1,944	2019	Current
		0.994	18	1,855	2020	Current
		0.993	18	1,739	2021	Current
	Emissions	0.969	18	2,117	2017	Historical
		0.972	18	2,116	2018	Historical
		0.988	18	1,944	2019	Current
		0.985	18	1,855	2020	Current
		0.978	18	1,739	2021	Current
	Resource Use	0.966	18	2,117	2017	Historical
		0.967	18	2,116	2018	Historical
		0.984	18	1,944	2019	Current
		0.98	18	1,855	2020	Current
		0.975	18	1,739	2021	Current
	Total	0.947	54	2,117	2017	Historical
		0.95	54	2,116	2018	Historical
		0.991	54	1,944	2019	Current
		0.989	54	1,855	2020	Current
		0.985	54	1,739	2021	Current
Social	Workforce	0.977	28	2,088	2017	Historical
		0.995	28	2,087	2018	Historical
		0.98	28	1,919	2019	Current
		0.97	28	1,834	2020	Current
		0.96	28	1,720	2021	Current
	Community	0.996	13	2,117	2017	Historical
		1	13	2,116	2018	Historical
		0.997	13	1,944	2019	Current
		0.996	13	1,855	2020	Current

	0.995	13	1,739	2021	Current
Product Responsibility	0.987	10	2,117	2017	Historical
	0.996	10	2,116	2018	Historical
	0.987	10	1,944	2019	Current
	0.984	10	1,855	2020	Current
	0.981	10	1,739	2021	Current
Human Rights	0.983	8	2,045	2017	Historical
	0.999	8	2,044	2018	Historical
	0.99	8	1,875	2019	Current
	0.986	8	1,792	2020	Current
	0.982	8	1,678	2021	Current
Total	0.986	59	2,117	2017	Historical
	0.997	59	2,116	2018	Historical
	0.988	59	1,944	2019	Current
	0.984	59	1,855	2020	Current
	0.98	59	1,739	2021	Current

Table 6

***Panel A**: T-tests for the difference in average "YES" values for Boolean variables between the post- and the pre-period. The post period indicator equals 1 in years 2020 and 2021, and 0 in years 2017, 2018, and 2019 (2017, and 2018 data come from the Historical Refinitiv 1.0 data). An alternative definition of the post- and pre-period is in Appendix E.*

	Post-period observations	Pre-period observations	Post-period average disclosed values	Pre-period average disclosed values	Difference Post-Pre	Std Error	T value	p value
Innovation Category	3,300	5,639	0.321	0.183	0.138	0.007	19.050	0.000
Emissions Category	3,594	6,177	0.306	0.169	0.138	0.005	27.150	0.000
Resource Use Category	3,591	6,169	0.35	0.228	0.121	0.007	19.250	0.000
Environment Pillar	3,594	6,177	0.329	0.198	0.131	0.005	25.000	0.000
Workforce Category	3,594	6,177	0.452	0.234	0.218	0.005	49.200	0.000
Community Category	3,594	6,177	0.82	0.478	0.342	0.006	56.700	0.000
Product Responsibility Category	3,594	6,177	0.481	0.279	0.203	0.005	37.900	0.000
Human Rights Category	3,594	6,177	0.413	0.155	0.257	0.007	37.950	0.000
Social Pillar	3,594	6,177	0.547	0.288	0.26	0.005	58.650	0.000
Shareholders Category	3,594	6,177	0.92	0.853	0.067	0.004	15.800	0.000
Management Category	3,594	6,177	0.734	0.649	0.086	0.003	28.700	0.000
Csr Strategy Category	3,594	6,177	0.318	0.149	0.17	0.005	29.850	0.000
Governance Pillar	3,594	6,177	0.673	0.571	0.102	0.003	33.600	0.000
Es Overall	3,594	6,177	0.455	0.249	0.205	0.004	48.450	0.000
Esg Overall	3,594	6,177	0.54	0.379	0.162	0.004	49.150	0.000

***Panel B**: T-tests for the difference in average disclosure percentage between the pre- and post-period. The post period indicator equals 1 in years 2020 and 2021, and 0 in years 2017, 2018, and 2019 (2017, and 2018 data come from the Historical Refinitiv 1.0 data). Only Float KPIs are considered in this table. An alternative definition of the post- and pre-period is in Appendix E.*

	Post-period observations	Pre-period observations	Post-period average disclosed values	Pre-period average disclosed values	Difference Post-Pre	Std Error	T value	p value
Innovation Category	780	1,295	0.072	0.025	0.048	0.007	6.550	0.000
Emissions Category	3,367	5,756	0.188	0.057	0.131	0.005	26.450	0.000
Resource Use Category	3,367	5,756	0.342	0.088	0.254	0.007	37.600	0.000
Environment Pillar	3,367	5,756	0.237	0.067	0.17	0.005	34.150	0.000
Workforce Category	3,594	6,177	0.37	0.262	0.108	0.003	34.800	0.000
Community Category	3,594	6,177	0.29	0.153	0.137	0.008	16.750	0.000
Product Responsibility Category	3,089	5,289	0.072	0.051	0.021	0.005	4.300	0.000
Social Pillar	3,594	6,177	0.343	0.239	0.104	0.003	34.450	0.000
Shareholders Category	3,594	6,177	0.96	0.839	0.121	0.004	29.650	0.000
Management Category	3,594	6,177	0.972	0.914	0.058	0.004	14.450	0.000
Governance Pillar	3,594	6,177	0.969	0.896	0.072	0.004	20.000	0.000
Es Overall	3,594	6,177	0.318	0.196	0.121	0.003	38.350	0.000
Esg Overall	3,594	6,177	0.603	0.503	0.1	0.003	34.350	0.000

Table 7

Descriptive Statistics

	Observations	Mean	p1	p50	p99	sd
Environment_Ryp_Float	7,985	0.129	0.000	0.000	0.875	0.240
Social_Ryp_Float	8,585	0.282	0.000	0.235	0.714	0.147
Governance_Ryp_Float	8,585	0.935	0.059	1.000	1.000	0.148
Es_Ryp_Float	8,585	0.244	0.000	0.190	0.731	0.158
Esg_Ryp_Float	8,585	0.544	0.027	0.525	0.846	0.136
Environment_Ryp_Boolean	8,585	0.245	0.000	0.158	1.000	0.257
Social_Ryp_Boolean	8,585	0.388	0.000	0.385	0.897	0.242
Governance_Ryp_Boolean	8,585	0.615	0.000	0.606	0.848	0.137
Es_Ryp_Boolean	8,585	0.327	0.000	0.277	0.860	0.223
Esg_Ryp_Boolean	8,585	0.441	0.012	0.408	0.833	0.171
Size	8,585	8.120	4.563	8.000	12.755	1.748
ROA	8,585	0.007	-0.677	0.027	0.286	0.145
BTM	8,585	0.534	-0.382	0.437	2.680	0.475
Leverage	8,585	0.619	0.075	0.629	1.394	0.258
Analyst_Following	8,585	9.588	0.000	8.000	32.000	7.242
Return_volatility	8,585	0.028	0.010	0.025	0.076	0.013
ESG Disclosure Score	8,006	0.401	0.271	0.349	0.720	0.110
Environment Disclosure Score	8,006	0.148	0.000	0.018	0.725	0.197
Governance Disclosure Score	8,006	0.860	0.711	0.850	1.000	0.050
Social Disclosure Score	8,006	0.192	0.054	0.144	0.550	0.116
Board_Size	8,585	9.531	5.000	9.000	16.000	2.405
Board_Independence	8,585	0.860	0.600	0.889	1.000	0.073
Board_Female	8,585	0.216	0.000	0.222	0.533	0.116
Average_Tenure	8,585	6.152	0.788	5.829	15.330	3.095
Ior	8,585	0.794	0.193	0.842	1.000	0.188
N	8,585					

Table 8

Pre-post research design

The outcome variables in this table are the percentage of "YES" responses from the total number of relevant Boolean KPIs, categorized by pillar. In the odd-numbered columns, the main variable of interest is the POST dummy, which equals 1 for the years 2020 and 2021, and 0 for 2017, 2018, and 2019. In the even-numbered columns, year dummies are used to disentangle the time effect for each year. For the years 2017 and 2018, the data come from the historical dataset, while from 2019 onwards, current data are employed.

VARIABLES	*(1)* Environment_Ryp_Boolean	*(2)* Environment_Ryp_Boolean	*(3)* Social_Ryp_Boolean	*(4)* Social_Ryp_Boolean	*(5)* Governance_Ryp_Boolean	*(6)* Governance_Ryp_Boolean	*(7)* Es_Ryp_Boolean	*(8)* Es_Ryp_Boolean	*(9)* ESG_Ryp_Boolean	*(10)* ESG_Ryp_Boolean
Post	0.109***		0.191***		0.064***		0.155***		0.119***	
	(0.014)		(0.010)		(0.005)		(0.012)		(0.009)	
2018.year		0.012***		-0.215***		-0.042***		-0.117***		-0.083***
		(0.004)		(0.007)		(0.010)		(0.010)		(0.005)
2019.year		0.106***		0.175***		0.061***		0.149***		0.114***
		(0.027)		(0.017)		(0.005)		(0.020)		(0.014)
2020.year		0.158***		0.227***		0.083***		0.200***		0.154***
		(0.029)		(0.018)		(0.005)		(0.021)		(0.015)
2021.year		0.205***		0.263***		0.102***		0.237***		0.186***
		(0.031)		(0.020)		(0.005)		(0.024)		(0.017)
Size	-0.003	-0.039**	0.057***	-0.015*	0.031***	0.006	0.033***	-0.024**	0.031***	-0.015**
	(0.015)	(0.016)	(0.012)	(0.008)	(0.007)	(0.005)	(0.011)	(0.011)	(0.009)	(0.007)
ROA	-0.007	-0.012	-0.054**	-0.039**	-0.017	-0.016	-0.027	-0.022	-0.023	-0.021
	(0.037)	(0.031)	(0.027)	(0.018)	(0.016)	(0.014)	(0.027)	(0.019)	(0.020)	(0.015)
BTM	-0.022	-0.011	-0.120***	-0.024**	-0.038***	-0.014**	-0.078***	-0.019	-0.062***	-0.018**
	(0.017)	(0.016)	(0.029)	(0.012)	(0.009)	(0.006)	(0.021)	(0.013)	(0.016)	(0.009)
Leverage	-0.045	-0.065	-0.130**	-0.117***	-0.043**	-0.041***	-0.090**	-0.090***	-0.078**	-0.078***
	(0.052)	(0.043)	(0.052)	(0.026)	(0.020)	(0.013)	(0.044)	(0.030)	(0.031)	(0.020)
Analyst_Following	-0.006***	-0.003	-0.003	0.000	-0.001	0.001	-0.003	-0.000	-0.003**	-0.000
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)

Return_volatility	1.172	-0.170	4.563***	-0.514*	1.325***	-0.034	3.040***	-0.579	2.447***	-0.210
	(0.732)	(0.445)	(0.653)	(0.306)	(0.197)	(0.225)	(0.561)	(0.365)	(0.385)	(0.270)
Board_Size	0.005	0.003	0.006**	0.003	0.003*	0.002	0.006**	0.003	0.005**	0.003*
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Board_Independence	-0.050	-0.041	0.013	0.035	0.015	0.020	-0.013	0.003	0.003	0.014
	(0.080)	(0.074)	(0.076)	(0.048)	(0.039)	(0.036)	(0.072)	(0.053)	(0.047)	(0.033)
Board_Female	0.086	-0.123	0.281***	-0.033	0.098***	-0.019	0.235***	-0.035	0.168***	-0.044
	(0.072)	(0.084)	(0.052)	(0.043)	(0.026)	(0.028)	(0.045)	(0.051)	(0.026)	(0.036)
Average_Tenure	-0.007**	-0.010***	0.000	-0.004**	0.002*	0.000	-0.002	-0.006**	-0.001	-0.004**
	(0.003)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
IOR		-0.117***		-0.089***		-0.008		-0.091***		-0.057***
		(0.033)		(0.025)		(0.022)		(0.024)		(0.018)
Observations	8,585	8,585	8,585	8,585	8,585	8,585	8,585	8,585	8,585	8,585
R-squared	0.585	0.603	0.570	0.797	0.539	0.588	0.622	0.743	0.645	0.758
Year Dummies	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
pvalue difference 2019 vs 2020		0.000		0.000		0.000		0.000		0.000

Table 9

Pre-post research design – Floats

The outcome variables in this table are the percentage of disclosed Float values from the total number of relevant Float KPIs, categorized by pillar. For clarity, these variables have been abbreviated using the initial letters of each category: 'E' for Environment_Ryp_Float, 'S' for Social_Ryp_Float, 'G' for Governance_Ryp_Float, 'ES' for both Environment and Social, and 'ESG' for all three pillars combined. In the odd-numbered columns, the main variable of interest is the POST dummy, which equals 1 for the years 2020 and 2021, and 0 for 2017, 2018, and 2019. In the even-numbered columns, year dummies are used to disentangle the time effect for each year. For the years 2017 and 2018, the data come from the historical dataset, while from 2019 onwards, current data are employed.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	E	E	S	S	G	G	ES	ES	ESG	ESG
Post	0.122***		0.077***		0.038***		0.090***		0.068***	
	(0.015)		(0.004)		(0.005)		(0.007)		(0.006)	
2018.year		0.019***		-0.033***		-0.065***		-0.018***		-0.037***
		(0.004)		(0.004)		(0.012)		(0.003)		(0.007)
2019.year		0.210***		0.059***		0.061***		0.100***		0.085***
		(0.022)		(0.006)		(0.006)		(0.012)		(0.008)
2020.year		0.251***		0.093***		0.059***		0.136***		0.105***
		(0.024)		(0.008)		(0.007)		(0.013)		(0.009)
2021.year		0.274***		0.121***		0.060***		0.164***		0.121***
		(0.027)		(0.007)		(0.005)		(0.013)		(0.009)
Size	0.027*	-0.045***	0.025***	-0.002	0.022***	-0.003	0.025***	-0.013*	0.022***	-0.010**
	(0.015)	(0.015)	(0.005)	(0.005)	(0.007)	(0.006)	(0.007)	(0.007)	(0.005)	(0.004)
ROA	0.038	-0.024	-0.022	-0.022	0.002	0.004	-0.019	-0.025*	-0.007	-0.010
	(0.037)	(0.038)	(0.021)	(0.013)	(0.026)	(0.023)	(0.026)	(0.015)	(0.022)	(0.015)
BTM	-0.052***	-0.028*	-0.033***	-0.012*	-0.040***	-0.011	-0.037***	-0.017*	-0.039***	-0.015**
	(0.016)	(0.015)	(0.010)	(0.007)	(0.009)	(0.007)	(0.011)	(0.009)	(0.009)	(0.006)
Leverage	-0.065**	-0.050	-0.054***	-0.054***	-0.036	-0.027	-0.055***	-0.060***	-0.048**	-0.048***
	(0.032)	(0.037)	(0.020)	(0.015)	(0.023)	(0.018)	(0.020)	(0.015)	(0.019)	(0.014)
Analyst_Following	-0.003	0.001	-0.001	0.001	-0.001	0.000	-0.001	0.000	-0.001	0.000
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Return_volatility	3.663***	-0.598	1.053***	-0.042	1.681***	-0.204	1.690***	-0.127	1.729***	-0.143
	(0.529)	(0.451)	(0.307)	(0.230)	(0.238)	(0.234)	(0.373)	(0.278)	(0.285)	(0.232)
Board_Size	0.003	0.001	0.003*	0.002	0.002	0.001	0.003**	0.002	0.003*	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Board_Independence	0.006	0.004	0.036	0.041	-0.034	-0.029	0.028	0.034	-0.001	0.005
	(0.067)	(0.054)	(0.039)	(0.034)	(0.054)	(0.054)	(0.040)	(0.033)	(0.037)	(0.032)
Board_Female	0.206***	-0.127**	0.066**	-0.058**	0.038	-0.063**	0.106***	-0.081**	0.078***	-0.074***
	(0.057)	(0.053)	(0.027)	(0.026)	(0.030)	(0.029)	(0.032)	(0.031)	(0.025)	(0.025)
Average_Tenure	0.000	-0.004	-0.000	-0.002	-0.000	-0.002	-0.000	-0.003*	-0.000	-0.002**
	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IOR	-0.014	-0.135***	-0.052**	-0.050**	-0.012	-0.002	-0.043*	-0.071***	-0.028	-0.042*
	(0.042)	(0.044)	(0.022)	(0.023)	(0.030)	(0.032)	(0.022)	(0.024)	(0.020)	(0.021)
Observations	7,985	7,985	8,585	8,585	8,585	8,585	8,585	8,585	8,585	8,585
R-squared	0.588	0.649	0.710	0.746	0.337	0.397	0.701	0.752	0.613	0.679
Year Dummies	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
P-value (2019 vs. 2020)		0.000		0.000		0.210		0.000		0.000

Table 10

Pre-post research design – Bloomberg Disclosure Score

The outcome variables in this table are Bloomberg Disclosure scores, categorized by pillar. In the odd-numbered columns, the main variable of interest is the POST dummy, which equals 1 for the years 2020 and 2021, and 0 for 2017, 2018, and 2019. In the even-numbered columns, year dummies are used to disentangle the time effect for each year. For the years 2017 and 2018, the data come from the historical dataset, while from 2019 onwards, current data are employed.

