

**Mobilizing Firms for Climate Action:  
Paris Climate Agreement, National Institutions, and Corporate Green Bonds**

**Yifan Wei**

Beedie School of Business  
Simon Fraser University  
8888 University Drive  
Burnaby, BC V5A 1S6, Canada  
[yifan\\_wei@sfu.ca](mailto:yifan_wei@sfu.ca)

**Kenneth G. Huang\***

NUS Business School & College of Design and Engineering  
National University of Singapore  
15 Kent Ridge Drive  
Singapore 117575  
[kennethhuang@nus.edu.sg](mailto:kennethhuang@nus.edu.sg)

**Ya Gao**

I.H. Asper School of Business  
University of Manitoba  
181 Freedman Crescent  
Winnipeg, MB R3T 5V4, Canada  
[ya.gao@umanitoba.ca](mailto:ya.gao@umanitoba.ca)

\*Corresponding author

**ABSTRACT**

This study examines the effect of the Paris Climate Agreement, as a plausibly exogenous shock, on the issuance of corporate green bonds (CGBs), a new financial instrument to address climate change in line with the goals of the Agreement. We argue that firms in industries that contribute most to climate change are potentially more affected by the Agreement because they perceive themselves as the target of the upcoming national environmental regulations derived from the Agreement. So firms in the affected industries are more likely to issue CGBs after the Agreement than firms in the minimally affected (or unaffected) industries. This differential effect becomes stronger among firms in countries with more media attention on environmental issues, but weaker in countries with more stringent legal enforcement. Using a proprietary cross-national dataset of CGBs and difference-in-differences estimation, we find strong support for our hypotheses. This study advances our understanding of the intersection between firms' green financing as a form of self-regulation and the broader institutional context, and responds to the recent call for more research on integrating multiple pressures that jointly shape firms' environmental behaviors.

*Keywords:* Firm environmental behavior, self-regulation, green financing, institutions, sustainability

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## 1. INTRODUCTION

Climate change is one of the grand challenges facing humanity, and businesses have been recognized as a major contributor (Bateman and Mace 2020, Howard-Grenville et al. 2014). In recent years, firms are under increasing pressure from regulators and stakeholders to adopt pro-environmental practices or internal compliance structures that conform with regulative and normative imperatives (e.g., Delmas and Toffel 2008, Marquis et al. 2016, Short and Toffel 2010, York et al. 2018). At the same time, more firms start to voluntarily engage in environmental practices (e.g., participation in voluntary environmental programs, self-disclosure of environmental regulatory compliance), which are considered as supplementary to regulatory force, in order to demonstrate a commitment to climate change mitigation (Delmas and Montes-Sancho 2010, Short and Toffel 2008).

A growing body of research in management literature has examined the effects of both institutional forces and voluntary environmental practices on firms' environmental performance. One stream of research focuses on system-wide institutional factors (Scott, 2013) and identifies regulatory (Christmann 2004, Delmans and Montes-Sancho 2010, Doshi et al. 2013, Ioannou and Serafeim 2018, Reid and Toffel 2009, Weigelt and Shittu 2016) and normative pressure (Hamilton 1995, Marquis et al. 2016) as having a strong influence on corporate environmental performance respectively. Another stream of research looks at voluntary environmental practices and finds that self-regulation, despite its potential to have a positive effect, is usually fragile and even broken down during implementation (Kim and Lyon 2015, King and Lenox 2000, Lenox and Nash 2003, Steelman and Rivera 2006, Short and Toffel 2010). Although the literature has generated fruitful findings, most research focuses on firms' less committed environmental actions (e.g., disclosure, participation in a voluntary program), and tends to highlight the symbolic implementation of firms' voluntary actions and the importance of external pressures (Kim and Lyon 2015, Marquis et al. 2016). Few studies examine how firms' more *substantive* action can be enhanced or weakened by institutional forces.

We build on previous management scholarship on corporate environmental behavior and examine firms' voluntary environmental practices from a more dynamic perspective. Specifically, our study

leverages a global environmental regulation change and investigates how firms' substantive environmental action changes before and after the regulatory framework is strengthened. We also take into account the multifaceted institutional environment and explore how country-level variations in media attention and legal enforcement moderate firms' commitment to addressing climate change.

Empirically, we study firms' issuance of corporate green bonds (CGBs), a new financial instrument whose proceeds are exclusively applied to finance new or existing projects that focus on emissions reductions, sustainable development, renewable energy, cleaner production, and resource conservation (Flammer 2019, 2021; ICMA 2018). Given the heightened awareness of climate change, CGBs are increasingly popular among investors who want to bolster sustainable investing. Firms' voluntary CGB issuance to attract investors for combating climate change means firms have to carry both financial and legal commitment (Breen and Campbell 2016), because CGBs involve major financial investment in environmental projects and are relatively transparent to investors. In this regard, CGB issuance itself is a more committed and substantive environmental action than other voluntary practices (e.g., disclosure) although it is less studied in prior research. Our data shows that the total value of CGBs issued across the globe has soared from \$832 million in 2012 (1 bond issue) to \$369 billion in 2020 (1,388 bond issues).

On the other hand, global regulations to combat climate change was strengthened, and a key milestone is the adoption of the Paris Climate Agreement (the Agreement hereafter). This landmark agreement was signed by 196 parties under the United Nations Framework Convention on Climate Change (UNFCCC) in December 2015 to limit global warming to well below 2 °C (UNFCCC 2023), and was the most widely supported legally binding international treaty to date. It requires signatory countries to set their own national targets and actions for reducing greenhouse gas (GHG) emissions, increase their use of renewable energy, and adapt to the impacts of climate change. Thus, firms, particularly those in industries that contribute most to climate change, expect to be more affected by the Agreement. In this regard, the Agreement provides an ideal context to examine how firms' change in voluntary environmental practices (i.e., CGBs) under mounting regulatory pressure.

In this study, we consider a quasi-natural experiment to identify the causal effect of the Agreement

on CGB issuance. We treat the Agreement as a top-down (government initiated), plausibly exogenous event, because firms are unlikely to know how stringent the Agreement would be. It is difficult for firms to predict *ex ante* the specific terms and the extent of coverage of the Agreement, whether their home-country governments would sign or ratify it, and the timeline of adopting and implementing the Agreement. Using a difference-in-differences (DID) design (Dutt and King 2014, Furman and Stern, 2011, Singh and Agrawal 2011), we investigate the causal effect of the Agreement on the difference in CGB issuance between firms in industries that contribute most to climate change and hence most affected by the Agreement (i.e., affected industries hereafter) and those in industries that are minimally or unaffected by the Agreement (i.e., minimally affected industries hereafter) in the period before versus after the Agreement. We argue that firms that contribute most to climate change are potentially more affected by the Agreement because they perceive themselves as the target of the upcoming national environmental regulations derived from the Agreement. They expect to face more regulatory pressure after the adoption of the Agreement than firms in industries that are least responsible for climate change and thus minimally or not affected by the Agreement, and such perceived regulatory pressure may enhance the self-regulation of firms in the affected industries. We thus predict that, all else equal, firms in the affected industries are more likely to issue CGBs after the Agreement than firms in the minimally affected (or unaffected) industries.

Moreover, as CGB issuers are subject to other institutional pressures of their home countries, we theorize that the variations in country-level normative and regulative institutions may moderate the first-order effect of the Agreement, and lay out the following arguments. First, firms are exposed to different normative pressure (i.e., media attention) across countries (Bansal 2005). In countries with more media attention on environmental issues, firms in the affected industries are more pressured to behave environmentally responsible. Therefore, we hypothesize that the effect of the Agreement on the difference in CGB issuance between firms in affected and minimally affected industries is stronger in countries with more media attention. Second, we suggest that legal enforcement is a crucial factor (Marquis et al. 2011) since regulatory authorities generally lack the resources to enforce the laws (Baron and Lyon 2012). CGB is essentially a legal agreement between issuing firms and bondholders and require enforcement. In

countries where legal enforcement is strong, firms in affected industries could be reluctant to issue CGB due to default risks and strong enforcement. Thus, we hypothesize that the effect of the Agreement on the difference in CGB issuance between firms in affected and minimally affected industries is weaker in countries with strong legal enforcement.

We test our hypotheses using a firm-year panel dataset that combines a novel and proprietary green bond dataset covering the population of CGBs worldwide from 2012 to 2021 with firms' financial information as well as country-level data of institutions. We construct a matched sample consisting of 2,411 firm-year observations that contains firms in both affected industries (treatment group) and minimally affected (or unaffected) industries (control group). The results of our DID estimation provide empirical support for our hypotheses.

