Climate Risk Disclosure and Mergers and Acquisitions

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Abstract

This study examines the impact of climate risk disclosures on merger and acquisition (M&A) activities in US public firms from 2001 to 2020. Leveraging the 2010 Securities and Exchange Commission (SEC) interpretive guidance as an exogenous shock, we analyze 10-K filings to understand how enhanced climate risk disclosure influences corporate takeovers. By adopting a difference-in-difference (DID) framework, we find a significant reduction in the takeover likelihood for firms beginning climate risk disclosures after the SEC 2010 interpretive guidance. The study also observes a shift in acquisition payment structures for deals acquiring these firms, with acquirers favoring stock components over cash, and identifies a decrease in synergy gains and extended deal completion times. Our analysis also reveals that transparent information environments and strong operational characteristics in policy-driven disclosing firms further decrease their attractiveness in the corporate control market. Overall, our research underscores the critical role of climate risk disclosure in shaping acquirers' decision-making processes in M&A transactions.

Keywords**:** Climate Risk; Disclosure; Mergers; 10-K; Textual Analysis

JEL classification**:** D81, G34, K32, Q54

1. Introduction

The provision of high-quality information regarding firms' climate risk exposures is crucial for informed investment decisions, enabling investors to accurate price risks and opportunities (Krueger et al., 2020). Larry Fink, CEO and Chairman of BlackRock, recognized this significance by stating, "climate risk is investment risk", in his 2020 annual letter to CEOs. Recent studies have underscored the long-term risk factors that carbon risk and environmental pollution pose to firms' returns (Bansal et al., 2017; Bolton & Kacperczyk, 2021; Hsu et al., 2020). The escalating threats posed by climate change, coupled with its potential to inflict specific damages, make climate risk disclosures increasingly valuable for users of financial statements (Hope et al., 2016). In this study, we explore the influence of climate risk disclosures on firms' most prominent investment decisions - mergers and acquisitions (M&A).

Despite heightened scrutiny on climate-related risks and the increasing disclosure mandates, investors continue to face insufficient information concerning climate risks. This limitation stems, in part, from inherent costs associated with the dissemination of climate risk information. Goldstein and Yang (2017) and Christensen et al. (2021) have shown that while both financial and non-financial disclosures can enhance stock liquidity, reduce the cost of capital, and improve pricing efficiency, they may concurrently impose undue expenses upon firms. For instance, climate risk disclosure might inadvertently reveal proprietary information about a firm's future strategy. Therefore, although many companies acknowledge that climate change affects their strategic decisions (TCFD, 2020), investors often lack sufficient information on corporate climate risks from the company, leading to information asymmetry and adverse selection (Ilhan et al., 2022). Empirical inquiries have documented that shareholders and debt holders perceive climate risk as a significant factor detrimentally influencing investment viability (Andersson et al., 2016; Chava, 2014). Therefore, a firm's

failure to disclose material climate risk may expose investors seeking credible information to significant losses (Matsumura et al., 2022).

The intensifying focus on climate risk within investors' decision-making process indicates a parallel shift in the corporate sector. Firms are beginning to integrate vital climate risk factors into their major investment and financing strategies (Bartram et al., 2022; Bolton & Kacperczyk, 2021; Boone & Uysal, 2020; Houston & Shan, 2021; Krueger et al., 2020). This integration is imperative for several reasons, in particular, in the context of M&A. First, the inherent large-scale and irreversible nature of M&A transactions necessitates comprehensive risk assessments, with climate-related factors gaining increasing prominence. Second, the relationship between climate risk disclosures and M&A activities is intricate, owning to the pronounced sensitivity to information asymmetries between potential bidders and targets in the market for corporate controls. In M&A markets, parallels can be drawn with Akerlof (1970)'s concept of the 'market for lemons' observed in product markets. Here, buyers often face significant challenges in accurately assessing the quality of potential targets, and sellers may be motivated to overstate their quality. This mismatch in information and incentives can lead to a situation where potentially beneficial transactions are not realized (Reuer & Ragozzino, 2008). Empirical studies consistently show a negative relationship between information asymmetry, represented by factors like geographic proximity, technological overlap, and cultural distance, and the likelihood of takeovers (Chondrakis, 2016; Lawrence et al., 2021; Zhang et al., 2021).

As highlighted by Goldstein and Yang (2017) and Leuz and Wysocki (2016), the extant literature on corporate takeovers presents a considerable degree of ambiguity regarding the impact of improved disclosures on information asymmetry. On the one hand, according to Verrecchia (2001), disclosure can alleviate information asymmetry, thereby promoting deal completion and facilitating the corporate control market. Conversely, enhanced disclosure

might also exacerbate information asymmetry (Kim & Verrecchia, 1994), particularly considering that climate risk disclosures tend to be multidimensional, qualitative, and primarily negative in nature (Christensen et al., 2021; Kim et al., 2022).

To establish a causal inference of climate risk disclosure on corporate acquisition activities, we utilize the exogenous regulatory shock from the 2010 Securities and Exchange Commission (SEC) interpretive guidance, which reinforced climate risk disclosures in Form 10-Ks (hereinafter referred to as 'the Guidance'). The Guidance specifies that companies should disclose any climate risk that could materially affect their business operations and financial performance (SEC, 2010). This led to a substantial increase in the number of firms reporting material climate risks, verifying the validity of our setting in which the Guidance is used as an exogenous shock to corporate climate risk disclosures (Kim et al., 2022).

We conduct a comprehensive textual analysis of 10-K filings from the SEC EDGAR database to capture firms' disclosures of climate risks. Our empirical strategy utilizes a difference-in-difference (DID) framework, which allows us to assess the changes in takeover activities before and after the implementation of regulatory guidance on climate risk disclosure. Recognizing that prior research (Dyer et al., 2017; Hope et al., 2016; Lang & Stice-Lawrence, 2015) has identified a tendency for risk disclosures in corporate filings to be generic or boilerplate, potentially enabling firms to avoid detailed reporting, our approach is designed to mitigate these concerns. Using the DID method, we categorize companies into two groups: the treatment group, consisting of firms that begin disclosing climate risks post-Guidance, and the control group, comprising firms that voluntarily disclosed climate risks prior to the Guidance and continued to do so thereafter. This methodology is designed to minimize the influence of time-invariant boilerplate language, thereby enhancing the robustness and validity of our findings.

By analyzing a sample of US public firms spanning from 2001 to 2020, we find that firms that start their initial reporting of climate risk after the implementation of Guidance experience a statistically significant reduction in the likelihood of being acquired. This finding lends support to the hypothesis that enhanced disclosure dampens acquisition activities. Our baseline results are robust to a variety of robustness tests, including analyzing with a PSM sample and a sample with alternative control group.

Furthermore, for acquisition deals involving firms that commenced reporting climate risk post-Guidance, we observe that acquirers are increasingly inclined to avoid all-cash transactions, preferring a higher stock component in their payment structures. This shift in payment methods appears to be related to risk-sharing motives. In addistion, these deals are accompanied by a discernible decrease in synergy gains and an extended timeline for deal completion.

Moreover, we explore two potential mechanisms: information asymmetry and firm operational characteristics. Our findings indicate a heightened sensitivity among acquirers to climate risk disclosures from targets with a more transparent information environment within the treatment group. These targets see a more significant reduction in takeover likelihood compared to companies with greater information asymmetry. This suggests that climate risk disclosure exacerbates, rather than mitigates, existing information asymmetries. In terms of firm's operation characteristics, we find that firms in the treatment group with better operational characteristics experience a more pronounced decrease in attractiveness in the corporate control market. This sheds light on the ongoing discussion regarding the impact of ESG factors on investment decisions, reinforcing the perspective that ESG-related issues can alter investor perceptions of a company and discount its current strong performance in market valuations.

Previous studies have centered on valuation and performance impacts of voluntary climate-related disclosures. For example, Kölbel et al. (2020) observed that the disclosure of transition risks led to an increase in credit default swap (CDS) spreads following the Paris Climate Agreement in 2015, whereas the disclosure of physical risks led to a decrease in these spreads. In another study, Plumlee et al. (2015) discovered that the quality of voluntary environmental disclosures has a positive correlation with firm value, affecting both the cash flow and cost of equity components. Dhaliwal et al. (2012) identified an improvement in analyst forecast accuracy with CSR (Corporate Social Responsibility) disclosure. However, the accurate prediction of the economic consequences of climate risk disclosure remains questionable due to complexities introduced by confounding factors (Lambert et al., 2007; Leuz & Wysocki, 2016). This is further complicated by the endogeneity inherent in the voluntary nature and diversity of topics covered in climate risk disclosures (Christensen et al., 2021). By exploring an exogeneous mandatory disclosure, we effectively address the selection and unobservable confounding problems that arise from the largely voluntary nature of climate disclosures and CSR activities.

Our study works in tandem with other investigations that concentrate on mandatory climate disclosures. Matsumura et al. (2022) found that the climate disclosure within 10-K reports, as per the SEC's 2010 interpretive guidance, was associated with lower equity costs. Ioannou and Serafeim (2017) proposed that regulatory-driven increases in sustainability disclosure correlated with rises in firm valuations, as reflected in Tobin's Q. They reached this conclusion by investigating the effects of regulations requiring the disclosure of ESG information in China, Denmark, Malaysia, and South Africa. Our research broadens the comprehension of the effects of compulsory climate risk disclosures by firms on the corporate control market, with a special emphasis on examining the Guidance.

The existing literature seldom addresses the role of mandatory disclosure in the context of acquisitions (Bonetti et al., 2020; Griffin et al., 2022). This is in contrast to the abundance of literature that examines the role of voluntary disclosure in acquisitions (Ahern & Sosyura, 2014; Amel-Zadeh & Zhang, 2015; Chen et al., 2022; Ge & Lennox, 2011; Kimbrough & Louis, 2011). There are few exceptions offering mixed results. For example, Ortiz et al. (2023) identified a positive correlation between mandatory financial disclosure by private European firms and their attractiveness as M&A targets, attributing this to reduced information asymmetry and uncertainty. In contrast, Bonetti et al. (2020) argued that mandatory disclosures about financial and ownership details in the corporate control market could slow down M&A activities due to the significant costs these disclosures impose. Similarly, research by Griffin et al. (2022) revealed that the SEC's simplification for redaction process, which allows firms to omit proprietary information by redacting their SEC filed contracts, increased their likelihood of being acquired. However, authors argue that the consequent non-disclosing increases costs of information uncertainty and adverse selection, thereby reducing offer values and increasing the number of attempts to acquisition completion for deals involving target redaction firms. Building on these diverse findings, our study uniquely investigates the economic consequences of mandatory climate risk disclosures in the corporate control market, aiming to untangle the complex effects of such disclosures on M&A activities.

Moreover, our study offers deeper insights into the impact of climate risk. Previous studies primarily focused on valuation and performance impacts of climate-related activities and performance. For instance, research by Khan et al. (2016) suggested that firms with higher sustainability ratings markedly outperform those with lower ratings on material sustainability issues. Eccles et al. (2014) demonstrated high-sustainability companies outperforming their low-sustainability counterparts across stock market performance, ROA, and ROE. Additionally, Bolton and Kacperczyk (2021) found that firms with greater total CO2 emissions (including

emission changes) secured higher returns. Griffin et al. (2017) suggested that investors view firms' greenhouse gas (GHG) emissions as a negative determinant of equity value, and Berkman et al. (2022) found a negative correlation between a 10-K measure of climate risk and firm value. In the context of mergers and acquisitions, previous studies have shown that acquirers with higher CSR performance ratings have significantly positive effects on their announcement stock returns, along with post-merger performance and long-term stock returns (Deng et al., 2013). Arouri et al. (2019) demonstrated that transactions involving firms with a strong CSR record are associated with lower uncertainty, as reflected by narrower arbitrage spreads. There are also instances of firms with high carbon risks potentially outsourcing their carbon risks to foreign entities (Bose et al., 2021), and the likelihood of a takeover is found to be higher for firms with both the lowest and highest CSR scores (Fairhurst & Greene, 2022). Our study highlights that the corporate control market responds effectively to the climate risks associated with the target entities.

Our research aims to evaluate the effectiveness of the Guidance on climate change reporting, a subject that has been involved in disputes and debates. Proponents of regulated climate risk disclosure argue that climate-related information disclosure is critical for investors to assess and price the impact of climate risk. In contrast, critics contend that these disclosures are not decision-useful, redundant, and overly burdensome. This discussion remains ongoing. In 2016, the SEC requested public input on this policy in a concept release, asking, "Are existing disclosure requirements adequate to elicit the information that would permit investors to evaluate material climate change risk?" (SEC, 2016). In March 2022, the SEC proposed a rule change that would mandate public companies to disclose certain climate-related information in their reports (SEC, 2022). However, this proposed rule has met resistance from various stakeholders, leading SEC Chair Gary Gensler in 2023 to express his openness to

"adjustments" based on public feedback. The rule has not yet been finalized or dismissed (Ho, 2023). Our study offers a response to the SEC's query and contributes to this enduring debate.

The remainder of the paper is organized as follows: Section 2 examines the existing literature and predictions. Section 3 presents a description of the data, variables construction and research design. Section 4 discusses our main findings for the baseline model and the mechanisms underpinning them. Section 5 delves into further analysis, exploring additional implications and the broader context of our results.