VARIABLES	(1) Environmental Disclosure	(2) Environmental Disclosure	(3) Social Disclosure	(4) Social Disclosure	(5) Governance Disclosure	(6) Governance Disclosure	(7) ESG Disclosure	(8) ESG Disclosure
Post	0.045***		0.034***		0.006***		0.028***	
	(0.006)		(0.002)		(0.001)		(0.003)	
2018.year		0.017***		0.016***		0.002***		0.012***
		(0.002)		(0.001)		(0.001)		(0.001)
2019.year		0.040***		0.030***		0.006***		0.026***
		(0.006)		(0.002)		(0.001)		(0.002)
2020.year		0.060***		0.049***		0.009***		0.040***
		(0.008)		(0.003)		(0.002)		(0.003)
2021.year		0.093***		0.067***		0.013***		0.058***
		(0.012)		(0.003)		(0.002)		(0.005)
Size	0.016***	-0.002	0.019***	0.008**	0.005***	0.002	0.013***	0.003
	(0.006)	(0.006)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
ROA	-0.020	-0.025	-0.008	-0.012	-0.008	-0.009*	-0.012	-0.016**
	(0.015)	(0.017)	(0.009)	(0.008)	(0.005)	(0.005)	(0.007)	(0.007)
BTM	-0.011	-0.009	-0.007*	-0.008**	0.001	0.001	-0.006	-0.005
	(0.007)	(0.007)	(0.004)	(0.004)	(0.001)	(0.001)	(0.003)	(0.003)
Leverage	-0.032**	-0.041***	-0.010	-0.017**	0.000	-0.001	-0.014*	-0.020***
	(0.015)	(0.014)	(0.007)	(0.006)	(0.004)	(0.004)	(0.008)	(0.007)
Analyst_Following	-0.001*	-0.000	-0.002***	-0.001*	0.000	0.000	-0.001**	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Return_volatility	0.426***	0.295**	0.281***	0.097	0.018	-0.034	0.241***	0.120
	(0.121)	(0.142)	(0.074)	(0.094)	(0.037)	(0.055)	(0.058)	(0.078)

Board_Size	0.001	0.000	0.001	0.000	0.000	-0.000	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Board_Independence	-0.006	-0.005	0.021	0.021	0.005	0.005	0.006	0.007
	(0.027)	(0.025)	(0.018)	(0.017)	(0.012)	(0.012)	(0.014)	(0.014)
Board_Female	0.125***	0.029	0.063***	-0.001	0.026***	0.013*	0.071***	0.014
	(0.027)	(0.024)	(0.013)	(0.011)	(0.007)	(0.007)	(0.013)	(0.012)
Average_Tenure	-0.000	-0.002	0.000	-0.001	0.000	0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
IOR	-0.013	-0.030	0.008	-0.010	0.005	0.002	-0.000	-0.013
	(0.021)	(0.020)	(0.013)	(0.012)	(0.007)	(0.007)	(0.011)	(0.010)
Observations	8,003	8,003	8,003	8,003	8,003	8,003	8,003	8,003
R-squared	0.910	0.916	0.898	0.905	0.805	0.807	0.928	0.934
Year Dummies	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
pvalue difference 2019 vs 2020		0.000		0.000		0.000		0.000

Table 11

Cross-Sectional tests – Institutional Ownership's role

Panel A*: The outcome variables in this panel represent the percentage of "YES" responses out of the total number of relevant Boolean KPIs, categorized by pillar. For clarity, these variables have been abbreviated using the initial letters of each category: 'E' for Environment_Ryp_Br, 'S' for Social_Ryp_Br, 'G' for Governance_Ryp_Br, 'ES' for both Environment and Social, and 'ESG' for all three pillars combined. The variable POST is assigned a value of 1 for the years 2020 and 2021, and a value of 0 from 2017 to 2019. Odd-numbered columns refer to the subsample where the Institutional Ownership Ratio (IOR) is below the median value as of March 2020. The significance of the differential effect of the POST variable between the two subsamples (High-IOR and Low-IOR) has been evaluated using a t-test on the interaction between the POST variable and the High-IOR dummy in a fully interacted model (the p-value is reported below).*

	Low IOR	High IOR	Low IOR	High IOR	Low IOR	High IOR	Low IOR	High IOR	Low IOR	High IOR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	E	E	S	S	G	G	ES	ES	ESG	ESG
Post	0.089***	0.133***	0.180***	0.201***	0.060***	0.066***	0.140***	0.169***	0.109***	0.127***
	(0.019)	(0.008)	(0.012)	(0.008)	(0.007)	(0.004)	(0.015)	(0.008)	(0.012)	(0.006)
Size	0.000	-0.004	0.062***	0.056***	0.028***	0.036***	0.035**	0.033**	0.030**	0.033***
	(0.023)	(0.021)	(0.015)	(0.016)	(0.009)	(0.008)	(0.017)	(0.016)	(0.012)	(0.012)
Roa	-0.025	0.001	-0.101**	0.007	-0.004	-0.029	-0.074**	0.033	-0.039	-0.002
	(0.041)	(0.070)	(0.040)	(0.046)	(0.019)	(0.018)	(0.036)	(0.045)	(0.026)	(0.035)
Btm	-0.024	-0.016	-0.112***	-0.118***	-0.027**	-0.042***	-0.076***	-0.072***	-0.054**	-0.062***
	(0.022)	(0.019)	(0.039)	(0.025)	(0.011)	(0.008)	(0.028)	(0.018)	(0.021)	(0.013)
Leverage	0.028	-0.102**	-0.095**	-0.149**	-0.009	-0.064***	-0.055	-0.109*	-0.039	-0.103***
	(0.060)	(0.048)	(0.042)	(0.064)	(0.017)	(0.023)	(0.033)	(0.057)	(0.024)	(0.037)
Analyst_Following	-0.003	-0.008***	-0.002	-0.004*	0.001	-0.002***	-0.001	-0.005**	-0.001	-0.004***
	(0.004)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)
Retvol_Daily_Fthree	0.823	1.275*	4.286***	4.840***	1.383***	1.238***	2.795***	3.236***	2.275***	2.582***
	(0.957)	(0.731)	(0.587)	(0.771)	(0.236)	(0.220)	(0.566)	(0.659)	(0.427)	(0.418)
Board_Size	0.005	0.005	0.003	0.009***	0.004	0.003*	0.004	0.008***	0.004*	0.006**
	(0.003)	(0.005)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Board_Independence	-0.125	0.016	0.092	-0.074	0.065	-0.016	0.000	-0.020	0.031	-0.017
	(0.144)	(0.091)	(0.109)	(0.096)	(0.067)	(0.042)	(0.114)	(0.083)	(0.076)	(0.061)

Board_Female	0.105	0.039	0.264***	0.301***	0.077*	0.129***	0.235***	0.222***	0.161***	0.173***
	(0.087)	(0.080)	(0.057)	(0.059)	(0.038)	(0.032)	(0.047)	(0.054)	(0.032)	(0.034)
Average_Tenure	-0.012**	-0.005	-0.003	0.004	0.002	0.001	-0.006*	0.001	-0.003	0.001
	(0.005)	(0.003)	(0.003)	(0.003)	(0.002)	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)
Observations	4,074	4,073	4,074	4,073	4,074	4,073	4,074	4,073	4,074	4,073
R-squared	0.600	0.561	0.570	0.566	0.554	0.525	0.626	0.613	0.652	0.633
Year FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
P-Value Equality High vs Low IOR	0.000		0.000		0.000		0.000		0.000	

***Panel B**: The outcome variables in this panel represent the percentage of disclosed Float KPIs out of the total number of relevant Float KPIs, categorized by pillar. For clarity, these variables have been abbreviated using the initial letters of each category: 'E' for Environment_Ryp_Fl, 'S' for Social_Ryp_Fl, 'G' for Governance_Ryp_Fl, 'ES' for both Environment and Social, and 'ESG' for all three pillars combined. The variable POST is assigned a value of 1 for the years 2020 and 2021, and a value of 0 from 2017 to 2019. Odd-numbered columns refer to the subsample where the Institutional Ownership Ratio (IOR) is below the median value as of March 2020. The significance of the differential effect of the POST variable between the two subsamples (High-IOR and Low-IOR) has been evaluated using a t-test on the interaction between the POST variable and the High-IOR dummy in a fully interacted model (the p-value is reported below).*

	Low IOR	High IOR	Low IOR	High IOR	Low IOR	High IOR	Low IOR	High IOR	Low IOR	High IOR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	E	E	S	S	G	G	ES	ES	ESG	ESG
Post	0.117***	0.126***	0.068***	0.086***	0.038***	0.034***	0.082***	0.098***	0.064***	0.070***
	(0.019)	(0.010)	(0.004)	(0.006)	(0.008)	(0.005)	(0.008)	(0.007)	(0.008)	(0.006)
Size	0.015	0.038**	0.023**	0.022***	0.021*	0.025**	0.018	0.026***	0.020**	0.022***
	(0.025)	(0.018)	(0.011)	(0.008)	(0.011)	(0.009)	(0.012)	(0.009)	(0.008)	(0.006)
Roa	0.007	0.066	-0.049***	-0.001	0.018	-0.019	-0.039**	-0.003	-0.011	-0.007
	(0.052)	(0.070)	(0.013)	(0.041)	(0.035)	(0.024)	(0.017)	(0.048)	(0.021)	(0.031)
Btm	-0.062***	-0.047***	-0.024	-0.040***	-0.027**	-0.042***	-0.032*	-0.041***	-0.031**	-0.042***
	(0.022)	(0.016)	(0.015)	(0.008)	(0.012)	(0.009)	(0.017)	(0.009)	(0.013)	(0.007)
Leverage	-0.058	-0.063	-0.051***	-0.041	0.008	-0.055**	-0.053***	-0.044	-0.025	-0.054**
	(0.052)	(0.045)	(0.018)	(0.027)	(0.023)	(0.025)	(0.019)	(0.028)	(0.020)	(0.022)
Analyst_Following	-0.001	-0.005**	0.001	-0.003**	0.001	-0.002**	0.000	-0.003***	0.001	-0.003***
	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Return_volatility	3.693***	3.742***	1.060***	1.000***	1.867***	1.492***	1.668***	1.706***	1.785***	1.675***
	(0.633)	(0.605)	(0.345)	(0.308)	(0.302)	(0.253)	(0.438)	(0.362)	(0.341)	(0.284)
Board_Size	0.006**	0.001	0.003	0.004*	0.003	0.003	0.004*	0.003	0.003	0.003
	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Board_Independence	0.049	-0.034	0.073	-0.003	0.040	-0.082	0.066	-0.012	0.055	-0.047
	(0.096)	(0.113)	(0.050)	(0.068)	(0.090)	(0.054)	(0.054)	(0.070)	(0.060)	(0.047)
Board_Female	0.255***	0.168*	0.046	0.078**	0.047	0.053	0.099***	0.109**	0.079***	0.085**
	(0.062)	(0.092)	(0.028)	(0.038)	(0.045)	(0.039)	(0.031)	(0.049)	(0.029)	(0.037)
Average_Tenure	-0.000	-0.000	-0.001	0.001	0.001	-0.001	-0.002	0.000	-0.001	-0.000

	(0.004)	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Observations	3,795	3,801	4,074	4,073	4,074	4,073	4,074	4,073	4,074	4,073
R-squared	0.592	0.580	0.725	0.692	0.321	0.327	0.709	0.686	0.597	0.624
Year FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
P-Value Equality High vs Low IOR	0.000		0.000		0.000		0.000		0.000	

***Panel C**: The outcome variables in this panel represent the disclosure quantity, which is measured using the Disclosure Score provided by Bloomberg and categorized by pillar. The variable POST is assigned a value of 1 for the years 2020 and 2021, and a value of 0 from 2017 to 2019. Odd-numbered columns refer to the subsample where the Institutional Ownership Ratio (IOR) is below the median value as of March 2020. The significance of the differential effect of the POST variable between the two subsamples (High-IOR and Low-IOR) has been evaluated using a t-test on the interaction between the POST variable and the High-IOR dummy in a fully interacted model (the p-value is reported below).*

	Low IOR	High IOR	Low IOR	High IOR	Low IOR	High IOR	Low IOR	High IOR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Environmental Disclosure	Environmental Disclosure	Social Disclosure	Social Disclosure	Governance Disclosure	Governance Disclosure	ESG Disclosure	ESG Disclosure
Post	0.033***	0.058***	0.030***	0.038***	0.006***	0.006***	0.023***	0.034***
	(0.007)	(0.004)	(0.002)	(0.003)	(0.001)	(0.001)	(0.003)	(0.002)
Size	0.016*	0.013*	0.016***	0.022***	0.005**	0.006***	0.012***	0.013***
	(0.009)	(0.007)	(0.006)	(0.003)	(0.002)	(0.002)	(0.005)	(0.003)
Roa	-0.014	-0.023	0.001	-0.015	-0.005	-0.012	-0.006	-0.017
	(0.018)	(0.019)	(0.014)	(0.013)	(0.006)	(0.008)	(0.009)	(0.010)
Btm	-0.008	-0.010	-0.004	-0.010*	0.002	-0.000	-0.003	-0.007
	(0.007)	(0.010)	(0.003)	(0.006)	(0.002)	(0.002)	(0.003)	(0.005)
Leverage	-0.014	-0.047**	-0.013	-0.009	-0.004	0.004	-0.010	-0.017*
	(0.016)	(0.018)	(0.010)	(0.011)	(0.007)	(0.006)	(0.009)	(0.009)
Analyst_Following	-0.000	-0.002**	-0.000	-0.002***	0.000	0.000	-0.000	-0.002***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Retvol_Daily_Fthree	0.218	0.582***	0.288***	0.259***	0.061	-0.025	0.189**	0.272***
	(0.150)	(0.135)	(0.081)	(0.094)	(0.076)	(0.046)	(0.075)	(0.068)
Board_Size	0.000	0.002	0.000	0.001	0.000	-0.000	0.000	0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Board_Independence	0.042	-0.068	0.040*	-0.007	0.017	-0.010	0.033**	-0.028
	(0.027)	(0.054)	(0.021)	(0.025)	(0.014)	(0.023)	(0.015)	(0.027)
Board_Female	0.082***	0.156***	0.042**	0.083***	0.023***	0.031***	0.049***	0.090***
	(0.022)	(0.039)	(0.016)	(0.021)	(0.006)	(0.010)	(0.011)	(0.020)
Average_Tenure	-0.000	-0.001	-0.001	0.001	0.001**	-0.000	-0.000	0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Observations	3,988	3,977	3,988	3,977	3,988	3,977	3,988	3,977