This study makes the following contributions. First, our study adds to the burgeoning literature on green financing. As an innovative instrument of green financing, CGBs have received little attention in management scholarship. Most studies on green bonds are from finance literature and focus on the pricing of green bonds, primarily government green bonds (Baker et al. 2018, Hachenberg and Schiereck 2018, Larcker and Watts 2019, Zerbib 2019) although the findings are mixed. Some other studies examine the green bond market at the macro level (Tolliver et al. 2019, Tolliver et al. 2020). There is limited research that investigates the firm-level outcome of CGBs (Fatica and Panzica 2021, Flammer 2021, Tang and Zhang 2020). We extend the literature on green financing to management by highlighting the nature of CGB issuance as firms' more committed and substantive environmental action (with serious legal implications) compared to other actions that have received more attention in the literature on corporate environmental strategy (e.g., disclosure, participation in voluntary program). To our best knowledge, this is one of the first studies to theorize and empirically demonstrate the adoption and growth of CGBs using data of the entire population of firms issuing CGB.

Second, we contribute to the literature on corporate environmental behaviors by examining firms' green financing, a form of committed firms' self-regulation, and its fragility as the regulatory environment changes. Existing research on corporate environmental practices mainly focuses on less substantive actions

(e.g., disclosure) and tends to assume firms' voluntary environmental actions are likely to be symbolic (Delmas and Montes-Sancho 2010, Kim and Lyon 2015, Marquis et al. 2016; Westphal and Zajac 2013). We show that the increasingly heightened global regulatory pressure on tackling climate change can enhance firms' environmental commitment such that firms in affected industries are more likely to be self-regulated to mitigate climate change, although overly stringent legal enforcement might hurt firms' commitment. In this regard, this study not only advances our understanding of the intersection between firms' green financing as a form of self-regulation and the broader institutional context but also responds to the recent call for more research on integrating multiple pressures that jointly shape firms' environmental behaviors (Aragón-Correa et al. 2020).

## **2. THEORETICAL BACKGROUND**

Management scholarship primarily uses neo-institutional theory as the theoretical framework (e.g., DiMaggio and Powell 1983, Scott 2013) to study corporate environmental behavior as regulators and other stakeholders are increasingly pressuring firms to improve their environmental performance (e.g., Aragón-Correa et al. 2020; Delmas and Toffel 2012). This literature has identified the regulative and normative pillar of institutions as two major drivers of firms' environmental practices and looked at how firms respond to these pressures.

The first line of work in this literature focuses on *regulatory* pressure. Research has examined a variety of mandatory environmental regulations at the local and country level (e.g., Chakraborty and Chatterjee 2017, Fremeth and Shaver 2014, Fabrizio and Hawn 2013). Scholars generally agree that mandatory environmental regulations have a strong positive effect on firms' environmental performance (e.g., Child and Tsai 2005, Christmann 2004, Doshi et al. 2013, Ioannou and Serafeim 2018, Weil et al. 2006), since not complying with these regulations may result in sanctions and penalties (Diestre and Rajagopalan 2011). The literature has shown various firms' responses to regulations, such as investment in innovation or new technologies (Chakraborty and Chatterjee 2017, Dutt and Joseph 2019), adoption of pro-environmental strategy (Child and Tsai 2005), and increase in self-disclosure of environmental practices

(Doshi et al. 2013, Reid and Toffel 2009), and focused on the effectiveness of mandatory regulations in making firms improve environmental performance (Delmas et al. 2009). It shows that firms vary in their subsequent reactions to improve their environmental performance due to different attributes (Benneer and Olmstead 2008, Christmann 2004, Doshi et al. 2013, Fremeth and Shaver 2014, Hoffmann et al. 2009, Konar and Cohen 1997) as well as their operating contexts and regulatory environment (Doshi et al. 2013, Kim et al. 2017, Madsen, 2009).

The second line of work in this literature taking an institutional perspective focuses on *normative* pressure. Firms' environmental action is subject to the influence of norms and values that provide legitimacy for firms' operation (Chatterji and Toffel 2010, Kim and Lyon 2011, 2015). Research has shown that firms face normative pressure from their market and nonmarket stakeholders (Delmas and Toffel 2008), such as shareholders (Flammer et al. 2021, Kim et al. 2019, Reid and Toffel 2009), rating agencies (Chatterji and Toffel 2010), media (Bansal 2005, Hamilton 1995), environmental activists (Eesley and Lenox 2006, Lenox and Eesley 2009), and local civil society (Lyon and Maxwell 2011, Marquis et al. 2016). In general, studies have found that firms tend to be more sensitive to the environmental impact of their operations when they are more exposed to stakeholders' scrutiny (Delmas and Montes-Sancho 2010, Kim and Lyon 2015, Short and Toffel 2010), or challenged by stakeholder activism (Marquis et al. 2016, Reid and Toffel 2009). These normative pressures determine the degree of disclosure (e.g., Delmas and Burbano 2011, Kirk and Vincent 2014, Kim and Lyon 2015), which in turn, affect stakeholders' evaluations of the firms (Fisher-Vanden and Thorburn 2011, Oberholzer-Gee and Mitsunari 2006).

For those studies that looked at how normative or regulative pressure affects firms' environmental action, they largely focus on whether firms comply with a regulation or participate in a voluntary program. Specifically, a few studies looking at the impact of the U.S. Toxics Release Inventory on firms' environmental strategy only considered whether firms comply or not (e.g., disclosure or diversification) (Diestre and Rajagopalan 2011, Doshi et al. 2013). This left an important gap in the literature because firms' responses may vary over time when the institutional environment changes or when firms expect the institutional change to be under way (Christmann 2004, Hoffman 1999). As another example, Christmann

(2004) has found that there is a positive relationship between multinational companies' managers' perception of more stringent global environmental regulations and companies' level of minimum internal global environmental standards. But such correlation may not warrant a causal interpretation since managers' perception may correlate with unobservable firm characteristics that also affect internal environmental standard (e.g., executives' pro-environmental inclination). Thus, the dynamic nature of firms' responses remains underexplored and would require better identification strategies for causal inference.

Moreover, existing management research assumes firms' voluntary environmental practices are likely to be symbolic (e.g., Kim and Lyon 2015, Marquis et al. 2016) because environmental actions may compromise firms' financial performance and competitive advantage (Aragón-Correa et al. 2020). While firms voluntarily adopt pro-environmental practices or participate in environmental programs—including voluntary environmental certification (e.g., Bansal and Hunter 2003, Carlos and Lewis 2018, Delmas and Toffel 2008, Jiang and Bansal 2003, York et al. 2018), government-led or industry association-led environmental program (Barnett and King 2008, Delmas and Montes-Sancho, 2010, King and Lenox 2000), or voluntary pro-environmental practices (Howard-Grenville et al. 2017)—most scholars agree that, despite its positivity, these voluntary actions usually fail to live up to expectations due to opportunism, adverse selection or moral hazard (Kim and Lyon 2015, King and Lenox 2000, Lenox and Nash 2003, Steelman and Rivera 2006, Short and Toffel 2010). This assumption, however, may not hold in some cases like CGBs that involve real investment in environmental projects and signal firms' self-regulated commitment, and only limited attention has been paid to firm's committed voluntary actions (Short and Toffel 2010). Therefore, we still lack understanding of how firms' commitment to tackle environmental problems will change in conjunction with institutional forces which are important for the effectiveness of firms' voluntary actions (Delmas and Montes-Sancho 2010, Marquis et al. 2016).

Our study fills these important gaps by examining a major, plausibly exogenous policy change that strengthens the global regulatory pressure on corporate environmental behavior—the Agreement—in the context of the nascent green bond market. We draw on institutional theory and prior literature on corporate environmental strategy to identify the casual effect of the Agreement on CGB issuance by comparing firms



in the affected industries with those in the minimally affected (or unaffected) industries. We further examine how this main relationship is contingent upon local normative institutions such as media attention on environmental issues and upon regulative institutions such as the quality of legal enforcement in the focal firms' home countries.

### **3. CONTEXT: THE PARIS CLIMATE AGREEMENT AND CGBs**

The past two decades have witnessed the increase in environmental regulations and programs at the local or national level, but international government cooperation in the area of climate change did not make so much progress after the adoption of the Kyoto Protocol in 1997. The Agreement adopted in 2015 is considered as a landmark in global efforts to combat climate change. It sets the target of limiting the rise in global warming and outlines a regulatory framework for signatory countries to reduce their GHG emissions, increase their use of renewable energy, and leverage financing and technologies for decarbonization (UNFCCC 2023). More importantly, The Agreement represents a significant shift in the international approach to addressing climate change, as it is the first time that all countries have committed to taking action on this issue. Prior to the Agreement, the Kyoto Protocol only applied to developed countries, leaving developing nations with no legal obligation to reduce their GHG emissions. Countries that ratify the Agreement are required to introduce legislations and regulations to support their nationally determined contributions (NDCs) submitted to the Agreement reporting their national targets and actions for reducing GHG emissions (Nachmany et al. 2017). It represents a plausibly exogenous shock for firms, since firms may have difficulty knowing *ex ante* the specific terms and extent of coverage of the Agreement, as well as the willingness of their home-country governments to sign and ratify the Agreement as different national governments hold different views of climate change.<sup>1</sup>

Firms, particularly those in industries that contribute most to climate change, may expect more

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<sup>1</sup> For example, reportedly India was originally a reluctant signatory in the Agreement because India claimed that it was a developing country, which should prioritize its development agenda of eradication of poverty, and its involvement in the Agreement depended on the fulfillment of the commitments and financial assistance from other major powers, particularly the rich industrialized countries. (CNN, 2017).

stringent regulation underway. One major way that firms can feasibly reach the goals of the NDCs and the Agreement is by issuing CGBs (Bishop 2019). Green bonds are a type of bond instruments whose proceeds are exclusively applied to finance new or existing environmentally beneficial projects, such as renewable energy or energy efficiency, and are recognized as part of the Agreement's call for the role of financing in de-carbonization (ICMA 2018). The market for green bonds has grown fast (Tolliver et al. 2020), and CGBs have caught up with the government green bonds since 2012. By issuing CGBs, firms signal their commitment to reducing their carbon footprint and contributing to the goals of the Agreement (Fatica and Panzica 2021). In turn, this can help attract environmentally conscious investors who are interested in supporting sustainable investments.

