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Sudipta Bose, Kristina Minnick, Syed Shams

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Does Carbon Risk Matter for Corporate Acquisition Decisions?

kminnick@bentley.edu, Syed Shams[3] syed.shams@usq.edu.au
[1]University of Newcastle, Australia
[2]Bentley University, Waltham, Massachusetts
[3]University of Southern Queensland, Australia
[*]Corresponding author.

Abstract

In this study, we examine whether carbon risk matters in acquisitions. Using a firm's carbon emissions to proxy for carbon risk, we examine whether an acquirer's level of carbon emissions is related to the decision to engage in acquisitions and achieve subsequent acquisition returns. The results show that firms with higher emissions have an increased likelihood of acquiring foreign targets while, at the same time, having a decreased likelihood of acquiring domestic targets. Acquirers with large carbon footprints seek out targets in foreign countries that have low gross domestic product (GDP) or weak environmental, regulatory, or governance standards. We also examine the relationship between carbon emissions and announcement returns. We find that cross-border acquisition announcement returns are higher when acquirers with high carbon emissions acquire targets in countries with fewer regulations or weaker environmental standards. Focusing on the interplay of corporate social responsibility (CSR) and carbon emissions, we find that investors censure acquirers that promote CSR while also having high carbon emissions, thus resulting in worse abnormal returns. This is particularly the case if the target country is wealthy or has stronger country governance or strong environmental protection. Our findings add insight on the channels through which a focus on reducing carbon risk can add value for shareholders.

Keywords: carbon emissions; mergers and acquisitions; corporate governance; acquisition announcement returns

JEL Classification: G14, G30, G34, Q54

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> The purpose of a company is to engage all its stakeholders in shared and sustained value creation. In creating such value, a company serves not only its shareholders, but all its stakeholders – employees, customers, suppliers, local communities and society at large. The best way to understand and harmonize the divergent interests of all stakeholders is through a shared commitment to policies and decisions that strengthen the long-term prosperity of a company.
>
> – Klaus Schwab, Founder and Executive Chairman, World Economic Forum
> *(Davos Manifesto 2020)*

1. Introduction

A significant challenge today are the risks associated with climate change linked to carbon and greenhouse gas (GHG) emissions (Intergovernmental Panel on Climate Change (IPCC), 2019). The increase in concern by the public and other stakeholders in the

environment has served as motivation for policymakers to find ways to encourage firms to

change will destroy between US$4.2 trillion and US$43 trillion worth of shareholder value in the global stock market over the next decade. GHG emissions[1] are responsible for global warming and climate change risk (Intergovernmental Panel on Climate Change (IPCC), 2019) and companies need to manage their emissions or face significant risks such as increased regulation, higher taxation, greater clean-up and compliance costs, and reputational damage (Eccles et al., 2012).[2] Unfortunately, many firms view GHG emissions as a negative externality and find it can be more costly to manage GHG emissions than to deal with the penalty of non-compliance. For example, Shapira and Zingales (2017) demonstrate that executives can rationally conclude that violating GHG emissions regulations versus complying with them is value maximizing for shareholders. As a result, countries are beginning to pass stricter regulations which internalize the cost of emissions to firms. Additionally, due to heightened concerns about the consequences of GHG emissions, the costs of non-compliance are increasing due to pressure from environmentalists, regulators, policymakers, and other stakeholders (Matsumura et al., 2014; Clarkson et al., 2015; Griffin et al., 2017).

With investors increasingly evaluating carbon risk as part of a broader environmental, social, and governance (ESG) screen when making investments, firms may likewise evaluate carbon risks in making investments, especially acquisitions. In this study, we examine whether carbon risk matters in the merger and acquisition (M&A) decision. Recent studies highlight the importance of carbon risk and environmental pollution as long-run risk factors for firm returns.[3] One way for firms to reduce the costs associated with carbon risk is to make environmentally sustainable investments. Merger and acquisition (M&A) activity is one driver of value for shareholders: it also has important consequences for a variety of stakeholders as the merger approval process is subject to a range of challenges including regulatory approval (Deng et al., 2013). Greater consideration of carbon risk-related issues when evaluating potential M&A transactions may improve acquisition performance and potentially reduce acquisition-related frictions that can negatively affect all stakeholders. Alternatively, a firm may use an acquisition investment to diversify or off-load carbon risk.

[1] According to the *Kyoto Protocol*, the term 'greenhouse gas (GHG)' includes seven types of gases: carbon dioxide (CO_2) (the major GHG), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and chlorofluorocarbons (CFCs) (Simnett et al., 2009a). These GHGs are measured as carbon dioxide equivalents (CO_2-e) that allow the levels of GHG gases (also termed 'carbon') to be reported in aggregate. We interchangeably use the terms 'carbon emissions' and 'GHG emissions' in this paper.

[2] Non-compliance costs refer to costs like cap-and-trade programs where firms need to buy carbon emission allowances in the market place when they are non-compliant.

[3] For a review of the literature, see (Bansal et al., 2017; Bolton and Kacperczyk, 2020; Hsu et al., 2020).

Specifically, we examine the extent to which carbon risk is considered when firms look to

literature has explored various aspects of acquisitions, this study is one of the first attempts to investigate how climate change risk may be related to M&A decisions and performance. Specifically, we examine whether an acquirer's carbon risk is related to acquisition decisions and market reactions to M&A announcements.

Prior studies find that firms with better corporate social responsibility (CSR) performance have better reputations that enhance firm performance and stakeholder engagement (e.g., Elliott et al., 2014; Gregory et al., 2016). However, a large carbon footprint may have negative consequences for a firm's reputation. Firms can alleviate this negative impression through better CSR performance. For example, prior studies argue that firms with better CSR performance build goodwill through stakeholder engagement, which can alleviate the harm from negative events (Cooper et al., 2018). Therefore, in this study, we also examine whether a strong CSR reputation protects the acquirer from the potential adverse effects of carbon risks on acquisition performance.

Using a cross-country sample of acquisitions from 31 countries from 2006–2018, we look at the interplay of a firm's carbon risk and CSR performance. We use a firm's carbon emissions to proxy for a firm's carbon-related risk. Firms with higher emissions may be more likely to face sanctions or to otherwise internalize external risks associated with carbon risk. We firstly explore whether an acquirer's carbon risks influence the choice between acquiring a domestic or a foreign target. We find that firms with higher carbon risks are more likely to acquire foreign targets rather than domestic targets. One reason may be that foreign acquisitions offer an avenue to outsource carbon risk; for example, costs associated with carbon emissions, such as increased regulations, sanctions, and lawsuits are lower in countries with weaker regulatory standards. To investigate this conjecture, we explore how the acquirer's emissions and the target's country characteristics affect the acquisition decision. In addition, we explore whether shareholder value reflects the potential change in carbon-associated risk. We find that acquirers with large carbon footprints are more likely to acquire targets in countries that have lower gross domestic product (GDP) per capita, or that have weak environmental, regulatory, or governance standards. Secondly, we analyze announcement returns around acquisitions and find that acquirers with lower carbon emissions have higher announcement returns. Furthermore, cross-border acquisition announcement returns are higher when acquirers with high carbon emissions acquire targets in countries with fewer regulations or weaker environmental standards. This is consistent with the value placed by shareholders on the reduction in carbon-related risk from the regulatory regime. Taken together, these results are consistent with acquirers with high

carbon emissions offshoring emissions to countries in which sanctions are less likely to be

Another risk to which emissions activity can expose a firm is reputation risk. That is, a large carbon footprint from GHG emissions can have negative consequences for a firm's reputation. To reduce the harm to reputation from pollution, Cooper et al. (2018) show that firms can build goodwill through engagement in social activities, such as human rights, community engagement, and product responsibility. Therefore, we also investigate whether engagement in CSR activities protects the acquirer from the potential adverse effects of carbon risks on acquisition performance. Our measure of CSR captures the firm's commitment to stakeholders, including the local community, customers, and employees. In line with Cooper et al. (2018), we find that a firm's focus on stakeholder-related CSR accentuates the negative effects of carbon risk. Investors censure acquirers that promote CSR while also having higher carbon risks, thus resulting in worse abnormal returns. This is particularly the case if the target country is wealthy or has stronger country governance protecting shareholders through regulations or strong environmental protection.

Potentially, carbon risk is endogenous to the acquisition decision. To address this, we utilize a quasi-experiment that provides an exogenous source of variation in the main explanatory variable. We utilize the passage of carbon legislation in the acquirer's home country, which is an exogenous event that affects carbon emissions.[4] After stricter environmental regulation is passed in the acquirer's country, we find that acquirers with high emissions experience better announcement returns when they acquire targets in a country with weaker regulation. In addition, we use alternative approaches to address potential endogeneity in our empirical investigations including a propensity score matching (PSM) approach and two-stage least squares (2SLS) with instrumental variables. We also address selection bias associated with the choice of reporting emissions using Heckman (1979) two-stage approach. Our results remain robust.

Our study contributes to the literature in several ways. Firstly, academic research on the role of carbon risks in corporate decisions has grown in recent years. Bolton and Kacperczyk (2020) suggest that concerns over carbon emissions and climate change are only becoming salient more recently as investors are directly seeing the effects of climate change. They find that carbon emissions are becoming a material risk for investors and are beginning to be reflected in the cost of capital. Carbon management and mitigation require substantial resources and long-term strategic commitments of shareholders, boards, and executive management. As countries begin to pass regulations on carbon emissions to address climate

[4] Carbon legislation is regulation that taxes companies which exceed a certain level of carbon emissions (Stavins, 2003).

change, firms must internalize the cost of emissions, thus forcing firms to focus on ways to

carbon emissions. Matsumura et al. (2014), Clarkson et al. (2015), and Griffin et al. (2017) find that equity values are lower for firms with higher emissions, with this related to the likelihood of future regulatory actions arising from high carbon emissions. Focusing on debt markets, Herbohn et al. (2019) find that banks incorporate carbon risk in lending decisions. Firms with higher carbon emissions are potentially riskier and receive higher loan spreads owing to the potential for future regulatory action. Our study adds to this literature by examining how firms can manage carbon risk through acquisition decisions.

Secondly, we add to the burgeoning literature on corporate social responsibility (CSR). Existing studies establish a link between CSR and firm performance; however, the evidence is mixed depending on the sample and measurement of CSR activities.[5] The literature has also examined whether mutual funds that focus on socially responsible firms have stronger performance, again with mixed results (Bauer et al., 2005; Humphrey and Lee, 2011). By examining the moderating role of CSR performance in the relationship between carbon risk and market reactions to acquisition announcements, we provide insight on why CSR studies have mixed results.

Additionally, our study differs from prior CSR research in that we examine the role of carbon risks in acquisition outcomes (Deng et al., 2013; Gomes and Marsat, 2018; Fairhurst and Greene, 2019; Gomes, 2019). Focusing on managing carbon emissions comes with uncertainty and financial risks, such as clean-up costs, research and development (R&D) costs, compliance and litigation costs, and reputational damage (Matsumura et al., 2014; Griffin et al., 2017). Moreover, carbon emissions are a direct and auditable measure of environmental performance compared to CSR performance. Corporate social responsibility (CSR) performance covers a broader and more diverse range of non-financial issues, such as social issues, human rights, occupational health and safety, labor practices, and product responsibility (Simnett et al., 2009b; O'Dwyer et al., 2011; Casey and Grenier, 2015; Peters and Romi, 2015), which can be more difficult to quantify.

Finally, we extend the findings in Moeller and Schlingemann (2005) to broaden our understanding about cross-border acquisitions and market reactions to these deals. These authors show that cross-border acquirers have significantly lower announcement returns than domestic acquirers and suggest that a target's institutional and legal environments may influence these returns. In certain environments, agency issues may reduce acquirer gains. Our study offers an alternative explanation for the observed cross-border effect where results are driven by climate change concerns.

[5] See Galbreath (2016) for a summary of the CSR literature.

2. Literature review and research questions

Mergers and acquisitions (M&As) serve as important events that add insight to the ongoing debate about whether maximizing shareholder value and engaging in socially responsible behavior are mutually exclusive. As Friedman (1970) suggests, unless maximizing other stakeholders' concerns leads to greater firm value in the long run, engaging in socially responsible behavior creates frictions between shareholders and other stakeholders. Research has found that, for some firms, focusing on concerns of other stakeholders can impair firm value, especially for firms that are resource- or capacity-constrained (Cornell and Shapiro, 1987; Brammer and Millington, 2008).

However, Bénabou and Tirole (2010) suggest that, under certain circumstances, focusing on other stakeholders can be beneficial for a firm's shareholders, particularly if it helps to promote a long-term perspective. For instance, shareholders can benefit when firms appease other stakeholders by avoiding certain activities with long-tailed environmental effects, such as pollution and activities that increase carbon emissions. Evidence suggests that capital markets reward environmentally friendly firms with lower risk premiums, while markets penalize poor environmental performance in firms by assessing higher risk premiums (Cormier et al., 1993; Renneboog et al., 2008). Furthermore, high levels of carbon emissions result in higher costs (such as regulatory threats, mandatory investment in abatement technologies, and carbon taxes). These costs can decrease firm value as the costs of non-compliance for a firm with high levels of carbon emissions produce uncertain future cash flows. Indeed, Matsumura et al. (2014) and Griffin et al. (2017) confirm that firms with higher carbon emissions have lower market values.