R-squared	0.944	0.864	0.926	0.858	0.852	0.719	0.954	0.889
Year FE	NO	NO	NO	NO	NO	NO	NO	NO
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
P-Value Equality								
High vs Low IOR	0.000		0.000		0.000		0.000	

Table 12

Difference-in-differences analysis

Panel A: *The outcome variables in this panel are divided into two categories. Columns 1 to 5 present the percentage of "YES" responses from the total number of relevant Boolean KPIs, categorized by pillar. In columns 6 to 9, the outcome variable is the disclosure quantity, measured using the Bloomberg Disclosure Score. The variable ESG_Treat_BooleanXpost is the interaction term between the treatment group dummy and the POST dummy. A firm is assigned to the treatment group if its percentage of "YES" responses out of the total number of relevant Boolean KPIs is below the median percentage as of 2018 across all pillars. The variable POST is set to 1 for the years 2020 and 2021.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Environment_Ryp_Boolean	Social_Ryp_Boolean	Governance_Ryp_Boolean	Es_Ryp_Boolean	ESG_Ryp_Boolean	Environmental Disclosure	Social Disclosure	Governance Disclosure	ESG Disclosure
ESG_Treat_BooleanXpost	0.088***	0.029**	0.079***	0.039**	0.062***	-0.003	-0.005	-0.002	-0.003
	(0.020)	(0.011)	(0.013)	(0.016)	(0.010)	(0.009)	(0.004)	(0.002)	(0.004)
Size	-0.044**	-0.018*	0.001	-0.028**	-0.019**	-0.001	0.009**	0.003*	0.004
	(0.019)	(0.010)	(0.006)	(0.013)	(0.008)	(0.007)	(0.004)	(0.002)	(0.003)
Roa	-0.042	-0.062**	-0.016	-0.044	-0.035	-0.029	-0.015*	-0.012**	-0.019**
	(0.041)	(0.028)	(0.019)	(0.029)	(0.022)	(0.019)	(0.008)	(0.005)	(0.008)
Btm	-0.022	-0.034**	-0.021***	-0.029*	-0.027**	-0.014*	-0.009**	0.001	-0.007**
	(0.021)	(0.016)	(0.007)	(0.017)	(0.012)	(0.008)	(0.004)	(0.001)	(0.004)
Leverage	-0.072	-0.139***	-0.044**	-0.109***	-0.090***	-0.045***	-0.017**	-0.003	-0.022***
	(0.056)	(0.032)	(0.018)	(0.035)	(0.025)	(0.015)	(0.007)	(0.005)	(0.007)
Analyst_Following	-0.003	0.001	0.001	0.001	0.000	-0.000	-0.001*	0.000	-0.000
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Return_volatility	-0.976	-1.004**	-0.382	-1.155**	-0.664*	0.368**	0.150	0.018	0.179*
	(0.593)	(0.444)	(0.283)	(0.484)	(0.369)	(0.177)	(0.136)	(0.073)	(0.104)
Board_Size	0.002	0.002	0.002	0.003	0.002	0.000	0.001	0.000	0.000
	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Board_Independence	-0.101	0.012	0.008	-0.030	-0.013	0.005	0.022	0.012	0.013
	(0.095)	(0.056)	(0.048)	(0.065)	(0.042)	(0.032)	(0.021)	(0.013)	(0.016)
Board_Female	-0.141	-0.053	-0.021	-0.051	-0.056	0.038	0.003	0.009	0.017

	(0.087)	(0.050)	(0.030)	(0.059)	(0.040)	(0.028)	(0.013)	(0.007)	(0.013)
Average_Tenure	-0.012***	-0.005**	-0.000	-0.007***	-0.005***	-0.002	-0.001	0.000	-0.001
	(0.004)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)
IOR	-0.117***	-0.096***	0.000	-0.095***	-0.056**	-0.037	-0.011	0.003	-0.015
	(0.038)	(0.029)	(0.025)	(0.029)	(0.022)	(0.023)	(0.013)	(0.008)	(0.011)
Observations	6,800	6,800	6,800	6,800	6,800	6,328	6,328	6,328	6,328
R-squared	0.602	0.802	0.601	0.748	0.768	0.908	0.898	0.799	0.928
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel B: *The outcome variables in this panel are divided into two categories. Columns 1 to 5 present the percentage of disclosed Float KPIs from the total number of relevant Float KPIs, categorized by pillar. In columns 6 to 9, the outcome variable is the disclosure quantity, measured using the Bloomberg Disclosure Score. The variable ESG_Treat_BooleanXpost is the interaction term between the treatment group dummy and the POST dummy. A firm is assigned to the treatment group if its percentage of disclosed Float KPIs out of the total number of relevant Float KPIs is below the median percentage as of 2018 across all pillars. The variable POST is set to 1 for the years 2020 and 2021.*

VARIABLES	(1) Environment_Ryp_Float	(2) Social_Ryp_Float	(3) Governance_Ryp_Float	(4) Es_Ryp_Float	(5) ESG_Ryp_Float	(6) Environmental Disclosure	(7) Social Disclosure	(8) Governance Disclosure	(9) ESG Disclosure
ESG_Treat_FloatXpost	-0.033*	0.051***	0.117***	0.034***	0.072***	0.026***	0.009**	-0.001	0.011***
	(0.018)	(0.008)	(0.012)	(0.011)	(0.010)	(0.007)	(0.004)	(0.001)	(0.003)
Size	-0.052***	0.000	0.006	-0.013	-0.006	0.002	0.009**	0.003*	0.005
	(0.017)	(0.006)	(0.007)	(0.008)	(0.006)	(0.007)	(0.004)	(0.002)	(0.004)
Roa	-0.054	-0.037***	-0.003	-0.041***	-0.023	-0.028	-0.014*	-0.012**	-0.018**
	(0.048)	(0.012)	(0.024)	(0.015)	(0.015)	(0.019)	(0.008)	(0.006)	(0.008)
Btm	-0.037**	-0.014	-0.013	-0.020*	-0.018**	-0.013*	-0.009**	0.001	-0.007**
	(0.018)	(0.009)	(0.009)	(0.010)	(0.007)	(0.008)	(0.004)	(0.001)	(0.004)
Leverage	-0.070*	-0.050***	-0.015	-0.062***	-0.044***	-0.040**	-0.016**	-0.003	-0.019**
	(0.037)	(0.018)	(0.020)	(0.017)	(0.016)	(0.015)	(0.007)	(0.005)	(0.007)
Analyst_Following	0.002	0.000	0.000	0.001	0.001	-0.000	-0.001*	0.000	-0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Return_volatility	-1.142*	-0.424	-0.541*	-0.496	-0.486	0.374**	0.151	0.017	0.181*
	-0.635	(0.295)	(0.307)	(0.367)	(0.294)	(0.170)	(0.132)	(0.073)	(0.099)
Board_Size	0.000	0.003	0.003	0.002	0.002	0.001	0.001	0.000	0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Board_Independence	-0.035	0.037	-0.055	0.018	-0.016	0.000	0.020	0.012	0.011
	(0.064)	(0.038)	(0.073)	(0.036)	(0.042)	(0.031)	(0.021)	(0.013)	(0.016)
Board_Female	-0.164**	-0.057*	-0.057*	-0.090**	-0.079***	0.041	0.004	0.010	0.018
	(0.062)	(0.031)	(0.034)	(0.035)	(0.027)	(0.027)	(0.013)	(0.007)	(0.013)
Average_Tenure	-0.005*	-0.002	-0.001	-0.003**	-0.002*	-0.001	-0.001	0.000	-0.001
	(0.003)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
IOR	-0.145***	-0.047*	0.012	-0.072***	-0.036	-0.034	-0.010	0.003	-0.014
	(0.052)	(0.025)	(0.036)	(0.026)	(0.023)	(0.022)	(0.013)	(0.008)	(0.011)

Observations	6,328	6,800	6,800	6,800	6,800	6,328	6,328	6,328	6,328
R-squared	0.618	0.744	0.457	0.742	0.688	0.909	0.899	0.799	0.929
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 13

Difference-in-differences analysis with continuous treatment

Panel A: *The outcome variables in this panel are divided into two categories. Columns 1 to 5 present the percentage of "YES" responses from the total number of relevant Boolean KPIs, categorized by pillar. In columns 6 to 9, the outcome variable is the disclosure quantity, measured using the Bloomberg Disclosure Score. The variable ESG_Continuous_Treat_BoolXpost represents the interaction term between the continuous treatment group and the POST dummy. The continuous treatment group is defined by the percentage of "NO" responses and missing values from the total number of relevant Boolean KPIs as of 2018, aggregated across all pillars. The POST variable is assigned a value of 1 for the years 2020 and 2021.*

VARIABLES	(1) Environment_Ryp_Boolean	(2) Social_Ryp_Boolean	(3) Governance_Ryp_Boolean	(4) Es_Ryp_Boolean	(5) ESG_Ryp_Boolean	(6) Environmental Disclosure	(7) Social Disclosure	(8) Governance Disclosure	(9) ESG Disclosure
ESG_Continuous_Treat_BoolXPost	0.779***	0.370***	0.506***	0.484***	0.522***	0.024	-0.019	-0.012	-0.002
	(0.071)	(0.055)	(0.049)	(0.075)	(0.043)	(0.029)	(0.018)	(0.009)	(0.014)
Observations	6,800	6,800	6,800	6,800	6,800	6,328	6,328	6,328	6,328
R-squared	0.621	0.807	0.618	0.759	0.786	0.908	0.898	0.799	0.928
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel B: *The outcome variables in this panel are divided into two categories. Columns 1 to 5 present the percentage of disclosed Float KPIs from the total number of relevant Float KPIs, categorized by pillar. In columns 6 to 9, the outcome variable is the disclosure quantity, measured using the Bloomberg Disclosure Score. The variable ESG_Continuous_Treat_BoolXpost represents the interaction term between the continuous treatment group and the POST dummy. The continuous treatment group is defined by the percentage of "NO" responses and missing values from the total number of relevant Boolean KPIs as of 2018, aggregated across all pillars. The POST variable is assigned a value of 1 for the years 2020 and 2021.*

VARIABLES	(1) Environment_Ryp_Boolean	(2) Social_Ryp_Boolean	(3) Governance_Ryp_Boolean	(4) Es_Ryp_Boolean	(5) ESG_Ryp_Boolean	(6) Environmental Disclosure	(7) Social Disclosure	(8) Governance Disclosure	(9) ESG Disclosure
ESG_Continuous_Treat_FloatXPost	-0.070	0.383***	1.008***	0.316***	0.621***	0.119***	0.030*	-0.001	0.049***
	(0.088)	(0.069)	(0.238)	(0.033)	(0.102)	(0.024)	(0.017)	(0.008)	(0.013)
Observations	6,328	6,800	6,800	6,800	6,800	6,328	6,328	6,328	6,328
R-squared	0.617	0.758	0.544	0.752	0.733	0.909	0.898	0.799	0.929
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 14

Difference-in-differences with Entropy Balancing

Panel A: *The outcome variables in this panel are divided into two categories. Columns 1 to 5 present the percentage of "YES" responses from the total number of relevant Boolean KPIs, categorized by pillar. In columns 6 to 9, the outcome variable is the disclosure quantity, measured using the Bloomberg Disclosure Score. The variable ESG_Continuous_Treat_BoolXpost represents the interaction term between the continuous treatment group and the POST dummy. The continuous treatment group is defined by the percentage of "NO" responses and missing values from the total number of relevant Boolean KPIs as of 2018, aggregated across all pillars. The POST variable is assigned a value of 1 for the years 2020 and 2021.*

VARIABLES	(1) Environment_Ryp_ Boolean	(2) Social_Ryp_B oolean	(3) Governance_Ryp_ Boolean	(4) Es_Ryp_Bo olean	(5) ESG_Ryp_B oolean	(6) Environmental Disclosure	(7) Social Disclosure	(8) Governance Disclosure	(9) ESG Disclosure
ESG_Treat_Boole anXpost	0.185***	0.092***	0.078***	0.135***	0.113***	0.002	-0.002	-0.001	-0.001
	(0.023)	(0.008)	(0.012)	(0.014)	(0.007)	(0.005)	(0.003)	(0.002)	(0.002)
Observations	6,800	6,800	6,800	6,800	6,800	6,328	6,328	6,328	6,328
R-squared	0.572	0.774	0.568	0.694	0.715	0.891	0.879	0.782	0.912
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel B: *The outcome variables in this panel include the percentage of "YES" responses from the total number of relevant Boolean KPIs, categorized by pillar and presented in columns 1 to 5. For columns 6 to 9, the outcome variable is the disclosure quantity, measured by the Bloomberg Disclosure Score. The variable ESG_Treat_BooleanXpost is the interaction term between the treatment group dummy and the POST dummy. A firm is assigned to the treatment group if its percentage of "YES" responses out of the total number of relevant Boolean KPIs is below the median percentage as of 2018 across all pillars. The variable POST is set to 1 for the years 2020 and 2021.*

VARIABLES	(1) Environment_Ryp_Float	(2) Social_Ryp_Float	(3) Governance_Ryp_Float	(4) Es_Ryp_Float	(5) ESG_Ryp_Float	(6) Environmental Disclosure	(7) Social Disclosure	(8) Governance Disclosure	(9) ESG Disclosure
ESG_Treat_FloatXpost	-0.027	0.072***	0.113***	0.040***	0.071***	0.024***	0.014***	-0.001	0.012***
	(0.023)	(0.008)	(0.019)	(0.012)	(0.009)	(0.007)	(0.004)	(0.002)	(0.004)
Observations	6,328	6,800	6,800	6,800	6,800	6,328	6,328	6,328	6,328
R-squared	0.634	0.755	0.433	0.741	0.604	0.916	0.908	0.811	0.936
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 15

Parallel trends

Panel A: *The outcome variables in this panel include the percentage of "YES" responses from the total number of relevant Boolean KPIs, categorized by pillar and presented in columns 1 to 5. For columns 6 to 9, the outcome variable is the disclosure quantity, measured by the Bloomberg Disclosure Score. The variable ESG_Treat_BooleanXpost is the interaction term between the treatment group dummy and the POST dummy. A firm is assigned to the treatment group if its percentage of "YES" responses out of the total number of relevant Boolean KPIs is below the median percentage as of 2018 across all pillars. The variable POST is set to 1 for the years 2020 and 2021.*