Compared with other voluntary actions (e.g., participation in a program, self disclosure), CGBs are considered a more substantive environmental action by the firms. First, by issuing CGBs, firms have to involve actual investments in sustainable projects including renewable energy, energy efficiency, clean transportation, sustainable agriculture and other environmentally friendly initiatives. Moreover, the process of issuing a green bond is typically more rigorous and costly than traditional bonds. CGBs must meet specific criteria and obtain accredited third-party certification and verification to provide transparency to investors, ensure that the proceeds are used for the intended purposes, and build trust in the market (ICMA 2018). Furthermore, CGB issuers are prescribed to report the use of bond proceeds annually for the market to evaluate the compliance of green bonds (ICMA 2018), which provides transparency, accountability and credibility. All of these actions indicate that CGB issuers are committed to behave in an environmentally responsible way.

## **4. HYPOTHESIS DEVELOPMENT**

### **4.1. The Impact of The Agreement**

We first postulate the role of the Agreement on the difference in CGB issuance between firms in affected and minimally affected (or unaffected) industries. The Agreement adopted in 2015 specifies the desired environmental goals of keeping the rise in average global temperatures to a maximum of 2°C but

leaves regulatory discretion to national governments. Firms facing regulatory uncertainty of their national governments in the area of climate change may likely re-evaluate their own environmental strategies and make their moves accordingly (Dutt and Joseph 2019).

Existing literature has shown that when facing regulatory uncertainty, firms tend to develop proactive environmental strategies in order to maintain their competitive advantage and alleviate institutional pressure (Aragón-Correa and Sharma 2003, Hoffmann et al. 2009). This is also the approach whereby firms can strategize and make moves after the Agreement has come into effect (but sometimes before the specific regulations have been concretized) to minimize the possibility of being negatively affected (Engau et al. 2011). In order to develop such strategies, firms need to deploy its resources to generate environmental capabilities (e.g., investment in R&D, technologies, or pro-environmental practices) (Aragón-Correa and Sharma 2003). For instance, Hoffmann and colleagues (2009) find that firms underlined an increase in investments in new technologies for emission reduction facing regulatory uncertainty because such investment can also be leveraged for the complementary goals of fuel efficiency and alleviate pressures from stakeholders.

CGBs are one of such firms' proactive environmental strategies. The Agreement strengthens the global regulatory framework for national governments to take actions against climate change and sends a clear signal to the corporate sector that there is a growing regulatory pressure for their low-carbon investments. Firms that are committed to environmental protection before the Agreement (e.g., issuing CGBs) anticipate increasing national regulations derived from the Agreement. They have more incentives to use CGBs to mobilize financial resources for investment in clean technology development and climate-friendly projects to meet the regulatory demand and maintain their competitiveness in the post-Agreement era (Fatica and Panzica 2021).

The Agreement exerts differential impacts on CGB issuance by firms operating in different industries. Highly polluting industries are expected to be more affected by the Agreement. For example, the energy sector, including oil and gas, coal, and electricity production, is well known for its contribution to climate change. The Agreement calls for a shift to cleaner and more sustainable energy sources and the

expected carbon taxes that follow targeting at the energy sector exert much more pressures on firms in the sector to take environmental actions (Fortune 2015). In addition to the energy sector, industries such as transportation and manufacturing are also likely to be affected by the Agreement. The transportation sector is another significant contributor to GHG emissions, particularly through the use of fossil fuels in cars, trucks, and airplanes, and will be subject to stricter regulations to reduce their carbon footprint (EPA 2023). Firms in these highly polluting industries are expected to be under more regulatory pressure after the adoption of the Agreement to reduce their carbon footprint and transition to cleaner sources of energy. This transition could be challenging for firms in these industries as it requires significant investments in new technologies and infrastructure through CGBs to reduce their emissions. On the other hand, industries such as technology, finance, and healthcare may have a substantially smaller carbon footprint. Firms in these industries are expected to face less regulatory pressure and thus are less affected by the Agreement.

We argue that upon the adoption of the Agreement by nations, firms in affected industries expect to face more regulatory pressures and become more committed to the climate change mitigation. They are more likely to take proactive environmental actions by issuing CGBs to act in line with the Agreement. For firms that have already issued CGBs before the Agreement, they tend to issue more CGBs. On the other hand, firms in minimally affected (or unaffected) industries expect to be less regulated and thus face less regulatory uncertainty. It follows that they are less incentivized to adopt the approach to issue CGBs. For those that have already issued CGBs before the Agreement, they are well-positioned and tend to maintain the status quo under the Agreement. Taken together, the above arguments suggest that firms in affected industries are more likely to issue CGBs than those in minimally affected (or unaffected) industries after the adoption of the Agreement. This leads to our baseline hypothesis:

**Hypothesis 1 (H1).** *Upon the adoption of the Agreement by the state, firms in the affected industries are more likely to issue CGBs than comparable firms in the minimally affected (or unaffected) industries.*

#### **4.2. The Roles of Media Attention on Environmental Issues**

Next, we examine the condition under which the abovementioned differential effect of the Agreement on firms' CGB issuance will become more or less pronounced. Research on self-regulation

suggests that whether self-regulation facilitates or undermines organizations' commitment is contingent on external institutional forces (King and Lenox 2000, Marquis et al. 2016, Short and Toffel 2010). One of the key institutional forces is normative pressure. Institutional theorists have suggested that the normative pillar of institutions influences behavior by defining what is appropriate or desirable in a given social situation (Scott 2013). It includes both values and norms that prescribe how actors are supposed to behave, and pressure actors to conform to social expectations and obligations (Hoffman et al. 2002, Scott 2013), and to maintain legitimacy (Meyer and Rowan 1977, Suchman 1995, Zajac and Westphal 2004).

Media plays a key role in creating and exerting normative pressure. Media is the primary source of environmental information for the public and can often distribute such information to a broader audience (Bansal 2005). Media attention can raise firms' visibility, inviting public attention and scrutiny and thus pressuring firms to commit to pro-environmental practices. Negative media attention on firms' environmental violation may erode their legitimacy (Bansal and Clelland 2004). Empirical studies have shown that media attention significantly influences firms' environmental behaviors (Bansal 2005, Hamilton 1995, Berrone et al. 2017). For example, Bansal (2005) has found that media attention is positively associated with corporate sustainable development. Research also suggests that media attention may incite other stakeholders to change firm environmental practices (Marquis et al 2016).

The role of media attention is also pertinent in the context of CGBs. We contend that media attention on environmental issues varies across firms' home countries. Given the variation in the media attention across the countries in which the focal firms are based, these firms are subject to different levels of normative pressures on their CGB issuance. Thus, we expect the first-order effect of the Agreement on the difference in CGB issuance between firms in affected and less affected industries may vary across countries, depending on the level of media attention of the country in which the focal firms are based. In countries with more media attention on environmental issues, firms in the affected industries are exposed to more public scrutiny due to their significant contribution to the climate change. Such high exposure may invite the public and other stakeholders to put more pressure on firms in affected industries to behave in an environmentally responsible manner. Thus, the difference in CGB issuance between firms in affected and

minimally affected (or unaffected) industries are likely to be more pronounced after the adoption of the Agreement. In countries with less media attention, firms in affected industries face less public scrutiny as well as pressures from stakeholders. Therefore, the difference in CGB issuance between firms in affected and minimally affected (or unaffected) industries will be less pronounced after the Agreement. In summary, the effect of the Agreement on the difference in CGB issuance between firms in affected and minimally affected (or unaffected) industries are expected to be more salient in countries with more media attention.

Therefore, we hypothesize that:

**Hypothesis 2 (H2).** *Upon the adoption of the Agreement by the state, the difference in the likelihood of issuing CGBs between firms in affected and minimally affected (or unaffected) industries is larger in countries with more media attention on environmental issues.*

#### **4.3. The Moderating Role of Legal Enforcement on CGBs**

Another institutional force which may moderate the effect of the Agreement on the difference in CGB issuance is the degree of legal enforcement in the countries where the focal firms are based (Edelman and Suchman 1997). In essence, CGBs are debt securities issued by firms to raise capital from investors. The terms and conditions of CGBs, including the interest rate, maturity, and payment schedule, are typically governed by a bond indenture or other legal agreement between the corporate issuers and bondholders (Qi et al. 2011). The enforceability of these agreements is conceived to be critical for the proper functioning of the bond market (La Porta et al. 1998, Qi et al. 2011).