Firms engage in acquisitions when synergies created by the M&A result in a combined value of the acquirer and target that is higher than the stand-alone value of the two firms. Compared to domestic M&As, cross-border acquisitions potentially face additional valuation concerns arising from cultural and value differences between the various stakeholders of the target and acquirer, which potentially reduce any synergies. According to Seth et al. (2000), access to different resources and the magnitude of synergy varies in cross-border versus domestic acquisitions. Synergy (or, in contrast, friction) may arise from differences in views on climate change risk in acquirer and target countries. Acquirers operating in a country with strict environmental standards and regulations may seek ways to reduce the firm's carbon emissions by engaging in acquisitions in countries with more relaxed environmental standards and regulations, especially if the acquirer is a high carbon emitter. Overall, the firm will appear greener in the acquirer's home country, as they have moved carbon risk across

borders. However, if the target is in a country with more relaxed environmental standards and

that could negatively affect the acquirer and increase costs of the combined firms. Therefore, we evaluate the extent to which a firm's carbon emissions influence the decision to engage in cross-border acquisitions.

RQ1: Does carbon risk matter for acquisition decisions, particularly the choice of a cross-border target?

Jensen (1986) documents that acquisitions can generate substantial gains for shareholders. Deng et al. (2013) show that when acquisitions benefit stakeholders, the potential exists for value creation. They document that greater stakeholder satisfaction ultimately creates value for shareholders by reducing frictions in the M&A process. However, not all acquisitions create value. As Bolton and Kacperczyk (2020) show, global warming and carbon emissions represent a material risk to investors and other stakeholders. Acquiring firms with high levels of carbon risk may be viewed by stakeholders less favorably. As a result, these stakeholders may be less willing to support an acquisition, particularly if the acquisition is seen as a way of avoiding carbon risk compliance. Accordingly, high carbon risk acquirers would see a negative announcement period return at an acquisition. Friedman (1970) argues that the converse can also be true. Firms that engage in activities benefiting other stakeholders at the expense of shareholders can damage shareholder value. For instance, Deng et al. (2013) find that the adoption of environmental controls reduces a firm's profitability and shareholder wealth. Therefore, firms may increase shareholder wealth by engaging in cross-border acquisitions which reduce their domestic carbon risk. Moving carbon risk outside the acquirer's home country could therefore result in higher announcement period returns in an acquisition. We therefore examine whether shareholders integrate carbon risk into an acquisition's announcement period returns.

RQ2a: Is an acquirer's carbon risk related to the market reaction of the acquisition announcement?

Deng et al. (2013) find that a focus on CSR in an acquisition increases acquirer returns at the acquisition announcement. A CSR-focused acquirer helps build trust between all parties to the acquisition (Cording et al., 2014), thus leading to higher announcement period returns for the acquisition. The interplay of CSR and firm value is particularly important when focusing on environmental issues. Acquiring firms that focus on CSR have a better reputation which reduces the negative effects of environmental issues, such as high carbon risks (Godfrey et al., 2009; Chakravarthy et al., 2014). Godfrey et al. (2009) find that CSR can act

like insurance for a firm, protecting the firm from potential legal and regulatory sanctions.

spills over to protect firms from potential negative valuation effects that arise from carbon risk. However, high carbon risk could have a fallen angel effect for acquirers with a reputation for having a CSR focus. As a result, acquirers would see negative returns at the acquisition announcement (Cooper et al., 2018). Therefore, we examine whether an acquiring firm's CSR has an impact on acquisition announcement period returns.

RQ2b: Are the effects of emissions on acquisition announcement returns lessened or intensified by the firm's CSR reputation?

3. Carbon emissions and acquisition likelihood

Our initial sample begins with carbon emissions data from the CDP (previously, Carbon Disclosure Project) database which reports firm-level carbon emissions from 2006–2018. Prior studies have extensively used this database for carbon emissions research (Matsumura et al., 2014; Griffin et al., 2017). One downside of the CDP dataset is that only a subset of firms reported their carbon emissions. We recognize that our data are only a sample from the full population. If our sample's distribution is not an accurate representation of all firms engaging in acquisitions, the accuracy of our conclusions could be affected. We attempt to address this concern by comparing the firms in our sample that disclosed carbon emissions to the entire universe of firms and find our sample includes significantly larger acquirers and larger transactions. We address this concern later in the paper.

Our acquisitions sample is collected from the Refinitiv SDC Platinum Mergers and Acquisition database. Financial data are collected from the Refinitiv Worldscope database; CSR performance data are collected from the Refinitiv ESG database; stock market data from the Refinitiv DataStream database; institutional investors' ownership data from the FactSet LionShares database; and analysts' forecast data from the Institutional Brokers' Enterprise Systems (I/B/E/S) database. Corporate governance data are from the BoardEx database and country-level data are from the World Bank database. We include country-level climate change performance index data, rated by the Germanwatch and Climate Action Network Europe, which indicates the strength of a country's climate change protection activities. We use a cross-country sample to better understand the impact of CSR performance and carbon emissions globally and to identify key factors underlying the cross-border acquisition discount. This multi-country setting allows us a unique opportunity to demonstrate the role of carbon risk in the M&A decision across countries.

The acquisition must have been completed and the acquirer must have carbon emissions data. Additionally, the acquirer must be publicly traded with available firm-level financial information. We split the acquisition sample into two groups: domestic targets and foreign targets. We also have a control group of firms that do not engage in acquisition activity in that given year as a non-acquirer sample. The control firms also need to have both financial and carbon data. The sample firms include 1,007 unique acquirers that acquire domestic firms, 1,020 unique acquirers that acquire foreign firms, and 6,072 benchmark firm-year observations where no acquisitions are made in a given year.

Table 1 reports the descriptive statistics of the full sample used to analyze the impact of carbon emissions on acquisition likelihood (domestic vs. cross-border acquisitions). We measure carbon risk as total carbon emissions, which is the sum of direct and indirect emissions in millions of CO_2-e metric tons. We use two measures of carbon emissions in our analysis: *LNEMISSION* and *EMITR*. *LNEMISSION* is the log of total carbon emissions, which captures the total amount of carbon emitted by acquirers. However, a firm's carbon emission level is related to its volume of production. Therefore, we use another proxy, *EMITR*, that represents the emissions intensity (total emissions scaled by the revenue). We use the logarithmic transformation of *EMITR* as it is highly skewed. Using both proxies helps to triangulate the results. We measure CSR performance as the average of the social and environmental performance scores reported by the Refinitiv ESG database, where a higher value is representative of better CSR performance. The CSR performance score reflects the firm's performance in managing stakeholder relations, specifically workforce relations, human rights, community, and product responsibility as well as managing environmental performance.[6] We also create an indicator variable that is equal to one if the firm has an above-median CSR performance and zero otherwise (*HIGH_CSR).* Table 1 shows the mean and median differences for the firm and country characteristics for three samples: domestic acquirers, cross-border acquirers, and non-acquiring firms.

The descriptive statistics show significant differences between firms that acquire domestic versus foreign targets. Focusing on the research variables of interest, we first find that foreign acquirers have significantly higher carbon emissions compared to either domestic

[6] The workforce relations measure captures a firm's ability to meet the needs of its employees and provide job satisfaction and safe working conditions, as well as maintaining diversity and equal opportunities for its workforce. Human rights capture a firm's ability to respect fundamental human rights conventions. Community captures a firm's commitment to being a good citizen, protecting public health and respecting business ethics. Product responsibility captures a company's ability to satisfy customers with quality products that protect consumers' health and safety. The environmental performance captures a firm's usage of resources, environmental emissions reduction, and innovation.

acquirers or our benchmark sample. We also find that foreign acquirers have significantly

firms. Additionally, cross-border acquirers have statistically larger boards *(BSIZE)* and lower board independence *(BIND)* than either the domestic acquirers or the non-acquirers. Furthermore, these cross-border acquirers are larger *(SIZE)* and more profitable *(ROA)* than their domestic counterparts. Finally, these cross-border acquirers have higher country-level climate change performance *(CCPI)* and gross domestic product *(CGDP)* and lower country-level market capitalizations *(CMCAP)* compared to acquirers that acquire domestic targets. We find differing statistics in comparison with benchmark sample firms. We also find that domestic acquirers tend to be larger *(SIZE),* with larger boards *(BSIZE),* and have higher CSR performance *(CSR)* compared to the non-acquiring sample. These domestic acquirers are also headquartered in countries with higher country-level governance *(CGOV),* lower market capitalizations *(CMCAP),* and lower climate change performance *(CCPI)* compared to the non-acquiring sample.

Prior literature shows that carbon emissions negatively impact on firms' market value (Matsumura et al., 2014; Clarkson et al., 2015; Griffin et al., 2017), whereas focusing on CSR can enhance firm value (Gregory et al., 2016). We extend this line of argument by investigating whether carbon risk is associated with the decision to acquire domestically or abroad. Using carbon emissions as a proxy for carbon risk, our objective is to test whether the level of the bidder's carbon risk is associated with the bidder's choice of a specific target's geographic location when deciding whether to acquire. We also control for the acquirer's CSR performance. This is motivated by the fact that high-emitter acquirers are likely to diversify the risk of their carbon emissions through cross-border M&A decisions; however, a better CSR performance may influence this decision.

We create an indicator variable that is equal to one for domestic acquisitions in a given year (*D_FOR = 1*), two for foreign acquisitions in a given year (*D_FOR = 2*), and zero for the non-acquirer benchmark sample (*D_FOR = 0*).[7] We estimate a multinomial logit model that takes the form:

$$Pr(D\_FOR_{i,t}) = \propto_0 + \propto_1 \left(EMISSION_{i,t-1}\right) + \sum \propto_i Controls_{i,t-1} + \sum \propto_i Year + \sum \propto_i Industry_{i,t} + \varepsilon_{i,t} \qquad (1)$$

where the dependent variable, $D\_FOR_{i,t}$, is a categorical variable, as explained above, and our main explanatory variable is firm-level carbon emissions *(EMISSION)*. We use two proxies for carbon emissions: the natural logarithm of the total amount of carbon emissions *(LNEMISSION)* and the natural logarithm of the total emissions scaled by total revenues

[7] We drop multiple acquisition announcements by the same firm when estimating the multinomial logit regression models.

(EMITR). We control for CSR performance as Deng et al. (2013) show a relationship

1988; Yermack, 1996; Levi et al., 2014), we use three governance characteristics: board size *(BSIZE)*, board independence *(BIND)*, and CEO duality *(DUAL)*. In addition to governance variables, several financial characteristics (firm size *[SIZE]*, leverage *[LEV]*, cash holdings *[CASH]*, growth *[GROWTH]*, return on assets *[ROA]*, and Tobin's Q *[TOBINQ]*) have been used as control variables in our model. These control variables are widely used in prior M&A studies (for example, Jensen, 1986; Lang et al., 1991; Maloney et al., 1993; Harford, 1999; Moeller and Schlingemann, 2005; Capron and Shen, 2007).

As this is a cross-country study, we also control for a number of country characteristics. For example, Rossi and Volpin (2004) find that country-level investor protection is a determinant of cross-border acquisitions. Therefore, we use three proxies for investor protection and potential regulatory oversight, which can potentially increase the cost of carbon risks: country-level gross domestic product *(CGDP)*, common law *(CLAW)*, and anti-director rights *(CGOV)*. Tunyi and Ntim (2016) show that more developed stock markets are associated with M&A activity; therefore, we include stock market capitalization *(CMCAP)* as a control variable. Finally, we include the climate change performance index score *(CCPI)* as an indicator for the climate change awareness of the country (Germanwatch and Climate Action Network, 2019) where the bidding firms operate.

Table 2 reports the multinomial logistic regression results using Equation 1. Models 1 and 2 report the regression results with the natural logarithm of carbon emissions *(LNEMISSION)*, while Models 3 and 4 report the regression results with the natural logarithm of carbon emissions scaled by total revenues *(EMITR)* as a dependent variable. In Models 1 and 3, the dependent variable (*D_FOR* = 1) reflects acquisitions of domestic firms, while in Models 2 and 4, the dependent variable (*D_FOR* = 2) reflects acquisitions of foreign firms.

The coefficients of *EMISSION* are negative and statistically significant in Models 1 and 3, using both *LNEMISSION* and *EMITR* as proxies for carbon emissions, respectively. This suggests that acquirers with higher levels of carbon emissions are less likely to acquire domestic targets. Conversely, the coefficients of *LNEMISSION* and *EMITR* are positive and statistically significant in Models 2 and 4 using both proxies for carbon emissions, indicating that acquirers with high carbon emissions are more likely to acquire foreign targets, which answers our first research question (R1). In economic terms, a one standard deviation change in *LNEMISSION* (*EMITR*) leads to a 31.61% (11.73%) decrease in the likelihood of domestic acquisitions, but a 10.94% (16.76%) increase in the likelihood of foreign acquisitions.[8] These

[8] The standard deviations of *LNEMISSION* and *EMITR* are 2.360 and 0.377, respectively. We calculate the economic significance (changes in odds, or relative probability) as follows: exp[((-0.161 or 0.044)×2.360]-1) and exp[((-0.331 or 0.411)×0.377)-1].

results suggest that acquirers with a high carbon risk may want to shift their carbon risk

Based on Models 1 and 3, we document that the following firm characteristics are positively related to the likelihood of engaging in domestic acquisitions versus either not acquiring any target or acquiring a foreign target: larger firms (*SIZE*), higher leverage ratio *(LEV)*, higher sales growth *(GROWTH)*, more independent board *(BIND)*, or better country-level governance *(CGOV)*. Furthermore, firms with lower growth opportunities *(TOBINQ)*, lower gross domestic product *(CGDP)*, or lower climate change performance *(CCPI)* also have a higher likelihood of engaging in domestic acquisitions. Moreover, we find that the following characteristics are positively associated with the likelihood of engaging in foreign acquisitions: larger size *(SIZE)*, larger boards *(BSIZE)*, higher sales growth *(GROWTH)*, higher country-level governance *(CGOV)*, or higher country-level climate change performance *(CCPI)*. Firms with higher growth opportunities *(TOBINQ)* or firms that operate in common law countries *(CLAW)* have a lower likelihood of foreign acquisitions.