VARIABLES	(1) Environment_Ryp_ Boolean	(2) Social_Ryp_B oolean	(3) Governance_Ryp_ Boolean	(4) Es_Ryp_Bo olean	(5) ESG_Ryp_B oolean	(6) Environmental Disclosure	(7) Social Disclosure	(8) Governance Disclosure	(9) ESG Disclosure
ESG_Treat_Boole an_2018	-0.059***	0.120***	-0.120***	0.050***	-0.025**	-0.006*	-0.003*	-0.003*	-0.004***
	(0.008)	(0.009)	(0.019)	(0.013)	(0.010)	(0.003)	(0.002)	(0.002)	(0.001)
ESG_Treat_Boole an_2020	0.061**	0.091***	0.016***	0.066***	0.049***	-0.008	-0.006	-0.004**	-0.006
	(0.025)	(0.011)	(0.006)	(0.013)	(0.008)	(0.008)	(0.004)	(0.002)	(0.004)
ESG_Treat_Boole an_2021	0.053***	0.090***	0.020***	0.064***	0.050***	-0.004	-0.007	-0.004	-0.005
	(0.019)	(0.012)	(0.006)	(0.013)	(0.008)	(0.011)	(0.005)	(0.003)	(0.006)
Observations	6,800	6,800	6,800	6,800	6,800	6,328	6,328	6,328	6,328
R-squared	0.604	0.809	0.623	0.750	0.769	0.908	0.898	0.799	0.928
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel B: *The outcome variables in this panel include the percentage of "YES" responses from the total number of relevant Boolean KPIs, categorized by pillar and presented in columns 1 to 5. For columns 6 to 9, the outcome variable is the disclosure quantity, measured by the Bloomberg Disclosure Score. The variable ESG_Treat_BooleanXpost is the interaction term between the treatment group dummy and the POST dummy. A firm is assigned to the treatment group if its percentage of "YES" responses out of the total number of relevant Boolean KPIs is below the median percentage as of 2018 across all pillars. The variable POST is set to 1 for the years 2020 and 2021.*

VARIABLES	(1) Environment_Ryp_Float	(2) Social_Ryp_Float	(3) Governance_Ryp_Float	(4) Es_Ryp_Float	(5) ESG_Ryp_Float	(6) Environmental Disclosure	(7) Social Disclosure	(8) Governance Disclosure	(9) ESG Disclosure
ESG_Treat_Float_2018	-0.000	-0.049***	-0.176***	-0.034***	-0.094***	0.006**	-0.002	-0.000	0.001
	(0.002)	(0.007)	(0.021)	(0.005)	(0.011)	(0.003)	(0.002)	(0.001)	(0.002)
ESG_Treat_Float_2020	-0.041**	0.025***	0.028***	0.014	0.022***	0.022***	0.006	-0.001	0.009***
	(0.018)	(0.007)	(0.008)	(0.011)	(0.008)	(0.006)	(0.004)	(0.002)	(0.003)
ESG_Treat_Float_2021	-0.026	0.027***	0.024***	0.019**	0.025***	0.037***	0.010**	-0.001	0.015***
	(0.018)	(0.006)	(0.009)	(0.009)	(0.008)	(0.009)	(0.005)	(0.002)	(0.004)
Observations	6,328	6,800	6,800	6,800	6,800	6,328	6,328	6,328	6,328
R-squared	0.618	0.748	0.495	0.744	0.703	0.909	0.899	0.799	0.929
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

VIII. APPENDIX

Appendix A

Variable Definitions

Variable	Description	Data source
Main variables		
Pillar_ Ryp_Boolean	One minus the ratio of the number of missing values that are pertinent to the TRBC Industry Group's relevant KPIs within a specific category (or Pillar) of Refinitiv ESG data to the total number of KPIs included in that category. Both the numerator and denominator consider only the Boolean KPIs relevant to the TRBC Industry Group. This variable indicates how much a firm discloses "YES" ("NO") when the KPI has positive (negative) polarity, in terms of all its Refinitiv relevant Boolean KPIs.	Refinitiv ESG
Pillar_ Ryp_Float	One minus the ratio of the number of missing values that are pertinent to the TRBC Industry Group's relevant KPIs within a specific category (or Pillar) of Refinitiv ESG data to the total number of KPIs included in that category. Both the numerator and denominator consider only the Float KPIs relevant to the TRBC Industry Group. This variable indicates how much a firm discloses in terms of all its Refinitiv relevant Float KPIs.	Refinitiv ESG
Post	Indicator equalling to one in one of the "post" periods definitions (please, see **Table 3** for reference).	
Bloomberg Disclosure Score	"These disclosure scores are based on information firms disclose in various ways, such as via sustainability reports, annual reports, and corporate websites.23 The scores ranges from 0.1 for firms that disclose a minimum amount of ESG data to 100 for firms that disclose every data point that Bloomberg collects. Thus, the more ESG information a company discloses, the higher the disclosure score. Bloomberg also tailors the disclosure scores for different industry sectors, so that companies are only evaluated based on data that are relevant to their industry." (excerpt from Christensen, et al., 2022).	Bloomberg
Institutional Ownership Ratio (IOR)	Total Institutional Ownership / Adjusted Total Shares Outstanding.	CRSP, Thomson 13-F
Control variables		
Size	Natural logarithm of total assets (at).	Compustat
ROA	Income Before Extraordinary Items (ib) / Total Assets (at)	Compustat

Book-To-Market ratio	[Common Shareholders' Equity (ceq) + Deferred Taxes (txdb) + Investment Tax Credit (itcb) / Market Value of Equity*]. If ceq is missing, the Total Shareholders' Equity (seq) is used. *Market Value of Equity is computed as: (Adjusted price * Adjusted Total Shares Outstanding).	Compustat, CRSP
Book Leverage	Total liabilities (lt) / Total Assets (at), consistently with Christensen, et al. (2022), though they use Refinitiv financial data.	Compustat
Analyst Following	Number of analysts issuing at least one forecast during the last quarter of fiscal year end.	I/B/E/S
Return Volatility	Standard deviation of daily returns over a 252-day window	CRSP
Board Size	Number of directors.	BoardEx
Board Independence	Number of independent directors / board size.	BoardEx
Board Gender Ratio	Number of female directors on the board / board size. In case the value is missing from the summary module, it is computed from BoardEx raw data.	BoardEx
Average Tenure	Average time in role for each director.	BoardEx

Appendix B

***Panel A**: This table shows the average number of relevant KPIs with missing values in relation to the total number of relevant KPIs, categorized by Boolean or Float type. Both "YES" and "NO" are considered as non-missing values for Boolean type variables.*

Pillar	Category	Relevant Missing KPIs / Relevant KPIs	Total KPIs considered for each Category or Pillar	Number of Observations	Year	Historical or Current data
Environment	Innovation	0.4	18	1931	2017	Historical
		0.431	18	1931	2018	Historical
		0.095	18	1777	2019	Current
		0.088	18	1702	2020	Current
		0.083	18	1598	2021	Current
	Emissions	0.539	18	2117	2017	Historical
		0.561	18	2116	2018	Historical
		0.235	18	1944	2019	Current
		0.227	18	1855	2020	Current
		0.22	18	1739	2021	Current
	Resource Use	0.348	18	2114	2017	Historical
		0.379	18	2113	2018	Historical
		0.159	18	1942	2019	Current
		0.148	18	1853	2020	Current
		0.141	18	1738	2021	Current
	Total	0.438	54	2117	2017	Historical
		0.465	54	2116	2018	Historical
		0.186	54	1944	2019	Current
		0.177	54	1855	2020	Current
		0.17	54	1739	2021	Current
Social	Workforce	0.53	28	2117	2017	Historical
		0.757	28	2116	2018	Historical
		0.406	28	1944	2019	Current
		0.383	28	1855	2020	Current
		0.365	28	1739	2021	Current
	Community	0.342	13	2117	2017	Historical
		0.848	13	2116	2018	Historical
		0.111	13	1944	2019	Current
		0.102	13	1855	2020	Current
		0.095	13	1739	2021	Current
		0.319	10	2117	2017	Historical

	Product Responsibility	0.801	10	2116	2018	Historical
		0.224	10	1944	2019	Current
		0.219	10	1855	2020	Current
		0.218	10	1739	2021	Current
	Human Rights	0.299	8	2117	2017	Historical
		0.95	8	2116	2018	Historical
		0.003	8	1944	2019	Current
		0	8	1855	2020	Current
		0	8	1739	2021	Current
	Total	0.433	59	2117	2017	Historical
		0.809	59	2116	2018	Historical
		0.266	59	1944	2019	Current
		0.251	59	1855	2020	Current
		0.24	59	1739	2021	Current
Governance	Shareholders	0.095	11	2117	2017	Historical
		0.176	11	2116	2018	Historical
		0.01	11	1944	2019	Current
		0.014	11	1855	2020	Current
		0.015	11	1739	2021	Current
	Management	0.06	31	2117	2017	Historical
		0.145	31	2116	2018	Historical
		0.016	31	1944	2019	Current
		0.013	31	1855	2020	Current
		0.011	31	1739	2021	Current
	CSR Strategy	0.345	8	2117	2017	Historical
		0.41	8	2116	2018	Historical
		0.279	8	1944	2019	Current
		0.252	8	1855	2020	Current
		0.225	8	1739	2021	Current
	Total	0.113	50	2117	2017	Historical
		0.194	50	2116	2018	Historical
		0.057	50	1944	2019	Current
		0.052	50	1855	2020	Current
		0.046	50	1739	2021	Current

Appendix C

Number of relevant KPIs for each category-industry group

Pillar	Category	Industry Group	Relevant Boolean KPIs	Relevant Float KPIs	Total Number of KPIs
Environment Pillar	Innovation Category	501010	1	0	18
Environment Pillar	Innovation Category	501020	2	0	18
Environment Pillar	Innovation Category	501030	2	0	18
Environment Pillar	Innovation Category	502010	2	0	18
Environment Pillar	Innovation Category	503010	0	1	18
Environment Pillar	Innovation Category	511010	4	1	18
Environment Pillar	Innovation Category	512010	1	0	18
Environment Pillar	Innovation Category	512020	3	1	18
Environment Pillar	Innovation Category	513010	1	2	18
Environment Pillar	Innovation Category	513020	1	1	18
Environment Pillar	Innovation Category	521010	4	0	18
Environment Pillar	Innovation Category	521020	6	1	18
Environment Pillar	Innovation Category	522010	6	0	18
Environment Pillar	Innovation Category	522020	5	1	18
Environment Pillar	Innovation Category	522030	2	0	18
Environment Pillar	Innovation Category	524050	1	0	18
Environment Pillar	Innovation Category	524060	1	0	18
Environment Pillar	Innovation Category	524070	1	0	18
Environment Pillar	Innovation Category	531010	5	3	18
Environment Pillar	Innovation Category	532020	2	0	18
Environment Pillar	Innovation Category	532030	7	1	18
Environment Pillar	Innovation Category	532040	4	1	18
Environment Pillar	Innovation Category	532050	1	0	18
Environment Pillar	Innovation Category	533010	2	0	18
Environment Pillar	Innovation Category	533020	1	0	18
Environment Pillar	Innovation Category	534020	3	0	18
Environment Pillar	Innovation Category	534030	3	0	18
Environment Pillar	Innovation Category	541010	3	0	18
Environment Pillar	Innovation Category	541020	3	0	18
Environment Pillar	Innovation Category	543010	2	0	18
Environment Pillar	Innovation Category	544010	7	1	18
Environment Pillar	Innovation Category	551010	4	0	18
Environment Pillar	Innovation Category	551020	4	0	18
Environment Pillar	Innovation Category	553010	4	0	18
Environment Pillar	Innovation Category	555010	2	0	18
Environment Pillar	Innovation Category	556010	1	1	18
Environment Pillar	Innovation Category	561010	1	0	18

Environment Pillar	Innovation Category	561020	0	0	18
Environment Pillar	Innovation Category	562010	2	0	18
Environment Pillar	Innovation Category	562020	0	0	18
Environment Pillar	Innovation Category	571010	4	1	18
Environment Pillar	Innovation Category	571020	4	0	18
Environment Pillar	Innovation Category	571040	3	1	18
Environment Pillar	Innovation Category	571050	3	1	18
Environment Pillar	Innovation Category	574010	2	0	18
Environment Pillar	Innovation Category	591010	2	3	18
Environment Pillar	Innovation Category	591020	2	2	18
Environment Pillar	Innovation Category	591030	2	2	18
Environment Pillar	Innovation Category	591040	3	3	18
Environment Pillar	Innovation Category	601010	3	0	18
Environment Pillar	Innovation Category	601020	2	0	18
Environment Pillar	Emissions Category	501010	11	5	18
Environment Pillar	Emissions Category	501020	11	5	18
Environment Pillar	Emissions Category	501030	9	4	18
Environment Pillar	Emissions Category	502010	11	4	18
Environment Pillar	Emissions Category	503010	8	4	18
Environment Pillar	Emissions Category	511010	11	5	18
Environment Pillar	Emissions Category	512010	11	5	18
Environment Pillar	Emissions Category	512020	11	5	18
Environment Pillar	Emissions Category	513010	11	5	18
Environment Pillar	Emissions Category	513020	10	5	18
Environment Pillar	Emissions Category	521010	11	4	18
Environment Pillar	Emissions Category	521020	11	5	18
Environment Pillar	Emissions Category	522010	12	4	18
Environment Pillar	Emissions Category	522020	9	5	18
Environment Pillar	Emissions Category	522030	10	4	18
Environment Pillar	Emissions Category	524050	12	4	18
Environment Pillar	Emissions Category	524060	12	4	18
Environment Pillar	Emissions Category	524070	9	4	18
Environment Pillar	Emissions Category	531010	12	5	18
Environment Pillar	Emissions Category	532020	10	5	18
Environment Pillar	Emissions Category	532030	11	5	18
Environment Pillar	Emissions Category	532040	8	5	18
Environment Pillar	Emissions Category	532050	9	4	18
Environment Pillar	Emissions Category	533010	9	4	18
Environment Pillar	Emissions Category	533020	7	3	18
Environment Pillar	Emissions Category	534020	8	3	18
Environment Pillar	Emissions Category	534030	8	3	18
Environment Pillar	Emissions Category	541010	10	5	18
Environment Pillar	Emissions Category	541020	10	5	18

Environment Pillar	Emissions Category	543010	9	3	18
Environment Pillar	Emissions Category	544010	11	5	18
Environment Pillar	Emissions Category	551010	8	3	18
Environment Pillar	Emissions Category	551020	9	3	18
Environment Pillar	Emissions Category	553010	8	3	18
Environment Pillar	Emissions Category	555010	1	0	18
Environment Pillar	Emissions Category	556010	7	4	18
Environment Pillar	Emissions Category	561010	8	4	18
Environment Pillar	Emissions Category	561020	6	3	18
Environment Pillar	Emissions Category	562010	11	5	18
Environment Pillar	Emissions Category	562020	1	0	18
Environment Pillar	Emissions Category	571010	11	5	18
Environment Pillar	Emissions Category	571020	8	4	18
Environment Pillar	Emissions Category	571040	11	5	18
Environment Pillar	Emissions Category	571050	11	5	18
Environment Pillar	Emissions Category	574010	9	4	18
Environment Pillar	Emissions Category	591010	12	4	18
Environment Pillar	Emissions Category	591020	12	5	18
Environment Pillar	Emissions Category	591030	12	5	18
Environment Pillar	Emissions Category	591040	12	4	18
Environment Pillar	Emissions Category	601010	8	3	18
Environment Pillar	Emissions Category	601020	8	3	18
Environment Pillar	Resource Use Category	501010	11	3	18
Environment Pillar	Resource Use Category	501020	12	3	18
Environment Pillar	Resource Use Category	501030	10	2	18
Environment Pillar	Resource Use Category	502010	12	2	18
Environment Pillar	Resource Use Category	503010	3	3	18
Environment Pillar	Resource Use Category	511010	14	3	18
Environment Pillar	Resource Use Category	512010	12	3	18
Environment Pillar	Resource Use Category	512020	13	4	18
Environment Pillar	Resource Use Category	513010	12	3	18
Environment Pillar	Resource Use Category	513020	12	3	18
Environment Pillar	Resource Use Category	521010	12	2	18
Environment Pillar	Resource Use Category	521020	13	3	18
Environment Pillar	Resource Use Category	522010	12	3	18
Environment Pillar	Resource Use Category	522020	11	3	18
Environment Pillar	Resource Use Category	522030	12	2	18
Environment Pillar	Resource Use Category	524050	12	2	18
Environment Pillar	Resource Use Category	524060	12	2	18
Environment Pillar	Resource Use Category	524070	11	3	18
Environment Pillar	Resource Use Category	531010	13	3	18
Environment Pillar	Resource Use Category	532020	13	3	18
Environment Pillar	Resource Use Category	532030	13	3	18