Despite the conventional view of legal enforcement as a necessary condition for market activities (Teece 2020), some research has noted that a high level of legal enforcement may hurt firms' commitment for self-regulation (Short and Toffel 2010). Prior studies suggest that organizations' intrinsic motivations are fragile and can be undermined by extrinsically coercive pressure (e.g., legal enforcement) which can manipulate firm behaviors (Malhotra and Murnighan 2002, Tenbrunsel and Messick 1999). In particular, Short and Toffel (2010) has shown that even though firms' self-regulatory behavior cannot be isolated from extrinsic motivation of the regulatory environment, "its efficacy depends heavily on the intrinsic and reputational motivations of the firms that adopt it." (p. 369) When a strong legal enforcement (i.e., sanctions)

is absent, firms tend to follow through on their commitment to adopt internal compliance practice for environmental protection.

Following this logic, we argue that issuing CGBs is a self-regulated commitment and reflects the issuing firms' intrinsic motivations to comply with the Agreement. Such commitment, however, can be affected by the strength of the legal enforcement in the CGB issuers' home countries. In countries where the legal enforcement (and thus punishment) is weak, firms in affected industries tend to more readily issue CGBs as they face less direct sanctions if their investments in new environmental projects fail. On the other hand, in countries where the legal enforcement and punishment are strong, firms' motivation to issue CGBs could be reduced because investments from CGBs in new green technologies or climate-friendly projects involve a lot of uncertainties and there is a relatively high likelihood that CGB issuer may fail to make timely payments of interest or principal as scheduled. In other words, firms face higher default risk of CGBs and the chances of being sanctioned are higher. This is particularly true for firms in affected industries since their intrinsic motivation to issue CGBs and behave in an environmentally responsible manner are more fragile (Li et al. 2022). Hence, the effect of the Agreement on the difference in CGB issuance between firms in affected and minimally affected (or unaffected) industries is likely to be weakened. Therefore, we hypothesize that:

**Hypothesis 3 (H3).** *Upon the adoption of the Agreement by the state, the difference in the likelihood of issuing CGBs between firms in affected and minimally affected (or unaffected) industries is smaller in countries with more stringent legal enforcement.*

Figure 1 presents our conceptual framework based on H1 to H3 as depicted above.

[INSERT FIGURE 1 ABOUT HERE]

## 5. METHODS

### 5.1. Data and Sample

To test our hypotheses, we compile a dataset including all available firms issuing CGBs and those without CGBs over the period from 2012 to 2021 from several sources. First, we collected data of firms

issuing CGBs from the Environmental Finance Bond Database (EFBD). It is one of the few available databases on the market that covers the universe of all types of green bonds globally (supranational, government, and corporate), and tracks every self-labelled green bond issued since the inception of the green bond market in 2007. The database contains a wealth of bond-level information including issuers, financials, and other information, and has been used by leading international organizations that provide support and advice to green bond issuers like ICMA. We also obtain available financial information for firms issuing CGBs globally in the EFBD from COMPUSTAT and Center for Research in Security Prices (CRSP), such as total asset, cash holdings, Tobin's Q, employees, market-to-book value, and location identifiers from COMPUSTAT.<sup>2</sup> The market-to-book values of issuers are calculated using CRSP data. We merge the firms issuing CGBs in the EFBD with firms in COMPUSTAT and CRSP and the resulting sample covers 230 firms issuing CGBs between 2012 and 2021. We choose 2012 as the beginning year of our sample because it is the year when the first CGB was issued. These firms are also the treatment group for our matching to be discussed later. We keep the remaining firms in COMPUSTAT that cannot be matched with firms issuing CGBs in the EFBD in our sample as the pool of potential control group firms in our matching procedure. Furthermore, we retain key bond-level variables such as the issuer, issue year and country for each green bond.

We obtain country-level data for media attention and coverage on environmental issues from the Factiva database, which has been used by prior studies to examine firms' responses to media attention (e.g., Bednar et al. 2013). Country-level governance data (e.g., legal enforcement) and economic data (e.g., GDP) are collected from the World Bank's Worldwide Governance Indicators (WGI) database.<sup>3</sup>

## 5.2. Variables

*Dependent variable.* Our main dependent variable is an indicator variable, *CGB issuance*, which

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<sup>2</sup> We use both COMPUSTAT North America (including data for U.S. and Canadian companies) and COMPUSTAT Global (including data for all other public companies) for the financial information of firms issuing CGB globally in the EFBD data.

<sup>3</sup> We access the WGI database at <https://info.worldbank.org/governance/wgi/>. It is the most comprehensive data that ranks institutional quality of over 200 countries. The data has been widely used in management research that examine the cross-national variation of institutional quality in relation to firms' strategy (van Hoorn and Maseland 2016).



equals to 1 if a firm issues at least one CGB in year  $t$ , and zero otherwise. This variable captures firms' willingness and capability to participate in green financing. In our robustness analysis, we use the annual count number of CGB issuance as an alternative dependent variable. We do not use the count measure as our main dependent variable, as it could usually be distorted by how firms structure their deals based on firms' planned capital structures, as well as conditions of the capital market at the time of financing.

*Independent variable.* To ascertain the differential effects of the Agreement on firms' CGB issuance across different industries, we construct the dichotomous independent variable, *post-treat*. Following prior literature (Huang and Li 2019, Singh and Agrawal 2011), the value of *post-treat* equals to 1 when the focal firm is a CGB issuer in the affected industries and year  $t$  is equal or greater than 2017 when the Agreement comes into force; the variable equals to 0 otherwise. For the control group of firms, this variable always equals 0. This is our DID variable of interest. Building on Berkman, Jona, and Soderstrom (2019), we manually categorize firms issuing CGBs into affected and minimally affected (or unaffected) industries based on each industry's sensitivity to climate change.<sup>4</sup> We use Fama and French 48 industry classification for the categorization as shown in Table A1 in the Appendices.

*Moderating variables.* Our first moderator is *media attention* which captures country-level normative pressure. We use common keywords to search for environment-related articles from major media outlets in Factiva for each country in our matched sample. Based on recent research that examines common words in social discussions on environmental sustainability (Ballestar et al., 2020), we identify our keywords including "climate change/goal", "carbon neutral\*/sequestration", "emission / emission reduction", "fossil fuel / coal / oil", "energy consumption", "sustainab\*", "natural environment", and "greenwashing". We focus on four highly influential media outlets: *Wall Street Journal*, *Reuters*, *New York Times*, and *Financial Times*. We count the number of articles containing one or more of the keywords for each country and lag the measure by one year.

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<sup>4</sup> Firms issuing CGBs are distributed in both affected and minimally affected industries and it provides a source of random variation to mitigate the concern that all firms are already facing high regulatory pressure before the Agreement.

Our second moderator is *legal enforcement* in each country. Prior studies have suggested the rule of law reflects the degree to which laws and contractual agreements are backed by legitimate power of the judicial system and reflects the strength of a country's formal regulative institutions (Nartey et al. 2018). We follow prior studies and measure *legal enforcement* using the rule of law index taken from the World Bank Institute's World Governance Indicators (WGI) (Kaufmann et al. 2010). This provides an aggregate measure of each country's perception of the quality of contract enforcement, property rights, and law enforcement, etc. A higher value indicates strong legal enforcement.

*Control variables.* We control for both firm-level and country-level factors that would affect CGB issuance. At the firm level, we control for firms' *asset* and *Tobin's Q* as calculated by dividing the sum of a firm's market value of equity and debt by total assets to account for the effect of financial positions (Flammer 2021). Firms' *cash holdings* are included as well to control the effect of asset liquidity on CGB issuance (Goldstein et al. 2017). We also include *firm size*, measured by a firm's total number of employees, which may also affect firms' bond issuance (Jankowitsch et al. 2014). To control for the firm's alternative financing channels other than bonds, we include firm's *market-to-book value*, which is measured by the market price per share divided by book value per share (Pástor et al. 2022). At the country level, we control for *purchasing power adjusted gross domestic product (GDP PPP)* collected from the World Bank database in order to control for the effect of economic development on CGB issuance (Tolliver et al. 2020). We also construct the control variable *firm region*, which is a categorical variable indicating one of the main geographic regions (i.e., Asia Pacific, Europe, Middle East and Africa, North America, and Latin America) in which the firm is based. In all our regression models, we control for firm fixed effects and region fixed effects to control for potential unobserved heterogeneity across firms and regions. All control variables are lagged by one year. Table 1 shows the descriptive statistics and correlations of the key variables.

[INSERT TABLE 1 ABOUT HERE]

Table A2 in the Appendices provides the definitions of the variables and their data sources.