As shown in Table 2, we find some support for the idea that firms with high carbon risk seek cross-border targets as a way of potentially outsourcing their carbon risk. To better understand these results and whether certain country characteristics of target firms influence this choice, we run a logistic regression on the decision to choose a foreign or domestic target. The dependent variable in the logistic model is an indicator variable (*FOREIGN*) that is equal to one if the target is in a foreign country and to zero if the target is domestic. We use the same empirical set-up shown in Equation 1. We define *HIGH* vs *LOW GDP (GOV)* based on the yearly median of GDP (country-level governance based on revised anti-directors' rights index by Djankov et al (2008)). We create an indicator variable of one if a target country's GDP (anti-directors' rights) is at or above the median and otherwise zero. We measure country-level environmental regulatory stringency (*ENV_REG*) based on the stringency ratings by Esty and Porter (2005). Furthermore, we collect the environmental value systems data (*ENV_VALUE*) from the World Value Survey (WVS).[1] Following the above classification approach, we create an indicator variable of *HIGH_EREG (HIGH_EVAL)* equal to one if a target country's environmental regulatory stringency score (environmental value) is at or above the median and zero otherwise, with Table 3 showing the results.

We find that firms with high carbon risk choose certain target country characteristics. Specifically, in Table 3, Models 1 and 2, we segment the sample into high and low GDP for the target country. We find that, for wealthy countries, carbon emissions do not influence the choice between domestic or foreign targets. However, we find that high carbon emissions significantly increase the probability of a foreign target when the target is located in a poor

country. In economic terms, with a 1% increase in carbon emissions, the odds of acquiring a

for country-level governance (Table 3, Models 3 and 4), which captures the legal protection and regulations for shareholders. In target countries with a high level of country governance, carbon emissions are not related to the decision to acquire a domestic or foreign target. However, in target countries with weak governance, we find that firms with high emissions have a 58.90% increase in the odds of acquiring a foreign target.

Another driver of the choice to offshore carbon risk could be that foreign targets operate in countries with weaker environmental regulatory stringency.[9] In Table 3, Models 5 and 6, we look at the segmentation of environmental regulatory stringency and find that firms with high emissions choose foreign targets in countries with weak environmental regulatory stringency. We also segment target countries by their environmental values, as shown in Table 3, Models 7 and 8.[10] Firms are 32.60% more likely to choose foreign targets in countries with weak environmental values. Focusing on the control variables, we find that if the acquirer's home country is wealthy or is highly regulated, they will be unlikely to pursue foreign targets that are also in countries that are wealthy or highly regulated. However, these same firms have an increased probability of choosing foreign targets if the targets are located in poor countries or in countries that have weak regulations or weak environmental values. Taken together, the results from Table 3 suggest that firms with high carbon risk seek out targets in countries that may not care as much about carbon risk versus domestic targets that may be more concerned about carbon emissions.

4. Carbon emissions and market reaction to foreign acquisition announcements

We find evidence that firms with high carbon risk may seek to outsource that risk to other countries by engaging in cross-border acquisitions, whereas firms with low carbon risk engage in domestic acquisitions. However, we do not know if this outsourcing strategy is valued by capital markets. By offshoring carbon risk, firms may create value for shareholders.

We begin with global cross-country M&A announcements made by 31,872 publicly listed acquirers during the 13-year period from 2006–2018 with data from the Refinitiv SDC Platinum M&A database. We consider all acquisitions of public, private, and subsidiary targets. Following Shen et al. (2014), Bris (2005), and King (2009), we exclude all announcements related to leveraged buyouts, spinoffs, recapitalizations, self-tenders,

[9] We measure country-level environmental regulatory stringency based on the stringency ratings by Esty and Porter (2005).

[10] We collect the environmental value systems data from the World Value Survey (WVS).

exchange offers, repurchases, minority stock purchases, acquisitions of remaining interest, or

Worldscope database, we obtain 20,647 acquisition announcements. Subsequently, we drop an additional 13,440 announcements due to non-availability of the required carbon emissions data. Finally, we drop 3,203 and 1,241 announcements due to missing M&A and country-related variables, respectively, which results in 2,763 M&A announcements from 841 firms.

Table 4 reports the distribution of the M&A sample across countries, years, and industries. Panel A shows the M&A industry sample distribution based on the classification by Dhaliwal et al. (2011). The mining and construction industry represents the largest proportion of firms in our sample (10.57%), followed by the computer industry (9.08%) and transportation industry (8.98%). Focusing on distribution across time, the largest proportion (10.86%) of acquisitions is in 2015, followed by 2017 (8.98%), while 2006 has the lowest number of acquisitions (4.96%). The yearly distribution of M&A announcements is evenly distributed, except for 2006 which was the year in which CDP started disclosing carbon emissions information.

Table 4, Panel B shows the acquirers' country distribution. Our sample is dominated by firms from the United States (US) (25.37%), followed by Japan (14.37%), while the Czech Republic, Kazakhstan, and Poland present the fewest observations.[11] Regarding carbon emissions, firms in Russia have the highest (at 74.90 million CO_2-e metric tons), followed by the Czech Republic (46.90 million CO_2-e metric tons) and Italy (44.80 million CO2-e metric tons), while firms operating in Luxembourg emit the lowest amount of carbon emissions (0.04 million CO2-e metric tons).

Following Brown and Warner (1985), we calculate cumulative abnormal returns (*CARs*) over a five-day event window (from t = -2 to t = +2) surrounding the announcement day (t = 0) using daily returns for the acquirer and for the market for a 200-day estimation period spanning t = -210 to t = -11. The length of our estimation period equals those employed in prior studies including the work of Chang (1998), Moeller and Schlingemann (2005), and Masulis et al. (2007). We use country-specific, value-weighted market returns. We exclude the 10-day window immediately prior to the acquisition announcement period from the estimation period as it is common in acquisition events for information to be leaked to the capital market well before the actual announcement.

In unreported tests, we find that both domestic and foreign acquirers have average five-day CARs of -0.10%. The average carbon emissions intensity *(EMITR)* is 0.179 for our domestic acquisitions and 0.171 for our cross-border acquisitions. We next split the sample

[11] We drop the countries with the least number of observations from our regression models to check the sensitivity of our results. We find that dropping small numbers of observations does not qualitatively affect our findings.

into low and high carbon emitters based on whether *LNEMISSION* is above the median value

acquisitions. Table 5 shows the descriptive statistics of our announcement sample. Focusing on domestic acquisitions, we find that the CARs of the lower emissions group are 0.3% versus the CARs of the high emissions group, which are -0.2%, an almost 0.50% significant difference in returns. Cross-border acquisitions show an even larger difference between low and high carbon emitter CARs, a 0.6% average difference significant at the 1% level. Focusing on CSR performance, we find that, for both domestic and foreign acquirers, the high emitter group has better CSR performance, which is surprising but may be indicative of the fallen angel effect.[12] Table 5, Panel B shows the deal characteristics. Significant differences are found between high emissions and low emissions groups for domestic acquirers regarding the deal characteristics, *PRIVATE*, *ALLSTOCK*, *RELSIZE*, and *SERIAL*, while foreign acquirers with high versus low emitter groups differ significantly in relation to the deal characteristics of *PRIVATE*, *ALLCASH*, *RELSIZE*, *HOSTILE* and *SERIAL*. We also find that, for both domestic and foreign acquirers, the high-emitter group is larger, has higher revenue, lower growth, and larger boards than their low-emissions counterparts. Finally, these high-emitters are more likely to have their CEO also chair the board than their low-emitter counterparts.

For the sake of brevity, the correlation table is not reported in this paper. We find that the proxies for carbon emissions are negatively correlated with the five-day cumulative abnormal returns (CARs) providing initial support for our research question (RQ2a). Furthermore, the correlation matrix shows no high correlations between variables.[13] We also examine the variance inflation factor (VIF) values to further test for multicollinearity. This examination reveals no sign of potential multicollinearity, with the result confirmed by running collinearity tests after each regression. The mean VIF value of the variables in the regression model is 1.39 and all of our variables have VIF values less than 10, suggesting that multicollinearity problems are unlikely in our regression models (Greene, 2008).

The literature shows that high carbon emissions may reduce firms' market value (Matsumura et al., 2014; Clarkson et al., 2015; Griffin et al., 2017). From our earlier analysis, we find that an acquirer's carbon emissions are related to the decision to acquire abroad. In this section, we investigate the market's reaction to acquisitions in relation to the acquirer's

[12] The halo effect is defined as the firm's reputation for CSR performance protecting its firm value from the adverse effect of carbon emissions, while the fallen angel effect is defined as the firm's reputation for CSR performance not protecting its firm value from the adverse effect of carbon emissions (Cooper et al., 2018).

[13] The exception is the correlation between *ROA* and *TOBINQ* which is 0.611. However, Gujarati and Porter (2009) suggest that correlations between variables below 0.80 do not create any multicollinearity problems in regression models. Hence, the correlation between *ROA* and *TOBINQ* is considered to have less impact on the overall result.

carbon emissions and the moderating role of CSR performance. It is important to investigate

this may mitigate carbon concerns. For this purpose, using the five-day cumulative abnormal return (CAR) earned by acquirers, we estimate the following regression model:

$$CAR_{i,t} = \propto_0 + \propto_1 \left(EMISSION_{i,t-1}\right) + \sum \propto_i Controls_{i,t-1} + \sum \propto_i Year_{i,t} + \sum \propto_i Industry_{i,t} + \varepsilon_{i,t} \qquad (2)$$

where $CAR_{i,t}$ is the cumulative abnormal return (CAR) earned by acquirers during the five-day announcement period ($CAR_{i,(t-2\ to\ t+2)}$). *EMISSION* is the main explanatory variable that captures the firm's carbon emissions. We use the same two proxies for carbon emissions as well as the financial- and governance-related control variables from Equation 1. In addition, we include M&A-specific control variables in the regression models that are influential in explaining acquirers' abnormal returns. Based on prior empirical studies, we include the following controls: private target indicators *(PRIVATE)* (Fuller et al., 2002); cash only *(ALLCASH)* and stock only *(ALLSTOCK)* indicators (Travlos, 1987); unrelated indicators *(UNRELATED)* (Morck et al., 1990); relative size of the target *(RELSIZE)* (Asquith et al., 1983); hostile bid indicator *(HOSTILE)* (Jarrell and Bradley, 1980); serial bidder indicator *(SERIAL);* and tender offer indicator *(TENDER)*. The inclusion of these variables is motivated by acquisition characteristics that are shown to impact on acquisition announcement returns.

We first run the regression models to examine the impact of carbon emissions on acquirers' announcement returns, combining both domestic and cross-border acquisitions. Our other objective is to examine whether acquirers' CSR performance can mitigate the negative impact of carbon emissions on announcement returns. Cooper et al. (2018) argue that CSR performance does not have a halo effect on firm-value reductions of carbon emissions; rather, it has a fallen angel effect. Drawing on this view, we examine the moderating role of CSR performance on the association between carbon emissions and acquirers' announcement returns using both domestic and foreign acquisitions.

Table 6, Panel A reports the regression results. Models 1 and 2 report the regression results controlling for CSR performance. The coefficients of our emissions proxies are negative and statistically significant, suggesting that acquirers with higher carbon emissions have lower announcement returns, which provides insight on our research question (RQ2a). In terms of economic significance, the estimated coefficient suggests that a one standard deviation increase in carbon emissions measured by *LNEMISSION (EMITR)* reduces the average announcement returns by 15.56% (10.67%).[14] However, acquirers with a high CSR

[14] The standard deviations (unreported) of *CAR*, *LNEMISSION*, and *EMITR* are 0.044, 2.292, and 0.314, respectively. We compute 15.56%: [(-0.003×2.292)/0.044]×100 and 10.67% as [(-0.015×0.314)/0.044]×100.

performance increase the announcement CARs by 0.80%. Considering that the average CARs

We next split the sample into domestic and foreign acquirers: Models 3 and 4 show regression results for domestic acquisitions, while Models 5 and 6 show results for foreign acquisitions. We interact carbon emissions with high CSR performance (*EMISSION*×*HIGH_CSR*) in Models 3–6 to capture the difference in the effects of carbon emissions on announcement returns between acquirers with high versus low CSR performance. The negative coefficients of *EMISSION*×*HIGH_CSR* (in Model 3, β = -0.005, p < 0.01; in Model 4; β = -0.028, p < 0.01) for domestic acquisitions indicate that, after controlling for other factors, the average decrease in acquirers' announcement returns due to carbon emissions is exacerbated for acquirers with high CSR performance. Interestingly, the coefficients of *EMISSION* are negative but insignificant in Models 3 and 4, suggesting that acquirers with low CSR performance are not penalized for carbon emissions by the market. Conversely, the coefficients of *EMISSION* are negative and significant for foreign acquirers in Models 5 and 6, but the interaction coefficient is statistically insignificant for the foreign sample. These findings can be interpreted as meaning that domestic acquirers with higher carbon emissions suffer an additional market penalty when they have better CSR performance. This evidence suggests that investors are more sensitive to carbon risk when acquirers have higher CSR performance but fail to adopt green strategies in their operation. However, CSR performance is not important to investors when acquirers buy foreign targets.