2. Related Literature and Predictions

2.1 Institutional Background

The SEC issued an interpretive guidance that sought to clarify the disclosure requirements related to climate risk under Regulation S-K in 2010. Regulation S-K is a SEC regulation that outlines how registrants should disclose material qualitative descriptors of their business on registration statements, periodic reports, and any other filings. This guidance, which was a significant regulatory development, emphasized the expectation for companies to disclose any climate risk that could materially impact their operational activities and financial performance. Notwithstanding, it is necessary to note that the Guidance did not mandate the disclosure of all climate risks, but only those deemed materially significant.

The Guidance was issued in response to the growing public interest in climate change and its potential impacts on businesses. It was also a response to the increasing number of state and local governments enacting legislation and regulations aimed at regulating greenhouse gas emissions. For instance, in California, the Global Warming Solutions Act of 2006 resulted in restrictions on greenhouse gas emissions. Regional initiatives, such as the Regional Greenhouse Gas Initiative, which includes ten Northeast and Mid-Atlantic states, and the Western Climate Initiative, including seven Western states and four Canadian provinces, were developed to restrict greenhouse gas emissions. On the international front, many registrants

with operations outside of the United States were subject to standards set by the Kyoto Protocol, even though the United States itself did not ratify the Protocol. The European Union Emissions Trading System (EU ETS) was another significant regulatory system that impacted companies globally. It was launched as an international "cap and trade" system of allowances for emitting carbon dioxide and other greenhouse gases, based on mechanisms set up under the Kyoto Protocol.

The Guidance was designed to help companies navigate their disclosure obligations under federal securities laws and regulations in light of these developments. It acknowledged that regulatory, legislative, and other developments related to climate change could significantly affect companies' operational and financial decisions. For instance, companies might need to make capital expenditures to reduce emissions or purchase allowances under a "cap and trade" system if they cannot meet reduction targets. Furthermore, companies could be indirectly affected by changing prices for goods or services provided by companies directly affected by such developments. Moreover, the Guidance acknowledged the potential physical effects of climate change that could materially impact a company's business and operations. These effects could include changes in weather patterns, sea-level rise, and temperature extremes, which could impact a company's personnel, physical assets, supply chain, and distribution chain.

The Guidance represented a significant regulatory advancement, underscoring the importance of climate risk disclosures in Form 10-Ks. It acted as an exogenous regulatory shock that potentially impacted M&A decisions by providing more comprehensive information about the climate risk exposure of potential targets. As depicted in Figure 1, the general trend shows an increase over time in the proportion of firms disclosing climate risks. Notably, a pronounced leap occurs around the file year 2010, during which the shock event of February 8, 2010, took place. The slope of the time trend line in Panel A becomes significantly steeper,

rising from approximately 41% in 2008 to 47% in 2010. In Panel B, there is a conspicuous spike in the change in the percentage of climate risk disclosing firms in 2010, showing a value of 13% - markedly higher than values recorded for other years. This evidence strongly suggests that the Guidance triggered an extraordinary and significant increase in the number of firms initiating climate risk reports following the Guidance. These firms, having not disclosed relevant information prior to 2010, experienced a significant shock to their climate risk disclosures due to the rule. This substantial shift helps us detect meaningful changes in the risk information disclosed, playing a pivotal role in our research on how climate risk disclosure in 10-K forms influences M&A decisions.

2.2 Literature Review

In the market for corporate control, information asymmetry between potential acquirers and targets significantly influences transactions. Often, the target quality assessment process is expensive and complex for buyers, and sellers may be incentivized to misrepresent their quality. Such scenarios can result in inefficient trading and the risk of choosing less suitable companies, known as adverse selection (Akerlof, 1970; Reuer & Ragozzino, 2008). Research has demonstrated that companies often seek acquisition targets that share similar traits, which can mitigate the risks posed by information asymmetry. These traits include geographical proximity (Bick et al., 2017; Chakrabarti & Mitchell, 2013; Zhang et al., 2021), technological overlap (Bena & Li, 2014; Chondrakis, 2016), cultural distance (Lawrence et al., 2021), shared institutional investors (Ferreira et al., 2009), corporate social responsibility alignment (Bereskin et al., 2018), and environmental reputation (Boone & Uysal, 2020).

Another intuitive solution to decrease information asymmetry and facilitate transactions in the corporate control market is to encourage information disclosures. However, many studies indicate that, when corporate disclosure improves, its impact on the corporate control market becomes less distinct due to notable ambiguity concerning its impact on information

asymmetry (Goldstein & Yang, 2017; Leuz & Wysocki, 2016). On one hand, it is argued that information disclosure could facilitate market transactions by reducing asymmetry between acquirers and targets. Theoretical models, such as those by Diamond and Verrecchia (1991) and Verrecchia (2001), suggest that disclosure can mitigate information asymmetry, potentially increasing trading volume, liquidity, and reducing the returns investors demand (Amihud & Mendelson, 1986; Constantinides, 1986). Direct evidence from Khan et al. (2022) shows that banks with more frequent and comprehensive financial disclosures are more likely to be targeted in M&A transactions. Reduced mandatory disclosure deters acquirers from bidding for targets with greater information asymmetry, proxied by geographical distance. Similarly, Zhao et al. (2013) suggest that managers with less legal protection against takeovers may deliberately limit disclosure as a strategy to increase uncertainty among potential bidders, thereby deterring takeover attempts. These evidence may imply that targets' climate risk disclosures may enhance informational certainty, impacting bidders' ability to assess their value and incentivize acquisition offers.

On the other hand, a set of theories postulates that enhanced disclosure can potentially heighten information asymmetry, which will discourage corporate takeover activities. The information overload theory built up by many scholars (Fertakis, 1969; Snowball, 1979) posits that an increase in information quantity can paradoxically lead to a state of overload, thereby diminishing the effectiveness of users' decision-making processes. Building upon this foundation, Kim and Verrecchia (1994) argue that in financial contexts, disclosure practices can further aggravate information asymmetries, particularly when a select group of well-informed investors is better equipped to understand and interpret the disclosed information. This occurs especially when disclosure provides information that may lead to different interpretations of a firm's performance. In such instances, adept information processors, who can deduce more accurate valuations from the disclosures, attain a relative informational

advantage over other market participants. In response to this disadvantage, the latter group may retreat from active trading to avoid transactions based on insufficient information, which can subsequently lead to a decrease in overall market liquidity. Empirical studies provide substantial evidence supporting these theoretical frameworks. For instance, Impink et al. (2022) found that beyond a certain threshold, increased disclosure requirements correlate with a marked difficulty in the effective use of financial statements by analysts. These adverse effects are more pronounced when analysts are less experienced, follow more firms, and have access to fewer resources. This is consistent with information overload theory, as even though firms may disclose a vast amount of information in their annual reports, the critical data relevant to investment decisions can become obscured by the volume of information provided.

In the context of climate risk disclosure, the enhanced disclosure can increase information asymmetry. The nature of climate risk disclosure, as described by Christensen et al. (2021), is inherently diverse, multifaceted, and typically addresses long-term, non-monetary, and intangible factors. For instance, typical metrics such as CO2 emissions or the number of trees preserved are not readily quantifiable in financial terms. Disclosures may also include potential environmental litigation or the costs associated with mitigating climate risks, which tend to be intangible, speculative and project into the distant future, making them difficult to quantify. This nature of disclosure is likely to lead to varied interpretation quality, depending on the capabilities of the users. This is supported empirically by Chapman et al. (2019), who explored the channels through which disclosure overload intensifies challenges in disclosure management for corporate managers. They define 'disclosure smoothing' as the managerial effort to mitigate information overload by spreading out disclosures over time. The study reveals that managers are more inclined to employ smoothing techniques particularly when disclosures are lengthy, when companies are large and thus have a more robust information environment, when the information complexity is greater—such as having multiple business

segments—and when there is a high degree of uncertainty in information, reflected in earnings volatility. These conditions tend to accentuate the challenges of information overload. Therefore, given the characteristics of climate risk disclosure, unlike financial disclosure tested by Khan et al. (2022), the information asymmetry tends to deteriorate with enhanced climate risk disclosure.

The repercussions of enhanced disclosure, particularly in the context of climate risk, extend well beyond the mere increase in information asymmetry. Kim et al. (2022) observe that climate risk disclosures often cast a predominantly negative light on a firm. Such disclosures can spark concerns regarding future regulatory compliance costs and potential environmental liabilities, amplifying external stakeholders' perceptions of potential downside risks. In a strategic context, Chen et al. (2022) found evidence of peer firms employing a disclosure strategy that emphasizes bad news to render themselves less attractive in the corporate control market. Consequently, the predominantly negative nature of climate risk disclosure could render a firm less appealing in this market.

Moreover, the uncertainties introduced by climate risks can adversely affect the persistence of a firm's current performance. Ginglinger and Moreau (2023) report that physical climate risks are linked to higher expected distress costs and elevated operating expenses, leading firms to adopt lower leverage strategies. Pankratz et al. (2023) find that increased exposure to physical climate risks, proxied by high temperatures, can diminish firms' revenues and operating income. Complementing these findings, Javadi et al. (2023) delve into firms' cash holding strategies. Their research aligns with the precautionary motive framework, suggesting that firms are accumulating more cash reserves as a safeguard against the detrimental effects of climate change. This strategic shift might reallocate resources away from core operations and future innovations towards mitigating climate risks, thereby injecting further uncertainties about the companies' future operational focus. These factors collectively

complicate the accurate valuation of a company. As prior empirical research, such as that by Peng et al. (2020) and Rogers et al. (2009), suggests that disclosure of adverse news can escalate uncertainty over firm value. The ambiguity surrounding the impact of climate risks on future cash flows and growth prospects presents significant valuation challenges, leading to increased hesitancy among potential bidders.

The literature also emphasizes significant trade-offs associated with enhanced disclosure rules. For example, Goldstein and Yang (2017) argue that increased disclosure might discourage the production of private information and diminish risk-sharing and trading opportunities. Moreover, stricter disclosure requirements may inadvertently disseminate proprietary information, increasing potential bidders' costs and deterring marginally profitable takeovers. This viewpoint is empirically, supported by findings from Aggarwal and Hsu (2014) and Bonetti et al. (2020), who observed that certain disclosure mandates, while enhancing transparency, could impose costs on acquirers and impede takeover activity. Recent changes to the SEC's redaction process, as examined by Griffin et al. (2022), have illustrated how eliminating the requirement for proprietary information disclosure can significantly increase acquisition likelihood and stimulate surplus in the corporate control market. Thus, while aiming to foster transparency, enhanced disclosure rules may inadvertently impose indirect costs that curb takeover activities

In light of these discussions, we hypothesize that the climate risk disclosure of a firm decreases its takeover likelihood. This hypothesis is rooted in the interplay of increased information asymmetry following disclosure, the recognition of additional climate mitigation costs by acquirers, the valuation discount on growth prospects of the potential target, and the indirect costs resulting from the enhanced disclosure.

3. Data and Research Design

3.1 Sample construction

We construct our sample to investigate the relationship between climate risk disclosure in 10-K forms and firm targetiveness from the universe of U.S. firms included in the Compustat database. Climate risk disclosure in 10-K forms is identified through a textual analysis using a 64-keyword dictionary specifically designed for climate risk disclosures in 10-K forms, as established by Kim et al. (2022). Further details can be found in Appendix A. Accounting data was sourced from Compustat, while stock price and return data were obtained from the Center for Research in Security Prices (CRSP) database. M&A data was sourced from the Platinum Database of the Securities Data Company (SDC). Our selection of deals was limited to completed and withdrawn deals involving U.S. acquirers and targets. We further narrowed down this selection to cases where the acquirer owned less than 50% of the target firm prior to the bid and intended to own more than 50% post-acquisition. Additionally, we only included deals with a disclosed value exceeding $1 million. The forms of the deals considered included mergers, acquisitions of assets, and acquisitions of majority assets.

To form the sample for takeover likelihood analysis, we merge the Compustat data with M&A data. We chose to exclude firms from the utility (Standard Industrial Classification (SIC) codes 4900–4999) and financial industries (SIC codes 6000–6999), due to their highly regulated environments. To ensure a longitudinal data structure for the DID analysis, observations were restricted to firms that were operational around the exogenous shock of the Guidance (i.e., firms with observations available for both period before 2010 and after 2010). The final sample consists of 36,424 firm-year observations in 42 industries spanning from 2001 to 2020.

3.2 DID Analysis of the Impacts of Climate Risk Disclosure

We begin by identifying the treatment group of firms that commenced disclosing climate risk in their 10-K filings following the implementation of the Guidance in 2010. This treatment group consists of firms that did not disclose climate risk prior to the Guidance but began reporting it in their 10-Ks thereafter. The control group comprises firms that voluntarily disclosed climate risk before the enactment of the Guidance in 2010 and continued to disclose it subsequently.

We investigate the change in takeover likelihood before and after treatment firms report climate risk in their 10-Ks, following the Guidance, and compare this change to the corresponding change in the control firms during the same timeframe. The DID effect captures the difference in takeover likelihood from the pre-guidance to the post-guidance period between the treatment and control firms. The DID methodology enables us to control for potential time trends of climate risk-related matters, such as societal carbon awareness and associated pressures or firms' environmental motives, which generally influence firms' climate risk disclosure behaviour and bidders' acquisition decisions.