### **5.3. Empirical Strategy**

Our goal is to ascertain the differential effects of the Agreement on CGB issuance by firms in

different industries, which are either affected or minimally affected (or unaffected) by climate change (Pástor et al. 2022, Flammer 2021). We consider firms issuing CGBs from affected industries as our treatment group of firms (quadrant I in Figure 2, labelled as “Treatment”). We consider firms from minimally affected (or unaffected) industries as our baseline control group of firms (quadrants II and III, labelled as “Baseline Control” in Figure 2). As a robustness analysis, we consider firms from minimally affected (or unaffected) industries and those issuing CGB as our restricted control group of firms (quadrant II, labelled as “Restricted Control” in Figure 2).

[INSERT FIGURE 2 ABOUT HERE]

Next, we employ the propensity score matching (PSM) method (Guo and Fraser 2014) to match the firms in the treatment group to comparable firms in the baseline control group based on the following dimensions: firms’ asset, Tobin’s Q, and age. After PSM, our matched sample consist of 275 unique firms (2,411 firm-year observations) for both firms in affected industries (treatment group) and those in minimally affected (or unaffected) industries (baseline control group) between 2012 and 2021. Table 2 shows the descriptive statistics of these key dimensions for the treatment group and matched baseline control group of firms.

[INSERT TABLE 2 ABOUT HERE]

#### **5.4. Model Specifications**

We employ a DID estimation (Dutt and King 2014, Singh and Agrawal 2011) to examine the effect of the Agreement on the difference in CGB issuance between firms in affected and minimally affected industries before and after the Agreement. Given our main dependent variable, *CGB issuance*, is dichotomous, we use logistic regression with one-year lagged control variables as our main model. This analysis relies on the estimation of maximum likelihood to model the probability of dichotomous outcomes (DesJardine et al. 2021). We include firm fixed effects and region fixed effects to control for unobserved heterogeneity across firms and regions that may influence firms’ CGB issuance. We also include robust errors to account for potential heteroscedasticity and lack of normality in the error terms (Wooldridge 1999). It has been used by prior studies to identify the effect of an exogenous event on firms’ differential responses

(Huang et al. 2017, Zeng et al. 2012). Specifically, we estimate the following model in Equation (1):

$$P_{i,t} = \frac{\exp^{\beta_0 + \beta_1 \cdot Posttreat_{i,t} + \beta_2 \cdot X_{i,j,t-1} + \varepsilon_{i,t}}}{1 + \exp^{\beta_0 + \beta_1 \cdot Posttreat_{i,t} + \beta_2 \cdot X_{i,j,t-1} + \varepsilon_{i,t}}} \quad (1)$$

where  $i$  indexes a focal firm,  $j$  indexes the region of the focal firm, and  $t$  indexes the year of observation.  $P_{i,t}$  indicates the probability of a focal firm  $i$  issuing a CGB in year  $t$ . The key independent variable is *post-treat*, and the coefficient of interest  $\beta_1$  captures the first-order differential effect of the Agreement on the likelihood of CGB issuance between firms in affected and minimally affected industries.  $X_{i,j,t-1}$  is a matrix of firm- and country-level controls for firm  $i$  in country  $j$  in year  $t-1$  as introduced above.  $\varepsilon_{i,t}$  is the error term.

As a robustness analysis, we follow prior studies (Bartling et al. 2015) and use ordinary least squares (OLS) regressions with firm fixed effects and region fixed effects to ascertain the differential effects of the Agreement on CGB issuance between firms in affected and minimally affected industries. We also perform fixed-effects Poisson regressions (e.g., Azoulay et al. 2010, Jia et al. 2019) to estimate the impact of the Agreement on the number of CGB issuance, where the dependent variable is the number of CGB issued by a focal firm  $i$  in year  $t$ .

### 5.5. Testing the “Parallel Trends” Assumption

The DID model requires the “parallel trends” assumption to hold. Specifically, the differences (if any) between firms in affected industries and firms in minimally affected industries before the Agreement should be stable. Following Beck, Levine, and Levkov (2010), we test the dynamic impact of the Agreement to identify the pre-trend and post-trend of difference in CGB issuance with the regressions as indicated by Equation (2).

$$Difference\ in\ CGB_{i,t} = \beta_0 + \beta_1 \cdot D_{i,t}^{-5} + \beta_2 \cdot D_{i,t}^{-4} + \dots + \beta_{10} \cdot D_{i,t}^{+5} + \theta_i + \varphi_t + \varepsilon_{i,t} \quad (2)$$

where  $D$ 's indicate the Agreement shock dummy variables and equal zero except as follows:  $D_{i,t}^{-n}$  equals one for observations in the  $n$ th year before the Agreement, and  $D_{i,t}^{+n}$  equals one for observations in the  $n$ th year after the Agreement. The year before the Agreement ( $D_{i,t}^{-1}$ ) is set as the reference group.  $\theta_i$  and

$\varphi_t$  are firm and year fixed effects that incorporate firm-level factors and macro shocks affecting firm's CGB issuance. Figure 3 plots the coefficient estimates. We find that the estimates for  $\beta$  is close to and not statistically significantly different from zero in years before 2016, relative to the reference year. It suggests that there are no different trends in CGB issuance between firm in affected and less affected industries, thus the “parallel trends” assumption is validated.

[INSERT FIGURE 3 ABOUT HERE]

## 6. RESULTS

Table 3 presents the results from the logistic regressions with firm and region fixed effects to test for H1. Models 3-1 shows the results based on the baseline control group matched sample. The coefficient of *post-treat* is positive and significant ( $\beta = 4.684, p < 0.001$ ). Model 3-2 shows highly consistent results when we use the restricted control group matched sample ( $\beta = 5.185, p < 0.001$ ). This suggests that firms in affected industries are more likely to issue CGBs compared with those in minimally affected industries after the adoption of the Agreement. The differential effect of the Agreement on CGB issuance is of economic significance. That is, the adoption of the Agreement increases the odds of CGB issuance by firms in affected industries by a factor of 108 ( $\exp(4.684), p < 0.001$ ). The effect size is even larger in the restricted matched sample: the adoption of the Agreement increases the odds of CGB issuance by firms in affected industries by a factor of 179 ( $\exp(5.185), p < 0.001$ ). These results lend strong support to H1.

[INSERT TABLE 3 ABOUT HERE]

We further explore the moderating effects of country-level media attention and legal enforcement on the main relationship between the impact of the Agreement and CGB issuance to test for H2 and H3. Table 4 presents the results from the logistic regressions with firm and region fixed effects. For our testing of H2, Models 4-1 reports the results of the moderating effect of media attention using the baseline control group matched sample. The coefficient of the interaction term between *post-treat* and *media attention* is positive and significant ( $\beta = 0.707, p < 0.001$ ), indicating that the Agreement will increase the likelihood of firms' CGB issuance more in affected relative to minimally affected industries in countries with more media

attention to environmental issues. In other words, upon the adoption of the Agreement, the difference in CGB issuance between firms in affected and minimally affected industries become more pronounced in countries that are subject to more media scrutiny on their environmental issues. Thus, H2 is supported.

For our testing of H3, Model 4-2 reports the results of the moderating effect of legal enforcement in the baseline control group matched sample. The coefficient of the interaction term between *post-treat* and *legal enforcement* is negative and highly significant ( $\beta = -0.906, p < 0.001$ ). This result suggests that the effect of the Agreement on CGB issuance between firms in affected and minimally affected industries will decrease in countries with stronger legal enforcement. That is, the difference in CGB issuance between firms in affected and minimally affected industries will become smaller in countries with more stringent legal enforcement after the adoption of the Agreement. Therefore, H3 is supported.

Models 4-3 and 4-4 report the results of the moderating effects of *media attention* and *legal enforcement* using the restricted control group matched sample and they are highly consistent with the results using the baseline control group matched sample. The coefficient of the interaction term between *post-treat* and *media attention* remains positive and significant ( $\beta = 0.578, p < 0.01$ ) as shown in Model 4-3. The coefficient of the interaction term between *post-treat* and *legal enforcement* remains negative and significant ( $\beta = -0.932, p < 0.001$ ). Taken together, these results provide additional support for H2 and H3.

[INSERT TABLE 4 ABOUT HERE]

## 6.1. Robustness Analyses

We conduct several robustness analyses to check our results. First, we test the differential effect of the Agreement on CGB issuance between firms in affected and minimally affected industries using OLS regressions with firm and region fixed effects. Models 3-3 and 3-4 in Table 3 present these results. In Model 3-3, we perform OLS regression with firm and region fixed effects using the baseline control group matched sample and the coefficient of *post-treat* remains positive and significant ( $\beta = 0.444, p < 0.001$ ). Model 3-4 shows similar and consistent results using the restricted control group matched sample ( $\beta = 0.385, p < 0.001$ ). These results lend further support to H1.