Focusing on control variables in the primary estimations shown in Models 1 and 2, the coefficients of *TOBINQ* are positive and significant, which indicates that higher market-based performance generates higher cumulative abnormal returns (CARs). On the other hand, the coefficients of *TENDER*, *BIND*, and *CLAW_ACQ* are negative and statistically significant in Models 1 and 2, suggesting that acquirers which use tender offers, have independent boards, or are located in common law countries have lower announcement period abnormal returns.[15]

In an acquisition, it is not only the acquirer's focus on the environment but also the target's characteristics that may drive market reactions. Due to data limitations, we do not have a large enough sample to control for the target firm's carbon emissions. In addition, our data on target characteristics are limited as we control for both public and private targets in our sample. Table 6, Panel B shows the regression results of the CAR model controlling for

[15] The literature on announcement returns around acquisitions typically shows a negative relationship between firm size and cumulative abnormal returns (CARs) (Masulis et al., 2007). However, our sample relies on the CDP carbon dataset. We find that firms which report carbon emissions are significantly larger than non-reporting firms. In an unreported test, we compare the size of all acquirers on the SDC database and find that total assets are US$78,504 million, on average, for firms with carbon emissions data compared to US$39,962 million for acquirers that do not report carbon emissions. Therefore, our sample is significantly larger than a typical M&A sample.

target firm's characteristics as well as target country's characteristics. For the sake of brevity,

subsample of 701 targets and report these estimations for the full sample in Models 1 and 2. Even after controlling for target characteristics, we find that acquirers with high emissions have worse cumulative abnormal returns (CARs). We also find that CSR performance is still positively related to acquisition returns. The only target characteristic that is related to announcement returns is sales growth (*GROWTH_TAR*). We find that higher growth targets lead to worse announcement returns for acquirers.

We next split the estimations into domestic deals (Models 3 and 4) and foreign deals (Models 5 and 6). Without enough data to use actual target characteristics when splitting the sample, we use the target country's characteristics, namely, country-level market capitalization *(CMCAP_TAR)*, common law *(CLAW_TAR)*, governance *(CGOV_TAR)*, gross domestic product *(CGDP_TAR)*, and climate change performance *(CCPI_TAR)*. The coefficients of *EMISSION* are negative and statistically significant across all models from Models 3–6, confirming the robustness of our findings. Interestingly, the only two target country characteristics that are significant are country level market capitalization and the common law indicator. Focusing on foreign deals, acquirers that buy targets in developed countries with higher market capitalization have higher returns, while common law countries have worse cumulative abnormal returns (CARs). Typically, better transparency is found in wealthier countries which can facilitate the due diligence process. However, common law countries tend to have a strong focus on environmental protection (Horváthová, 2010). Acquirers with high carbon risk that buy targets in wealthy countries or in countries with a focus on the environment may have more difficulty outsourcing their carbon risk.

As considerable variation is evident in target country characteristics, particularly when the target is foreign, we next segment our analysis into four aspects of the target country that may influence acquisition announcement returns. More specifically, we examine the impact of two economic characteristics of target countries in Panel A: the level of country-level financial development *(CGDP)* and the level of country-level governance *(CGOV)*. Panel B looks at the target country's focus on the environment, specifically country-level environmental regulatory stringency *(ENV_REG)* and country-level environmental values *(ENV_VALUE)*.

Table 7, Panel A reports the subsample analysis based on the target's country-level financial development *(CGDP_TAR)* and governance *(CGOV_TAR)*. Swart and van Marrewijk (2011) show that developed countries with strong financial systems care more about carbon emissions. Therefore, we expect a negative relationship between carbon emissions and the target country's level of development and governance. We rerun our

baseline models in Table 7 for the subsample of acquirers operating in target countries with

development or governance *(LOW GDP* or *LOW GOV*) using the same classifications defined in Section 3. Focusing on domestic acquisitions, carbon risk alone does not impact on acquisition returns. However, we find that CSR's fallen angel effect is larger if the country is developed or has strong governance. Investors in wealthy countries chastise acquirers that promote CSR while also having high carbon risk when they acquire targets in their home country, thus resulting in worse abnormal returns. Foreign acquirers are punished by investors for trying to offshore carbon risk to target countries with high GDP or governance. These results may be driven by shareholders anticipating more integration issues if acquirers with high carbon risk are acquiring firms in developed countries with better governance. However, acquirers with strong CSR performance actually experience better announcement effects when they acquire in countries with strong governance. Taken together, the results from Table 7 answer the research question (RQ2b). The interplay of CSR and carbon emissions matters when the target country has more regulations and is wealthier.

Similarly, prior studies show that country-level environmental regulatory stringency and environmental values impact on firms' environmental performance (Esty and Porter, 2005). A more stringent environmental regulatory regime drives a lower level of carbon emissions and a lower use of energy leading to greater corporate innovation (Porter and van der Linde, 1995) and economic success. Targets in countries with weak environmental regulatory stringency may care less about carbon emissions. Panel B reports the subsample analysis based on the target country's environmental regulatory stringency *(ENV_REG)* and environmental values (*ENV_VALUE)*, as defined in Section 3. We find results similar to those reported in the above panels for domestic acquisitions. The negative effects of carbon risk are accentuated by a firm's CSR rating only when the country cares about the environment. Focusing on cross-border acquisitions, we find that, although negative relationships between emissions and CARs exist for both subsamples, the effects are stronger for target countries with high environmental regulatory stringency. We also find that the fallen angel effect exists for cross-border deals in target countries with strict environmental regulations. Additionally, we find that high carbon emitters that acquire targets in countries with low environmental values are not punished for offshoring their emissions. The stock market recognizes the challenges faced by acquirers with carbon risk. This issue is exacerbated when the acquirer is buying a target in a developed country that cares about the environment, resulting in deals that are more likely to reduce value.[16]

[16] In unreported tests, we find qualitatively similar results using country fixed effects instead of country-level variables to account for unobserved country-level characteristics. Additionally, we repeat our analyses after excluding the following groups one at a time: US acquirers, Japanese acquirers (second largest group of

We next investigate whether the negative association between carbon emissions and acquisitions, acquirers with high emissions are likely to expand their business operations to diversify their carbon emissions rather than to diversify their business. Acquirers with high carbon risk may want to relocate their dirty industries in developing countries that are not environmentally friendly. It is possible that shareholders approve of offshoring carbon risk to less developed countries. This strategy makes sense for related acquisitions but not for diversifying acquisitions. We expect shareholders to react negatively when acquirers with high emissions in their home country acquire unrelated firms as opposed to related industry firms. Table 8 reports the regression results where, for the sake of brevity, we only show the variables of interest. We find that announcement returns are worse when deals are diversifying if the firm has high carbon emissions. However, if the deal is in the same industry, carbon emissions do not matter. When we segment the sample based on foreign and domestic acquisitions, we find that, although diversifying acquisitions are related to lower announcement returns regardless of where a target is located, the returns are worse if the target is in a foreign country. This suggests that offshoring carbon risk is more difficult during a cross-border diversifying acquisition and may be driven by the fact that diversifying acquisitions do not allow for the delocalizing of carbon risk. An acquisition in an industry related to the acquirer may however allow the firm to outsource its carbon risk.

Endogeneity arises when the variable of interest is correlated with the error term. Potential sources of endogeneity include omitted variables, measurement errors, selection bias due to observable and unobservable differences between treatment and control firms, and reverse causality that may cause regression models to be biased. Although we add several control variables to our regression models to minimize omitted variable bias and measure our variables of interest differently, we include additional robustness tests to ensure that our results hold.

We use an external shock to carbon emissions for firms: the introduction of carbon tax legislation for the first time in a country. The objective of the legislation is to restrict carbon emissions. We define *POST* as an indicator variable that is coded one after the issuance of the carbon tax legislation and zero otherwise. The interaction between *POST* and *EMISSION* (our variable of interest) captures whether acquirers start offshoring their carbon risk following a change in carbon-related legislation. As our study covers an international setting, our sample includes targets across the world with variations in when or if countries enact carbon tax

observations), and countries with fewer than 10 observations. Finally, we test whether structural time differences are found in the relationship between carbon emissions and announcement returns, and do not find any significant differences over time. For the sake of brevity, we do not report the results, but the findings are qualitatively similar to our main results.

legislation.[17] Hence, these countries offer a quasi-experimental setting in which to study the

regression results. We document that the coefficients of *POST×EMISSION* are negative and statistically significant in Models 1 and 2. These findings corroborate the findings that bidders' carbon emissions negatively affect announcement returns. Our results suggest that markets punish firms that try to elude legislation meant to improve the environment by acquiring targets, particularly after the acquirer's country strengthens its focus on climate change.[18]

We also separate the sample into high and low CSR performance to analyze the impact of carbon tax legislation on acquirers' announcement returns. Model 3 (Model 4) shows the results for *HIGH_CSR (LOW_CSR*) acquirers. This segmentation shows that new carbon tax legislation only matters for firms with high CSR performance. This suggests that the fallen angel effect becomes stronger when regulations become more punitive in policing carbon emissions.[19] We also segment the sample based on the target country's characteristics. In Models 5 and 6, we segment by the target country's GDP and in Models 7 and 8, we segment by the stringency of environmental regulations. We find that when an acquirer's home country increases the regulatory costs for non-compliance regarding carbon emissions, acquirers that offshore their risk to poor countries or to countries with weak regulation can potentially minimize these costs. However, if the acquirer seeks targets in wealthy countries with high environmental regulations, their returns are worse after their home country increases the costs of non-compliance.

Our models may suffer selection bias from observable and unobservable differences between treatment and control firms. Certain industries and firm characteristics may have high carbon emissions due to the nature of their business or industry. We use propensity score matching (PSM) to correct for any endogenous selection on the observed variables (Rosenbaum and Rubin, 1983) and create a sample of firms with a set of firm-, industry-, and country-specific characteristics that potentially determine an acquirer's level of carbon

[17] The introduction and enactment of carbon tax legislation are as follows: Australia, 2012; China, 2013; Costa Rica, 1997; Denmark, 2002; Finland, 1990; France, 2014; Germany, 1999; India, 2010; Ireland, 2010; Japan, 2012; South Korea, 2008; the Netherlands, 1990; Norway, 1991; New Zealand, 2005; Singapore, 2017; Slovenia, 1997; South Africa, 2015; Sweden, 1991; Switzerland, 2008; and the United Kingdom (UK), 2001. An example of carbon legislation is Australia's introduction of a carbon pricing scheme or 'carbon tax' through the Clean Energy Act. The initiative was intended to control emissions in the country.

[18] The portability of target and acquirer country and firm differences may drive the decision to choose a domestic or foreign target. To gain a better understanding, in unreported tests, we run a logistic model where the dependent variable is equal to one if the acquirer buys a foreign target and zero otherwise. We find that, without the passage of carbon legislation, carbon emissions do not drive the choice between countries. However, after the passage of carbon legislation, high emitter acquirers look for foreign targets.

[19] Spamann (2020) show that clustering of treatment firms at the state level leads to over-rejection of the null hypothesis. To ensure that our results and conclusions are not driven by these clustering issues, we cluster at the firm level.

emissions. An indicator value of one for *EMI_DUM* is assigned if an acquirer emits carbon

level of carbon emissions or zero otherwise. We firstly use a logistic model to estimate the probability that a firm has carbon emissions above the norm, conditional on the observable firm, industry, and country characteristics. Based on the coefficients from this model, we compute a propensity score for each observation and then match our treatment acquirers with control acquirers.[20] We match 1,516 acquirers from a final sample of 2,763 acquirers. We report the PSM second-stage regression results in Table 10, Model 1. The coefficient of *EMI_DUM* is negative and statistically significant, which suggests that our findings do not suffer from observable sample selection bias.

Secondly, our sample comprises only those firms that respond to the CDP's questionnaire. This introduces a self-selection bias to our analysis. To address the potential self-selection bias, we adopt Heckman (1979) two-stage analysis. In the first stage, we model the decision to respond to the CDP *(CDP_DISC)* as the dependent variable for all acquirers.[21] Lennox et al. (2012) highlight the importance of imposing "exclusion restrictions" when using Heckman (1979) procedure. The reason is that the absence of exclusion restrictions in the selection model can lead to biased coefficients that may be due to multicollinearity in regression models. The exclusion restriction requires at least one variable in the selection model to be conceptually excluded from the acquisition performance model. To satisfy the exclusion restriction, we include instruments in our selection model which are related to the firm's decision to disclose carbon emissions but do not directly affect acquisition performance (Matsumura et al., 2014). These comprise *PROPDISCL* that captures industry pressure to disclose emissions and *CDP_LAG* that captures whether the firm reported emissions in the prior year. We use the inverse Mills ratio (*IMR*) from the first-stage model to control for selection bias in the second stage. Table 10, Model 2 shows the first-stage regression results, while Model 3 shows the second-stage regression results. The coefficient of *LNEMISSION* is negative and statistically significant. The coefficient of *IMR* is also insignificant, thus suggesting that our results are not driven by sample selection bias.