Environment Pillar	Resource Use Category	532040	13	3	18
Environment Pillar	Resource Use Category	532050	12	2	18
Environment Pillar	Resource Use Category	533010	12	2	18
Environment Pillar	Resource Use Category	533020	11	2	18
Environment Pillar	Resource Use Category	534020	13	2	18
Environment Pillar	Resource Use Category	534030	13	2	18
Environment Pillar	Resource Use Category	541010	13	3	18
Environment Pillar	Resource Use Category	541020	13	3	18
Environment Pillar	Resource Use Category	543010	13	2	18
Environment Pillar	Resource Use Category	544010	13	3	18
Environment Pillar	Resource Use Category	551010	11	2	18
Environment Pillar	Resource Use Category	551020	10	2	18
Environment Pillar	Resource Use Category	553010	10	2	18
Environment Pillar	Resource Use Category	555010	0	0	18
Environment Pillar	Resource Use Category	556010	9	2	18
Environment Pillar	Resource Use Category	561010	13	2	18
Environment Pillar	Resource Use Category	561020	11	2	18
Environment Pillar	Resource Use Category	562010	13	3	18
Environment Pillar	Resource Use Category	562020	1	0	18
Environment Pillar	Resource Use Category	571010	13	3	18
Environment Pillar	Resource Use Category	571020	13	2	18
Environment Pillar	Resource Use Category	571040	13	3	18
Environment Pillar	Resource Use Category	571050	13	3	18
Environment Pillar	Resource Use Category	574010	12	3	18
Environment Pillar	Resource Use Category	591010	13	3	18
Environment Pillar	Resource Use Category	591020	11	2	18
Environment Pillar	Resource Use Category	591030	11	3	18
Environment Pillar	Resource Use Category	591040	12	3	18
Environment Pillar	Resource Use Category	601010	11	3	18
Environment Pillar	Resource Use Category	601020	9	2	18
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Social Pillar	Workforce Category	501030	8	13	28
Social Pillar	Workforce Category	502010	8	11	28
Social Pillar	Workforce Category	503010	8	11	28
Social Pillar	Workforce Category	511010	10	16	28
Social Pillar	Workforce Category	512010	11	15	28
Social Pillar	Workforce Category	512020	11	15	28
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Social Pillar	Workforce Category	513020	9	13	28
Social Pillar	Workforce Category	521010	10	15	28
Social Pillar	Workforce Category	521020	10	16	28
Social Pillar	Workforce Category	522010	10	15	28

Social Pillar	Workforce Category	522020	11	15	28
Social Pillar	Workforce Category	522030	10	14	28
Social Pillar	Workforce Category	524050	10	14	28
Social Pillar	Workforce Category	524060	10	14	28
Social Pillar	Workforce Category	524070	10	15	28
Social Pillar	Workforce Category	531010	11	16	28
Social Pillar	Workforce Category	532020	11	16	28
Social Pillar	Workforce Category	532030	10	14	28
Social Pillar	Workforce Category	532040	10	15	28
Social Pillar	Workforce Category	532050	10	14	28
Social Pillar	Workforce Category	533010	10	14	28
Social Pillar	Workforce Category	533020	11	14	28
Social Pillar	Workforce Category	534020	10	14	28
Social Pillar	Workforce Category	534030	10	13	28
Social Pillar	Workforce Category	541010	11	15	28
Social Pillar	Workforce Category	541020	11	14	28
Social Pillar	Workforce Category	543010	11	15	28
Social Pillar	Workforce Category	544010	10	16	28
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Social Pillar	Workforce Category	556010	8	13	28
Social Pillar	Workforce Category	561010	10	12	28
Social Pillar	Workforce Category	561020	9	12	28
Social Pillar	Workforce Category	562010	11	16	28
Social Pillar	Workforce Category	562020	5	8	28
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Social Pillar	Workforce Category	571020	11	13	28
Social Pillar	Workforce Category	571040	10	15	28
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Social Pillar	Workforce Category	574010	12	16	28
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Social Pillar	Workforce Category	591020	11	16	28
Social Pillar	Workforce Category	591030	10	16	28
Social Pillar	Workforce Category	591040	10	16	28
Social Pillar	Workforce Category	601010	10	15	28
Social Pillar	Workforce Category	601020	8	12	28
Social Pillar	Community Category	501010	7	1	13
Social Pillar	Community Category	501020	8	1	13
Social Pillar	Community Category	501030	8	1	13
Social Pillar	Community Category	502010	7	1	13
Social Pillar	Community Category	503010	8	2	13

Social Pillar	Community Category	511010	8	1	13
Social Pillar	Community Category	512010	9	1	13
Social Pillar	Community Category	512020	7	1	13
Social Pillar	Community Category	513010	8	1	13
Social Pillar	Community Category	513020	8	1	13
Social Pillar	Community Category	521010	8	1	13
Social Pillar	Community Category	521020	8	1	13
Social Pillar	Community Category	522010	8	1	13
Social Pillar	Community Category	522020	7	1	13
Social Pillar	Community Category	522030	7	1	13
Social Pillar	Community Category	524050	7	1	13
Social Pillar	Community Category	524060	8	1	13
Social Pillar	Community Category	524070	7	1	13
Social Pillar	Community Category	531010	8	1	13
Social Pillar	Community Category	532020	8	1	13
Social Pillar	Community Category	532030	7	1	13
Social Pillar	Community Category	532040	8	1	13
Social Pillar	Community Category	532050	7	1	13
Social Pillar	Community Category	533010	7	1	13
Social Pillar	Community Category	533020	7	1	13
Social Pillar	Community Category	534020	7	1	13
Social Pillar	Community Category	534030	7	1	13
Social Pillar	Community Category	541010	8	1	13
Social Pillar	Community Category	541020	8	1	13
Social Pillar	Community Category	543010	8	1	13
Social Pillar	Community Category	544010	8	1	13
Social Pillar	Community Category	551010	7	2	13
Social Pillar	Community Category	551020	7	1	13
Social Pillar	Community Category	553010	7	2	13
Social Pillar	Community Category	555010	2	1	13
Social Pillar	Community Category	556010	8	1	13
Social Pillar	Community Category	561010	8	1	13
Social Pillar	Community Category	561020	7	1	13
Social Pillar	Community Category	562010	10	1	13
Social Pillar	Community Category	562020	6	1	13
Social Pillar	Community Category	571010	8	1	13
Social Pillar	Community Category	571020	8	1	13
Social Pillar	Community Category	571040	7	1	13
Social Pillar	Community Category	571050	8	1	13
Social Pillar	Community Category	574010	8	1	13
Social Pillar	Community Category	591010	7	1	13
Social Pillar	Community Category	591020	8	1	13
Social Pillar	Community Category	591030	7	1	13

Social Pillar	Community Category		591040	8	1	13
Social Pillar	Community Category		601010	7	1	13
Social Pillar	Community Category		601020	7	1	13
Social Pillar	Product Category	Responsibility	501010	3	2	10
Social Pillar	Product Category	Responsibility	501020	4	1	10
Social Pillar	Product Category	Responsibility	501030	3	1	10
Social Pillar	Product Category	Responsibility	502010	4	1	10
Social Pillar	Product Category	Responsibility	503010	3	0	10
Social Pillar	Product Category	Responsibility	511010	4	2	10
Social Pillar	Product Category	Responsibility	512010	3	2	10
Social Pillar	Product Category	Responsibility	512020	4	2	10
Social Pillar	Product Category	Responsibility	513010	3	1	10
Social Pillar	Product Category	Responsibility	513020	4	1	10
Social Pillar	Product Category	Responsibility	521010	3	1	10
Social Pillar	Product Category	Responsibility	521020	4	2	10
Social Pillar	Product Category	Responsibility	522010	4	2	10
Social Pillar	Product Category	Responsibility	522020	4	1	10
Social Pillar	Product Category	Responsibility	522030	3	2	10
Social Pillar	Product Category	Responsibility	524050	3	2	10
Social Pillar	Product Category	Responsibility	524060	4	1	10
Social Pillar	Product Category	Responsibility	524070	4	2	10
Social Pillar	Product Category	Responsibility	531010	5	2	10
Social Pillar	Product Category	Responsibility	532020	6	0	10
Social Pillar	Product Category	Responsibility	532030	4	2	10
Social Pillar	Product Category	Responsibility	532040	5	1	10
Social Pillar	Product Category	Responsibility	532050	5	0	10
Social Pillar	Product Category	Responsibility	533010	6	1	10
Social Pillar	Product Category	Responsibility	533020	4	0	10
Social Pillar	Product Category	Responsibility	534020	5	0	10

Social Pillar	Product Category	Responsibility	534030	5	1	10
Social Pillar	Product Category	Responsibility	541010	6	1	10
Social Pillar	Product Category	Responsibility	541020	6	1	10
Social Pillar	Product Category	Responsibility	543010	8	1	10
Social Pillar	Product Category	Responsibility	544010	5	2	10
Social Pillar	Product Category	Responsibility	551010	3	1	10
Social Pillar	Product Category	Responsibility	551020	1	1	10
Social Pillar	Product Category	Responsibility	553010	3	1	10
Social Pillar	Product Category	Responsibility	555010	1	0	10
Social Pillar	Product Category	Responsibility	556010	3	1	10
Social Pillar	Product Category	Responsibility	561010	4	1	10
Social Pillar	Product Category	Responsibility	561020	4	1	10
Social Pillar	Product Category	Responsibility	562010	5	0	10
Social Pillar	Product Category	Responsibility	562020	3	0	10
Social Pillar	Product Category	Responsibility	571010	4	2	10
Social Pillar	Product Category	Responsibility	571020	4	1	10
Social Pillar	Product Category	Responsibility	571040	3	2	10
Social Pillar	Product Category	Responsibility	571050	4	2	10
Social Pillar	Product Category	Responsibility	574010	6	1	10
Social Pillar	Product Category	Responsibility	591010	5	2	10
Social Pillar	Product Category	Responsibility	591020	5	1	10
Social Pillar	Product Category	Responsibility	591030	5	2	10
Social Pillar	Product Category	Responsibility	591040	5	1	10
Social Pillar	Product Category	Responsibility	601010	3	1	10
Social Pillar	Product Category	Responsibility	601020	2	1	10
Social Pillar	Human Rights Category		501010	6	0	8
Social Pillar	Human Rights Category		501020	7	0	8
Social Pillar	Human Rights Category		501030	7	0	8
Social Pillar	Human Rights Category		502010	7	0	8

Social Pillar	Human Rights Category	503010	6	0	8
Social Pillar	Human Rights Category	511010	7	0	8
Social Pillar	Human Rights Category	512010	7	0	8
Social Pillar	Human Rights Category	512020	7	0	8
Social Pillar	Human Rights Category	513010	7	0	8
Social Pillar	Human Rights Category	513020	7	0	8
Social Pillar	Human Rights Category	521010	7	0	8
Social Pillar	Human Rights Category	521020	7	0	8
Social Pillar	Human Rights Category	522010	7	0	8
Social Pillar	Human Rights Category	522020	7	0	8
Social Pillar	Human Rights Category	522030	7	0	8
Social Pillar	Human Rights Category	524050	7	0	8
Social Pillar	Human Rights Category	524060	7	0	8
Social Pillar	Human Rights Category	524070	7	0	8
Social Pillar	Human Rights Category	531010	7	0	8
Social Pillar	Human Rights Category	532020	7	0	8
Social Pillar	Human Rights Category	532030	7	0	8
Social Pillar	Human Rights Category	532040	7	0	8
Social Pillar	Human Rights Category	532050	7	0	8
Social Pillar	Human Rights Category	533010	7	0	8
Social Pillar	Human Rights Category	533020	7	0	8
Social Pillar	Human Rights Category	534020	7	0	8
Social Pillar	Human Rights Category	534030	8	0	8
Social Pillar	Human Rights Category	541010	7	0	8
Social Pillar	Human Rights Category	541020	7	0	8
Social Pillar	Human Rights Category	543010	7	0	8
Social Pillar	Human Rights Category	544010	7	0	8
Social Pillar	Human Rights Category	551010	7	0	8
Social Pillar	Human Rights Category	551020	6	0	8
Social Pillar	Human Rights Category	553010	6	0	8
Social Pillar	Human Rights Category	555010	2	0	8
Social Pillar	Human Rights Category	556010	6	0	8
Social Pillar	Human Rights Category	561010	7	0	8
Social Pillar	Human Rights Category	561020	6	0	8
Social Pillar	Human Rights Category	562010	7	0	8
Social Pillar	Human Rights Category	562020	2	0	8
Social Pillar	Human Rights Category	571010	7	0	8
Social Pillar	Human Rights Category	571020	7	0	8
Social Pillar	Human Rights Category	571040	7	0	8
Social Pillar	Human Rights Category	571050	7	0	8
Social Pillar	Human Rights Category	574010	7	0	8
Social Pillar	Human Rights Category	591010	7	0	8
Social Pillar	Human Rights Category	591020	6	0	8

Social Pillar	Human Rights Category	591030	6	0	8
Social Pillar	Human Rights Category	591040	7	0	8
Social Pillar	Human Rights Category	601010	6	0	8
Social Pillar	Human Rights Category	601020	6	0	8
Governance Pillar	Shareholders Category	501010	7	4	11
Governance Pillar	Shareholders Category	501020	7	4	11
Governance Pillar	Shareholders Category	501030	7	4	11
Governance Pillar	Shareholders Category	502010	7	4	11
Governance Pillar	Shareholders Category	503010	7	4	11
Governance Pillar	Shareholders Category	511010	7	4	11
Governance Pillar	Shareholders Category	512010	7	4	11
Governance Pillar	Shareholders Category	512020	7	4	11
Governance Pillar	Shareholders Category	513010	7	4	11
Governance Pillar	Shareholders Category	513020	7	4	11
Governance Pillar	Shareholders Category	521010	7	4	11
Governance Pillar	Shareholders Category	521020	7	4	11
Governance Pillar	Shareholders Category	522010	7	4	11
Governance Pillar	Shareholders Category	522020	7	4	11
Governance Pillar	Shareholders Category	522030	7	4	11
Governance Pillar	Shareholders Category	524050	7	4	11
Governance Pillar	Shareholders Category	524060	7	4	11
Governance Pillar	Shareholders Category	524070	7	4	11
Governance Pillar	Shareholders Category	531010	7	4	11
Governance Pillar	Shareholders Category	532020	7	4	11
Governance Pillar	Shareholders Category	532030	7	4	11
Governance Pillar	Shareholders Category	532040	7	4	11
Governance Pillar	Shareholders Category	532050	7	4	11
Governance Pillar	Shareholders Category	533010	7	4	11
Governance Pillar	Shareholders Category	533020	7	4	11
Governance Pillar	Shareholders Category	534020	7	4	11
Governance Pillar	Shareholders Category	534030	7	4	11
Governance Pillar	Shareholders Category	541010	7	4	11
Governance Pillar	Shareholders Category	541020	7	4	11
Governance Pillar	Shareholders Category	543010	7	4	11
Governance Pillar	Shareholders Category	544010	7	4	11
Governance Pillar	Shareholders Category	551010	7	4	11
Governance Pillar	Shareholders Category	551020	7	4	11
Governance Pillar	Shareholders Category	553010	7	4	11
Governance Pillar	Shareholders Category	555010	7	4	11
Governance Pillar	Shareholders Category	556010	7	4	11
Governance Pillar	Shareholders Category	561010	7	4	11
Governance Pillar	Shareholders Category	561020	7	4	11
Governance Pillar	Shareholders Category	562010	7	4	11