The methodology we employ to construct our treatment and control samples is widely recognized and utilized in scholarly literature. For instance, Chhaochharia and Grinstein (2009) studied the effects of board requirement regulations by designating firms that had already complied as the control group, and those that had not complied as the treatment group. Similarly, Huang et al. (2022) employed the same approach, identifying treatment and control firms based on their early and late disclosure times in relation to the SEC's generic risk factor disclosure mandate in 2005. Kim et al. (2022) also followed this model, identifying treatment and control firms based on early and late disclosers in the context of the SEC's 2010 interpretive guidance on climate risk disclosure. Given the significant number of dummy variables and

fixed effects, we employ the linear probability model [1] (Angrist & Pischke, 2009; Cameron & Trivedi, 2010; Fairhurst & Greene, 2022; Friedman & Schady, 2013; Karpoff et al., 2017).

Specifically, our baseline DID model is as follows,

$$Targetiveness_{i,t+1} = \beta_0 + \beta_1 Treatment_i \times Post_t + \beta_2 Treatment_i + \beta_3 Post_t + \mathbf{C}_{i,t} + \text{Industry Fixed Effects} + u_{it} \quad (1)$$

where $Targetiveness_{i,t+1}$ is a dummy that that is set to 1 if firm i is acquired at least once in year t + 1, and 0 otherwise. $Treatment_i$ represents firms subjected to climate risk disclosure shocks upon the implementation of the Guidance. This variable is assigned a value of 1 for late disclosers ($Treatment_i$ = 1 if firm i did not disclose climate risk in the pre-guidance period and initiated disclosure following the Guidance.) and zero for always disclosers ($Treatment_i$ = 0 if the firm i had previously disclosed climate risk in the pre-guidance period and continued to do so after the Guidance). Whether or not there is climate risk disclosure in 10-Ks is defined by conducting a textual analysis using the 64-keyword dictionary of climate risk disclosures in 10-Ks defined by Kim et al. (2022). (Appendix A contains details). $Post_t$ serves as an indicator for the period following the implementation of the Guidance within our sample period, which spans 2001 to 2020. The Guidance came into effect in 8 February 2010. Thus, $Post_t$ equals one for the sample period after 8 February 2010, and zero for the sample period before 8 February 2010. $\mathbf{C}_{i,t}$ is a vector of control variables. We follow the M&A literature in controlling for firm characteristics that have power in explaining firms acquisition decisions, including firm size (SIZE), ROE, stock returns (STOCKR),

[1] Using a linear probability model (LPM) is consistent with the approach discussed in econometrics texts such as Angrist & Pischke (2009), Cameron & Trivedi (2010), and Friedman & Schady (2013), where the LPM predicted probabilities are nearly identical to the predicted probabilities from a probit model. It's also commonly used empirical research in the M&A setting (Fairhurst & Greene, 2022; Karpoff et al., 2017).

tangibility (TANG), cash holdings (CASH), R&D expenses (RD), advertising expenses (AD), market-to-book ratio (MTB), leverage (LEV), noncash corking capital (Noncash_WK), sales growth (SGROW), Herfindahl–Hirschman index (HHI), growth-resource dummy variable (GDUMMY), and industry dummy (IDUMMY) (Amel-Zadeh & Zhang, 2015; Arouri et al., 2019; Boone & Uysal, 2020; Grullon et al., 2019; Harford, 1999; Ho et al., 2021; Nguyen & Phan, 2017; Palepu, 1986; Rhodes-Kropf & Robinson, 2008; Rhodes-Kropf & Viswanathan, 2004; Song & Walkling, 1993). Additionally, we incorporate common industry factors that could influence targetiveness by including industry fixed effects in our regressions.

Our key variable of interest is the interaction term $Treatment_i \times Post_t$. Its coefficient signifies the change in climate change-related takeover likelihood in the post-guidance period for treatment firms, relative to the control firms. As per our hypothesis, we anticipate a significantly negative coefficient on $Treatment_i \times Post_t$.

3.3 Descriptive Statistics

Table 1 presents the cross-year and cross-industry distributions of these sample observations, respectively. The firm-year observations in our sample are approximately evenly distributed throughout the sample period, as illustrated in Panel A. As displayed in Panel B, our sample firms are representative of a wide range of industrial sectors. However, over 40% of the observations originate from specific sectors, including Business Services (12.12%), Pharmaceutical Products (8.10%), Electronic Equipment (7.69%), Oil (6.81%), and Retail (6.74%). Table 2 presents the descriptive statistics of the key variables. Treatment firms constitute 66.5% of the sample, suggesting that many firms had already voluntarily disclosed their climate risks prior to the Guidance. More than 50% of observations fall in the post-guidance period in the sample.

4. Main Results

4.1 Climate Risk Disclosure and Takeover Likelihood

Table 4 presents the results of our baseline regression in Equation (1). The coefficient on our key variable of interest, $Treatment_i \times Post_t$, is negative across all columns and is significant at the 1% level during the 2001-2020, 2005-2015 and 2007-2013 sample periods. This result suggests a significant decrease in targetiveness among firms in the treatment group from the pre-guidance to the post-guidance period, compared to the corresponding change in targetiveness for firms in the control group over the same period. Specifically, late disclosers in the treatment sample—relative to the early disclosers serving as the benchmark—have an average takeover likelihood that is 0.0149 lower, equivalent to 10% of the sample standard deviation (0.15 as indicated in Table 2). These results align with our main hypothesis, suggesting that firms which begin disclosing their climate risks become less attractive to potential acquirers. The baseline results we have detailed are generated after controlling for numerous firm characteristic variables and industry-fixed effects. In sum, our findings regarding the impact of climate risk disclosures on takeover likelihood cannot be explained by various firm characteristics or differences in industry nature alone.

4.2 Parallel Trends Test

The validity of our DID analysis hinges on the parallel trend assumption. To check whether this assumption is violated, in Table 3, we follow Bertrand et al. (2004) and introduce several year indicators to track the effects of the Guidance before and after it became effective. we center our analysis around the key year of policy implementation, 2010, which we designate as 'Year 0.' We establish indicator variables relative to this year. Specifically, 'Year 0' is assigned a value of one for the year 2010, and zero for all other years. Similarly, we define 'Year -1' to represent the year immediately preceding the policy implementation, which is 2009. This variable takes a value of one for 2009 and zero otherwise. Likewise, 'Year +1' is used to denote

the year following the policy implementation, 2011, with a value of one assigned to 2011 and zero to all other years. Further, we employ the indicator variable 'After Year 3+' to represent the years following Year 3+, specifically 2014 and subsequent years. 'Before Year -3' denotes the period preceding Year -3, encompassing 2006 and earlier years. We intentionally exclude Year -3 from our analysis to avoid issues of multicollinearity.

We modified Eq. (1) by replacing $Post_t$ with year indicators, interacting these with $Treatment_i$. In our regression analysis with Targetiveness as the dependent variable, we observed that the interaction term is insignificant for the policy implementation year and prior years when interacted with $Treatment_i$. However, it turns significantly negative for the post-guidance period. This suggests that there were parallel trends in takeover likelihood between treatment and control firms before the Guidance. Visual test is also available in Figure 2.

4.3 Propensity Score Matching

We also conduct another set of robustness test using Propensity Score Matching (PSM) sample, where treatment and control firms are more comparable based on firm-specific covariates. This approach mitigates concerns that the variation in firms' takeover likelihood stems from differences in firm characteristics rather than disparities in climate risk disclosure actions. Initially, we estimate the propensity score of being in the treatment group, utilizing the same set of firm characteristic variables controlled in the primary test, with modifications guided by the balancing property test. Each treatment firm is then matched to benchmark control firms using the nearest neighbor matching technique with replacement. conducting a DID analysis after the PSM aids in relaxing the conditional independence assumption—that treatment assignment should be independent of potential outcomes given the observed covariates—by accommodating unobserved time-variant determinants of the untreated outcome that may affect treatment selection (Blundell & Dias, 2009).

Matching is conducted in both baseline sample and sample with alternative control group. We find that, in both PSM samples (Table 5 & B.2), the key variable of interest, $Treatment_i \times Post_t$, maintains a significantly negative coefficient, suggesting that our main results are unlikely to be driven by differences in the specified firm characteristics between treatment and control groups.

4.4 Mechanism Tests

In this section, we provide evidence of the potential underlying mechanisms through which climate risk disclosure may affect takeover likelihood. We discuss two potential mechanisms: information asymmetry and operational characteristics.

4.4.1 Information Asymmetry

As discussed in the previous section, climate risk disclosure may contribute to larger information asymmetry between acquirors and targets that deters acquirors from acquiring firms in the treatment group. In this sense, we anticipate that acquirors will demonstrate increased sensitivity in their target selection process to the climate risk disclosures made by firms characterized by low information asymmetry. This expectation is rooted in the presumption that, in the absence of mandatory risk disclosures, acquirors would show a preference for acquiring these low asymmetry firms. Such a trend suggests that the presence of mandatory climate risk disclosures might significantly influence acquiror behavior, particularly in contexts where information asymmetry is already minimal.

In Table 8, we present our estimates of the treatment effect within two distinct subsamples, delineated by their levels of information asymmetry. The 'high information asymmetry' subsample encompasses firms whose asymmetry levels exceed the industry-year defined median, while the 'low information asymmetry' subsample includes those at or below this threshold. To ensure robustness, we adopted a comprehensive set of proxies, as advocated in existing literature. These include the bid-ask spread, idiosyncratic volatility, analyst coverage,

dispersion in analyst forecasts, and discretionary accruals, all serving as measures of information asymmetry (Amihud & Mendelson, 1986; Brennan & Subrahmanyam, 1995; Cheng et al., 2011; Cho et al., 2013; Goyal & Santa-Clara, 2003; Kothari et al., 2005; Lang & Lundholm, 1996).

Our analysis reveals a notable pattern in the post-guidance period. Specifically, firms in the treatment group with low information asymmetry exhibit, on average, a reduction in takeover likelihood exceeding 0.02 when compared to their counterparts in the control group. This difference in coefficients across the subgroups is statistically significant. Such findings underscore the pronounced impact of climate risk disclosure on reducing the likelihood of takeovers, predominantly within firms characterized by lower levels of information asymmetry.

4.4.2 Operational Characteristics

In spite of the extreme importance of climate factors noted by both academia and the industry, there is a growing debate on if ESG investing is nothing special than other intangible assets that create long-term financial and social returns, such as management quality, corporate culture, and innovative capability (Edmans, 2023). Especially, in settings of M&A, where the investment scale is so large that one would naturally question how much weight on environmental concerns would acquiror put in decision-making. Therefore, we examine the sensitivity acquiror's climate risk avoidance behaviour to different target operational characteristics.

In our analysis, detailed in Table 9, we utilized several operational characteristics for subsample tests. These include Tobin's Q, sales, R&D expenses (Ng & Rezaee, 2015), firm efficiency, and managerial ability as defined by Demerjian et al. (2012). Subsamples were defined based on the industry-year defined median value of these measures, with the median included in the lower group. Our findings reveal that, in the post-guidance period, treatment firms in the subsample with higher operational performance experienced a significant reduction

in takeover likelihood, generally over 0.02, compared to control firm. The difference in the coefficients is significant between the subgroups. This underscores a key insight: acquirers' behavior in avoiding climate risks during target selection is more pronounced when considering potential targets with strong operational characteristics. This outcome aligns with our initial hypothesis, affirming that climate risk disclosure not only signals potentially large risk-mitigation expenses but also casts significant doubts on the persistency of a firm's current strong performance. Such disclosures, therefore, complicate the process of accurately valuing a target firm, leading to increased hesitancy among potential bidders.

5. Further Analysis

In the preceding section, we demonstrated that acquirers generally exhibit reluctance to engage with firms that begin disclosing their climate risks post-Guidance. In the subsequent sections, we will delve into the characteristics of deals where bidders opted to acquire targets despite their recent climate risk disclosures following the Guidance. This analysis aims to determine whether the initial tendency of acquirers to avoid firms in the treatment group is a rational decision. Specifically, we looked into synergy, payment method and time to complete of the deal. The regression model is as follows,

$$Deal\ Characteristics_{i,t+1} = \beta_0 + \beta_1 Treatment_i \times Post_t + \beta_2 Treatment_i + \beta_3 Post_t + \mathbf{C}_{i,t} + \text{Industry Fixed Effects} + u_{it} \quad (2)$$

A new set $\mathbf{C}_{i,t}$, control variables are adopted to account for characteristics of both target and acquiror involved in the deal, including target firm size (SIZE_T), relative firm size (RELATIVE_SIZE), target market-to-book ratio (MTB_T), acquiror market-to-book ratio (MTB_A), target leverage (LEV_T), acquiror leverage (LEV_A), target cash holdings (CASH_T), acquiror cash holdings (CASH_A), tender offer (TENDER), diversifying dummy

(DIVERSIFY), hostile (HOSTILE), competition dummy (COMPETITION), and percentage of cash payment (CASH_PAY) (Amel-Zadeh & Zhang, 2015; Boone & Uysal, 2020; Fairhurst & Greene, 2022; Nguyen & Phan, 2017).