We also mitigate the potential for endogeneity from omitted variables by using a two-stage least squares (2SLS) instrumental variable approach. As our instrument, we use the 10-

[20] Our propensity matching uses the replacement to a unique observation with a lower level of emissions, using the closest propensity score based on a calliper width of 0.01.

[21] We include the following determinants of a firm's decision to participate in the CDP in the first-stage model for the Heckman (1979) procedure: lagged CDP response *(CDP_LAG)*; firm's proportion of disclosures *(PROPDISCL)*; firm size *(SIZE)*; leverage *(LEV)*; growth *(GROWTH)*; profitability *(ROA)*; Tobin's Q *(TOBINQ)*; foreign sales *(FOREIGN);* capital intensity *(CAPEX);* relative environmental performance *(ENVPERF)*; institutional investors' ownership *(INSTOWN);* country-level stock market capitalization *(CMCAP)*; common law *(CLAW);* anti-director rights *(CGOV)*; gross domestic product *(CGDP);* and climate change performance index score *(CCPI)*.

year average mortality rate from air pollution *(MORTALITY)* before acquisition. The

affect acquisition performance. Therefore, we believe that our instrument is valid. Model 4 reports the first-stage regression results, showing that the coefficient of the instrumental variable *(MORTALITY)* is significant. The coefficients of other control variables (unreported) are significant as per our expectation. Our instrument satisfies the relevance and validity criteria. Shea's partial R^2 value is 7.40%, while the partial *F*-statistic of the first-stage model is 280.919, as shown in Model 4, which suggests that our instruments are not weak (Stock et al., 2002). Overall, these test statistics suggest that our instruments fulfill the conditions of exogeneity and relevance. The results for the second-stage regression in Model 5 show that the coefficient of *LNEMISSION* is negative and statistically significant, even when controlling for endogeneity.

5. Additional analyses and robustness check

Several studies document that carbon emissions reduce shareholders' value (Matsumura et al., 2014; Griffin et al., 2017; Bolton and Kacperczyk, 2020). Our study extends this literature by investigating the role of carbon emissions in the decision to engage in acquisitions based on the deal's potential synergies. Our objective is to test whether focusing on carbon risk encourages value-enhancing acquisitions while discouraging value-reducing acquisitions. Market participants view some acquisitions as value-creating acquisitions due to positive announcement returns while others are viewed as value-reducing acquisitions by awarding negative announcement period abnormal returns. Focusing on our sample of acquisitions employed in Equation 2, we utilize 2,763 deals that have CAR information. Among these deals, 1,391 deals have positive CARs, while 1,372 deals have negative cumulative abnormal returns (CARs).

For this purpose, we divide the acquisitions into two groups: value-creating acquisitions (those with a positive cumulative announcement period abnormal return) and value-reducing acquisitions (those with a negative cumulative announcement period abnormal return). We then create a categorical variable that is equal to one if an acquirer makes value-reducing acquisitions in a given year (*D_CAR* = 1), and equal to two if an acquirer makes value-creating acquisitions in a given year (*D_CAR* = 2).[22] We use this indicator variable together with the non-acquirer benchmark sample (*D_CAR* = 0) as the dependent variable, and we estimate a multinomial logistic model that takes the form:

[22] If an acquirer makes multiple acquisitions in a given year, we calculate the weighted-average cumulative abnormal return (CAR) by using deal values to assign weights to respective deals.

$$\Pr(D\_CAR_{i,t}) = \propto_0 + \propto_1 (LNEMISSION_{i,t-1}) + \sum \propto_i Controls_{i,t-1} + \sum \propto_i Year_{i,t} + \sum \propto_i Industry_{i,t} + e_{i,t} \quad (3)$$

The dependent variable $D\_CAR_{i,t}$ is the indicator variable explained above. Our main explanatory variable is carbon emissions *(*$LNEMISSION_{i,t-1}$*)*. We use both governance characteristics (board size, board independence, and CEO duality) and financial characteristics (firm size, leverage, cash holdings, growth, return on assets, Tobin's Q, and firm age) of acquirers as control variables in the above model (unreported).

Table 11 reports the regression estimates for Equation 3. In this table, Model 1 shows the dependent variable (D_CAR_1 = 1) which reflects value-reducing acquisitions, while the dependent variable (D_CAR_1 = 2) reflects value-creating acquisitions in Model 2. We find that, in Model 1 the coefficient of *LNEMISSION* is positive and significant at the 1% level. Clearly, higher carbon emissions lead to a significantly higher probability of making value-reducing acquisitions. In contrast, the coefficient of *LNEMISSION* is negative and significant at the 1% level in Model 2. In economic terms, a one standard deviation change in carbon emissions leads to a 10.94% increase in the likelihood of value-reducing acquisitions and a 47.38% decrease in the likelihood of value-enhancing acquisitions.[23] For the sake of brevity, we do not report the control variables, other than to indicate that we find the expected significance and sign.

In this section, we provide evidence of the potential underlying mechanisms through which carbon emissions may affect acquisitions performance. We discuss two potential mechanisms: institutional investor ownership and analyst coverage. Institutional investors are concerned about the negative effects of carbon emissions as these emissions will drive a redistribution of value from firms that do not successfully control carbon emissions to firms that focus on carbon risk (GS Sustain, 2009; Eccles et al., 2011). Prior research argues that investors are willing to accept a lower market return on investments from firms that show a greater commitment to the environment (Richardson et al., 1999; Dhaliwal et al., 2011). Furthermore, Hong and Kacperczyk (2009) find that norm-constrained institutional investors (e.g., pension plans) consider very few "sin" stocks in their investment portfolios, compared to natural arbitrageurs (e.g., mutual or hedge funds) who are based on publicly trading firms involved in producing alcohol or tobacco, or gaming. Therefore, a high level of carbon emissions may reduce institutional investors' stake in a firm that might reduce a firm's acquisition performance. We follow Ferreira and Matos (2008) and examine the impact of carbon emissions on total, domestic, and foreign institutional investor ownership. We report

[23] The standard deviation of *LNEMISSION* is 2.360. We calculate the economic significance (changes in odds, or relative probability) as follows: exp[(0.044×2.360)-1] and exp[(-0.272×2.360)-1].

the regression results in Table 12.[24]

coefficients of *EMISSION* are negative and statistically significant in both models, which suggests that high carbon emissions reduce institutional investor ownership. In unreported estimations, we segment institutional ownership into whether institutions are domestic or foreign, finding that high carbon emissions reduce the shareholdings of both domestic and foreign institutional investors.

Furthermore, Hong and Kacperczyk (2009) show that "sin" firms receive less analyst coverage, implying that analysts are more inclined to spend time analyzing and reporting on "good" firms. Similarly, carbon emissions change analysts' behavior as analysts' investment recommendations include the financial implications of carbon emissions (Eccles et al., 2011). Thus, a high level of carbon emissions increases a company's risk exposure by increasing the potential for regulation or taxation of emissions which potentially discourages analysts following. We measure analysts' coverage as the 12-month total and monthly average of analysts following a firm over the year.[25] Models 3 and 4 report the regression results which show that the coefficients of *EMISSION* are negative and statistically significant across all models. These findings suggest a high level of carbon emissions reduces analysts' coverage of a firm.

5. Conclusion

In this study, we investigate whether an acquirer's carbon risk is related to acquisition decisions and market reactions to acquisition announcements. Additionally, we examine whether a firm's focus on CSR helps to alleviate a firm's carbon risk or whether it accentuates or attenuates the costs of carbon emissions. We follow the existing literature and use the firm's carbon emissions as a proxy for carbon risk. We find that firms with high carbon risks potentially outsource their carbon risks to foreign targets. Acquirers with high carbon emissions are more likely to choose foreign targets in poorer countries with fewer regulations protecting shareholders and weaker environmental controls. This is particularly

[24] We include several variables to control for firm-level and country-level characteristics, following Ferreira and Matos (2008), although we do not report these for the sake of brevity. We control for firm size *(SIZE)*; leverage *(LEV)*; cash *(CASH)*; growth *(GROWTH)*; profitability *(ROA)*; Tobin's Q *(TOBINQ)*; annualized stock return *(RET)*; closely-held shares *(CLOSE)*; stock turnover *(TURN)*; idiosyncratic volatility *(IRISK)*; dividend yield *(DY)*; country-level stock market capitalization *(CMCAP)*; common law *(CLAW)*; anti-director rights *(CGOV)*; gross domestic product *(CGDP)*; climate change performance index score *(CCPI)*; cross-listing on multiple exchanges *(ADR)*; English language *(ENGLISH)*; and bilateral distance *(DISTANCE)*.

[25] We include several variables to control for firm-level and country-level characteristics, following Dhaliwal et al. (2011). We control for firm size *(SIZE)*; standard deviation of return on equity *(STDROE)*; inverse of stock prices *(INVPRICE)*; return variance *(RETVAR)*; research and development (R&D) expenses *(RD)*; profitability *(ROA)*; correlation between stock return *(CORR)*; leverage *(LEV)*; trades in the US markets through American Depositary Receipts *(ADR)*; country-level stock market capitalization *(CMCAP)*; common law *(CLAW)*; anti-director rights *(CGOV)*; gross domestic product *(CGDP)*; and climate change performance index score *(CCPI)*.

true when the acquirer's home country is wealthy and has strong shareholder protection.

when the potential regulation and cost around non-compliance may be high in their home country. We examine the market's reaction to the acquisition announcement and find a significant negative relationship between carbon risk and announcement returns for foreign acquisitions but not for domestic acquisitions. However, cross-border acquisition announcement returns are higher when acquirers with high carbon emissions acquire targets in poor countries with weak regulations and governance. Our findings suggest that acquirers offshore their carbon emissions to countries in which sanctions are less likely to be imposed, thereby reducing the financial risk associated with emissions.

We look at whether a focus on CSR performance may influence the market's reaction to firms managing carbon risk through acquisitions. We find that a firm's focus on CSR accentuates the negative effects of carbon risk that primarily stem from carbon regulation. Investors react negatively when CSR-focused acquirers have high carbon emissions resulting in worse abnormal returns, particularly if the target country is wealthy and has stronger country governance or strong environmental protection.

We control for potential endogeneity involving carbon risk in the acquisition decision by conducting a quasi-experiment based on an exogenous shock to carbon emissions that arises from the introduction of carbon tax legislation in the acquirer's country. Consistent with our baseline results, the findings of this natural experiment suggest that acquisition announcement returns are higher post-regulation for firms that focus on reducing their carbon risk. The results are accentuated when an acquirer seeks targets in wealthy countries with a high level of environmental regulations.

Finally, we apply a battery of robustness tests to determine whether the importance of carbon emissions varies across different legal and governance structures. After dividing the sample based on the target firm's country's GDP and strength of legal system, we find that the acquirer's carbon risk only matters when the target is in a developed country or in a country with strong institutional protection, strong environmental stringency, or high environmental values. In a separate analysis, we show that the role of carbon risks is more significant during diversifying acquisitions. Diversifying acquisitions typically have negative returns, but when the acquirer is not focused on mitigating carbon risk, the announcement returns are worse, potentially as synergies are unlikely to be realized. We argue that if bidders with high emissions acquire related targets, these firms are trying to outsource their carbon emissions to the target country. However, diversifying acquisitions by bidders with high emissions simply signal that the bidders are not undertaking strategies to reduce their carbon emissions in their home country. Finally, we examine the channels through which a focus on

climate risks may create value for acquirers by examining the impact of carbon emissions

risk have lower institutional ownership and analyst coverage.

Our paper contributes to the literature by broadening our understanding about the role of climate risk in acquisition decisions. To the best of our knowledge, no prior study has examined the extent to which carbon risk affects an acquisition's likelihood and success. Similarly, while other papers have considered the effects of CSR on the creation of shareholder value, few have explicitly measured the corresponding effects on the likelihood of a value-reducing transaction. Future research can investigate the role of carbon risk in decisions pertaining to other corporate strategies and events.