Governance Pillar	Shareholders Category	562020	7	4	11
Governance Pillar	Shareholders Category	571010	7	4	11
Governance Pillar	Shareholders Category	571020	7	4	11
Governance Pillar	Shareholders Category	571040	7	4	11
Governance Pillar	Shareholders Category	571050	7	4	11
Governance Pillar	Shareholders Category	574010	7	4	11
Governance Pillar	Shareholders Category	591010	7	4	11
Governance Pillar	Shareholders Category	591020	7	4	11
Governance Pillar	Shareholders Category	591030	7	4	11
Governance Pillar	Shareholders Category	591040	7	4	11
Governance Pillar	Shareholders Category	601010	7	4	11
Governance Pillar	Shareholders Category	601020	7	4	11
Governance Pillar	Management Category	501010	18	13	31
Governance Pillar	Management Category	501020	18	13	31
Governance Pillar	Management Category	501030	18	13	31
Governance Pillar	Management Category	502010	18	13	31
Governance Pillar	Management Category	503010	18	13	31
Governance Pillar	Management Category	511010	18	13	31
Governance Pillar	Management Category	512010	18	13	31
Governance Pillar	Management Category	512020	18	13	31
Governance Pillar	Management Category	513010	18	13	31
Governance Pillar	Management Category	513020	18	13	31
Governance Pillar	Management Category	521010	18	13	31
Governance Pillar	Management Category	521020	18	13	31
Governance Pillar	Management Category	522010	18	13	31
Governance Pillar	Management Category	522020	18	13	31
Governance Pillar	Management Category	522030	18	13	31
Governance Pillar	Management Category	524050	18	13	31
Governance Pillar	Management Category	524060	18	13	31
Governance Pillar	Management Category	524070	18	13	31
Governance Pillar	Management Category	531010	18	13	31
Governance Pillar	Management Category	532020	18	13	31
Governance Pillar	Management Category	532030	18	13	31
Governance Pillar	Management Category	532040	18	13	31
Governance Pillar	Management Category	532050	18	13	31
Governance Pillar	Management Category	533010	18	13	31
Governance Pillar	Management Category	533020	18	13	31
Governance Pillar	Management Category	534020	18	13	31
Governance Pillar	Management Category	534030	18	13	31
Governance Pillar	Management Category	541010	18	13	31
Governance Pillar	Management Category	541020	18	13	31
Governance Pillar	Management Category	543010	18	13	31
Governance Pillar	Management Category	544010	18	13	31

Governance Pillar	Management Category	551010	18	13	31
Governance Pillar	Management Category	551020	18	13	31
Governance Pillar	Management Category	553010	18	13	31
Governance Pillar	Management Category	555010	18	13	31
Governance Pillar	Management Category	556010	18	13	31
Governance Pillar	Management Category	561010	18	13	31
Governance Pillar	Management Category	561020	18	13	31
Governance Pillar	Management Category	562010	18	13	31
Governance Pillar	Management Category	562020	18	13	31
Governance Pillar	Management Category	571010	18	13	31
Governance Pillar	Management Category	571020	18	13	31
Governance Pillar	Management Category	571040	18	13	31
Governance Pillar	Management Category	571050	18	13	31
Governance Pillar	Management Category	574010	18	13	31
Governance Pillar	Management Category	591010	18	13	31
Governance Pillar	Management Category	591020	18	13	31
Governance Pillar	Management Category	591030	18	13	31
Governance Pillar	Management Category	591040	18	13	31
Governance Pillar	Management Category	601010	18	13	31
Governance Pillar	Management Category	601020	18	13	31
Governance Pillar	Csr Strategy Category	501010	8	0	8
Governance Pillar	Csr Strategy Category	501020	8	0	8
Governance Pillar	Csr Strategy Category	501030	8	0	8
Governance Pillar	Csr Strategy Category	502010	8	0	8
Governance Pillar	Csr Strategy Category	503010	8	0	8
Governance Pillar	Csr Strategy Category	511010	8	0	8
Governance Pillar	Csr Strategy Category	512010	8	0	8
Governance Pillar	Csr Strategy Category	512020	8	0	8
Governance Pillar	Csr Strategy Category	513010	8	0	8
Governance Pillar	Csr Strategy Category	513020	8	0	8
Governance Pillar	Csr Strategy Category	521010	8	0	8
Governance Pillar	Csr Strategy Category	521020	8	0	8
Governance Pillar	Csr Strategy Category	522010	8	0	8
Governance Pillar	Csr Strategy Category	522020	8	0	8
Governance Pillar	Csr Strategy Category	522030	8	0	8
Governance Pillar	Csr Strategy Category	524050	8	0	8
Governance Pillar	Csr Strategy Category	524060	8	0	8
Governance Pillar	Csr Strategy Category	524070	8	0	8
Governance Pillar	Csr Strategy Category	531010	8	0	8
Governance Pillar	Csr Strategy Category	532020	8	0	8
Governance Pillar	Csr Strategy Category	532030	8	0	8
Governance Pillar	Csr Strategy Category	532040	8	0	8
Governance Pillar	Csr Strategy Category	532050	8	0	8

Governance Pillar	Csr Strategy Category	533010	8	0	8
Governance Pillar	Csr Strategy Category	533020	8	0	8
Governance Pillar	Csr Strategy Category	534020	8	0	8
Governance Pillar	Csr Strategy Category	534030	8	0	8
Governance Pillar	Csr Strategy Category	541010	8	0	8
Governance Pillar	Csr Strategy Category	541020	8	0	8
Governance Pillar	Csr Strategy Category	543010	8	0	8
Governance Pillar	Csr Strategy Category	544010	8	0	8
Governance Pillar	Csr Strategy Category	551010	8	0	8
Governance Pillar	Csr Strategy Category	551020	8	0	8
Governance Pillar	Csr Strategy Category	553010	8	0	8
Governance Pillar	Csr Strategy Category	555010	8	0	8
Governance Pillar	Csr Strategy Category	556010	8	0	8
Governance Pillar	Csr Strategy Category	561010	8	0	8
Governance Pillar	Csr Strategy Category	561020	8	0	8
Governance Pillar	Csr Strategy Category	562010	8	0	8
Governance Pillar	Csr Strategy Category	562020	8	0	8
Governance Pillar	Csr Strategy Category	571010	8	0	8
Governance Pillar	Csr Strategy Category	571020	8	0	8
Governance Pillar	Csr Strategy Category	571040	8	0	8
Governance Pillar	Csr Strategy Category	571050	8	0	8
Governance Pillar	Csr Strategy Category	574010	8	0	8
Governance Pillar	Csr Strategy Category	591010	8	0	8
Governance Pillar	Csr Strategy Category	591020	8	0	8
Governance Pillar	Csr Strategy Category	591030	8	0	8
Governance Pillar	Csr Strategy Category	591040	8	0	8
Governance Pillar	Csr Strategy Category	601010	8	0	8
Governance Pillar	Csr Strategy Category	601020	8	0	8

Appendix D

This table presents a comprehensive list of the codes and names of 61 industry groups as defined by Refinitiv. In our analyses, we focus on 49 of these industry groups, excluding 7 that have been introduced after the 2020 scoring methodology change. Additionally, 3 of the industry groups largely contributed to the creation of these 7 groups, which are also excluded from our analyses. Lastly, 2 industry groups have been excluded for insufficient information or because no firm belongs to it. We have retained the 4 industry groups that underwent a simple change in nomenclature for our analyses.

Industry Group Code	Industry Group Name	Notes
521010	Aerospace & Defense	
531010	Automobiles & Auto Parts	
551010	Banking Services	
541010	Beverages	
562020	Biotechnology & Medical Research	
511010	Chemicals	
501010	Coal	
555010	Collective Investments	Unavailable control variables
571020	Communications & Networking	
571060	Computers, Phones & Household Electronics	This industry group has mostly contributed to the construction of the newly insterted industry groups
522010	Construction & Engineering	
512020	Construction Materials	
544010	Consumer Goods Conglomerates	The old industry group code is: 523010
513020	Containers & Packaging	
522020	Diversified Industrial Goods Wholesale	
534020	Diversified Retail	
591010	Electric Utilities & IPPs	
571040	Electronic Equipment & Parts	
573010	Financial Technology (Fintech) & Infrastructure	This industry group has been introduced shortly after the 2020 scoring change
543010	Food & Drug Retailing	
541020	Food & Tobacco	
524050	Freight & Logistics Services	
621010	Government Activity	This industry group has been introduced shortly after the 2020 scoring change
561010	Healthcare Equipment & Supplies	
561020	Healthcare Providers & Services	
532030	Homebuilding & Construction Supplies	
533010	Hotels & Entertainment Services	
532040	Household Goods	

611010	Institutions, Associations & Organizations	This industry group has been introduced shortly after the 2020 scoring change
553010	Insurance	
571070	Integrated Hardware & Software	This industry group has been introduced shortly after the 2020 scoring change
551020	Investment Banking & Investment Services	
556010	Investment Holding Companies	
532050	Leisure Products	
521020	Machinery, Tools, Heavy Vehicles, Trains & Ships	
533020	Media & Publishing	
512010	Metals & Mining	
631010	Miscellaneous Educational Service Providers	This industry group has been introduced shortly after the 2020 scoring change
591040	Multiline Utilities	
591020	Natural Gas Utilities	
571050	Office Equipment	
501020	Oil & Gas	
501030	Oil & Gas Related Equipment and Services	
513010	Paper & Forest Products	
524060	Passenger Transportation Services	
542010	Personal & Household Products & Services	This industry group has mostly contributed to the construction of the newly insterted industry groups
562010	Pharmaceuticals	
631030	Professional & Business Education	This industry group has been introduced shortly after the 2020 scoring change
522030	Professional & Commercial Services	
601010	Real Estate Operations	The old industry group code is: 554020
502010	Renewable Energy	
601020	Residential & Commercial REITs	The old industry group code is: 554030
631020	School, College & University	This industry group has been introduced shortly after the 2020 scoring change
571010	Semiconductors & Semiconductor Equipment	
572010	Software & IT Services	This industry group has mostly contributed to the construction of the newly insterted industry groups
534030	Specialty Retailers	
574010	Telecommunications Services	The old industry group code is: 581010
532020	Textiles & Apparel	
524070	Transport Infrastructure	
503010	Uranium	No firm belonging to this industry group in our dataset
591030	Water & Related Utilities	

Appendix E

Panel A: T-tests for the difference in average disclosure percentage between the pre- and post-period. The post period indicator equals 1 in years 2020 and 2021, and 0 in 2019 (all data come from Refinitiv 2.0). Boolean KPIs equal to "NO" are considered as missing values.

	Post-period observations	Pre-period observations	Post-period average disclosed values	Pre-period average disclosed values	Difference Post-Pre	Std Error	T value	p value
Innovation Category	3300	1777	0.293	0.246	0.047	0.010	4.650	0.000
Emissions Category	3594	1944	0.272	0.207	0.065	0.007	9.200	0.000
Resource Use Category	3591	1942	0.347	0.272	0.075	0.009	8.900	0.000
Environment Pillar	3594	1944	0.308	0.24	0.069	0.007	9.500	0.000
Workforce Category	3594	1944	0.403	0.334	0.07	0.005	15.100	0.000
Community Category	3594	1944	0.747	0.712	0.035	0.005	8.150	0.000
Product Responsibility Category	3594	1944	0.379	0.349	0.03	0.005	5.650	0.000
Human Rights Category	3594	1944	0.413	0.307	0.105	0.011	10.300	0.000
Social Pillar	3594	1944	0.471	0.407	0.064	0.005	14.350	0.000
Shareholders Category	3594	1944	0.934	0.936	-0.002	0.003	-0.600	0.558
Management Category	3594	1944	0.834	0.821	0.013	0.002	8.000	0.000
Csr Strategy Category	3594	1944	0.318	0.223	0.096	0.008	11.700	0.000
Governance Pillar	3594	1944	0.773	0.75	0.024	0.002	11.400	0.000
Es Overall	3594	1944	0.412	0.348	0.065	0.005	12.350	0.000
Esg Overall	3594	1944	0.560	0.513	0.047	0.004	12.450	0.000

Panel B: T-tests for the difference in average missing values between the pre- and post-period. The post period indicator equals 1 in years 2020 and 2021, and 0 in 2019 (all data come from Refinitiv 2.0). Variables consider Boolean KPIs equal to "NO" as missing values.

	Post-period observations	Pre-period observations	Post-period average disclosed values	Pre-period average disclosed values	Difference Post-Pre	Std Error	T value	p value
Innovation Category	3300	1777	0.321	0.272	0.050	0.011	4.500	0.000
Emissions Category	3594	1944	0.306	0.231	0.075	0.007	9.900	0.000
Resource Use Category	3591	1942	0.350	0.272	0.077	0.009	9.100	0.000
Environment Pillar	3594	1944	0.329	0.256	0.073	0.007	9.950	0.000
Workforce Category	3594	1944	0.452	0.354	0.098	0.006	15.850	0.000
Community Category	3594	1944	0.820	0.790	0.030	0.004	7.200	0.000
Product Responsibility Category	3594	1944	0.481	0.448	0.034	0.007	5.100	0.000
Human Rights Category	3594	1944	0.413	0.307	0.105	0.011	10.300	0.000
Social Pillar	3594	1944	0.547	0.475	0.072	0.005	14.050	0.000
Shareholders Category	3594	1944	0.920	0.911	0.009	0.003	2.650	0.008
Management Category	3594	1944	0.734	0.715	0.020	0.002	9.750	0.000
Csr Strategy Category	3594	1944	0.318	0.223	0.096	0.008	11.700	0.000
Governance Pillar	3594	1944	0.673	0.637	0.036	0.003	12.750	0.000
Es Overall	3594	1944	0.455	0.383	0.072	0.006	12.400	0.000
Esg Overall	3594	1944	0.540	0.484	0.057	0.005	13.050	0.000

Panel C: T-tests for the difference in average disclosure percentage between the pre- and post-period. The post period indicator equals 1 in years 2020 and 2021, and 0 in 2019 (all data come from Refinitiv 2.0). Only Float KPIs are considered in this table.