5.1 Climate Risk Disclosure and Synergy

The primary objective in corporate takeovers is the realization of wealth gains for the involved firm. These gains can be attributed to a multitude of factors, including improved management efficiency, economies of scale, enhanced production techniques, merging of complementary resources, strategic redeployment of assets, and exploitation of market power. Such factors collectively contribute to what is broadly referred to as corporate synergy (Bradley et al., 1988). As Kale et al. (2003) points out, the wealth gain from a takeover is determined not only by the creation of these synergistic values but also by the proportion of these gains that the firm manages to secure. Consequently, our focus shifts to examining how the climate risk disclosure behavior of the target firm impacts these synergy gains. We measure synergy gains using the value-weighted combined cumulative abnormal returns (CARs) of both the acquirer and the target firm. This is calculated based on the five-day CARs over the [-2, +2] event window, relative to the deal announcement date, in line with methodologies used in prior studies (Bradley et al., 1988; Harford et al., 2012; Kale et al., 2003). CARs are predicted by the Fama-French three factor model estimated over the period from 60 days to 259 days before the merger announcement date using the value-weighted market portfolio following Louis (2004).

The results displayed in Table 10 report a negative and significant relationship between deal synergy and interaction term $Treatment_i \times Post_t$, indicating that compared to potential targets in the control group, deals acquiring firms in the treatment group after the policy suffer 0.0542 less synergy. This aligns with the baseline results that acquiror are less likely to acquiror firms from the treatment group after the Guidance.

5.2 Climate Risk Disclosure and Payment Method

Upon deciding to acquire a firm, bidders are presented with critical decisions, notably regarding the payment method and the premium on their offer. Hansen (1987) constructed a model to understand the selection of a payment method in situations where the target company has a better understanding of its value than the bidder. When such asymmetric information exists, bidders may prefer to use their stock as payment, ensuring that the target bears a portion of any post-acquisition revaluation effects. This perspective aligns with findings by Nguyen and Phan (2017), who suggested that amidst escalating uncertainties, acquirers tend to be hesitant in trading a liquid, stable asset like cash for assets of the target firm, which are comparatively less liquid and carry higher risks. If there is doubt on the acquirer's end about the fruition of the target's investment opportunities, they might lean towards using equity as their medium of financing.

It's interesting to observe that bidders choose to finalize the deal even in light of the target's climate risk disclosure and in the face of competitors' hesitancy. Such actions hint at the bidder's perceived investment prospects. Martin (1996) proposed that equity financing is valuable for firms with good investment opportunities. This is because using equity can ensure these firms make the best use of their investment potentials. The inclination to use stock as a payment method amplifies when both entities—the acquirer and the target—spot high-yield investment opportunities. This is mainly because targets would be more inclined to accept stock if they recognize the acquirer as having high investment opportunities.

Based on the above discussion, we would expect less use of cash and/or more use of stock as payment for deals acquiring firms in the treatment group after the Guidance. Our results reported in Table 11 confirm the prediction. There is a significant and negative relationship between the cash payment dummy and the interaction term $Treatment_i \times Post_t$. Although the relationship is insignificant with the stock payment dummy, we observe a

significant and positive relationship with the stock payment percentage. This indicates that bidders acquiring firms in the treatment group after the Guidance are less likely to pay entirely in cash and are more likely to increase stock payment proportion to share the risk.

5.3 Climate Risk Disclosure and Time to Complete

The complex nature of climate risk disclosure and the resultant increase in information asymmetry intuitively extend the time required to complete M&A deals. With regard to climate risk disclosure, its multidimensional, qualitative and complex nature becomes evident during the due diligence phase. Due diligence enables acquirers to make informed acquisition decisions by accessing private information that evaluates the target firm's value, risks, and the potential synergies of the acquisition (Wangerin, 2019). The multifaceted nature of climate risk disclosures necessitates a longer and more resource-intensive due diligence process.

Regarding information asymmetry stemming from climate risk disclosure, the real options theory provides further insights. Firms are generally inclined to postpone irreversible investments until uncertainties are somewhat resolved, as explained by Bernanke (1983) and Dixit et al. (1994). In line with this theory, Nguyen (2017) observes that acquiring firms engaged in M&A activities tend to prolong deal completion during periods of high uncertainty. Marquardt and Zur (2015) highlight that high-quality accounting information can expedite the due diligence process, thereby shortening the overall duration of the M&A process. The expanded information asymmetry due to climate risk disclosures compels acquirers to allocate more time and resources to acquire and validate information about targets, especially those with significant information asymmetry issues.

As our analysis in Table 12, the significant and positive relationship between time to complete and the interaction term indicates that deals acquiring firms in the treatment group after the Guidance tend to take longer time to complete.

6. Conclusion

Our study provides new insights into the impact of climate risk disclosures on corporate takeover activities. Anchored in the 2010 SEC interpretive guidance on climate risk disclosure as an exogenous shock, our rigorous DID analysis of 10-K filings reveals a significant decline in the likelihood of takeovers for firms that start disclosing climate risks following this guidance. This trend is notably accompanied by an increased preference for stock payments and diminished synergy gains, along with extended timelines for deal finalization.

Furthermore, our findings show that firms began disclosing climate risks post-Guidance are even less attractive in the market for corporate control if they have more transparent information environments and strong operational attributes. This outcome suggests that climate risk disclosures actually exacerbate information asymmetry, contrary to policymakers' intentions, and significantly shift investor perceptions, leading to a re-evaluation of these firms' current asset performance. As a result, firms previously considered as attractive targets become less appealing.

These findings unravel the intricate relationship between climate risk disclosures, information asymmetry, and corporate investment decision-making. They offer essential guidance for investors, policymakers, and corporate entities who are navigating a financial landscape increasingly influenced by environmental considerations.

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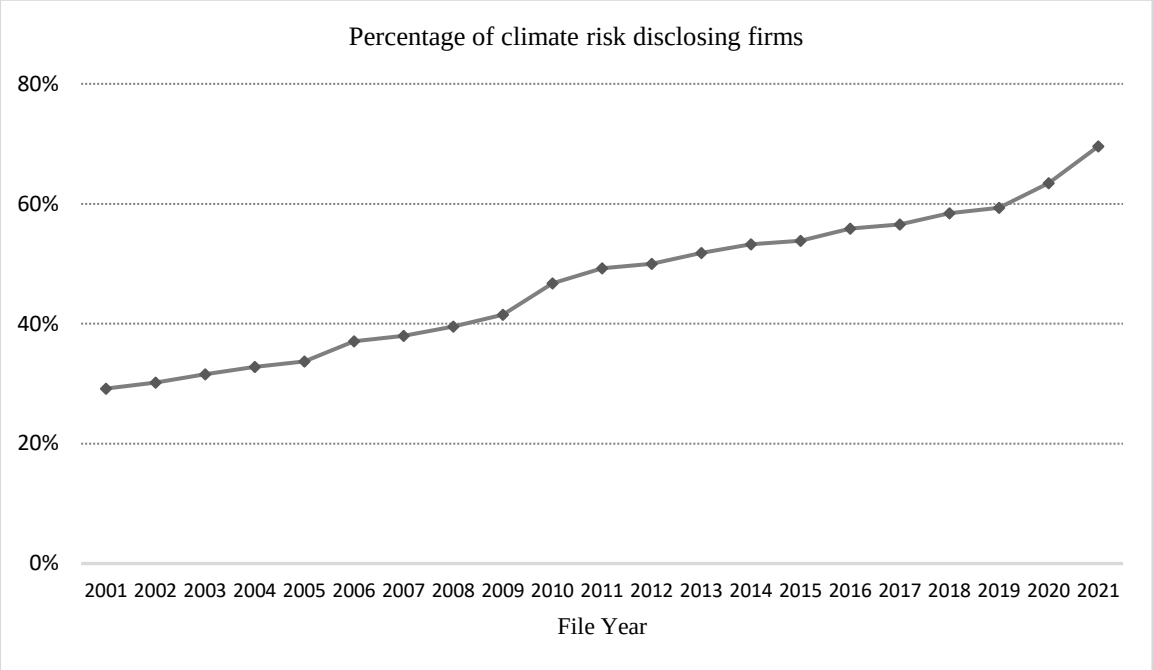
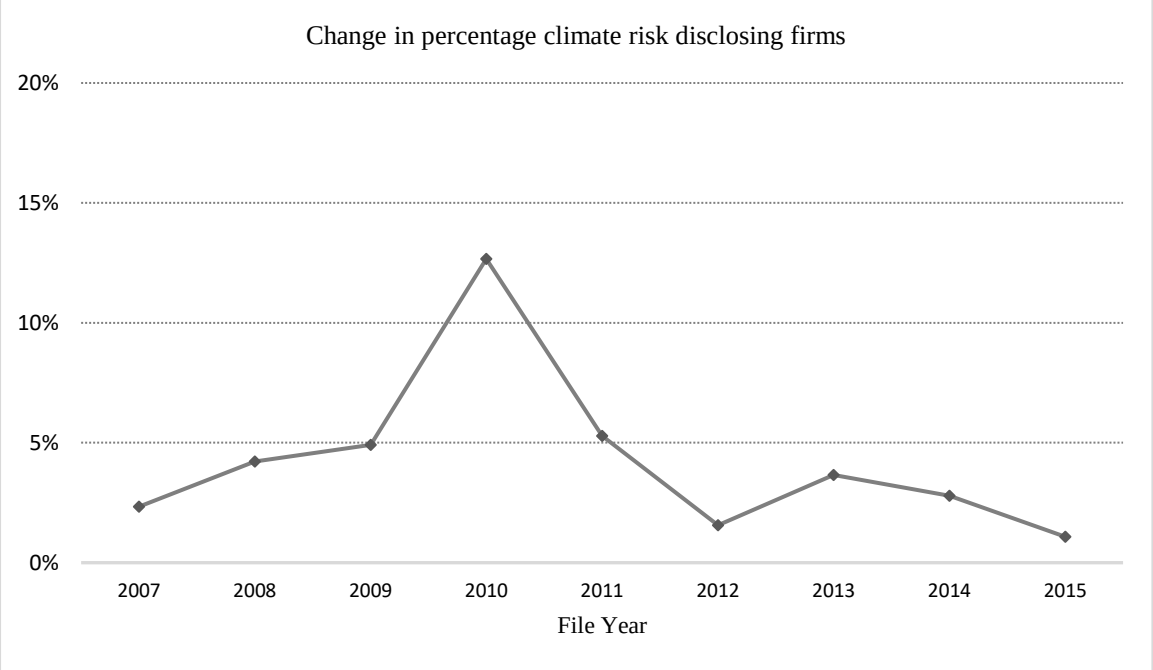
Figure 1 Climate risk disclosure across file years





This figure plots the percentage of climate risk firms and its yearly change in Panels A and B, respectively. Climate risk disclosure is identified through the textual analysis detailed in Appendix A.

Figure 2 Graphical parallel trend test

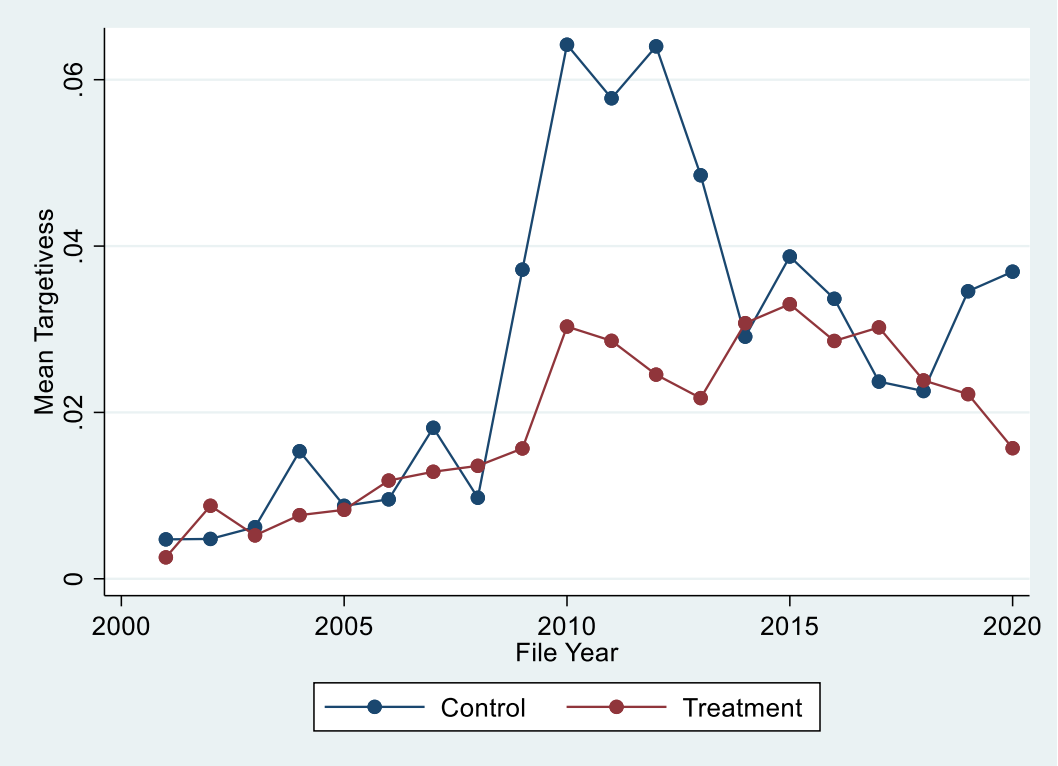


Table 1 Sample distributions

Panel A: Sample distribution by file year

Year	Freq.	Pct.
2001	599	1.64
2002	1,765	4.85
2003	1,794	4.93
2004	1,828	5.02
2005	1,890	5.19
2006	2,003	5.50
2007	2,092	5.74
2008	2,220	6.09
2009	2,302	6.32
2010	2,325	6.38
2011	2,247	6.17
2012	2,129	5.85
2013	2,020	5.55
2014	1,918	5.27
2015	1,814	4.98
2016	1,729	4.75
2017	1,622	4.45
2018	1,533	4.21
2019	1,441	3.96
2020	1,153	3.17
Total	36,424	100