Appendix A: Variable Descriptions

Panel A: Dependent Variable(s)		
D_FOR=1	Domestic target acquisition	An indicator variable that takes the value of one if the bidder acquires a domestic target in a given year and zero otherwise
D_FOR=2	Foreign target acquisition	An indicator variable that takes the value of one if the bidder acquires a foreign target in a given year and zero otherwise
D_CAR	Dummy cumulative abnormal return	An indicator variable that is equal to one (two) if the firm conducts at least one acquisition and the cumulative abnormal return (CAR) around the announcement is negative (positive) and is equal to zero if the firm makes no acquisition announcements in a given fiscal year
5DAYCAR	Five (5)-day cumulative abnormal return	Cumulative abnormal return (CAR) earned by the acquirer during the five-day announcement period
Panel B: Independent Variable(s)		
LNEMISSION	Carbon emissions	The natural logarithm of total carbon emissions
EMITR	Carbon emissions	The natural logarithm of total carbon emissions scaled by total revenues
Panel C: Firm Characteristics		
SIZE	Firm size	The natural logarithm of market capitalization
LEV	Leverage	The ratio of total debt to total assets
CASH	Cash	The ratio of total cash scaled by total assets
GROWTH	Sales growth	The percentage change in annual revenue
ROA	Profitability	The ratio of net profit scaled by total assets
TOBINQ	Tobin's Q	The sum of the market value of equity plus the book value of total debt divided by total assets
BSIZE	Board size	Total number of members on a board
BIND	Board independence	The percentage of independent members on a board
DUAL	CEO duality	An indicator variable equal to one if a CEO also holds the position of chairman and zero otherwise
INSTOWN	Institutional ownership	The percentage of ownership held by institutional investors
CSR	CSR performance	The average of the social and environmental performance scores reported by Refinitiv ESG database
HIGH_CSR	High CSR performance	An indicator variable that takes a value of one if the firm's CSR performance is greater than the median CSR performance and zero otherwise

CLOSEN	Closely held	The percentage of ownership held by closely held owners
IRISK	Idiosyncratic volatility	The natural logarithm of the standard deviation of the market-model residuals computed using daily stock returns
DY	Dividend yield	The ratio of dividend available to common shares and the market value of equity at the beginning of the fiscal year
ADR	American Depositary Receipts	An indicator variable that equals one if a non-US firm trades in the US markets through American Depositary Receipts programs during the year, and zero otherwise
ENGLISH	English language	An indicator variable that equals one if the firm is in a country that primarily speaks English, and zero otherwise
DISTANCE	Bilateral distance	Natural logarithm of the average bilateral distance in kilometers between a capital city and other capital cities
STDROE	Standard deviation of ROE	The standard deviation of return on equity (ROE) in the four quarters of the preceding year
INVPRICE	Inverse of stock price	Inverse of the stock price at the beginning of the fiscal year
RETVAR	Return variance	Annual standard deviation of daily stock returns over the past 12 months
RD	Research and development expenditures	The ratio of research and development (R&D) expenses to total revenues
CORR	Correlations between stock returns	Pearson's correlation coefficient between ROE and annual stock returns in the four quarters of the preceding year.
CDP	CDP response	An indicator variable equal to one if the firm discloses its carbon emissions to the CDP and to the public, and zero otherwise
CDP_LAG	Prior year's CDP response	An indicator variable equal to one if the firm discloses its carbon emissions to the CDP in the previous year to the public, and zero otherwise
PROPDISCL	Industry pressure	The ratio of the number of firms in the industry with publicly available carbon emissions data to the total number of firms in the industry in our sample
EMI_INS	Instrumental variable	Industry–year-adjusted carbon emissions
MORTALITY	Instrumental variable	Country-level mortality rate from air pollution
ANALYST	Analysts' coverage	The total number of analysts following a firm

Panel D: Deal Characteristics

PRIVATE	Private	An indicator variable that takes the value of one if the acquisition is a private target and zero otherwise
ALLCASH	All cash	An indicator variable that takes the value of one if the acquisition is 100% financed with cash and zero otherwise
ALLSTOCK	All stock	An indicator variable that takes the value of one if the acquisition is 100% financed with stock and zero otherwise
UNRELATED	Unrelated	An indicator variable that takes the value of one if the bidder and the target belong to different four-digit primary Standard Industrial Classification (SIC) codes reported by the SDC database and zero otherwise.
RELSIZE	Relative size	Transaction value reported by the SDC database divided by the market value of the acquirer one month prior to the acquisition announcement
HOSTILE	Hostile	An indicator variable that takes the value of one if the SDC database classifies the bid as a hostile takeover, and zero otherwise
SERIAL	Serial	An indicator variable that takes the value of one if the bidder acquires three or more targets in a given year, and zero otherwise
TENDER	Tender	An indicator variable that takes the value of one if the SDC database classifies the bid as a tender offer, and zero otherwise

Panel E: Country Characteristics

POST	Post ETS	An indicator variable that takes the value of one if the bidder's home country passed emissions trading scheme (ETS) legislation and zero otherwise

CM	Country stock	The natural logarithm of the country-level stock market capitalization (Source: World Bank)
CAP	market	

CLAW	Common law	An indicator variable that takes a value of one if a country has common law, and zero otherwise.
CGOV	Country-level governance	The revised anti-director rights index (Source: Djankov et al. [2008])
CGDP	Gross domestic product	The natural logarithm of the country-level gross domestic product per capita (Source: World Bank)
CCPI	Country-level climate change performance	The country-level climate change performance index score (Source: Germanwatch and Climate Action Network)
ENV_REG	Environmental regulatory stringency	The country-level environmental regulatory stringency score, as developed by Esty and Porter (2005)
ENV_VALUE	Country-level environmental value	Country-level environmental value (Schwartz, 1994)

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Table 1: Descriptive statistics

This table presents descriptive statistics for the main dependent and independent variables. We segment our sample into firms that choose domestic targets, foreign targets, and those that choose not to acquire any targets. Panel A highlights our variables of interest. Panel B shows the firm-level characteristics that we use as controls. Panel C shows the country-level characteristics that we use for controls. We test for significant differences in the mean and median values between: (i) domestic acquirers vs. foreign acquirers; (ii) foreign acquirers vs. non-acquirers; and (iii) domestic acquirers vs. non-acquirers using *t*-tests and Wilcoxon rank sum tests. Superscript asterisks ***, **, and * correspond to statistically significant differences at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

	Domestic (1,007)		Foreign (1,020)		Non-acquirers (6,072)		Domestic vs. Foreign		Foreign vs. Non-acquirers		Domestic vs. Non-acquirers	
	Mea	Media	Mea	Media	Mea	Media	Mea	Media	Mea	Media	Mea	Media
Panel A: Research variables												
LNEMISSI	12.72	12.908	13.43	12.817	12.78	12.717	**	*	***	**		
EMITR	0.173	0.045	0.195	0.051	0.204	0.045	**	***		***	**	
CSR	0.528	0.529	0.565	0.578	0.51	0.505	*	***	***	***	**	*
HIGH_CSR	0.501	1.000	0.561	1.000	0.477	0.000	***	***	***	***		
Panel B: Firm characteristics												
BSIZE	16.60	13.000	20.08	15.000	16.05	12.000	***	***	***	***	*	
BIND	0.556	0.571	0.509	0.501	0.544	0.571	*		***	***	***	*
DUAL	0.568	1.000	0.542	1.000	0.540	1.000						
SIZE	9.455	9.374	9.773	9.779	9.043	9.056	***	***	***	***	***	***
LEV	0.256	0.235	0.249	0.229	0.258	0.247			*			
CASH	0.078	0.058	0.077	0.056	0.083	0.059			**		*	
GROWTH	0.058	0.05	0.057	0.049	0.036	0.033			***	***	***	***
ROA	0.053	0.049	0.056	0.050	0.052	0.045			**	***		
TOBINQ	1.622	1.349	1.661	1.415	1.696	1.389		**			***	**
Panel C: Country characteristics												
CMCAP	4.629	4.678	4.642	4.621	4.636	4.681	***	***	***	***		*
CLAW	0.612	1.000	0.445	0.000	0.591	1.000	***	***	***	***		
CGOV	3.812	4.000	3.755	3.500	3.703	3.500	*		**	**	***	***
CGDP	10.54	10.760	10.59	10.75	10.56	10.778	*			**		***
CCPI	43.70	46.660	46.38	52.200	47.95	51.400	***	***	***	*	***	***

Table 2: Acquirers' carbon emissions and acquisitions likelihood

This table presents the multinomial logistic model in which the dependent variable is an indicator variable that equals one if the firm makes an acquisition and the target is located domestically (*D_FOR*=1), and that equals two if the firm makes an acquisition and the target is foreign (*D_FOR*=2). We use the non-acquirer sample as the benchmark and set the variable equal to zero (*D FOR* = 0). We use two proxies for carbon emission: log of total carbon emissions and total carbon emissions by revenue. All independent variables are lagged one year, and all specifications include year and industry fixed effects. All coefficient values (robust *t*-statistics) are shown with standard errors clustered at the firm level. Superscript asterisks ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

	Model 1	Model 2	Model 3	Model 4
	LNEMISSION	*LNEMISSION*	*EMITR*	*EMITR*
	Domestic *D_FOR*=1	*Foreign* *D_FOR*=2	*Domestic* *D_FOR*=1	*Foreign* *D_FOR*=2

EMISSION	-0.161***	0.044*	-0.331**	0.411***
	(-0.358)	(0.002)	(-0.712)	(0.240)
SIZE	0.491***	0.456***	0.361***	0.494***
	(11.890)	(10.940)	(9.766)	(13.042)
LEV	0.449*	0.202	0.350	0.252
	(1.721)	(0.747)	(1.339)	(0.935)
CASH	0.070	-0.094	0.122	0.020
	(0.131)	(-0.166)	(0.228)	(0.035)
GROWTH	0.970***	0.854***	1.042***	0.843***
	(3.329)	(2.758)	(3.586)	(2.729)
ROA	0.090	1.192	0.230	1.254
	(0.089)	(1.067)	(0.228)	(1.125)
TOBINQ	-0.499***	-0.296***	-0.369***	-0.321***
	(-6.806)	(-3.899)	(-5.226)	(-4.389)
BSIZE	0.001	0.012***	-0.001	0.012***
	(0.194)	(3.329)	(-0.215)	(3.320)
BIND	0.429**	0.296	0.405*	0.300
	(2.060)	(1.450)	(1.956)	(1.467)
DUAL	0.032	-0.067	0.029	-0.070
	(0.405)	(-0.854)	(0.364)	(-0.885)
CMCAP	-0.085	-0.080	-0.116	-0.100
	(-0.838)	(-0.824)	(-1.163)	(-1.031)
CLAW	-0.088	-0.527***	-0.065	-0.555***
	(-0.764)	(-4.694)	(-0.568)	(-4.927)
CGOV	0.335***	0.351***	0.330***	0.356***
	(5.165)	(5.510)	(5.113)	(5.590)
CGDP	-0.118*	0.081	-0.085	0.097
	(-1.875)	(1.197)	(-1.351)	(1.432)
CCPI	-0.025***	0.010**	-0.023***	0.009**
	(-5.542)	(2.09[illegible])	(-5.089)	(2.041)
Intercept	-1.990*	-7.13[illegible]***	-3.215***	-7.070***
	(-1.941)	(-6.839)	(-3.197)	(-6.884)
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Observations	8,0[illegible]		8,099	
Pseudo R^2	0.091		0.087	
Wald chi^2	108[illegible].65		1041.31	
Log pseudo likelihood	-5,418.6[illegible]		-5,441.14	

Table 3: Choice of foreign or domestic target based on target country characteristics

This table presents a logistic model focusing on the likelihood of domestic versus foreign acquisitions. The dependent variable is equal to one if the target is foreign and zero if the target is domestic. We use the log of total carbon emissions as our variable of interest. We use the same controls that we used in Table 2 but do not report them for the sake of brevity. Models 1 and 2 segment the sample by the median GDP of the target country. Models 3 and 4 segment the sample by the median *CGOV* (country-level governance) of the target country. Columns 5 and 6 (7 and 8) are segmented based on the median target country's level of environmental regulatory stringency (environmental values). All independent variables are lagged one year, and all specifications include year and industry fixed effects. We only include the variables of interest for the sake of brevity. All coefficient values (robust *t*-statistics) are shown with standard errors clustered at the firm level. Superscript asterisks ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**	**Model**	**Model**	**Model**	**Model**
	Dependent variable = Foreign vs. Domestic							
	HIGH_GD	***LOW_GD***	***HIGH_GO***	***LOW_GO***	***HIGH***	***LOW***	***HIGH***	***LOW***
LNEMISSION	-0.027	0.132**	0.033	0.589***	0.093	0.129*	-0.071	0.326**
	(-0.150)	(2.031)	(-0.582)	(-5.673)	(-1.219)	(-1.895)	(-1.335)	(-
CGOV_ACQ	-0.533***	0.305	-0.810***	1.816***	-	0.945***	-	0.510**
	(-3.359)	(1.397)	(-5.311)	(7.286)	(-4.790)	(5.156)	(-3.577)	(3.311)
CGDP_ACQ	-2.692***	0.835***	0.187	0.229	-0.120	0.508**	0.379**	0.115
	(-4.663)	(3.999)	(1.255)	(0.950)	(-0.615)	(2.512)	(2.298)	(0.604)
Intercept	28.140***	-8.981***	-2.475	-12.507***	-1.607	-	-6.072**	-5.011
	(-4.67)	(-2.923)	(-1.012)	(-4.268)	(-0.524)	(-2.824)	(-2.361)	(-
Observations	1,416	1,329	1,619	1,018	1,514	1,245	1,757	986
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Year fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Chi^2	295.3	307.43	325.2	259.77	267.22	316.44	263.85	257.35
Log	-664.82	-614.28	-853.16	-354.15	-763.73	-542.91	-998.47	-473.25

Table 4: Mergers and acquisitions (M&A) sample distribution

This table presents the industry, year and country distribution for the M&A sample. Panel A shows the industry and year distribution of our acquisition sample and Panel B shows the country distribution of our acquisition sample. In Panel B we also show the average emissions of acquirers by country. We provide variable definitions in Appendix A.