Second, we use the number of CGBs issued by the focal firm as an alternative dependent variable

and employ the Poisson regressions with firm and region fixed effects (Huang and Li 2019, Wooldridge 1999) to estimate the differential effect of the Agreement on the number of CGB issued by firms. Model 5-1 and Model 5-2 in Table 5 present the results from the fixed-effects Poisson regressions based on the baseline control group matched sample and restricted control group matched sample respectively. Model 5-1 shows that the coefficient of *post-treat* is positive and significant ( $\beta = 2.482, p < 0.001$ ). Model 5-2 shows highly consistent results when using the restricted control group matched sample ( $\beta = 2.911, p < 0.001$ ). These results suggest that upon the adoption of the Agreement, firms in affected industries are likely to issue more CGBs than firms in less affected industries. The results lend additional support to our argument that firms in affected industries are more likely to commit to pro-environmental practices than firms in minimally affected industries when the regulatory pressure is heightened. However, as we have discussed earlier, in the context of green bond issuance, the number of CGBs issued within a year is more of a corporate finance decision, rather than a managerial one.

[INSERT TABLE 5 ABOUT HERE]

## 6.2. Mitigating Potential Endogeneity

To mitigate the possibility of endogeneity concern that the Agreement could be anticipated by firms to some extent and thus is not fully exogenous, we employ the two-stage least squares regressions (2SLS). We choose two instruments for the Agreement. First, we use the geographic distance between Paris and the capital of the country where the focal firm is located (*distance*) as the instrument for the Agreement. It has been well established in the environmental studies literature that geographical proximity plays a significant role in political ideology (Guo et al. 2019) as well as the diffusion of government policies (Massey et al. 2014), especially as an important factor for shaping governments' preferences on policies toward environmental issues (Konisky et al. 2008). Hence, we conjecture that countries that are closer to France geographically are more likely to share similar views and attitudes toward the Agreement as the French government, who is the host, organizer, and promoter of the Agreement. But such geographic distance is less likely to affect whether firms issue CGBs.

Following prior studies (e.g., Ragozzino and Reuer 2011), we collect the latitude and longitude of

each country's capital and apply the Great Circle distance formula to calculate the *distance*. We further create the variable *distance-treat* by interacting *distance* and the treatment (i.e., the dummy variable to indicate if a focal firm is in an affected industry) and include it in our first-stage analysis.

Since our main analyses use logistic regressions given the dependent variable is an indicator variable, we produce instrumental variable estimates for both logistic regressions and OLS (Foster 1997). Table 6 presents the 2SLS results from both logistic regressions and OLS. Model 6-1 presents the first-stage logistic regression results with *post-treat* as the dependent variable. As reported, the coefficient estimates for *distance-treat* ( $\beta = 0.000$ ,  $p < 0.001$ ) is significant and positive, showing this instrument can predict *post-treat*. Model 6-2 reports the result from the second-stage logistic regression, where the coefficient of the instrumented *post-treat* is 2.816 ( $p < 0.001$ ). Also, we conduct conventional 2SLS as an additional analysis. Model 6-3 presents the first-stage results with *post-treat* as the dependent variable and the coefficient for *distance-treat* ( $\beta = 0.000$ ,  $p < 0.001$ ) remains highly significant and positive. The *F*-statistic is 10.16, which exceeds the first-stage *F* statistic of 10 to indicate a strong instrument (Staiger and Stock 1997), providing further support for a suitable and exogenous instrument. The coefficient of the instrumented *post-treat* in the second-stage result, as reported in Model 6-4, is 1.339 ( $p < 0.001$ ). These results lend further support to H1.

[INSERT TABLE 6 ABOUT HERE]

Second, we use a country's membership in international organizations (*Ios*) (*membership*) as the instrument for countries' ratification of the Agreement. Existing research on *Ios* has shown that countries' participation in *Ios* may subject them to a process of interaction and mutual pressure for consensus (Kent 2002) and increase their cooperation with other states in international affairs (Voeten 2014). For instance, Voeten (2014) shows that participation in the United Nations Human Rights Council makes countries more likely to ratify human rights treaties. In this regard, we suggest that countries that participate in more *Ios* are more likely to agree on climate change and ratify the Agreement. However, countries' IO membership is much less likely to affect firms' decision to issue green bonds. To measure a country's IO membership, we manually collect the data about state members of the United Nations as well as its affiliated entities



from the official websites of these Ios (total 26 Ios) and count the total number of Ios a country has in each year during our sample period. We further construct the variable *membership-treat* by interacting *membership* and the treatment (i.e., the dummy variable to indicate if a focal firm is in an affected industry) and include it in our first-stage analysis.

Table 7 presents the 2SLS results from both logistic regressions and OLS. Model 7-1 presents the first-stage logistic regression results with *post-treat* as the dependent variable. As reported, the coefficient estimates for *membership-treat* ( $\beta = 0.012$ ,  $p < 0.001$ ) is highly significant and positive, showing this instrument can predict *post-treat*. Model 7-2 reports results from the second-stage logistic regression, where the coefficient estimate is 2.843 ( $p < 0.001$ ). As an additional analysis, we perform 2SLS. Model 7-3 presents the first-stage results with *post-treat* as the dependent variable and the coefficient for *membership-treat* ( $\beta = 0.012$ ,  $p < 0.001$ ) remains highly significant and positive. The coefficient in the second-stage results, as reported in Model 7-4, is 1.514 ( $p < 0.001$ ). These results further support H1.

[INSERT TABLE 7 ABOUT HERE]

## 7. DISCUSSION AND CONCLUSION

In this study, we examine the effect of the Agreement on CGB issuance. We take advantage of the adoption of the Agreement, which served as a plausibly exogenous shock to the global regulation on climate change, and examine the difference in CGB issuance between firms in affected and minimally (or unaffected) industries before and after the adoption of the Agreement. We argue that such an exogenous shock will strengthen the global regulatory framework to tackle climate change so that firms in affected industries expect to face more regulatory pressures. They will become more committed to the climate change mitigation and are more likely to issue CGBs compared with firms in minimally affected (or unaffected) industries after the adoption of the Agreement. Also, the differential effect of the Agreement on CGB issuance between firms in affected and in minimally affected (or unaffected) industries are simultaneously subject to the normative and regulatory pressures in the home countries those firms are headquartered and the gap of CGB issuance may vary among countries.

Using a DID design, we present strong evidence that the differential effect of the Agreement on CGB issuance between firms in affected and in minimally affected (or unaffected) industries is significant. The difference in the likelihood of issuing CGBs between firms in affected and minimally affected (or unaffected) industries is stronger in countries with more media attention on environmental issues, but smaller in countries with more stringent legal enforcement.

### **7.1. Theoretical Contributions**

This study seeks to make two contributions. First, we contribute to the burgeoning body of literature on green financing in general and green bonds in particular. While most studies focus on the pricing of green bonds, primarily government green bonds (e.g., Zerbib 2019), few studies have examined the firm-level outcomes of corporate green bonds. (Two exceptions are Flammer (2021) and Fatica and Panzica (2021), which find that CGBs improve both issuers' financial performance and their environmental footprints). Other studies look at the national drivers of the green bond market (Tolliver et al. 2020) and bond proceed allocation at the regional and national levels (Tolliver et al. 2019). There have been no prior studies, to our knowledge, that investigate the drivers of CGB issuance as a form of firm self-regulation to date. Our pioneering effort helps advance our understanding of both institution- and firm- level determinants of CGBs, and the nascent green bond market in multiple disciplines.

Second, existing research tends to assume firms' voluntary environmental actions are likely to be symbolic (Delmas and Montes-Sancho 2010, Kim and Lyon 2015, Marquis et al. 2016; Westphal and Zajac 2013) because such actions may hurt firms' financial performance and competitive advantage. There has been scant empirical research on firms' committed self-regulation and its fragility (Short and Toffel 2010). Our study advances our understanding of firms' action to self-regulate by studying CGBs, which reflects the firms' commitment to self-regulation because this new financial instrument for sustainability involves their substantial investments and relatively high default risks. Our findings suggest that the Agreement can enhance firms' commitment to address climate change by issuing CGBs, but the overall positive effect is contingent on country-level institutions. While media attention can strengthen the positive effect, legal enforcement may weaken it since more stringent enforcement may hurt firm's commitment. In this regard,

we shed light on the nature of the interaction between global and national governance and voluntary corporate environmental strategy.

Furthermore, our study contributes to the literature on corporate environmental behaviors by examining the dynamic nature of firms' self-regulation as the institutional environment changes. Prior studies primarily focus on firm's one-time compliance with a regulation or participation in a voluntary program (Aragón-Correa et al. 2020). How firms adjust their environmental strategy when national or global institutions targeting climate change mitigation are strengthened (or weakened) remains underexplored. We address this gap by identifying the causal effect of the Agreement on firms' CGB issuance and showing the difference in CGB issuance between firms in affected and minimally affected (or unaffected) industries before and after the global regulatory framework (i.e., as detailed in the Agreement) is strengthened.