Panel B: Sample distribution by Fama-French industry

Industry		Freq.	Pct.	Industry		Freq.	Pct.
1	Agriculture	108	0.30	22	Electrical Equipment	742	2.04
2	Food Products	868	2.38	23	Autos	790	2.17
3	Candy & Soda	197	0.54	24	Aircraft	232	0.64
4	Beer & Liquor	179	0.49	25	Ships	72	0.20
5	Tobacco Products	52	0.14	26	Defense	118	0.32
6	Recreation	261	0.72	27	Precious Metals	117	0.32
7	Entertainment	563	1.55	28	Mines	205	0.56
8	Printing & Publishing	188	0.52	29	Coal	161	0.44
9	Consumer Goods	575	1.58	30	Oil	2,482	6.81
10	Apparel	606	1.66	32	Communication	1,177	3.23
11	Healthcare	839	2.30	33	Personal Services	471	1.29
12	Medical Equipment	1,505	4.13	34	Business Services	4,415	12.12
13	Pharmaceutical Prod.	2,951	8.10	35	Computers	1,140	3.13
14	Chemicals	1,095	3.01	36	Electronic Equipment	2,801	7.69
15	Rubber & Plastic Prod.	193	0.53	37	Lab Equipment	959	2.63
16	Textiles	147	0.40	38	Business Supplies	486	1.33
17	Construction Materials	842	2.31	39	Shipping Containers	186	0.51
18	Construction	360	0.99	40	Transportation	1,372	3.77
19	Steel Works Etc	503	1.38	41	Wholesale	1,452	3.99
20	Fabricated Prod.	137	0.38	42	Retail	2,454	6.74
21	Machinery	1,590	4.37	43	Hospitality	833	2.29
				Total		36,424	100

The sample includes 36,424 firm-year observations for treatment and control firms during the file years of 2001 to 2020. Panel A reports sample distribution by file year and Panel B reports the distribution across Fama-French industries.

Table 2 Descriptive statistics of main testing variables

	N	Mean	Std.	Min	P25	P50	P75	Max
Targetivess	36,424	0.023	0.150	0.000	0.000	0.000	0.000	1.000
Post	36,424	0.546	0.498	0.000	0.000	1.000	1.000	1.000
Treatment	36,424	0.665	0.472	0.000	0.000	1.000	1.000	1.000
SIZE	36,424	6.530	1.965	3.019	5.091	6.537	7.950	10.107
ROE	36,424	-0.025	0.167	-0.568	-0.030	0.036	0.061	0.123
SGROW	36,424	0.091	0.224	-0.314	-0.030	0.063	0.180	0.658
STOCKR	36,424	0.110	0.491	-0.639	-0.226	0.051	0.352	1.327
LEV	36,424	0.216	0.192	0.000	0.026	0.189	0.343	0.636
MTB	36,424	2.883	6.659	-12.120	0.793	2.317	5.039	19.530
TANG	36,424	0.263	0.227	0.023	0.083	0.186	0.383	0.790
CASH	36,424	0.131	0.127	0.004	0.031	0.087	0.189	0.459
Noncash_WK	36,424	0.111	0.165	-0.166	-0.011	0.092	0.221	0.452
RD	36,424	0.041	0.069	0.000	0.000	0.003	0.054	0.248
AD	36,424	0.010	0.019	0.000	0.000	0.000	0.008	0.071
HHI	36,424	0.240	0.159	0.077	0.116	0.192	0.310	0.655
GDUMMY	36,424	0.337	0.473	0.000	0.000	0.000	1.000	1.000
IDUMMY	36,424	0.743	0.437	0.000	0.000	1.000	1.000	1.000

This table report descriptive statistics of variables for takeover likelihood, DID method variables, and control variables in the baseline testing model.

Table 3 Parallel Trend Test

	Targetivess
Treatment x Before Year-3	0.0020
	(0.27)
Treatment x Year-2	0.0090
	(0.98)
Treatment x Year-1	-0.0162
	(-1.64)
Treatment x Year 0	-0.0279**
	(-2.50)
Treatment x Year 1+	-0.0299**
	(-2.20)
Treatment x Year 2+	-0.0440***
	(-3.38)
Treatment x Year 3+	-0.0353**
	(-2.58)
Treatment x After Year 3+	-0.0181*
	(-2.00)
R-squared	0.1276
N. of Obs.	36392
Controls	Yes
Industry Fixed Effects	Yes
Firm Fixed Effects	Yes
Year Fixed Effects	Yes
Clustering	Industry Level

* p<0.05 ** p<0.01 *** p<0.001

t statistics in parentheses

The dependent variable is Targetiveness, a dummy that indicates if firm i is acquired at least once in year t + 1, and 0 otherwise. The key independent variable is the interaction terms between the treatment firm indicator Treatment and the indicator for the implementation year of Guidance, Year 0. For pre-Guidance period indicators: one year before the Guidance, Year − 1; Two years before the Guidance, Year − 2; Period preceding Year -3, Before Year-3. Three years before the Guidance indicator is dropped for multicollinearity reason. For post-Guidance period indicators: one year after the Guidance, Year 1+; Two years after the Guidance, Year 2+; Three years after the Guidance, Year 3+; Three year after the rule and beyond, After Year 3+.

Table 4 Effects of climate risk disclosures on takeover likelihood (Sample-Control1)

	2001-2020		2005-2015		2007-2013	
Treatment_Post	-0.0149***	-0.0249***	-0.0224***	-0.0293***	-0.0258***	-0.0307***
	(-4.22)	(-6.05)	(-4.33)	(-4.96)	(-3.66)	(-3.71)
Post	0.0322***		0.0377***		0.0424***	
	(10.25)		(8.16)		(6.67)	
Treatment	-0.0013		-0.0024		-0.0056	
	(-0.67)		(-0.79)		(-1.26)	
SIZE	-0.0028***	-0.0063**	-0.0040***	-0.0083**	-0.0053***	-0.0144***
	(-5.83)	(-2.50)	(-5.59)	(-2.64)	(-5.58)	(-2.92)
ROE	-0.0042	0.0070	-0.0033	0.0102	0.0074	0.0231
	(-0.59)	(0.78)	(-0.32)	(0.75)	(0.61)	(1.47)
SGROW	-0.0054	-0.0059	-0.0081	-0.0053	-0.0105	-0.0050
	(-1.55)	(-1.67)	(-1.59)	(-1.15)	(-1.61)	(-0.68)
STOCKR	-0.0039**	-0.0045**	-0.0043*	-0.0057**	-0.0046	-0.0044
	(-2.44)	(-2.23)	(-1.82)	(-2.20)	(-1.41)	(-1.19)
LEV	0.0169***	0.0084	0.0167**	-0.0046	0.0112	-0.0464*
	(3.04)	(0.92)	(2.04)	(-0.29)	(1.01)	(-1.74)
MTB	-0.0002	-0.0000	-0.0003*	-0.0000	-0.0005**	-0.0002
	(-1.31)	(-0.01)	(-1.66)	(-0.02)	(-1.96)	(-0.61)
TANG	-0.0073	-0.0162	-0.0020	-0.0285	-0.0065	-0.0602
	(-1.21)	(-1.47)	(-0.22)	(-1.13)	(-0.56)	(-1.65)
CASH	-0.0119	-0.0210*	-0.0207	-0.0455**	-0.0164	-0.0442
	(-1.40)	(-1.92)	(-1.63)	(-2.68)	(-0.95)	(-1.57)
Noncash_WK	-0.0044	-0.0101	-0.0159*	-0.0392**	-0.0365***	-0.0564**
	(-0.69)	(-1.32)	(-1.77)	(-2.42)	(-2.91)	(-2.24)
RD	0.0189	0.0226	0.0135	0.0530	0.0068	0.0172
	(1.02)	(1.12)	(0.49)	(1.53)	(0.17)	(0.56)
AD	-0.0456	-0.1273	-0.0540	-0.5550***	-0.1146	-0.5611***
	(-0.87)	(-1.52)	(-0.71)	(-3.65)	(-1.13)	(-3.58)
HHI	-0.0088	-0.0011	-0.0034	0.0337	-0.0041	0.0954**
	(-1.31)	(-0.09)	(-0.32)	(1.39)	(-0.27)	(2.28)
GDUMMY	-0.0021	-0.0022	-0.0025	-0.0026	-0.0039	-0.0042
	(-1.30)	(-1.43)	(-1.01)	(-0.99)	(-1.14)	(-0.91)
IDUMMY	-0.0003	-0.0042**	-0.0013	-0.0070**	-0.0029	-0.0109**
	(-0.16)	(-2.04)	(-0.41)	(-2.61)	(-0.64)	(-2.19)
Constant	0.0344***	0.0853***	0.0482***	0.1131***	0.0668***	0.1659***
	(6.14)	(4.49)	(5.69)	(4.10)	(5.91)	(3.82)
R-squared	0.0125	0.1269	0.0159	0.1965	0.0206	0.2872
N. of Obs.	36424.0000	36392	19256	19222	11223	11157
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	Yes	No	Yes	No	Yes
Year Fixed Effects	No	Yes	No	Yes	No	Yes
Clustering	Firm Level	Industry Level	Firm Level	Industry Level	Firm Level	Industry Level

t statistics in parentheses

* p<0.10 ** p<0.05 *** p<0.01

The dependent variable is Targetiveness, a dummy that indicates if firm i is acquired at least once in year t + 1, and 0 otherwise. The key independent variable is the interaction term between the treatment firm indicator, Treatment, and the indicator for the period after the implementation of the Guidance, Post. Firm characteristic variables are controlled as in Eq. (1). Details about the variable definitions are provided in Appendix C.

Table 5 Effects of climate risk disclosures on takeover likelihood (PSM Sample-Control 1)

	2001-2020		2005-2015		2007-2013	
Treatment_Post	-0.0184***	-0.0283***	-0.0235***	-0.0319***	-0.0246***	-0.0304***
	(-4.22)	(-4.94)	(-3.72)	(-4.31)	(-2.89)	(-2.78)
Post	0.0359***		0.0392***		0.0422***	
	(8.82)		(6.65)		(5.29)	
Treatment	-0.0020		-0.0050		-0.0108**	
	(-0.88)		(-1.42)		(-2.00)	
SIZE	-0.0032***	-0.0071**	-0.0043***	-0.0079**	-0.0057***	-0.0113**
	(-6.39)	(-2.64)	(-5.57)	(-2.19)	(-5.58)	(-2.17)
ROE	-0.0050	0.0070	-0.0035	0.0106	0.0072	0.0167
	(-0.64)	(0.65)	(-0.31)	(0.67)	(0.54)	(0.85)
SGROW	-0.0037	-0.0026	-0.0089	-0.0047	-0.0084	0.0001
	(-0.95)	(-0.66)	(-1.56)	(-0.88)	(-1.13)	(0.01)
STOCKR	-0.0042**	-0.0047*	-0.0048*	-0.0072**	-0.0063*	-0.0084**
	(-2.37)	(-1.99)	(-1.82)	(-2.44)	(-1.78)	(-2.17)
LEV	0.0156***	0.0072	0.0125	-0.0098	0.0107	-0.0285
	(2.64)	(0.66)	(1.43)	(-0.61)	(0.90)	(-0.99)
MTB	-0.0001	0.0000	-0.0003*	-0.0001	-0.0005*	-0.0003
	(-1.03)	(0.12)	(-1.71)	(-0.41)	(-1.83)	(-1.29)
TANG	-0.0063	-0.0094	-0.0017	-0.0173	-0.0068	-0.0378
	(-0.97)	(-0.72)	(-0.17)	(-0.59)	(-0.55)	(-0.98)
CASH	-0.0067	-0.0155	-0.0132	-0.0354**	0.0018	-0.0176
	(-0.72)	(-1.66)	(-0.95)	(-2.20)	(0.10)	(-0.83)
Noncash_WK	-0.0051	-0.0136	-0.0198**	-0.0519**	-0.0415***	-0.0655**
	(-0.73)	(-1.52)	(-2.06)	(-2.47)	(-3.09)	(-2.13)
RD	0.0243	0.0450	0.0125	0.0487	-0.0263	-0.0781**
	(1.18)	(1.61)	(0.40)	(1.05)	(-0.59)	(-2.26)
AD	-0.0670	-0.2063**	-0.0844	-0.6425***	-0.1613	-0.4027**
	(-1.20)	(-2.13)	(-1.02)	(-3.50)	(-1.47)	(-2.12)
HHI	-0.0019	0.0101	0.0008	0.0478*	-0.0052	0.1080***
	(-0.26)	(0.75)	(0.07)	(1.77)	(-0.31)	(2.89)
GDUMMY	-0.0025	-0.0031*	-0.0021	-0.0028	-0.0033	-0.0048
	(-1.42)	(-2.00)	(-0.80)	(-1.14)	(-0.90)	(-1.06)
IDUMMY	-0.0005	-0.0051**	-0.0019	-0.0086***	-0.0016	-0.0113**
	(-0.24)	(-2.18)	(-0.58)	(-2.83)	(-0.33)	(-2.35)
Constant	0.0360***	0.0890***	0.0529***	0.1109***	0.0728***	0.1363***
	(5.86)	(4.26)	(5.64)	(3.53)	(5.75)	(2.95)
R-squared	0.0135	0.1174	0.0164	0.1901	0.0208	0.2825
N. of Obs.	31610	31600	16709	16696	9736	9699
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	Yes	No	Yes	No	Yes
Year Fixed Effects	No	Yes	No	Yes	No	Yes
Clustering	Firm Level	Industry Level	Firm Level	Industry Level	Firm Level	Industry Level

t statistics in parentheses

* p<0.10 ** p<0.05 *** p<0.01

The dependent variable is Targetiveness, a dummy that indicates if firm i is acquired at least once in year t + 1, and 0 otherwise. The key independent variable is the interaction term between the treatment firm indicator, Treatment, and the indicator for the period after the implementation of the Guidance, Post. Firm characteristic variables are controlled as in Eq. (1). Details about the variable definitions are provided in Appendix C.