	Post-period observations	Pre-period observations	Post-period average disclosed values	Pre-period average disclosed values	Difference Post-Pre	Std Error	T value	p value
Innovation Category	780	417	0.072	0.072	0.001	0.013	0.000	0.982
Emissions Category	3367	1815	0.188	0.150	0.037	0.009	4.400	0.000
Resource Use Category	3367	1815	0.342	0.279	0.062	0.011	5.500	0.000
Environment Pillar	3367	1815	0.237	0.192	0.044	0.009	5.250	0.000
Workforce Category	3594	1944	0.370	0.319	0.052	0.005	11.450	0.000
Community Category	3594	1944	0.290	0.222	0.068	0.012	5.600	0.000
Product Responsibility Category	3089	1666	0.072	0.059	0.013	0.007	1.900	0.057
Social Pillar	3594	1944	0.343	0.293	0.050	0.005	11.350	0.000
Shareholders Category	3594	1944	0.960	0.979	-0.018	0.003	-7.400	0.000
Management Category	3594	1944	0.972	0.968	0.004	0.002	2.200	0.028
Governance Pillar	3594	1944	0.969	0.971	-0.001	0.002	-0.700	0.496
Es Overall	3594	1944	0.318	0.269	0.049	0.005	9.850	0.000
Esg Overall	3594	1944	0.603	0.577	0.026	0.003	8.100	0.000

CHAPTER 3

Is it really silence? Disclosure externalities of allied peers on investments

I. INTRODUCTION

Firms disclose a considerable amount of information about their business strategy, customer demand, cost and supply conditions. Such information can impact on the investment decisions of other firms, in particular when they belong to the same peer group. Belonging to the same sector, for instance, implies that a firm shares more or less the same conditions in terms of customer demand and supplier relationships, labor market and input costs (Roychowdhury et al., 2019). If a firm discloses information on such economic conditions, other firms can benefit from such information as long as they belong to the same peer group. Indeed, previous research has found that the composition of an industry, in terms of firms that publicly disclose more or less information, impacts on the industry's information environment (Badertscher et al., 2013). In particular, Badertscher and colleagues have found that "greater public firm presence in an industry can increase the responsiveness of firms' investment to investment opportunities." The higher responsiveness of non-public firms has been attributed to the fact that public firms are subject to more mandatory disclosure than private firms and that, in general, disclose voluntarily more information to the market. Given the higher levels of disclosure by public firms, there is more transparency in the market, higher levels of information and, therefore, less uncertainty. The firms that can mostly benefit from this reduced level of uncertainty are the ones that belong to the same peer group. In particular, private firms (and also public firms) show higher investment sensitivity to investment opportunities when there are more public firms in a certain sector, due to the lower level of investment uncertainty stemming from such higher levels of disclosure.

In this research proposal, I aim to investigate whether another characteristic of an industry affects the investment uncertainty faced by market participants: the presence of strategic alliances. I focus on whether alliances, by altering firms' disclosure behavior, influence the investment sensitivity of non-allied firms and the forecast accuracy of financial analysts. Strategic alliances have become a widespread feature of modern corporate strategy, particularly in high-innovation and high-risk environments. Joint ventures alone account for over $5 trillion in annual investments (Bamford 2017), and nearly 40% of the revenues of U.S. public companies in 2010 were generated through alliances (Greve et al. 2014). These alliances enable firms to pool resources together to achieve common goals (Gulati and Singh 1998), reduce dependence on external resources (Hillman et al. 2009), while increasing interdependence among alliance members (Barnett and Hoffman 2008). While prior research has documented the firm-level benefits of alliances, such as private information exchange and technology transfers, less is known about the potential spillover effects on firms that are not part of these alliances. I build on recent findings by Kepler (2021), who shows that firms that engage in alliances tend to reduce public disclosure. Specifically, these firms issue fewer forward-looking management forecasts (e.g., earnings, sales, investment) and provide less qualitative information in their 8-K filings, particularly regarding market conditions and demand. I aim to examine whether this reduction in public disclosure affects the broader informational environment of the industry, and whether it creates informational disadvantages for non-allied firms and analysts relying on public signals. Stated shortly, the research question is:

Does the presence of firm alliances in an industry impact on peer firms' investment uncertainty?

Answering this question is important because firms often rely on peer behavior and industry trends when making investment decisions. Prior work shows that firms mimic the

financial and strategic behavior of their peers, particularly under uncertainty (Leary and Roberts 2014; Foucault and Fresard 2014). Yet, when alliances concentrate private information within a subset of firms, the resulting asymmetric information environment may weaken such peer learning. This could reduce investment sensitivity for non-allied firms, particularly when alliance activity is frequent or opaque. In this context, strategic alliances may generate information exclusion effects, where non-participating firms are left with less informative data for planning investments.

Indeed, in light of the findings of Kepler (2021), I would expect that the higher the alliances proportion in an industry, the higher the investment uncertainty, which can be noticed by lower investment sensitivity of peer firms not engaging in alliances and less accurate capex forecasts of financial analysts. However, engaging in alliances can be by itself considered as a signal of available investment opportunities and, in turn, may decrease the investment uncertainty. Indeed, announced alliances have a signaling role for stakeholders (Jolink and Niesten, 2020) and financial analysts (Jensen, 2004), given that they are observable and management exerts some control over the alliance formation (Spence, 1974). Plus, they have an informative role for stock market participants, given that alliance announcements typically elicit positive market reaction (McConnell and Nantell, 1985; Chan, Kensinger, Keown and Martin, 1997; Balakrishnan and Koza, 1993) and higher analyst coverage (Jensen, 2004). Therefore, alliance announcements convey important information that can make non-allied peers and financial analysts learn about existing growth opportunities.

In doing so, I would extend Kepler's (2021) findings that firms entering alliances reduce public disclosure of market and demand-related information, by testing whether such withheld information has any consequence for other market participants. If reduced disclosure primarily disadvantages non-allied firms but not analysts, this would offer new insight into how alliances

create informational advantages. Such a result would suggest that alliances benefit member firms not only through operational synergies but also by reducing the strategic value of public information to their competitors. Conversely, if analysts and peer firms are both affected, it would imply that allied firms provide unintended valuable market signaling when they reduce disclosure post-alliance, thus limiting one potential benefit of strategic alliances.

I plan to use a sample of alliances in the US over the 1994 – 2020 period. Firstly, I would test whether, as alliance proportion in a given industry increases, the investment sensitivity of non-allied peer firms decreases or not, using a model drawn from Badertscher et al. (2013), Tobin's Q sensitivity and a model of investment efficiency provided by Biddle et al. (2009). Secondly, I would test whether the alliance proportion impacts on the accuracy of financial analysts' forecasts of non-allied firms. Thirdly, I would test whether the number of alliances impact on the accuracy of financial analysts' forecasts of the focal firms, perhaps suggesting that private communication increases not only among allied firms but also between the allied firm and the analyst following. The last two tests would start from a later period, given the low diffusion of capex forecasts of financial analysts until the last decade (Choi et al. 2020).

Moreover, to better disentangle the mechanisms through which alliances can impact on firms' investment uncertainty, I would employ some cross-sectional tests both at the alliance level and at the industry level. Then, in the additional tests section, I would use an exogenous shock to alliance formation propensity as a falsification test to confirm (or not) my prediction regarding the lower investment sensitivity of non-allied peers. In particular, in 7 States during the sample period there has been a decrease in the opportunity cost of alliance formation due to a change in corporate income reporting rule. Namely, some States switched from separate reporting rules to a combined reporting rule, which implies that companies conducting their business in a State cannot shift their

income to subsidiaries in other States with favorable corporate tax rates. This decreases the opportunity cost of alliance formation, given that it increases the availability of assets to be allocated to the alliance (Bodnaruk et al., 2013). Such tax change impacts on firms which are headquartered in the seven States. Therefore, alliances that are formed there are not an actual signal of unobserved investment opportunities that non-allied firms have not noticed or, at least, such growth opportunities are less relevant than others (given that firms preferred to avoid taxes rather than engage in alliances). Hence, I expect that the informative signals about growth opportunities stemming from alliances that have been announced by firms headquartered in such States exhibit a stronger effect on non-allied peers, leading to lower investment sensitivity (only the less information channel would hold here). However, this test can be run only on firms that are not headquartered in such States, given that this taxation change may impact on the investment level of the focal firms (e.g.: Asiri et al., 2020). Clearly, this does not rule out potential endogeneity concerns, but can help rule out the fact that alliances decrease (or not) investment uncertainty, to the extent that they have informational value about growth opportunities.

This study contributes to the literature in several ways: firstly, it contributes to the literature on information transfers and its effects on peer firms' investments (e.g., Biddle and Hilary 2006; Biddle et al. 2009; Chen et al. 2011). In particular, the proportion of alliances in an industry could be another setting in which firms can alter their investment behavior, in addition to the presence of public firm presence (Badertscher et al., 2013). Hence, I also respond to the call by Roychowdhury et al. (2019) on more research on the learning channel, through which financial reporting information impacts on management decisions on investment opportunities.

Secondly, most of the literature in accounting focuses on earnings forecasts and, to a limited extent, sales and cash flow forecasts (for instance, DeFond and Hung, 2003), although capex

forecasts are becoming more and more common in the last years (Choi et al., 2020). Therefore, only few studies addressed the characteristics of capex. The most relevant recent papers are Choi et al., (2020) and Bae et al. (2021). Both show that firms may learn from capex forecasts of financial analysts, and exhibit greater investment efficiency. In particular, Bae et al. (2021) focus on the feedback effect on management's capex forecasts from financial analysts' capex forecasts, which ultimately leads to higher investment efficiency and financial performance of the focal firms, whereas Choi et al. (2020) focus only on financial analysts' capex forecasts and their effects on investment efficiency of the focal firms. They are complementary studies to my research, given that they provide support the argument that financial analysts may be more informed about investment opportunities and could issue more accurate capex forecasts, both for allied firms (supporting my third prediction) and non-allied firms (supporting the null hypothesis of my second prediction). Plus, my research relates to the conditions under which such capex forecasts can be more or less accurate and for which kind of firms (allied or non-allied companies), which is left unexplored by both studies.

Thirdly, alliances have been typically considered as a means through which companies could deal with uncertainty and provide advantages for alliance participants (for instance: Reuer and Koza, 2000a; Beckman et al, 2004), and not as a potential channel through which uncertainty could increase and impact on non-allied companies. Thus, to a lesser extent, this study contributes to the management literature on alliances.

II. THEORETICAL BACKGROUND AND HYPOTHESES BUILDING

Strategic alliances occur when two or more parties pool together some property and strategic decision rights, while maintaining separate ownership and control over other existing assets (Kepler, 2021; Gibbons and Roberts, 2013). A more precise definition comes from Gulati

and Singh (1998): "*any voluntarily initiated cooperative agreement between firms, that involves exchange, sharing, or co development, and it can include contributions by partners of capital, technology, or firm specific assets*". Alliances can involve equity sharing agreements, where a new entity is formed and the two allies share its ownership, or can be contractual agreements. Among such agreements, there are licensing and cross-licensing agreements, manufacturing agreements, R&D agreements, marketing and distribution agreements or strategic alliances. Given that, when engaging in alliances, firms have to pool together resources to create value for both parties (Anand and Khanna, 2000; Gulati, 1995), and given the information asymmetry among partners and the tendency to opportunistic behavior (Williamson, 1975; Brandenburger and Nalebuff, 1996), the two parties need to communicate, coordinate and share information. This information sharing activity is central to the research by Kepler (2021), that has found that allied firms tend to disclose less information publicly. Such lower disclosure is even lower when the parties have more private communication (i.e.: new partnerships, more participants, joint ventures, R&D or manufacturing), or can have higher benefits from coordination in an industry (i.e.: the lower the competition, the less alternative private communication channels and the more the incentives to coordinate). The public disclosure that Kepler has found to be decreasing is related to both quantitative forecasts (earnings, sales, investments, etc.) and qualitative topics in firms' 8Ks (production and market demand information). Such management quantitative forecasts are often value relevant (Beyer et al. 2010; Goodman et al. 2014). In particular, forecasts of earnings, future sales, cost of sales, inventories, etc., can be relevant to compute more precise estimates of aggregate demand and supply conditions (Bonsall IV et al., 2013), given that such conditions are interrelated within an industry (Mitchell and Mulherin, 1996; Admati and Pleiderer 2000). This implies that peer disclosures can increase the information available to the management about future demand and

market conditions. This kind of information is fundamental, given that there is a certain degree of uncertainty in investment decisions. Uncertainty is basically "the inability to predict the exact outcome of an investment decision" (Ferracuti and Stubben, 2019). Whenever there is uncertainty about the outcome of an investment, there is an option value in delaying it when its cost is not fully recoverable (McDonald and Siegel, 1986; Dixit and Pindyck, 1994), because it allows to gather more information on the investment value before committing not-fully recoverable resources (Bernanke, 1983). Such option value increases as uncertainty increases (McDonald and Siegel, 1986; Dixit and Pindyck, 1994).

Therefore, considering that peer disclosures can reduce uncertainty about expected future cash flows from an investment and lower investment adjustment costs (Dixit and Pindyck 1994), managers respond faster to investment opportunities and make better investment decisions (Bond and Van Reenen, 2007; Bloom et al. 2007; Badertscher et al. 2013).

Hence, to the extent that alliances among competitors reduce their public disclosure (Kepler, 2021), I predict that increased uncertainty (through greater alliance activities) decreases peer firms' investment sensitivity. The formal hypothesis is the following:

HP 1*: a higher level of peer alliances in a given industry is associated with a decrease in investment sensitivity by not allied peer firms*.

However, what makes the null hypothesis credible is that the formation and announcement of an alliance can be by itself considered as a signal of investment opportunity. Therefore, it can also be the case that the higher the alliance proportion in a given industry, the higher the investment sensitivity of non-allied peers. In other words, if a firm observes that some of its competitors are "joining forces" into an alliance agreement and observes the "object" (e.g., development of a new product, introduction to other distribution channels, etc.) of the alliance, the focal firm can actually

infer that there is some room in the market to increase its investments, i.e., it could in fact increase its investment sensitivity to its growth opportunities in response to a higher alliance proportion. This implies that, if a firm that faces uncertainty regarding an investment opportunity notices that there are competitors forming strategic alliances, it can decide not to wait before investing, thereby being more sensitive to growth opportunities. Indeed, previous research has shown that alliances may have a signaling role for stakeholders (Jolink and Niesten, 2020) and are also a signal of the "quality" of the participants in the alliance agreement, given that they experience a higher analyst coverage (Jensen, 2004). However, considering also that the alliance announcements typically elicit positive market reaction (McConnell and Nantell, 1985; Chan, Kensinger, Keown and Martin, 1997), this implies that such announcements convey information that is related not only to the quality of the participants, but also on the activity (i.e., the object of the alliance). Given the contracting nature of alliances and that there is not a formal registration thereof, we can be aware only of alliances that have been publicly disclosed, which are the only ones that can reduce the investment uncertainty, by signaling the existence of unexploited growth opportunities. Clearly, it is possible that the two effects (lower disclosure and higher learning from peer alliance announcements) may offset each other, leading to no association.

Moreover, it is also possible that the investment uncertainty due to more alliances impacts also on another set of stakeholders, i.e., financial analysts. These capital market intermediaries use not only financial information but also nonfinancial information (Simpson, 2010) to evaluate securities and make predictions, thereby playing an important role in improving market efficiency (Groysberg and Lee, 2008; Michaely and Womack, 1999; Pollock and Rindova, 2003; Stickel, 1995), given that they are expert about the industries and products they cover (Zuckerman, 1999). However, their predictions may be affected by the less information available (both lower

management forecasts and lower demand and supply condition disclosure) due to alliances and, like non-allied peers, can be more uncertain about the investments non-allied firms can undertake, thereby leading to less precise forecasts. An alternative and analogous argument can be that they are actually aware of existing growth opportunities that non-allied firms ignore, thereby they forecast an "optimal" amount of capex which deviates from the actual amount. Therefore:

HP 2*: a higher level of peer alliances in a given industry is associated with a decrease in capex forecast accuracy of non-allied firms by financial analysts*.

In this case, the null hypothesis is credible because financial analysts, thanks to their industry-specific expertise, are more likely to be more informed than managers about the environment they compete in (e.g., Kadan et al. 2012), considering also that they have frequent occasions to interact privately with firms, through conference calls, telephone conversations and the like (Green et al., 2014a; 2014b; Soltes, 2014; Kirk and Markov, 2016). This decreases their reliance on publicly available information. Hence, it is possible that they incorporate into their predictions the capex they expect from non-allied peers, confirming that analysts forecast "actual rather an optimal capex" (Jayaraman and Wu, 2020).