Panel A: Industry and Year Distribution

	Industry	Obs.	Percent	Year	Obs.	Percent
1	Mining/Construction	292	10.57	2006	137	4.96
2	Food	150	5.43	2007	198	7.17
3	Textiles/Print/Publishing	35	1.27	2008	235	8.51
4	Chemicals	106	3.84	2009	177	6.41
5	Pharmaceuticals	217	7.85	2010	220	7.96
6	Extractive	167	6.04	2011	214	7.75
7	Manufacturing: Rubber/Glass, etc.	40	1.45	2012	232	8.40
8	Manufacturing: Metal	49	1.77	2013	194	7.02
9	Manufacturing: Machinery	65	2.35	2014	246	8.90
10	Manufacturing: Electrical Equipment	152	5.50	2015	300	10.86
11	Manufacturing: Transport Equipment	106	3.84	2016	172	6.23
12	Manufacturing: Instruments	105	3.80	2017	248	8.98
13	Manufacturing: Miscellaneous	12	0.54	2018	190	6.88
14	Computers	251	9.08	**Total Sample**	**2,763**	**100**
15	Transportation	248	8.98			
16	Utilities	154	5.57			
17	Retail: Wholesale	57	2.06			
18	Retail: Miscellaneous	79	2.86			
19	Retail: Restaurant	4	0.14			
20	Financial	216	7.82			
21	Insurance/Real Estate	105	3.80			
22	Services	134	4.85			
23	Others	16	0.58			
	Total Sample	**2,763**	**100**			

Panel B: Country distribution

		Obs.	Percent	Average emissions of firms (million CO_2-e metric ton)
1	Australia	169	6.12	4.84
2	Austria	11	0.40	7.06
3	Belgium	10	0.36	3.15
4	Brazil	53	1.92	11.50
5	Canada	259	9.37	2.17
6	Czech Republic	1	0.04	46.90
7	France	245	8.87	10.70
8	Germany	147	5.32	15.40
9	Hungary	3	0.11	0.12
10	India	58	2.10	8.39
11	Ireland	17	0.62	0.24
12	Italy	21	0.76	44.80
13	Japan	397	14.37	4.90
14	Kazakhstan	1	0.04	0.23
15	Luxembourg	5	0.18	0.04
16	Mexico	3	0.11	0.95
17	Netherlands	36	1.30	0.67
18	Norway	52	1.88	5.04
19	New Zealand	10	0.36	0.30
20	Poland	2	0.07	0.00
21	Portugal	12	0.43	4.63
22	Russia	14	0.51	74.90

23	Singapore	10	0.36	7.66
26	Spain	105	3.80	8.94
27	Switzerland	111	4.02	5.30
28	Thailand	7	0.25	5.02
29	Turkey	6	0.22	0.31
30	United Kingdom	125	4.52	7.42
31	United States	701	25.37	3.74
	Total Sample	**2,763**	**100**	**6.71**

Table 5: Descriptive statistics

This table presents the descriptive statistics for the main dependent and independent variables. We segment the sample by whether the acquirer chooses a domestic or foreign target as well as whether the acquirer has above or at median carbon emissions or below median carbon emissions. Panel A reports the main dependent and independent variables; Panel B shows the M&A characteristics; Panel C shows the main firm characteristics; and Panel D reports the country characteristics. Superscript asterisks ***, **, and * correspond to statistically significant differences at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

	Domestic High		**Domestic Low**		**Sig.**		**Foreign High**		**Foreign Low**		**Sig.**	
	Mean	**Media**	**Mean**	**Medi**	**Me**	**Medi**	**Mean**	**Me…**	**Mean**	**Media**	**Me**	**Medi**
Panel A: Research variables												
5DCAR	-0.002	-0.001	0.003	-	**		-0.003	0.001	0.003	0.005	***	***
LNEMISS	14.063	14.045	11.906	12.13	***	***	14.331	14.…	12.192	12.165	***	***
EMITR	0.220	0.565	0.115	0.276	***	***	0.202	0.048	0.125	0.028	***	***
HIGH_CS	0.481	0.001	0.358	0.001	***	***	0.505	1.000	0.415	0.000	***	***
Panel B: M&A characteristics												
PRIVATE	0.184	0.001	0.234	0.001	**	**	0.21…	0.000	0.325	0.000	***	***
ALLCAS	0.521	1.000	0.527	1.000			0.469	0.000	0.552	1.000	***	***
ALLSTOC	0.071	0.001	0.100	0.001	**	**	0.022	0.000	0.148	0.000		
UNRELA	0.587	1.000	0.603	1.000			0.530	1.000	0.536	1.000		
RELSIZE	0.070	0.006	0.092	0.013	**	**	0.787	0.019	0.639	0.039	**	***
HOSTILE	0.115	0.001	0.113	0.001			0.171	0.000	0.129	0.000	**	**
SERIAL	0.451	0.001	0.318	0.001	**	**	0.549	1.000	0.319	0.000	***	***
TENDER	0.103	0.001	0.104	0.001			0.094	0.000	0.077	0.000		
Panel C: Firm characteristics												
MCAP	42284.	19774.	18218.	8002.	***		56,644.	36,606.	23,536.	10,245.	***	***
SIZE	9.897	9.892	9.014	8.987	**		10.336	10.508	9.282	9.235	***	***
REVENU	37144.	18138.	10682.	45…8	**		49,487.	31,984.	14,242.	5,955.9	***	***
LEV	0.249	0.235	0.252	0.223			0.255	0.234	0.233	0.211	***	***
CASH	0.072	0.053	0.082	0.05…	**		0.070	0.053	0.080	0.051	*	
GROWTH	0.078	0.059	0.074	0.048			0.059	0.048	0.097	0.065	***	***
ROA	0.051	0.047	0.050	0.048			0.053	0.047	0.059	0.052	**	**
TOBINQ	1.532	1.263	1.684	1.419	***		1.560	1.312	1.770	1.550	***	***
BSIZE	18.239	13.000	14.5…	12.00	***		23.105	18.000	17.170	14.000	***	***
BIND	0.550	0.571	0.…30	0.538			0.520	0.531	0.487	0.500	**	**
DUAL	0.598	1.0…	0.525	1.000	***		0.576	1.000	0.506	1.000	**	**
Panel D: Country characteristics												
CMCAP	4.609	4.663	4.609	4.660			4.518	4.585	4.553	4.621		
CLAW	0.576	1.000	0.613	1.000			0.408	0.001	0.483	0.001	***	***
CGOV	3.830	4.000	3.900	4.000	*		3.738	3.500	3.826	3.500	**	**
CGDP	10.57	10.74	10.49	10.74	**		10.625	10.723	10.609	10.767		
CCPI	43.00	46.65	43.54	46.30			45.150	52.300	46.164	52.100		
REG	0.585	1.000	0.523	1.000	**	**	0.582	0.565	0.620	0.415		
ENV_VA	0.709	1.000	0.586	1.000	***	***	0.611	0.613	0.612	0.612		
MORTA	0.878	0.893	0.869	0.895	**		0.877	0.892	0.874	0.893		

Table 6: Multivariate analysis of market reactions of acquisition announcements

This table shows results for regressions using Equation (2), where the dependent variable is the acquirer's five-day cumulative abnormal stock returns (CARs) around the acquisition announcement. Panel A presents the regression results of bidders for the full sample (Model 1) as well as for the segmentation of domestic acquisitions (Models 3 and 4) and cross-border acquisitions (Models 5 and 6). Panel B includes the target characteristics. Models 1, 3, and 5 use the natural log of total emissions, while Models 2, 4, and 6 use the natural log of total emissions scaled by total revenues. All independent variables are measured one year before the announcement. We control for year and industry fixed effects. All coefficient values (robust *t*-statistics) are shown with standard errors clustered at the firm level. Superscript asterisks ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

Panel A: Full Sample

	LNEMISSION	*EMITR*	*LNEMISSION*	*EMITR*	*LNEMISSION*	*EMITR*
	Full sample	**Full**	**Domestic Acq**	**Domestic**	**Foreign Acq**	**Foreign**
EMISSION	-0.003***	-0.015***	-0.001	-0.002	-0.004***	-0.018***
	(-4.663)	(-4.237)	(-0.106)	(-0.244)	(-4.059)	(-4.109)
EMISSION×HIGH_CSR			-0.005***	-0.028***	-0.001	-0.002
			(-4.026)	(-2.889)	(-0.626)	(-0.367)
HIGH_CSR	0.008***	0.008***	0.083***	0.016***	0.014	0.005
	(3.957)	(3.707)	(4.563)	(4.837)	(0.955)	(1.618)
FOREIGN	-0.003	-0.003				
	(-1.548)	(-1.535)				
SIZE	0.002	-0.001	-0.001	-0.002	0.004**	0.001
	(1.403)	(-1.020)	(-0.107)	(-1.300)	(2.300)	(0.012)
LEV	0.005	0.004	0.019*	0.019	-0.008	-0.009
	(0.631)	(0.501)	(1.648)	(1.642)	(-0.869)	(-0.951)
CASH	-0.023	-0.024	-0.046*	-0.049**	0.008	0.005
	(-1.391)	(-1.480)	(-1.944)	(-2.080)	(0.384)	(0.211)
GROWTH	0.001	0.001	0.008	0.008	-0.010	-0.009
	(0.081)	(0.088)	(0.814)	(0.763)	(-1.220)	(-1.156)
ROA	-0.038	-0.039	-0.037	-0.047	-0.040	-0.036
	(-1.426)	(-1.418)	(-0.870)	(-1.098)	(-0.983)	(-0.874)
TOBINQ	0.003	0.006***	0.002	0.005	0.004	0.007**
	(1.358)	(2.761)	(0.769)	(1.5[illegible]5)	(1.243)	(2.309)
PRIVATE	0.001	0.002	0.002	0.003	0.001	0.001
	(0.723)	(0.806)	(0.725)	1.013)	(0.084)	(0.025)
ALLCASH	0.001	0.001	0.004	0.00[illegible]	0.001	0.001
	(0.829)	(0.764)	(1.335)	(1.591)	(0.009)	(0.045)
ALLSTOCK	-0.003	-0.004	-0.007	-0.006	0.011	0.010
	(-0.527)	(-0.556)	(-1.020)	(-0.844)	(0.760)	(0.704)
UNRELATED	-0.001	-0.002	0.001	-0.001	-0.003	-0.003
	(-0.652)	(-0.703)	(0.012)	(-0.323)	(-1.008)	(-1.051)
RELSIZE	-0.005	-0.005	0.001	0.003	-0.018	-0.017
	(-0.601)	(-0.593)	(0.113)	(0.261)	(-1.465)	(-1.447)
HOSTILE	-0.001	-0.001	0.002	0.002	-0.004	-0.005
	(-0.379)	(-0.488)	(0.447)	(0.474)	(-1.075)	(-1.327)
SERIAL	0.001	0.001	0.003	0.003	-0.001	-0.001
	(0.369)	(0.543)	(0.795)	(0.829)	(-0.299)	(-0.059)
TENDER	-0.006**	-0.006*	-0.010**	-0.009*	-0.003	-0.002
	(-1.968)	(-1.839)	(-2.036)	(-1.951)	(-0.703)	(-0.655)
BSIZE	0.001	0.001	-0.001	-0.001	0.001	0.001
	(0.189)	(0.173)	(-0.597)	(-0.578)	(0.439)	(0.419)
BIND	-0.010*	-0.011*	-0.014	-0.012	-0.008	-0.007
	(-1.662)	(-1.662)	(-1.235)	(-1.075)	(-1.213)	(-1.057)
DUAL	0.001	0.001	-0.001	-0.001	0.003	0.004
	(0.494)	(0.593)	(-0.152)	(-0.074)	(1.056)	(1.337)
CMCAP_ACQ	0.002	0.003	0.004	0.004	0.002	0.002
	(0.835)	(0.951)	(0.884)	(0.786)	(0.616)	(0.687)
CLAW_ACQ	-0.00[illegible]*	-0.004*	-0.007	-0.007	-0.003	-0.002
	(-1.[illegible]73)	(-1.650)	(-1.395)	(-1.372)	(-0.902)	(-0.782)
CGOV_ACQ	0.001	0.001	0.001	0.001	0.002	0.002
	(1.026)	(0.953)	(0.280)	(0.494)	(0.884)	(0.929)
CGDP_ACQ	-0.001	-0.001	0.003	0.002	-0.003	-0.002
	(-0.481)	(-0.461)	(1.080)	(0.915)	(-1.029)	(-0.954)
CCPI_ACQ	0.001	0.001	-0.001	-0.001	0.001	0.001
	(0.122)	(0.253)	(-0.705)	(-0.644)	(0.958)	(1.118)
Intercept	0.007	-0.015	-0.091**	-0.084**	0.022	0.006
	(0.252)	(-0.527)	(-1.999)	(-1.980)	(0.549)	(0.148)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,763	2,763	1,419	1,419	1,344	1,344
Adj. R^2	0.057	0.054	0.085	0.077	0.109	0.105

Panel B: Controlling for target characteristics

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
	LNEMISSION	***EMITR***	***LNEMISSION***	***EMITR***	***LNEMISSION***	***EMITR***
	All Acqs	**All Acqs**	**Domestic Acq**	**Domestic**	**Foreign Acq**	**Foreign**
EMISSION	-0.003**	-0.017**	-0.002**	-0.011*	-0.004***	-0.017***
	(-2.321)	(-2.319)	(-2.048)	(-1.955)	(-3.502)	(-3.099)
HIGH_CSR	0.012***	0.011***	0.012***	0.011***	0.007**	0.006**
	(2.764)	(2.675)	(3.691)	(3.589)	(2.316)	(2.051)