Table 8 Mechanism Test: Information Asymmetry

	Bid-ask Spread		Idiosyncratic Volatility		Analyst Coverage		Dispersion of Analyst Forecast		Discretionary accruals	
	High Inf Asy	Low Inf Asy	High Inf Asy	Low Inf Asy	High Inf Asy	Low Inf Asy	High Inf Asy	Low Inf Asy	High Inf Asy	Low Inf Asy
Treatment_Post	-0.0066	-0.0229***	-0.0083*	-0.0230***	-0.0070	-0.0248***	-0.0094**	-0.0268***	-0.0076	-0.0227***
	(-1.37)	(-4.40)	(-1.71)	(-4.33)	(-1.42)	(-4.73)	(-2.15)	(-4.35)	(-1.53)	(-4.50)
Treatment	-0.0039	0.0014	-0.0036	0.0011	-0.0052*	0.0033	-0.0031	0.0048	-0.0053*	0.0028
	(-1.52)	(0.47)	(-1.32)	(0.43)	(-1.75)	(1.29)	(-1.27)	(1.44)	(-1.78)	(1.15)
Post	0.0315***	0.0341***	0.0308***	0.0344***	0.0240***	0.0435***	0.0279***	0.0426***	0.0263***	0.0385***
	(7.75)	(7.03)	(7.47)	(6.97)	(5.77)	(9.01)	(7.47)	(7.26)	(6.12)	(8.39)
SIZE	-0.0014*	-0.0043***	-0.0020***	-0.0039***	-0.0033***	-0.0058***	-0.0024***	-0.0057***	-0.0018***	-0.0037***
	(-1.79)	(-5.78)	(-2.69)	(-5.12)	(-4.84)	(-6.47)	(-4.05)	(-5.38)	(-2.76)	(-5.57)
ROE	-0.0152*	0.0149	-0.0126	0.0246*	-0.0127	0.0060	-0.0128*	0.0430**	-0.0079	0.0006
	(-1.86)	(0.92)	(-1.55)	(1.70)	(-1.49)	(0.48)	(-1.70)	(2.15)	(-0.85)	(0.05)
SGROW	-0.0052	-0.0041	-0.0045	-0.0075	-0.0097**	-0.0021	-0.0073*	0.0003	-0.0122***	0.0027
	(-1.23)	(-0.65)	(-1.08)	(-1.18)	(-2.22)	(-0.37)	(-1.86)	(0.04)	(-2.64)	(0.51)
STOCKR	-0.0029	-0.0051*	-0.0048**	-0.0003	-0.0030	-0.0037	-0.0020	-0.0098***	-0.0032	-0.0047**
	(-1.44)	(-1.84)	(-2.48)	(-0.09)	(-1.45)	(-1.48)	(-1.03)	(-3.25)	(-1.45)	(-2.03)
MTB	-0.0004*	-0.0000	-0.0003	-0.0001	-0.0003	-0.0001	-0.0003	-0.0001	-0.0002	-0.0001
	(-1.80)	(-0.28)	(-1.41)	(-0.64)	(-1.27)	(-0.48)	(-1.51)	(-0.52)	(-1.30)	(-0.54)
TANG	-0.0129	-0.0035	-0.0094	-0.0070	-0.0029	-0.0099	-0.0083	-0.0062	0.0002	-0.0167*
	(-1.49)	(-0.41)	(-1.16)	(-0.75)	(-0.35)	(-1.15)	(-1.10)	(-0.61)	(0.03)	(-1.87)
LEV	0.0093	0.0258***	0.0106	0.0230***	0.0083	0.0194**	0.0162**	0.0238**	0.0185**	0.0159**
	(1.25)	(3.11)	(1.42)	(2.72)	(0.99)	(2.55)	(2.44)	(2.33)	(2.43)	(2.01)
CASH	-0.0215*	0.0019	-0.0190*	-0.0036	-0.0120	-0.0125	-0.0050	-0.0278**	-0.0025	-0.0228*
	(-1.87)	(0.15)	(-1.66)	(-0.29)	(-1.01)	(-1.03)	(-0.48)	(-2.06)	(-0.22)	(-1.89)
RD	0.0326	0.0446	0.0186	0.0633*	-0.0003	0.0254	0.0010	0.1012***	0.0111	0.0271
	(1.44)	(1.40)	(0.82)	(1.92)	(-0.01)	(0.88)	(0.05)	(2.62)	(0.46)	(1.00)
AD	0.0152	-0.1388**	-0.0078	-0.1269*	-0.0498	-0.0401	-0.0076	-0.1211	0.0193	-0.1174*
	(0.19)	(-2.13)	(-0.11)	(-1.85)	(-0.61)	(-0.58)	(-0.11)	(-1.50)	(0.25)	(-1.72)

Noncash_WK	-0.0027	-0.0180*	-0.0023	-0.0149	0.0055	-0.0263***	-0.0074	-0.0084	0.0040	-0.0143
	(-0.29)	(-1.89)	(-0.26)	(-1.56)	(0.60)	(-2.74)	(-0.96)	(-0.71)	(0.44)	(-1.58)
HHI	-0.0126	-0.0060	-0.0057	-0.0132	-0.0022	-0.0132	-0.0035	-0.0174*	-0.0151	-0.0046
	(-1.24)	(-0.69)	(-0.55)	(-1.57)	(-0.22)	(-1.46)	(-0.40)	(-1.71)	(-1.52)	(-0.50)
GDUMMY	-0.0015	-0.0031	-0.0019	-0.0024	-0.0011	-0.0026	-0.0009	-0.0040	0.0002	-0.0046**
	(-0.59)	(-1.37)	(-0.78)	(-1.04)	(-0.46)	(-1.12)	(-0.43)	(-1.45)	(0.09)	(-2.11)
IDUMMY	-0.0021	0.0012	-0.0006	0.0001	0.0005	-0.0013	-0.0009	0.0011	0.0006	-0.0015
	(-0.67)	(0.45)	(-0.18)	(0.02)	(0.14)	(-0.50)	(-0.33)	(0.41)	(0.20)	(-0.54)
Constant	0.0301***	0.0415***	0.0311***	0.0411***	0.0350***	0.0581***	0.0313***	0.0523***	0.0286***	0.0416***
	(3.83)	(5.11)	(4.15)	(4.77)	(4.31)	(6.53)	(4.46)	(5.14)	(3.65)	(5.40)
Coefficient Difference	0.0205**		0.0421**		0.0129**		0.0216**		0.0327**	
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of Obs.	18065	18359	19274	17150	16617	19807	23593	12831	18101	18323
R-squared	0.0160	0.0130	0.0149	0.0139	0.0142	0.0170	0.0125	0.0194	0.0119	0.0156

t statistics in parentheses

Standard errors clustered at the firm level

* p<0.10 ** p<0.05 *** p<0.01

The baseline model of Eq. (1) is estimated in subsamples partitioned according to the level of information asymmetry proxied by bid-ask spread, idiosyncratic volatility, analyst coverage, dispersion in analyst forecasts, and discretionary accruals. Subsamples are divided based on the industry-year defined median of the measure, with median assigned to the lower group. The key independent variable is the interaction term between the treatment firm indicator, Treatment, and the indicator for the period after the implementation of the Guidance, Post. Firm characteristic variables are controlled as in Eq. (1). The Coefficient Difference row reports the p-statistic of the difference between the coefficients on Treatment×Post in the two subsamples. Details about the variable definitions are provided in Appendix C.

Table 9 Mechanism Test: Firm Characteristics

	Tobin's Q		Sales		R&D		Firm Efficiency		Managerial Ability	
	High	Low	High	Low	High	Low	High	Low	High	Low
Treatment_Post	-0.0241***	-0.0060	-0.0217***	-0.0080	-0.0234***	-0.0090**	-0.0240***	-0.0065	-0.0230***	-0.0065
	(-5.00)	(-1.16)	(-4.21)	(-1.63)	(-4.23)	(-1.98)	(-4.59)	(-1.34)	(-4.68)	(-1.26)
Treatment	0.0023	-0.0052*	-0.0002	-0.0021	0.0021	-0.0032	0.0013	-0.0041	0.0028	-0.0051*
	(0.93)	(-1.77)	(-0.06)	(-0.74)	(0.81)	(-1.20)	(0.49)	(-1.50)	(1.06)	(-1.73)
Post	0.0348***	0.0298***	0.0389***	0.0259***	0.0414***	0.0257***	0.0374***	0.0288***	0.0362***	0.0281***
	(7.77)	(6.64)	(8.43)	(6.03)	(8.63)	(6.30)	(7.71)	(6.99)	(8.22)	(6.29)
SIZE	-0.0022***	-0.0029***	-0.0030***	-0.0029***	-0.0018**	-0.0031***	-0.0045***	-0.0018**	-0.0027***	-0.0030***
	(-3.43)	(-3.87)	(-4.36)	(-4.17)	(-2.15)	(-5.27)	(-6.16)	(-2.22)	(-4.57)	(-3.69)
ROE	0.0055	-0.0053	-0.0155	0.0017	0.0054	-0.0122	0.0014	-0.0085	-0.0086	0.0019
	(0.43)	(-0.61)	(-1.49)	(0.18)	(0.49)	(-1.39)	(0.12)	(-0.94)	(-0.80)	(0.20)
STOCKR	-0.0038*	-0.0027	-0.0049**	-0.0030	-0.0053**	-0.0031	-0.0025	-0.0051**	-0.0022	-0.0057**
	(-1.81)	(-1.08)	(-2.25)	(-1.27)	(-2.25)	(-1.47)	(-1.01)	(-2.36)	(-0.98)	(-2.43)
TANG	0.0026	-0.0227**	-0.0130	-0.0082	-0.0233**	-0.0069	-0.0065	-0.0068	-0.0137	-0.0005
	(0.32)	(-2.51)	(-1.39)	(-1.03)	(-2.02)	(-0.96)	(-0.79)	(-0.75)	(-1.62)	(-0.05)
LEV	0.0145**	0.0207**	0.0127	0.0210***	0.0145	0.0157**	0.0194**	0.0136*	0.0173**	0.0170**
	(2.07)	(2.40)	(1.55)	(2.73)	(1.59)	(2.23)	(2.53)	(1.77)	(2.24)	(2.12)
CASH	-0.0038	-0.0188	-0.0102	-0.0154	0.0015	-0.0198*	-0.0125	-0.0165	-0.0046	-0.0190
	(-0.39)	(-1.30)	(-0.73)	(-1.45)	(0.12)	(-1.73)	(-1.10)	(-1.33)	(-0.44)	(-1.39)
AD	-0.0272	-0.0363	-0.0387	-0.0849	-0.1994**	0.0181	-0.0662	-0.0251	-0.0372	-0.0434
	(-0.44)	(-0.41)	(-0.55)	(-1.09)	(-2.54)	(0.27)	(-1.04)	(-0.30)	(-0.56)	(-0.55)
Noncash_WK	-0.0023	-0.0105	-0.0070	-0.0016	0.0001	-0.0098	-0.0101	-0.0013	-0.0098	0.0032
	(-0.29)	(-1.03)	(-0.72)	(-0.18)	(0.02)	(-1.11)	(-1.16)	(-0.14)	(-1.17)	(0.33)
HHI	-0.0131	-0.0071	-0.0082	-0.0119	-0.0174	-0.0052	-0.0154*	-0.0013	-0.0070	-0.0128
	(-1.62)	(-0.68)	(-0.88)	(-1.22)	(-1.48)	(-0.63)	(-1.66)	(-0.13)	(-0.77)	(-1.33)
GDUMMY	0.0004	-0.0043*	-0.0024	-0.0015	-0.0044	-0.0013	-0.0032	-0.0013	-0.0031	-0.0011
	(0.21)	(-1.73)	(-0.99)	(-0.65)	(-1.54)	(-0.65)	(-1.43)	(-0.54)	(-1.43)	(-0.43)