## **7.2. Managerial and Policy Implications**

In practice, understanding how the Agreement impacts the development of CGBs is not only theoretically relevant to our knowledge of corporate environmental behaviors, but also critical for the global effort to combat climate change. Our study offers important implications for both managers and policymakers. For managers who are committed to combatting climate change, it is important to recognize the trend to leveraging new financial ways (e.g., CGBs) for sustainability given that the Agreement calls for new financial mechanism to combat climate change. Also, we confirm that firms' committed self-regulation—like CGBs—is fragile and depends on a conducive institutional environment to support it. For their part, policymakers should recognize the criticality of the global governance in facilitating the corporate sector to combat climate change. Despite Donald Trump's withdrawal from the Agreement, the new U.S. President Joseph Biden signed an executive order to rejoin it in January 2021. Therefore, it is still crucial for global leader to uphold the global governance framework to promote green financing for tackling climate change (Cho 2021). Institutionally, policymakers can play a key role by providing more discretion to firms in order to incentivize them to be more committed to environmental protection.

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**Table 1.** Descriptive statistics and pairwise correlations

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1 CGB issuance	0.503	0.500	1.000											
2 Number of CGB issued	1.096	3.483	0.310	1.000										
3 Post-treat	0.346	0.476	0.309	0.015	1.000									
4 Media attention	7.232	11.123	-0.060	-0.060	-0.130	1.000								
5 Legal enforcement	1.324	0.622	-0.089	0.001	-0.059	0.123	1.000							
6 Asset	2.537	0.233	0.119	0.130	-0.124	-0.292	-0.075	1.000						
7 Tobin's Q	0.714	2.053	-0.059	-0.043	-0.077	0.332	0.009	-0.538	1.000					
8 Cash holdings	7.598	2.752	0.094	0.011	-0.243	-0.261	-0.146	0.770	-0.234	1.000				
9 Size	0.453	0.954	0.026	0.023	-0.119	0.186	0.047	0.231	0.137	0.265	1.000			
10 Market-to-book value	7.137	48.774	0.020	-0.013	-0.001	-0.042	-0.064	-0.030	-0.007	-0.021	-0.030	1.000		
11 GDP (PPP)	688.440	783.293	-0.038	-0.059	-0.170	0.820	-0.136	-0.204	0.283	-0.119	0.186	-0.062	1.000	
12 Region	3.648	1.663	0.059	0.075	0.103	0.101	0.307	-0.227	0.053	-0.393	0.058	-0.098	-0.159	1.000

Note: 2,411 firm-year observations in total.

**Table 2.** Characteristics of treatment group vs. baseline control group of firms matching using the PSM procedure

	N	Treatment group		Baseline control group	
		Mean	SD	Mean	SD
Asset	2,411	2.519	0.005	2.514	0.011
Tobin's Q	2,411	0.323	0.017	1.016	0.142
Age	2,411	26.324	3.344	31.005	6.073

Note: None of the mean (except Tobin's Q) differ between treatment and control firms at the 5% significance level.

**Table 3.** Logistic regression and OLS on the effects of Paris Climate Agreement on firms' CGB issuance

Regression model	Main Analyses		Robustness Analyses	
	<b>Model 3-1</b>	<b>Model 3-2</b>	<b>Model 3-3</b>	<b>Model 3-4</b>
	Logistic	Logistic	OLS	OLS
Sample	Baseline control	Restricted control	Baseline control	Restricted control
Post-treat	4.684*** (0.825)	5.185*** (1.382)	0.444*** (0.049)	0.385*** (0.052)
Asset	8.388+ (4.602)	9.447+ (5.561)	0.241 (0.312)	0.308 (0.302)
Tobin's Q	0.129+ (0.071)	0.141* (0.067)	0.006* (0.003)	0.007** (0.003)
Cash holdings	0.807*** (0.217)	0.870* (0.343)	0.059*** (0.017)	0.052** (0.016)
Size	0.083 (0.302)	0.174 (0.324)	0.009 (0.023)	0.012 (0.020)
Market-to-book value	0.039* (0.018)	0.043+ (0.025)	0.002*** (0.000)	0.001+ (0.001)
GDP (PPP)	0.027*** (0.007)	0.024*** (0.007)	0.001*** (0.000)	0.001*** (0.000)
Firm fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Log-likelihood	-368.5	-256.3		
Pseudo-R <sup>2</sup>	0.516	0.483		
F-statistic			40.64	28.54

*Notes.* Robust standard errors are in parentheses. All tests are two-tailed and include constant.

N = 2,411 firm-year observations. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

**Table 4.** Logistic models on the moderating effects of media attention and legal enforcement

Regression model	Model 4-1	Model 4-2	Model 4-3	Model 4-4
	Logistic	Logistic	Logistic	Logistic
Sample	Baseline control	Baseline control	Restricted control	Restricted control
Post-treat	2.407** (0.785)	16.889** (5.291)	2.841* (1.200)	14.413** (5.297)
Media attention	-0.089* (0.045)		-0.054 (0.061)	
Post-treat × Media attention	0.707*** (0.213)		0.578** (0.200)	
Legal enforcement		-0.906*** (0.185)		-0.932*** (0.224)
Post-treat × Legal enforcement		-0.693* (0.273)		-0.551+ (0.293)
Asset	19.882* (9.359)	8.377+ (4.807)	19.978 (12.207)	9.247+ (5.592)
Tobin's Q	0.312* (0.156)	0.119+ (0.064)	0.324+ (0.194)	0.124+ (0.064)
Cash holdings	1.130*** (0.260)	0.663** (0.257)	0.993** (0.312)	0.741+ (0.403)
Size	1.559+ (0.892)	0.045 (0.345)	1.425 (0.944)	0.181 (0.385)
Market-to-book value	0.174** (0.059)	0.077* (0.037)	0.142* (0.063)	0.077+ (0.040)
GDP (PPP)	0.024*** (0.007)	0.025*** (0.007)	0.020** (0.006)	0.022*** (0.007)
Firm fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Log-likelihood	-274.2	-336.1	-195.0	-234.8
Pseudo-R <sup>2</sup>	0.427	0.559	0.394	0.526

*Notes.* Robust standard errors are in parentheses. All tests are two-tailed and include constant.

N = 2,411 firm-year observations. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

**Table 5.** Robustness analysis: Fixed-effects Poisson regression on the effect of the PCA on the number of CGB issued

Regression model	<b>Model 5-1</b>	<b>Model 5-2</b>
	Poisson	Poisson
Sample	Baseline control	Restricted control
Post-treat	2.482*** (0.529)	2.911*** (0.567)
Asset	6.870+ (3.867)	7.142+ (3.826)
Tobin's Q	0.081** (0.030)	0.086** (0.031)
Cash holdings	0.117 (0.080)	0.174+ (0.095)
Size	-0.087 (0.196)	-0.065 (0.183)
Market-to-book value	0.005 (0.004)	0.009+ (0.005)
GDP (PPP)	0.007** (0.002)	0.007** (0.003)
Firm fixed effects	Yes	Yes
Region fixed effects	Yes	Yes
Log-likelihood	-830.6	-425.8

*Notes.* Robust standard errors are in parentheses. All tests are two-tailed and include constant. N = 2,411 firm-year observations. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

**Table 6.** 2SLS logistic regression and OLS on the effects of Paris Climate Agreement on firms' CGB issuance using *distance* as the instrument for the Paris Agreement

Regression model	<b>Model 6-1</b>	<b>Model 6-2</b>	<b>Model 6-3</b>	<b>Model 6-4</b>
	Logistic First stage	Logistic Second stage	OLS First stage	OLS Second stage
Dependent variable	Post-treat	CGB issuance	Post-treat	CGB issuance
Distance-treat	0.00004*** (0.000)		0.00004*** (0.000)	
Instrumented post-treat		2.816*** (0.113)		1.339*** (0.211)
Asset	-0.003 (0.164)	0.255 (0.595)	-0.003 (0.165)	0.060 (0.252)
Tobin's Q	0.003 (0.007)	0.025 (0.019)	0.003 (0.007)	0.011 (0.008)
Cash holdings	-0.029* (0.014)	0.123** (0.042)	-0.029* (0.014)	0.060** (0.022)
Size	0.017 (0.024)	-0.027 (0.078)	0.017 (0.025)	-0.009 (0.035)
Market-to-book value	-0.000 (0.000)	0.002 (0.001)	-0.000 (0.000)	0.001 (0.001)
GDP (PPP)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Firm fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Log-likelihood	-1501.2	-1501.2		
F-statistic			10.16	10.16

*Notes.* Robust standard errors are in parentheses. All tests are two-tailed and include constant.