FOREIGN	-0.004	-0.004				
	(-1.237)	(-1.255)				
LEV_TAR	-0.011	-0.010				
	(-1.027)	(-0.973)				
CASH_TAR	-0.010	-0.009				
	(-0.623)	(-0.564)				
GROWTH_TAR	-0.001**	-0.001***				
	(-2.471)	(-2.639)				
ROA_TAR	0.017	0.016				
	(1.531)	(1.466)				
TOBINQ_TAR	0.001	0.001				
	(0.212)	(0.409)				
CMCAP_TAR			0.034	0.035	0.007*	0.007*
			(0.917)	(0.962)	(1.685)	(1.672)
CLAW_TAR			0.025	0.035	-0.007**	-0.007**
			(0.172)	(0.239)	(-2.085)	(-2.090)
CGOV_TAR			0.009	0.011	0.001	-0.001
			(0.515)	(0.627)	(0.034)	(-0.062)
CGDP_TAR			0.134	0.134	-0.001	-0.001
			(1.546)	(1.511)	(-0.059)	(-0.009)
CCPI_TAR			0.004	0.004	0.001	0.001
			(0.461)	(0.486)	(1.279)	(1.338)
Intercept	0.040	0.008	-0.024	-0.037	0.008	-0.005
	(0.759)	(0.157)	(-0.429)	(-0.693)	(0.175)	(-0.103)
Acquirer controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	701	701	1419	1419	956	956
Adj. R^2	0.157	0.154	0.074	0.073	0.130	0.128

Table 7: Multivariate analysis of market reactions of acquisition announcements: Segmented based on target country characteristics

This table presents the regression results of the bidder's carbon emissions and market reactions (5DCAR) based on the target's country characteristics segmented by whether the characteristic is above or below the median value. Panel A segments on high and low GDP and high and low governance of target countries, Panel B segments on high and low environmental regulatory stringency and high and low environmental values of the target country. For the sake of brevity, we only show the variables of interest. All independent variables are measured one year before the announcement. We control for year and industry fixed effects. All coefficient values (robust *t*-statistics) are shown with standard errors clustered at the firm level. Superscript asterisks ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

Panel A: Role of target's GDP and governance

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Domestic Acquisitions				Foreign Acquisitions			
	HIGH GDP	***LOW GDP***	***HIGH GOV***	***LOW GOV***	***HIGH GDP***	***LOW GDP***	***HIGH GOV***	***LOW GOV***
LNEMISSION	-0.001	-0.001	-0.001	-0.001	-0.004***	-0.003***	-0.004***	-0.002
	(-0.209)	(-0.302)	(-0.144)	(-0.028)	(-2.[illegible]8)	(-2.957)	(-2.943)	(-1.172)
LNEMISSION×HIGH_CSR	-0.009***	-0.003**	-0.005***	-0.002	0.001	-0.002	-0.002	0.001
	(-4.073)	(-1.999)	(-3.124)	(-0.928)	(0.465)	(-1.489)	(-1.414)	(0.452)
HIGH_CSR	0.138***	0.057**	0.092***	0.016	0.037	0.010	0.039*	0.010
	(4.711)	(2.488)	(4.215)	(0.516)	(1.650)	(0.463)	(1.815)	(0.431)
Acquirer controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	812	607	984	435	701	643	706	638
Adj. R^2	0.132	0.161	0.157	0.185	0.164	0.189	0.163	0.102

Panel B: Role of target's environmental regulatory stringency and

	Domestic Acquisitions				Foreign Acquisitions			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	HIGH EREG	***LOW EREG***	***HIGH EVAL***	***LOW EVAL***	***HIGH EREG***	***LOW EREG***	***HIGH EVAL***	***LOW EVAL***
LNEMISSION	0.002	-0.002	-0.001	0.001	-0.004***	-0.001***	-0.004***	-0.002
	(1.143)	(-1.069)	(-0.845)	(0.149)	(-2.819)	(-3.157)	(-3.004)	(-1.627)
LNEMISSION×HIGH_CSR	-0.007***	-0.003	-0.006***	-0.003	-0.003*	0.002	0.001	-0.001
	(-3.544)	(-1.612)	(-3.470)	(-1.591)	(-1.817)	(1.336)	(0.569)	(-0.583)
HIGH_CSR	0.109***	0.060**	0.087***	0.078***	-0.007	0.049**	0.007	0.025
	(4.155)	(2.288)	(3.784)	(2.783)	(-0.321)	(2.118)	(0.321)	(1.223)
Acquirer controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	796	623	938	481	803	541	822	522
Adj. R^2	0.126	0.161	0.128	0.188	0.145	0.217	0.183	0.188

Table 8: Multivariate analysis of market reactions of acquisition announcements: Related versus unrelated acquisitions

This table presents the regression results of the bidder's carbon emissions and market reactions *(5DCAR)* based on deal characteristics. Models 1 and 3 show the unrelated acquisitions while Models 2 and 4 show the related acquisitions for the full sample. Models 5 and 6 (7 and 8) show the unrelated (related) acquisitions for the foreign and domestic samples, respectively. For the sake of brevity, we only show the variables of interest. All independent variables are measured one year before the announcement. We control for year and industry fixed effects. All coefficient values (robust *t*-statistics) are shown with standard errors clustered at the firm level. Superscript asterisks ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

	Dependent Variable = *5DCAR*							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Full Sample				FOREI	DOMES	FOREI	DOMES
	UNRELAT FD=1	***UNRELAT FD=0***	***UNRELAT FD=1***	***UNRELAT FD=0***	***UNRELATED=1***		***UNRELATED=0***	
LNEMISS	-0.004***	-0.001	-0.019***	-0.013	-	-	-0.002	-0.001
	(-5.775)	(-1.168)	(-5.010)	(-1.534)	(-5.357)	(-2.942)	(-1.292)	(-0.561)

Intercept	0.032	0.010	0.018	-0.001	0.014	-0.001	-0.007	0.095
	(1.008)	(0.192)	(0.583)	(-0.015)	(0.354)	(-0.012)	(-0.103)	(1.111)
Acquirer	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observati	1,560	1,203	1,560	1,203	717	843	627	576
Adj. R^2	0.079	0.097	0.073	0.098	0.148	0.095	0.188	0.170

Table 9: Quasi-experimental analysis

This table presents the regression results of the bidder's carbon emission and market reactions (5DCAR) using carbon tax enactment as an exogenous shock. We create an indicator variable that is equal to one if the regulation in the bidder's country was passed and zero if it was not (*POST*). We interact *POST* with our carbon emissions proxies to determine if emissions become more important after the regulation is passed. Model 1 shows the full sample. Models 2 and 3 segment on the CSR of the acquirer. Models 4 and 5 segment on the GDP of the target country. Models 6 and 7 segment on the stringency of environmental regulations. For the sake of brevity, we only show the variables of interest. All independent variables are measured one year before the announcement. We control for year and industry fixed effects. All coefficient values (robust *t*-statistics) are shown with standard errors clustered at the firm level. Superscript asterisks ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

	Carbon Tax in Acquirer's Country as an Exogenous Shock						
	Full	***HIGH_CS***	***LOW_CS***	***HIGH_GD***	***LOW_GD***	***HIGH_ERE***	***LOW_ERE***
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
LNEMISSION	-	-0.003***	-0.001	-0.003***	-0.002**	-0.004***	-0.001
	(-3.054)	(-3.703)	(-1.009)	(-2.908)	(-2.038)	(-3.871)	(-0.620)
LNEMISSION×POS	-0.001*	-0.004***	0.001	-0.002**	-0.001	-0.002*	-0.001
	(-1.792)	(-2.923)	(0.668)	(-1.996)	(-1.113)	(-1.935)	(-0.568)
POST	0.023**	0.047***	-0.002	0.032**	0.018	0.035**	0.010
	(2.024)	(2.802)	(-0.191)	(2.135)	(1.227)	(2.116)	(0.721)
Intercept	0.034	0.101**	-0.026	0.062	0.016	0.003	0.009
	(1.214)	(2.318)	(-0.653)	(1.143)	(0.539)	(0.089)	(0.230)
Acquirer controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,763	1,292	1,471	1,513	1,250	1,599	1,164
Adj. R^2	0.047	0.161	0.092	0.068	0.069	0.066	0.07

Table 10: Endogeneity and sample selection bias

This table presents several tests to control for endogeneity and sample selection bias. Model 1 reports the propensity-matched regression results of the bidder's carbon emissions and market reactions *(5DCAR)*. We first use a logistic model to estimate the probability that a firm has carbon emissions above the norm conditional on the observable firm, industry, and country characteristics. Once we match the sample, we regress *EMI_DUM* on the announcement cumulative abnormal returns (CARs). *EMI_DUM* is an indicator variable defined as one if the bidder emits carbon emissions higher than or equal to the country-, industry-, and year-adjusted median level of carbon emissions, or zero otherwise. We report the regression estimation of CARs, where *EMI_DUM* is the variable of interest. Models 2 and 3 show Heckman's (1979) two-stage regression results. Model 2 shows the first-stage regression results for the firm's choice to disclose carbon emissions, where we use *CDP_LAG* and *PROPDISCL* as instruments. Model 3 show the second-stage regression results of the bidder's carbon emission and market reactions (*5DCAR*), controlling for the inverse Mills ratio (*IMR*). Models 4 and 5 present the 2SLS regression results. Model 4 reports the first-stage regression results where *LNEMISSIONS* is the dependent variable and *MORTALITY* is the instrument. Model 5 shows the second-stage regression results of the bidder's carbon emissions and market reactions (*5DCAR*). For the sake of brevity, we only report the variables of interest. All independent variables are measured one year before the announcement. We control for year and industry fixed effects. All coefficient values (robust *t*-statistics) are shown with standard errors clustered at the firm level. Superscript asterisks ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

	PSM	**Heckman**		**2SLS**	
	Second Stage	**First Stage**	**Second Stage**	**First Stage**	**Second Stage**
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
LNEMISSION			-0.003***		-0.008***
			(-4.070)		(-3.469)
EMI_DUM	-0.008***				
	(-3.214)				

CDP_LAG		2.157***			
		(30.348)			
PROPDISCL		2.757***			
		(30.348)			
MORTALITY				4.097***	
				(14.450)	
IMR			-0.004		
			(-0.808)		
Acquirer controls	Yes	Yes	Yes	Yes	Yes
Year fixed		Yes	Yes	Yes	Yes
Industry fixed		Yes	Yes	Yes	Yes
Observations	1,516	19,847	2,641	2,641	2,641
Pseudo R^2/Adj.	0.075	0.640	0.059	0.704	0.046
Test of					5.544***
Shea's partial R^2				0.074	
Partial *F*-statistic				280.919	

Table 11: Carbon emissions and acquisition likelihood (multinomial logistic model)

This table reports the results for the multinomial logistic model estimated from Equation (3) using the natural logarithm of total carbon emissions. The dependent variable (*D_CAR*) equals one (two) if the firm conducts at least one acquisition and the cumulative abnormal return (CAR) around the announcement is negative (positive). We calculated CAR using a five-day window (-2, +2), where zero is the acquisition announcement date. For the sake of brevity, we only show variables of interest. All independent variables are measured one year before the announcement. We control for year and industry fixed effects. All coefficient values (robust *t*-statistics) are shown with standard errors clustered at the firm level. Superscript asterisks ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

	Model 1	**Model 2**
	***D_CAR*=1**	***D_CAR*=2**
LNEMISSION	0.041**	-0.272***
	(2.045)	(-11.503)
Intercept	-0.450***	-2.903***
	(-6.586)	(-2.701)
Acquirer controls	Yes	
Year fixed effects	Yes	
Industry fixed effects	Yes	
Observations	8,099	
Pseudo R^2	0.095	
Log pseudo likelihood	-5500.94	

Table 12: Acquirer's carbon emissions, institutional investors, and analyst coverage

In this table, we use an ordinary least squares (OLS) estimation to understand the link between carbon emissions, institutional ownership, and analyst coverage. Models 1 and 2 present the regression results where the dependent variable is institutional ownership. Models 3 and 4 present the regression results where the dependent variable is analyst coverage. For the sake of brevity, we only show the independent variables of interest. All coefficient values (robust *t*-statistics) are shown with standard errors clustered at the firm level. Superscript asterisks ***, **, and * correspond to statistical significance at the 1%, 5%, and 10% levels, respectively. Variables are defined in Appendix A.

	INSTOWN	***INSTOWN***	***ANALYST***	***ANALYST***
	LNEMISSION	***EMITR***	***LNEMISSION***	***EMITR***
	Model 1	**Model 2**	**Model 3**	**Model 4**
EMISSION	-0.007*	-0.085***	-0.272***	-0.536***
	(-1.671)	(-3.440)	(-5.206)	(-2.592)
HIGH_CSR	0.004	0.003	0.125	0.144
	(0.319)	(0.253)	(0.880)	(0.985)

FOREIGN	-0.041***	-0.040***	1.129***	1.122***
	(-3.630)	(-3.533)	(6.548)	(6.554)
Intercept	-0.647	-0.647	7.400**	6.156*
	(-1.441)	(-1.494)	(2.299)	(1.903)
Acquirer controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	2,755	2,755	2,672	2,672
Observations	0.325	0.329	0.453	0.441
Adj. R^2	Yes	Yes	Yes	Yes

Highlights

- We examine whether carbon risk matters in acquisition decisions and performance.
- High carbon emitting acquirers buy firms in countries with low GDP.
- They also buy firms in countries with weak environmental or governance standards.
- Target country characteristics influence acquisition announcement returns.
- Investors censure acquirers that promote CSR while having high carbon emissions.