IDUMMY	0.0022	-0.0024	-0.0023	0.0011	-0.0021	-0.0005	-0.0011	0.0005	0.0044*	-0.0046
	(0.93)	(-0.73)	(-0.84)	(0.35)	(-0.60)	(-0.20)	(-0.42)	(0.17)	(1.68)	(-1.51)
RD	0.0321	0.0221	0.0123	0.0362			0.0052	0.0198	0.0336	0.0011
	(1.45)	(0.68)	(0.44)	(1.46)			(0.20)	(0.73)	(1.40)	(0.04)
SGROW	-0.0030	-0.0067			-0.0094*	-0.0044	-0.0017	-0.0097**	-0.0053	-0.0046
	(-0.65)	(-1.25)			(-1.77)	(-0.95)	(-0.33)	(-2.05)	(-1.12)	(-0.90)
MTB			-0.0004**	0.0000	-0.0002	-0.0002	-0.0001	-0.0002	-0.0003**	0.0000
			(-2.04)	(0.00)	(-1.06)	(-0.97)	(-0.96)	(-0.87)	(-2.07)	(0.27)
Constant	0.0210***	0.0440***	0.0379***	0.0344***	0.0292***	0.0405***	0.0498***	0.0264***	0.0277***	0.0405***
	(3.07)	(5.00)	(4.63)	(4.22)	(3.40)	(5.52)	(5.94)	(3.22)	(3.89)	(4.55)
Coefficient Difference	0.0108**		0.0550*		0.0434**		0.0145**		0.0194**	
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.0139	0.0133	0.0172	0.0109	0.0186	0.0122	0.0160	0.0119	0.0164	0.0116
N. of Obs.	18001	18423	17999	18425	12246	24178	18592	17832	18591	17833

t statistics in parentheses

Standard errors clustered at the firm level
* p<0.10 ** p<0.05 *** p<0.01

The baseline model of Eq. (1) is estimated in subsamples partitioned according to the level of firm operational characteristics including Tobin's Q, sales, R&D expenses, firm efficiency, and managerial ability. Subsamples are divided based on the industry-year defined median of the measure, with median assigned to the lower group. The key independent variable is the interaction term between the treatment firm indicator, Treatment, and the indicator for the period after the implementation of the Guidance, Post. Firm characteristic variables are controlled as in Eq. (1). The Coefficient Difference row reports the p-statistic of the difference between the coefficients on Treatment×Post in the two subsamples. Details about the variable definitions are provided in Appendix C.

Table 10 Synergy Gain

	Synergy 5-day
Treatment_Post	-0.0542*
	(-1.89)
Post	0.0633**
	(2.31)
Treatment	0.0778*
	(1.72)
SIZE_T	-0.0103
	(-1.67)
MTB_T	0.0002***
	(2.87)
MTB_A	-0.0000
	(-0.07)
LEV_T	0.0890*
	(1.77)
LEV_A	-0.0399
	(-0.86)
CASH_T	0.0838
	(1.43)
CASH_A	-0.0196
	(-0.22)
RELATIVE_SIZE	-0.1674*
	(-2.01)
TENDER	0.0342
	(1.32)
DIVERSIFY	-0.0058
	(-0.37)
HOSTILE	0.0000
	(.)
COMPETITION	-0.0630***
	(-3.69)
CASH_PAY	0.0003
	(1.65)
Constant	0.1995***
	(2.92)
Industry Fixed Effects	Yes
R-squared	0.3194
N. of Obs.	339

t statistics in parentheses

Standard errors clustered at the industry level

* p<0.10 ** p<0.05 *** p<0.01

The dependent variable is 5-day synergy gain, the value-weighted combined cumulative abnormal returns (CARs) of both the acquirer and the target firm. The key independent variable is the interaction term between the treatment firm indicator, Treatment, and the indicator for the period after the implementation of the Guidance, Post. Firm characteristic variables are controlled as in Eq. (2). Details about the variable definitions are provided in Appendix C.

Table 11 Payment Method

	Cash Payment Dummy	Stock Payment Dummy	Stock Payment Percentage
Treatment_Post	-0.4050***	0.1846	25.5441**
	(-3.75)	(1.11)	(2.08)
Post	0.2858***	-0.1283	-19.1658**
	(4.03)	(-1.09)	(-2.52)
Treatment	0.3718***	-0.2131	-28.6254**
	(3.47)	(-1.39)	(-2.52)
SIZE_T	0.0032	-0.0363**	-2.0609
	(0.25)	(-2.13)	(-1.48)
MTB_T	-0.0001	0.0003**	0.0375***
	(-0.33)	(2.09)	(3.63)
MTB_A	-0.0004*	0.0001	0.0327**
	(-1.77)	(0.94)	(2.06)
LEV_T	-0.2617*	0.1784	13.7560
	(-1.95)	(1.67)	(1.55)
LEV_A	0.2187	-0.1530	-13.4202
	(1.46)	(-1.13)	(-0.87)
CASH_T	-0.3237***	0.2891	16.6990
	(-2.83)	(1.46)	(1.22)
CASH_A	-0.2058	0.1130	0.7697
	(-0.75)	(0.45)	(0.04)
RELATIVE_SIZE	-1.1184***	0.7109***	90.5955***
	(-6.69)	(4.03)	(7.53)
TENDER	0.3228***	-0.1452***	-23.3480***
	(3.64)	(-5.02)	(-4.83)
DIVERSIFY	-0.0214	0.1160**	7.6164
	(-0.40)	(2.13)	(1.42)
HOSTILE	0.0000	0.0000	0.0000
	(.)	(.)	(.)
COMPETITION	0.1592**	-0.0635	-17.0194***
	(2.10)	(-1.03)	(-3.41)
Constant	1.0630***	-0.0321	-1.0000
	(6.61)	(-0.20)	(-0.06)
Industry Fixed Effects	Yes	Yes	Yes
R-squared	0.4159	0.2469	0.3927
N. of Obs.	343	343	343

t statistics in parentheses

Standard errors clustered at the industry level

* p<0.10 ** p<0.05 *** p<0.01

The dependent variables are cash payment dummy, equal to 1 if the acquisition is paid 100% by cash, 0 otherwise; stock payment dummy, 1 if the acquisition is paid 100% by stock, 0 otherwise; stock payment percentage, the percentage of stock in payment consideration for the deal. The key independent variable is the interaction term between the treatment firm indicator, Treatment, and the indicator for the period after the implementation of the Guidance, Post. Firm characteristic variables are controlled as in Eq. (2). Details about the variable definitions are provided in Appendix C.

Table 12 Time to Complete

	Time to Complete
Treatment_Post	2.0573**
	(2.32)
Post	-2.2888**
	(-2.48)
Treatment	-2.1646**
	(-2.48)
SIZE_T	0.3804***
	(3.77)
MTB_T	0.0040
	(0.92)
MTB_A	0.0016
	(1.41)
LEV_T	0.9555
	(1.30)
LEV_A	-0.6472
	(-1.10)
CASH_T	-1.0583
	(-1.19)
CASH_A	1.0300
	(0.63)
RELATIVE_SIZE	1.3714
	(1.43)
TENDER	-2.5681***
	(-6.92)
DIVERSIFY	0.1464
	(0.57)
HOSTILE	0.0000
	(.)
COMPETITION	0.0419
	(0.06)
CASH_PAY	-0.0105**
	(-2.41)
Constant	5.0170***
	(5.52)
Industry Fixed Effects	Yes
R-squared	0.5767
N. of Obs.	268

t statistics in parentheses

Standard errors clustered at the industry level

* p<0.10 ** p<0.05 *** p<0.01

The dependent variable is time to complete, the decile rank of the number of days from announcement to completion of the takeover. The key independent variable is the interaction term between the treatment firm indicator, Treatment, and the indicator for the period after the implementation of the Guidance, Post. Firm characteristic variables are controlled as in Eq. (2). Details about the variable definitions are provided in Appendix C.

Appendix A: 10-K-Based Measure of Climate Risk Disclosure

Whether or not there is climate risk disclosure in 10-Ks is defined by conducting a textual analysis using the 64-keyword dictionary of climate risk disclosures in 10-Ks defined by Kim et al. (2022).

We download the parsed 10-K data from Notre Dame Software Repository for Accounting and Finance at http://sraf.nd.edu, as widely used in textual analysis literature (Atanassov & Liu, 2020; Donelson et al., 2022). Lemmatization is used to standardize the texts, specifically removing plurals. For example, the string "emission" does not match to "emissions". After lemmatization both "emission" and "emissions" is "emission".

Next, we separate the dictionary into a 6-keyword case-sensitive dictionary for proper nouns comprising 'CO2', 'EU ETS', 'GHG', 'Kyoto protocol', 'Title V', and 'United Nations Framework Convention on Climate Change', and a 58-keyword case-insensitive dictionary for the rest. Then, we count how frequently climate change words in two dictionaries appear in each 10-K without and with lowercase conversion respectively. For example, for keywords in case-sensitive dictionary, only 'EU ETS' is counted, while 'eu ets' is not. For keywords in case-insensitive dictionary, both "climate change" and "Climate change" are counted.

The treatment and control recognition is based on whether the total keyword frequency count before and after the Guidance is equal to zero. The firm is in the treatment group if none of 64 climate-related keywords occurs in any of its 10-Ks during the pre-guidance period and at least one of the keywords occur in one of its 10-Ks following the Guidance. Control group 1 contains firms that have at least one of the keywords occur in one of its 10-Ks in both pre-guidance period and post-guidance period. Firms that have none of 64 climate-related keywords occurs in any of its 10-Ks in both pre-guidance period and post-guidance period are in control group2.

Dictionary of climate risk disclosures in 10-Ks

CO_2	climate change regulation	controls on emission	regulation related to climate change
EU ETS	climate change risk	cooler than normal summer	regulation risk from climate change
GHG	climate change statute	emission initiative	regulatory initiative
Kyoto protocol	climate change treaty	emission standard	regulatory risk from climate change
Title V	climate condition	extreme climate	rising temperature
United Nations Framework Convention on Climate Change	climate control	extreme temperature	sea level
adverse weather	climate control initiative	extreme weather	tailoring rule
cap and trade	climate initiative	global warming	unseasonably warm weather
carbon dioxide	climate legislation	greenhouse gas	unusual weather
changing climate	climate registry	greenhouse gas emissions legislation	volatility in seasonal temperature
clean air act	climate regulation	indirect effect	warm weather
climate challenge	climate risk	indirect regulatory risks	warmer than normal winter
climate change	climate statute	indirect risks from climate change	warmer weather
climate change laws	climate-change	methane	warming of the climate
climate change legislation	climate-change proposal	physical risk from climate change	weather concern
climate change registry	climate-related initiative	reduction of the emission	weather pattern

Appendix B: Alternative Control Group

To provide a robust analysis, we conduct an alternative test using the same treatment group and an alternative control group, never disclosers ($Treatment_i = 0$ if the firm refrained from disclosing climate risk in the pre-guidance period and maintained non-disclosure after the Guidance). The alternative control group consists of firms that did not disclose climate risk prior to the enactment of the Guidance in 2010 and continued to abstain from such disclosure thereafter. It is important to note that the Guidance extends the SEC's fundamental disclosure requirements, encompassing all registrants without exceptions. However, the alternative control group exists because, as mentioned earlier, the Guidance only mandates the disclosure of climate risks that can materially impact a registrant's business operations and financial performance, rather than requiring disclosure of all climate risks. As a result, management can argue that they either face no climate risk or, at the very least, no material climate risk that necessitates disclosure.

In the absence of random assignment, firms self-select into distinct groups, influenced by potentially endogenous factors. For instance, firms in the baseline control group might possess a management or board particularly sensitive to climate risks, exhibiting a heightened awareness of corporate responsibility regarding climate issues. In contrast, firms in the alternative control group could embody fundamentally different characteristics that lead to immaterial climate risk. Consequently, each control group exhibits unique, endogenous characteristics that influence their categorization. Conducting alternative tests on both control groups could alleviate this issue, at least partially. If the test results remain consistent despite the divergent endogenous selection, it offers some evidence that the outcome is not significantly affected by this selection process.

Using the newly constructed alternative control sample, we report the re-estimated baseline regression results in Table B.1. The coefficient on our key variable of interest,

$Treatment_i \times Post_t$, is negative across all three sample period and is significant at the 1% level. Its magnitude is much larger than that of the same coefficient in the baseline model. This finding confirms our main DiD results and is consistent with the sharper contrast between treatment and alternative control firms that never disclose climate risks. Consistent results are also available for PSM sample for alternative control group in Table B.2.