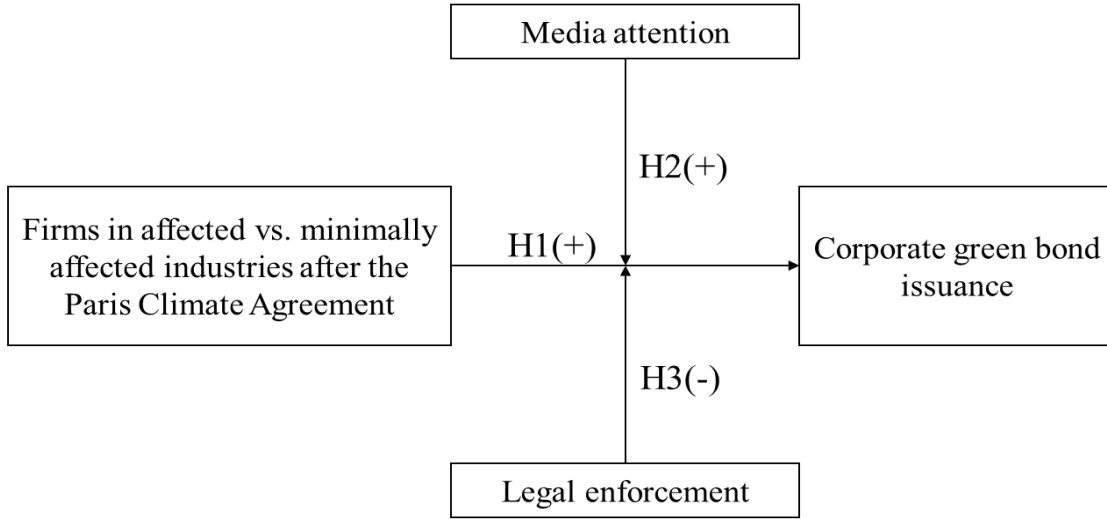
N = 2,411 firm-year observations. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

**Table 7.** 2SLS logistic regression and OLS on the effects of Paris Climate Agreement on firms' CGB issuance using the membership of international organizations as the instrument for the Agreement

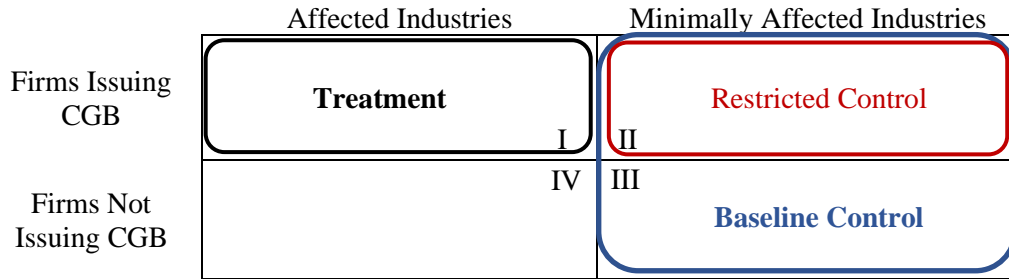
	<b>Model 7-1</b>	<b>Model 7-2</b>	<b>Model 7-3</b>	<b>Model 7-4</b>
Regression model	Logistic First stage	Logistic Second stage	OLS First stage	OLS Second stage
Dependent variable	Post-treat	CGB issuance	Post-treat	CGB issuance
Membership-treat	0.012*** (0.002)		0.012*** (0.002)	
Instrumented Post-treat		2.843*** (0.108)		1.514*** (0.313)
Asset	-0.006 (0.170)	0.165 (0.576)	-0.006 (0.170)	0.039 (0.275)
Tobin's Q	0.003 (0.007)	0.023 (0.018)	0.003 (0.007)	0.012 (0.009)
Cash holdings	-0.031* (0.013)	0.124** (0.042)	-0.032* (0.014)	0.066** (0.024)
Size	0.022 (0.025)	-0.023 (0.080)	0.022 (0.025)	-0.008 (0.039)
Market-to-book value	-0.000 (0.000)	0.002 (0.001)	-0.000 (0.000)	0.001 (0.001)
GDP (PPP)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Firm fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Log-likelihood	-1539.3	-1539.3		
F-statistic			6.77	6.77

*Notes.* Robust standard errors are in parentheses. All tests are two-tailed and include constant. N = 2,411 firm-year observations. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ .

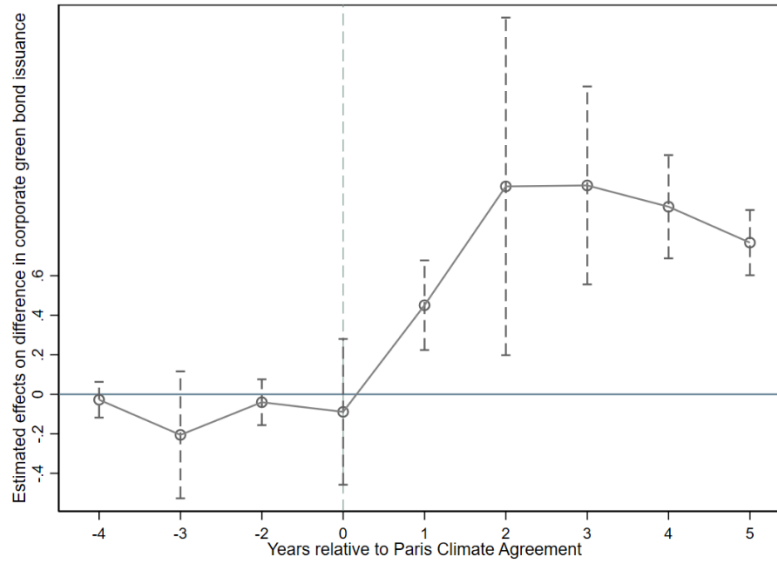
**Figure 1.** Conceptual framework



**Figure 2.** Matched samples for analyses



**Figure 3.** Parallel trend assumption test



## APPENDICES

**Table A1.** Categorization of affected (including somewhat affected) industries vs. minimally affected (including unaffected) industries

<b>Fama-French industry code</b>	<b>Industry</b>	<b>Sensitivity to climate change</b>
1	Agriculture	Affected
2	Food Products	Minimally affected
3	Candy & Soda	Minimally affected
4	Beer & Liquor	Affected
5	Tobacco Products	Affected
6	Toys & Recreation	Minimally affected
7	Fun & Entertainment	Minimally affected
8	Printing and Publishing	Minimally affected
9	Consumer Goods	Minimally affected
10	Apparel	Affected
11	Healthcare	Minimally affected
12	Medical Equipment	Minimally affected
13	Pharmaceutical Products	Minimally affected
14	Chemicals	Affected
15	Rubber and Plastic Products	Affected
16	Textiles	Affected
17	Construction Materials	Affected
18	Construction	Affected
19	Steel Works	Affected
20	Fabricated Products	Affected
21	Machinery	Affected
22	Electrical Equipment	Minimally affected
23	Automobiles and Trucks	Affected
24	Aircraft	Affected
25	Shipbuilding, Railroad Equipment	Affected
26	Defense	Minimally affected
27	Precious Metals	Affected
28	Non-Metallic and Industrial Metal Mining	Affected
29	Coal	Affected
30	Petroleum and Natural Gas	Affected
31	Utilities	Affected
32	Communication	Minimally affected
33	Personal Services	Minimally affected
34	Business Services	Affected
35	Computers	Minimally affected
36	Electronic Equipment	Minimally affected
37	Measuring and Control Equipment	Minimally affected
38	Business Supplies	Minimally affected
39	Shipping Containers	Affected
40	Transportation	Affected
41	Wholesale	Minimally affected
42	Retail	Minimally affected
43	Restaurants, Hotels, Motels	Minimally affected
44	Banking	Minimally affected
45	Insurance	Minimally affected
46	Real Estate	Affected
47	Trading	Minimally affected
48	Others	Minimally affected



**Table A2.** Variable definitions and data sources

Variable	Definition	Source
CGB issuance	Equals 1 if a firm issues a CGB for year $t$ ; 0 otherwise.	EFBD
Number of CGB issued	Count number of a firm's CGB for year $t$	EFBD
Post-treat	Equals 1 for CGB issuing firms in affected industries on and after Paris Climate Agreement and 0 for CGB issuing firms in affected industries before Paris Climate Agreement; always 0 for firms in minimally affected (or unaffected) industries	
Media attention	Count of the number of media reports on environment issues at country level	Factiva
Legal enforcement	WGI sub-index that captures perceptions of the extent to which agents have confidence in and abide by the rules of society/law, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence	WGI
Distance	Geographic distance between Paris and the capital of the country where the focal firm is located using the Great Circle distance formula	Public sources
IO membership	Count of the total number of IOs a country has in year $t-1$	UN websites
Asset	Natural logarithm of a CGB issuing firm's total asset in year $t-1$	Compustat
Tobin's Q	A CGB issuing firm's Tobin's Q in year $t-1$	Compustat
Cash	Natural logarithm of a CGB issuing firm's total cash in year $t-1$	Compustat
Size	A CGB issuing firm's total number of employees in year $t-1$	Compustat
Market-to-book value	A CGB issuing firm's market-to-book value in year $t-1$	Compustat
GDP (PPP)	GDP based on purchasing power parity	World Bank
Region	A categorical variable indicating the region where a CGB issuing firm is located. Regions include Asia Pacific, Europe, Middle East and Africa, North America, and Latin America.	World Bank