As for allied firms, previous research has shown that they receive more analyst coverage (Jensen, 2004) and disclose less information publicly while increasing private communications with peers (Kepler, 2021). Hence, to the extent that the announcements of alliances have informational value for the analysts about growth opportunities that the allies are trying to capture, the capex forecasts should be more accurate, despite the lower availability of publicly disclosed information. Moreover, analysts rely also on private communication with firms and, perhaps, they may increase it to collect more information. Indeed, Brown et al. (2015) found that industry knowledge is the main dimension upon which analysts' compensation is based. Thus, accurate

capex forecasts could be a good way to demonstrate their industry knowledge to investors. Therefore, capex forecast accuracy (i.e., lower investment uncertainty from the analyst viewpoint) should increase as the number of alliances a firm engages in increases. Formally:

HP 3*: a higher number of alliances of a firm is associated with an increase in capex forecast accuracy by financial analysts*.

The null hypothesis is credible because of the lower disclosure channel of allied peers. Understanding which effect prevails in all the above hypotheses is, ultimately, an empirical question.

III. SAMPLE AND RESEARCH DESIGN

I would start from a sample of alliances taken from *Securities Data Corporation (SDC) Platinum's Alliances and Joint Venture* database over the 1990 – 2020 period, given that before 1990 there are few alliances reported (Anand & Khanna, 2000). Then, the alliance dataset has to be merged with Compustat, CRSP and I/B/E/S to have the financials of both the companies involved in the alliances and their not-allied peers, such as the size, ROA, cash, leverage, etc., and data on financial analysts. Such merge between SDC Platinum and WRDS databases can be made by extracting individual firm-level details from each alliance in the database and match them to WRDS through the CUSIP code.

The baseline model I would employ draws from Badertscher et al. (2013):

$$INV_{i,t} = \beta_0 + \beta_1 SalesGrowth_{i,t-1} + \beta_2 AllianceProp_{j,t-1} + \beta_3 SalesGrowth_{i,t-1} \times AllianceProp_{j,t-1} + Controls + \varepsilon_{i,t}$$

The dependent variable is the investment amount of firm i at time t. It is computed as annual increase in fixed assets scaled by total assets at the beginning of the year (Asker et al., 2012; Badertscher et al., 2013). Moreover, I would also employ a compounded measure of investment:

the sum of investments in R&D, investments in capex and acquisition expenditure, less cash receipts from sales of PP&E, all scaled by lagged total assets (e.g., Biddle et al., 2009). This is a comprehensive measure of all investments, but I would like to test each of them separately, given that there may be different effects. For instance, it may be the case that if the alliance proportion is higher, non-allied peers may decrease their capex because they have less information to invest efficiently, but they could increase their R&D expenses to acquire more information. In other words, they could be delaying their current capex due to the higher uncertainty stemming from the lower disclosure of allied peers, while they try to figure out new growth opportunities through higher R&D expenditure. Conversely, if they increase their capex and decrease their R&D expense, they interpret the higher alliance proportion as a signal of currently available investment opportunities.

Sales growth is a commonly used accounting proxy for investment opportunities of a focal firm (among others: Lehn and Poulsen, 1989; Shin and Stulz, 1998; Whited, 2006; Whited and Wu, 2006; Bloom et al., 2007; Asker et al., 2012). Plus, I would also employ Tobin's q as a price-based proxy for investment opportunity, defined as market value of assets divided by book value of assets, consistently with other studies (e.g., Levine et al., 2016), instead of sales growth.

Given that the ideal measure for alliance proportion would be a ratio, for each industry, between the number of allied firms and the total number of firms in the same sector, I would proceed as follows: the total number of firms on Compustat falling within that sector is the denominator of such measure, which, ideally, proxies for the total number of firms in that industry. As for the numerator, given that I need the number of allied peers, I would proxy for it as follows: starting from the SDC sample (from 1990), I would drop alliances that do not entail at least two firms which are also part of the denominator, thereby considering only horizontal alliances.

Alternatively, it is possible to consider also the alliances between a firm in the focal sector and another firm in another sector (i.e., vertical alliances) as part of the numerator (i.e., without dropping alliances between firms in different industries). Therefore, the numerator is the number of peers that have an alliance agreement currently in place in that particular year. However, given that the sample period and the information about alliances start from 1990, it may be the case that I am not considering the alliances that started before 1990. Hence, given that the literature on alliances states that alliances generally last for three years (Phelps, 2003) and typically no more than five years (Kogut, 1988), the sample period would start from 1993, so that I can reasonably assume that alliances that have been formed before 1990 have already been terminated, and adjust the alliances formed after 1990 accordingly. This assumption has been used by previous research because alliance termination dates are not always reported (Rosenkopf and Schilling, 2007) and, therefore, I would follow the same conservative approach when the termination date is not available. Alternative windows can be used, spanning from three years to five years (Bae and Gargiulo, 2003; Gulati and Gargiulo, 1999). This *AllianceProp* measure, in the spirit of Badertscher et al. (2013), can also be weighted by the amount of sales, leading to a ratio of allied firms' sales to total industry sales. An alternative measure of alliance proportion, which has been employed in previous research (Jensen, 2004), is the alliance density. The alliance density is defined as the total number of alliances announced in the last three years, given that alliance termination is rarely reported and alliances typically last three years (Phelps, 2003). Of course, a five-year window would be used as a robustness check.

The standard errors would be industry clustered, given that the main variable of interest is defined at the industry level. The industry can be classified both with North American Industry Classification System (NAICS), consistently with Badertscher et al. (2013), or Fama and French

industry classifications, or with SIC codes. Moreover, focusing on the alliances of firms which are on Compustat would typically lead to the exclusion of private firms. However, private firms disclose less information than public firms and, therefore, their impact on investment uncertainty would have been limited.

The control variables are mainly firm-level controls, analogously to Badertscher et al. (2013): size, ROA, cash, leverage, assets, firm and time fixed effects. Industry level controls include industry dummies and the Herfindahl Hirschman measure of industry concentration of public firms. Such concentration index can be computed from Compustat or through US Census or Economic Census or with Keil (2017) data.

To confirm the prediction I have made above, my expectation is that the interaction coefficient (β_3) will be negative and significant. This means that the investment sensitivity decreases as the alliance proportion in an industry increases. However, it may be the case that the prediction is not supported, i.e., β_3 may be positive. This implies that alliance proportion could be by themselves a signal of opportunities in the market. Therefore, a positive interaction can imply that, in presence of investment opportunities (positive *SalesGrowth*) the alliance proportion can stimulate even more investments by non-allied peers. In case the two effects offset each other, β_3 could be insignificant.

In another specification of the model, I would follow Biddle et al. (2009):

$$INV_{i,t} = \beta_0 + \beta_1 AlliancProp_{j,t-1} + \beta_2 OverI_{i,t} + \beta_3 OverI_{i,t} \times AlliancProp_{j,t-1} + Controls + \varepsilon_{i,t}$$

Where $OverI_{j,t}$ distinguishes between firms which are more or less likely to overinvest. This is done by ranking into deciles firms according to their cash balance and to their leverage (multiplied by minus one), given that firms with the highest cash balance and lowest leverage are

more likely to overinvest (Jensen, 1986; Blanchard et al., 1994; Opler et al., 1999; Myers, 1977) and then rescaling the two rankings to range between zero and one, in order to finally compute the average of ranked values of the two partitions variables. In this case, I expect that the investment efficiency decreases for non-allied peers. In this model, β_1 represents the effect of *AllianceProp* when the firm is more likely to underinvest, while $\beta_2 + \beta_3$ is the effect of *AllianceProp* when the firm is more likely to overinvest. However, it may also be the case that non-allied peers which are more likely to overinvest actually overinvest because they interpret the high number of alliances as unexploited opportunities. Thus, it is possible to get even more insights from this test.

As for the analysis of financial analysts' capex, I would employ the following model:

$$ForecastError_{i,t} = \beta_0 + \beta_1 AllianceProp_{j,t-1} + Controls + \varepsilon_{i,t}$$

Where the forecast error is the inverse measure of the forecast accuracy. The forecast error is computed as the average of the absolute errors of all forecasts made in the year for the capex, following previous research on earnings forecast accuracy (e.g.: Dhaliwal et al., 2012; Tan et al., 2011). As an alternative measure, it would be possible to employ the forecast dispersion, calculated as the standard deviation of the capex forecasts scaled by the absolute value of the forecast mean (e.g.: Graham et al., 2008). To test the hypothesis on the capex forecast accuracy on allied firms, the alliance proportion variable would be substituted by the *StrategicAlliance* variable employed by Kepler (2021) and Bodnaruk et al. (2013), where it is a continuous measure of a firm's new total strategic alliance activity during the year, and, as a robustness check, different windows would be employed (ranging from 2 to 5 years). Standard errors would be clustered by firm in this case, given that the main variable of interest is defined at the firm level. The control variables to compute the forecast accuracy would be the following: size, ROA, cash, leverage, number of analysts following the focal firm, sales growth, industry dummies and the Herfindahl Hirschman measure

of industry concentration. Lastly, it is important to note that the analysis on capex forecasts would have a different starting date, given that capex forecasts have become more common in the last decade (Choi et al., 2020).

IV. CROSS-SECTIONAL TESTS

Some cross-sectional tests can be interesting to disentangle the mechanisms.

Firstly, Kepler (2021) found that the effect is stronger when the allied peers have more private communication. In particular, as for private communication, he considered whether the alliances were joint ventures, the number of partners involved in an alliance and whether that was the first alliance with a certain partner. With the same spirit, I would consider the density of joint venture alliances (i.e., equity-sharing agreements) against the density of non-joint venture alliances (i.e., non-equity sharing agreements), expecting a more negative effect on the investment sensitivity and capex forecast accuracy of non-allied firms (and the opposite for allied partners) as the joint venture alliances density increases.

Secondly, in management literature, alliances can be distinguished also according to their purpose. Indeed, they can pursue either exploration or exploitation objectives. The latter refers to the "refinement and extension of existing competences, technologies, and paradigms" with predictable, positive and proximate returns, while the former regards "experimentation with new alternatives" with uncertain, distant and often negative returns (March, 1991). In other words, while exploration alliances aim at creating new growth opportunities, exploitation alliances aim at leveraging existing growth opportunities. Therefore, the higher the exploitation alliances density, the higher the probability that non-allied firms interpret such alliances as a signal of investment opportunity, thereby increasing (or decreasing less) investment sensitivity to growth opportunities and capex forecast accuracy for non-allied peers. In contrast, exploration alliances are more

uncertain and are less likely to lead to higher investment sensitivity by non-allied peers and capex forecast accuracy. Such distinction can be carried out by content analyzing the deal text of alliances and sorting them into exploration density and exploitation density variables. With respect to this point, I would highlight that the effect on investment sensitivity may differ according to which part of the investment is considered. More simply, it can be the case that if there are more exploration alliances, the investment sensitivity may overall decrease, overall. Nonetheless, it may stimulate higher R&D investment sensitivity, given that it may signal the existence of growth opportunities yet to be explored. Analogously, more exploitation alliances may decrease investment sensitivity, overall, while having an opposite effect on capex. As for the hypothesis related to allied firms, the variable *StrategicAlliance* would be split into "exploration" and "exploitation" alliances, to see whether there is an analogous effect on the capex forecast accuracy by financial analysts.

Thirdly, sectors may be distinguished according to whether they are high- or low-tech sectors. Indeed, uncertainty is higher in high-tech sector and, therefore, I expect to observe a stronger decrease in investment sensitivity by non-allied peers and accuracy of capex forecasts. Analogously, in low-tech industries, it is more likely that a non-allied peer may be more investment sensitive. Industries can be defined as high- or low-tech by following Benfratello et al., (2008) or, alternatively, by considering the classification provided by Kile and Phillips (2009).

Fourthly, I would test whether the investment uncertainty increases even more when the degree of investment irreversibility increases (i.e., there is higher uncertainty). For instance, it would be possible to follow Panousi and Papanikolaou (2012) and Badertscher et al. (2013), and use the industry-level ratio of expenditure on new capital goods to all capital goods, given that if more capital goods are purchased from the primary market, the investment decisions are more

irreversible. Data on this can be taken from Annual Capital Expenditures Survey published by the Census Bureau.

V. ADDITIONAL ANALYSES

Firstly, it is possible to exploit an exogenous shock in the United States that has decreased the opportunity cost of alliance formation to mitigate such concern. Indeed, some States shifted from separate reporting rule to combined reporting rule: under the former, a multistate corporate group can reduce its taxable income by isolating highly profitable parts of its business in an affiliate that is not subject to State taxes. Under the latter, instead, it is required for companies conducting business in a State to combine the profits from all related subsidiaries before determining what portion of their profits are taxable in that State. Therefore, the combined reporting rule reduces the ability of a firm to shift income to subsidiaries with favorable corporate tax rates. This reduces the incentives to rely on internal operations to transfer assets across subsidiaries in other States to minimize State-specific corporate taxes. Given that firms that engage in alliances allocate capital to the alliances, they cannot engage in such internal asset transfer. Indeed, this is an opportunity cost on alliance formation. Consequently, impeding firms to do such internal transfers lowers this opportunity cost (Bodnaruk et al., 2013; Kepler, 2021). The list of States that changed to combined reporting rules can be found on Mazerov et al. (2009). In particular, 7 States changed to the combined reporting in the sample period (a staggered adoption). Therefore, I would split the alliance density measure in two parts: one relating to alliances that have been announced by firms in these seven States and the other one relating to all other alliances, so that it would be possible to see whether the coefficient of the former is higher than the coefficient of the latter.

Secondly, I would test whether the number of alliances in an industry impacts also on earnings forecasts. I expect to see a lower effect on this measure, given that capex forecasts are

more directly linked to expected growth opportunities of firms and, thereby, reflect analysts' expectations about a firm's growth opportunities (McConnell and Muscarella, 1985; Kerstein and Kim, 1995).

Thirdly, I would compute the average frequency of management forecasts of peer firms in the same industry j as firm i to proxy for the disclosure of other firms (Seo, 2021). In this case, I would focus only on the forecasts made by allied firms in order to use either a path analysis or a structural equation model. In particular, the latter would allow to test multiple relationships simultaneously: namely, the number of alliances in an industry affects the amount of public disclosure and, ultimately, it impacts on the investment sensitivity and capex forecast accuracy.

VI. CONCLUSION AND FUTURE DIRECTIONS

The aim of this proposal is to investigate whether the presence of alliances in a certain sector can impact on the investment uncertainty, thereby decreasing the investment sensitivity of non-allied peers and capex forecast accuracy of financial analysts. As any other study, there are some limitations. Firstly, compared to Badertscher et al. (2013), that obtained a comprehensive list of all the public firms from US Census, it is not possible to have a comprehensive list of all the alliances, given that there is not a formal registration of them (Silva and Ferreira, 2007). Nonetheless, SDC Platinum is the database on alliances with the highest industry coverage (Schilling, 2008). Secondly, ruling out some endogeneity concern while researching on alliances is a very hard task, even though I try to enhance potential conclusions with the additional tests and cross-sectional analyses.

This study provides interesting avenues for further research. For instance, it would be interesting to replicate Kepler's findings in the EU and test the effects of alliance proportion on private firms. Moreover, investigating the effect of alliance proportion on investment efficiency

can be a fruitful research avenue, for instance following the approach of Aretz and Pope (2018) on capacity overhang. Further, testing whether capex forecasts are revised after an alliance is announced may be an interesting, in particular looking at whether such revisions are informative for allied or non-allied firms, perhaps having real effects on firms' behavior, thereby incorporating Jayaraman and Wu's (2020) findings on the feedback effects of capex forecasts of financial analysts. Lastly, it can be interesting to investigate whether the lower disclosure of allied firms can have other consequences on other stakeholders.

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