Table B.1 Effects of climate risk disclosures on takeover likelihood (Sample-Control 2)

	2001-2020		2005-2015		2007-2013	
Treatment_Post	-0.0253***	-0.0369***	-0.0310***	-0.0403***	-0.0310***	-0.0435***
	(-5.39)	(-5.85)	(-4.77)	(-5.12)	(-3.60)	(-4.84)
Post	0.0422***		0.0449***		0.0451***	
	(9.67)		(7.46)		(5.64)	
Treatment	0.0038		0.0025		-0.0004	
	(1.64)		(0.72)		(-0.07)	
SIZE	-0.0023***	-0.0060***	-0.0029***	-0.0074*	-0.0041***	-0.0125*
	(-4.74)	(-3.16)	(-4.22)	(-1.98)	(-4.42)	(-1.97)
ROE	-0.0054	0.0009	0.0006	0.0073	0.0017	0.0076
	(-0.73)	(0.11)	(0.06)	(0.65)	(0.14)	(0.46)
SGROW	-0.0032	-0.0045	-0.0110**	-0.0091*	-0.0109	-0.0067
	(-0.88)	(-1.13)	(-2.09)	(-1.88)	(-1.56)	(-0.68)
STOCKR	-0.0025	-0.0018	-0.0017	-0.0028	0.0007	0.0012
	(-1.37)	(-1.08)	(-0.62)	(-1.05)	(0.17)	(0.30)
LEV	0.0169***	0.0022	0.0190**	-0.0231**	0.0083	-0.0515***
	(2.91)	(0.31)	(2.23)	(-2.11)	(0.73)	(-2.88)
MTB	-0.0001	-0.0000	-0.0002	-0.0001	-0.0002	-0.0004
	(-0.96)	(-0.24)	(-1.08)	(-0.58)	(-0.72)	(-0.97)
TANG	-0.0124**	-0.0110	-0.0109	-0.0152	-0.0222*	-0.0395
	(-1.96)	(-0.95)	(-1.17)	(-0.56)	(-1.81)	(-1.01)
CASH	-0.0019	-0.0146	-0.0030	-0.0275	0.0011	-0.0404
	(-0.22)	(-1.51)	(-0.23)	(-1.36)	(0.06)	(-1.20)
Noncash_WK	0.0009	-0.0074	-0.0092	-0.0338	-0.0193	-0.0373
	(0.13)	(-0.80)	(-1.00)	(-1.50)	(-1.49)	(-1.36)
RD	0.0071	-0.0101	-0.0100	0.0107	-0.0312	-0.1646*
	(0.36)	(-0.28)	(-0.34)	(0.14)	(-0.71)	(-1.95)
AD	0.0040	-0.0374	0.0003	-0.1610	0.0106	0.2191
	(0.07)	(-0.32)	(0.00)	(-0.66)	(0.09)	(0.79)
HHI	-0.0115*	-0.0064	-0.0066	0.0279	-0.0074	0.0463
	(-1.68)	(-0.54)	(-0.62)	(0.95)	(-0.48)	(1.01)
GDUMMY	-0.0009	-0.0015	-0.0015	-0.0016	-0.0005	-0.0018
	(-0.49)	(-0.67)	(-0.59)	(-0.57)	(-0.15)	(-0.32)
IDUMMY	-0.0025	-0.0070***	-0.0049	-0.0104***	-0.0058	-0.0132**
	(-1.13)	(-3.11)	(-1.45)	(-3.41)	(-1.19)	(-2.67)
Constant	0.0272***	0.0910***	0.0391***	0.1111***	0.0565***	0.1628***
	(4.79)	(7.21)	(4.57)	(3.89)	(4.83)	(3.25)
R-squared	0.0125	0.1319	0.0131	0.2036	0.0156	0.2982
N. of Obs.	3073	30701	16171	16122	9428	9355
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	Yes	No	Yes	No	Yes
Year Fixed Effects	No	Yes	No	Yes	No	Yes
Clustering	Firm Level	Industry Level	Firm Level	Industry Level	Firm Level	Industry Level

t statistics in parentheses

* p<0.10 ** p<0.05 *** p<0.01

The dependent variable is Targetiveness, a dummy that indicates if firm i is acquired at least once in year t + 1, and 0 otherwise. The key independent variable is the interaction term between the treatment firm indicator, Treatment, and the indicator for the period after the implementation of the Guidance, Post. Firm characteristic variables are controlled as in Eq. (1). Details about the variable definitions are provided in Appendix C.

Table B.2 Effects of climate risk disclosures on takeover likelihood (PSM Sample-Control 2)

	2001-2020		2005-2015		2007-2013	
Treatment_Post	-0.0307***	-0.0431***	-0.0349***	-0.0458***	-0.0338***	-0.0467***
	(-5.08)	(-5.39)	(-4.18)	(-5.56)	(-3.10)	(-5.20)
Post	0.0477***		0.0493***		0.0489***	
	(8.22)		(6.19)		(4.69)	
Treatment	0.0022		-0.0016		-0.0051	
	(0.86)		(-0.39)		(-0.80)	
SIZE	-0.0028***	-0.0056***	-0.0038***	-0.0082*	-0.0046***	-0.0128*
	(-5.55)	(-2.72)	(-5.22)	(-2.01)	(-4.80)	(-1.92)
ROE	-0.0076	0.0012	0.0001	0.0113	0.0015	0.0165
	(-0.93)	(0.15)	(0.01)	(1.05)	(0.12)	(0.99)
SGROW	-0.0020	-0.0039	-0.0104*	-0.0086	-0.0103	-0.0062
	(-0.50)	(-0.81)	(-1.82)	(-1.51)	(-1.36)	(-0.58)
STOCKR	-0.0017	-0.0016	-0.0014	-0.0032	0.0000	0.0006
	(-0.90)	(-0.91)	(-0.49)	(-1.19)	(0.01)	(0.13)
LEV	0.0143**	-0.0001	0.0203**	-0.0211*	0.0129	-0.0462**
	(2.36)	(-0.01)	(2.25)	(-1.73)	(1.06)	(-2.17)
MTB	-0.0001	0.0000	-0.0003	-0.0002	-0.0004	-0.0005
	(-0.61)	(0.29)	(-1.41)	(-0.72)	(-1.36)	(-1.29)
TANG	-0.0102	-0.0061	-0.0078	-0.0120	-0.0152	-0.0368
	(-1.54)	(-0.53)	(-0.79)	(-0.44)	(-1.20)	(-0.95)
CASH	-0.0021	-0.0102	-0.0053	-0.0306*	0.0071	-0.0344
	(-0.23)	(-1.07)	(-0.38)	(-1.74)	(0.36)	(-1.34)
Noncash_WK	-0.0020	-0.0122	-0.0128	-0.0417*	-0.0184	-0.0447*
	(-0.28)	(-1.39)	(-1.31)	(-1.84)	(-1.34)	(-1.83)
RD	-0.0011	0.0013	-0.0201	-0.0049	-0.0564	-0.2080**
	(-0.05)	(0.03)	(-0.61)	(-0.06)	(-1.15)	(-2.26)
AD	-0.0385	-0.0880	-0.0530	-0.2709	-0.0587	0.1735
	(-0.65)	(-0.65)	(-0.62)	(-1.01)	(-0.51)	(0.61)
HHI	-0.0118*	-0.0062	-0.0047	0.0240	-0.0119	0.0095
	(-1.71)	(-0.53)	(-0.42)	(0.86)	(-0.76)	(0.19)
GDUMMY	-0.0013	-0.0020	-0.0027	-0.0024	-0.0023	-0.0046
	(-0.70)	(-0.88)	(-0.98)	(-0.83)	(-0.61)	(-0.81)
IDUMMY	-0.0029	-0.0070***	-0.0050	-0.0115***	-0.0072	-0.0155***
	(-1.29)	(-2.84)	(-1.42)	(-3.52)	(-1.42)	(-2.93)
Constant	0.0332***	0.0917***	0.0497***	0.1245***	0.0654***	0.1815***
	(5.37)	(6.16)	(5.23)	(3.87)	(5.11)	(3.25)
R-squared	0.0129	0.1186	0.0146	0.1913	0.0169	0.2853
N. of Obs.	2777	2776	1462	14606	8508	847
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	Yes	No	Yes	No	Yes
Year Fixed Effects	No	Yes	No	Yes	No	Yes
Clustering	Firm Level	Industry Level	Firm Level	Industry Level	Firm Level	Industry Level

t statistics in parentheses

* p<0.10 ** p<0.05 *** p<0.01

The dependent variable is Targetiveness, a dummy that indicates if firm i is acquired at least once in year t + 1, and 0 otherwise. The key independent variable is the interaction term between the treatment firm indicator, Treatment, and the indicator for the period after the implementation of the Guidance, Post. Firm characteristic variables are controlled as in Eq. (1). Details about the variable definitions are provided in Appendix C.

Appendix C: Variable Definitions

Variable	Definition
Treatment	Dummy variable that is set to one if a firm discloses climate risk in 10-Ks from 2010 onwards, and zero if it has disclosed relevant information in 10-Ks before 2010 and continued to do so after 2010.
Post	Dummy variable that is set to one for firm-years within the post-guidance period of 2010–2020, and set to zero otherwise.
SIZE	The natural logarithm of a firm's market value of equity. [PRCC * CSHO]
ROE	The ratio of income before extraordinary items to the market value of equity, representing the return on equity. [IB / MKVALT]
SGROW	The annual sales growth rate. [(SALEt / SALEt-1) - 1]
STOCKR	The firm's annual stock return. [LOG (PRCCt / PRCCt-1)]
LEV	The financial leverage of the firm. [(DLTT + DLC) / AT]
MTB	The market-to-book ratio of the firm. [(PRCC * CSHO) / CEQT]
TANG	The tangibility of a firm's assets. [PPENT / AT]
CASH	The proportion of cash to total book assets. [CH / AT]
NONCASH_WK	The ratio of working capital minus cash to the book value of assets. [(WCAP - CH) / AT]
RD	Research and development expenses as a proportion of total assets, with missing values replaced by zero. [XRD / AT]
AD	Advertising expenses as a proportion of total assets, with missing values replaced by zero. [XAD / AT]
HHI	Herfindahl–Hirschman index; sum of squared market shares of all firms in the same three-digit SIC, where market share is defined as sales of a firm to sum of sales with the industry.
GDUMMY	Dummy variable that is set to one for firms with either low growth and high liquidity or low leverage, and high growth with low liquidity or high leverage, and set to zero otherwise.
IDUMMY	An industry dummy variable that is set to one if there has been at least one acquisition in the firm's four-digit SIC industry in the year before the observation year, and zero otherwise.
Bid-ask Spread	The annual average ratio of the daily bid-ask spread to the closing price of the firm. The daily bid-ask spread is computed using Ask or High Price and Bid or Low Price from the CRSP daily stock file.
Idiosyncratic Volatility	The standard deviation of the residuals from a regression of daily excess stock returns on the daily excess market factor.
Analyst Coverage	The number of unique analysts providing earnings per share forecasts for the current fiscal year.
Dispersion of Analyst Forecast	The standard deviation of earnings per share forecasts among analysts for the current fiscal year, scaled by the stock price at the fiscal year-end.
Discretionary accruals	Discretionary accruals are estimated using performance matching as per Kothari et al. (2005).
Tobin's Q	This ratio compares the market value of assets to their book value. [(AT + CEQ + CSHO * PRCC) / AT]
Sales	Sales figures normalized by total assets. [SALE/AT]
Firm Efficiency	Firm efficiency as defined by Demerjian et al. (2012).
Managerial Ability	Managerial ability as defined by Demerjian et al. (2012).
SIZE_T	The logarithm of the target firm's market value of equity.
MTB_T	Market-to-book ratio of the target firm.

MTB_A	Market-to-book ratio of the acquirer firm.
LEV_T	Financial leverage of the acquirer firm.
LEV_A	Financial leverage of the target firm.
CASH_T	Cash to Total Book Assets ratio of the target firm.
CASH_A	Cash to Total Book Assets ratio of the acquirer firm.
RELATIVE_SIZE	The logarithm of the target firm's market value of equity divided by that of the acquirer firms.
TENDER	Dummy variable that is set to one if the deal is a tender offer, and zero otherwise.
DIVERSIFY	Dummy variable that is set to one if the acquirer and target firms have different first two-digit SIC codes, and zero otherwise.
HOSTILE	Dummy variable that is set to one if the takeover offer is classified as hostile, and zero otherwise.
COMPETITION	Dummy variable that is set to one if multiple bidders are involved in the takeover process, and zero if only one bidder is involved.
CASH_PAY	The percentage of cash offered as payment in the acquisition.
Synergy 5-day	The value-weighted combined cumulative abnormal returns (CARs) of both the acquirer and the target firm over a five-day event window. Calculation based on five-day CARs over the [-2, +2] event window relative to the deal announcement date, using the Fama-French three-factor model estimated from 60 days to 259 days before the merger announcement.
Cash Payment Dummy	Dummy variable set to one when the form of consideration is cash-only, and zero otherwise.
Stock Payment Dummy	Dummy variable set to one when the form of consideration is stock-only, and zero otherwise.
Stock Payment Percentage	The percentage of stock offered as payment in the acquisition.
Time to Complete	The decile rank of the number of days from the announcement to the completion of the takeover.