Green game in town: Intra-industry spillover effects of corporate green bond announcements in the US*

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Keywords: Climate finance; Contagion effects; Financing decisions; Green bonds; Spillover effects

JEL classification: G14, G30, G32, Q56

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Abstract

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1 Introduction

Green bonds, a type of fixed-income instrument whose proceeds are earmarked for environmental and climate-friendly projects, have become an increasingly popular tool for financing environmentally sustainable projects.[1] A rapidly expanding body of research documents that the announcements of green bond issues by firms, on average, are associated with positive shareholder wealth effects (Flammer, 2021; Tang and Zhang, 2020). The literature attributes a credible signal of announcing firms' commitment to the environment as a primary reason for these positive announcement effects. What remains relatively unknown is whether these announcements have any effect on the valuation of rivals.[2] This question assumes significance in light of the fact that while green bond-issuing firms, on average, make only a minuscule proportion of the market capitalization of listed firms in any given year, their rivals form a much higher proportion.

Using data on green bond announcements by US firms over the period 2013 – 2023, we examine in this paper whether green bond announcements influence the stock prices of rival firms and, if so, what factors drive these spillover effects.[3] [4] In particular, we test whether the market takes notice of just the event firm or the entire industry. While the direct effects of green bond issuance on firm valuation are well-documented, we explore a largely overlooked dimension: the indirect, industry-wide implications of such announcements. Additionally, we examine if these spillovers vary depending on

[1] See Baker et al. (2022) for an excellent review on the pricing and ownership of green bonds.

[2] We use the terms 'event firms', 'announcers', 'announcing firms', and 'focal firms' synonymously throughout the paper, and we mean all terms to imply the firms that announce issuing green bonds in our sample. Similarly, we use the terms 'non-event firms', 'non-announcing firms', 'rivals', and 'rival firms' interchangeably to refer to other firms in the same industry.

[3] We identify the rivals of the event firm using the 10-K Text-based Network Industry Classifications (TNIC-2) proposed by Hoberg and Phillips (2010, 2016). For our robustness checks, we also identify rivals based on the matching of four-digit, three-digit, and two-digit SIC codes of event firms with those of rival firms. Both approaches yield qualitatively similar results.

[4] Spillovers have also been referred to as 'information externalities', 'information transfers', and 'information spillovers' in the prior literature.

whether the green bond is being issued for the first time by the issuer, the relative size of the issue, and the relative market share of the issuer.

If investors interpret a green bond issue announcement as an industry-wide signal of environmental commitment, regulatory preparedness, or shifting capital flows, then rival firms' valuations may adjust accordingly. Whether green bond announcements, on average, generate positive industry spillovers or shift competitive advantage away from rivals is theoretically ambiguous. On the one hand, a green bond announcement by a firm may increase investors' expectations that the entire industry is transitioning toward lower emissions, adopting greener technologies, or preparing for stricter climate regulation, generating contagion effects for rivals exposed to similar environmental trends. On the other hand, a green bond announcement may be interpreted as a competitive differentiation signal wherein the issuing firm strengthens its environmental reputation, appealing to climate-conscious investors, or reducing financing costs, thereby potentially disadvantaging rivals. The direction of the spillover is, therefore, an open empirical question.[5]

We find that a positive (negative) market reaction to the announcement of a green bond issue by an event firm is associated with a positive (negative) market reaction for its rivals. Put differently, we observe strong support for the contagion effect (i.e., positive spillover effect) of the announcement of a green bond issue by an event firm on the value of its rivals, indicating that investors, on average, interpret green bond announcements as industry-relevant environmental signals, not merely firm-specific financing decisions. In economic terms, a one-percentage-point change in the event firm's announcement-period abnormal return is accompanied by a 38-basis-point (bps) change in the rival's

[5]While a contagion effect leads to changes in the stock prices of the event and rival firms in the same direction, a competitive effect, on the other hand, results in changes in the stock prices of the event and rival firms in the opposite direction.

announcement-period abnormal return in the same direction. Additionally, we also find that the contagion effect of green bond announcements on the value of rivals is stronger (i) if the green bond is a first-time issue by an issuer, (ii) if the size of the green bond offering is relatively large, and (iii) if the announcing firm holds a larger share of its product market.

To check the robustness of our results, we conduct a battery of tests. First, to ensure that our results are not due to unobserved industry-wide shocks coinciding with green bond announcements, we conduct a falsification (placebo) test using pseudo-event dates. Our results indicate that observed spillover effects are primarily attributable to green bond announcements rather than any confounding factors. Second, our results remain qualitatively unchanged with the choice of the event window. Additionally, to ensure the results are not driven by the rival identification method, we implement alternative measures of rival identification. In particular, we filter firms that share the same n-digit SIC code as that of the event firm (with $n = 4$, 3, and 2) and then identify a rival that is the nearest neighbor match to the event firm based on the matching of several firm characteristics. Our results remain broadly unchanged to this alternative definition of rival identification. Finally, our results also remain robust to the choice of the model of expected returns. Specifically, our results remain qualitatively unchanged if we use the Fama-French five-factor model, instead of the market model, for estimating announcement effects.

Our study contributes to two major strands of literature. First, it contributes to the nascent but fast-growing literature on green bonds by showing that a green bond issue by a firm does not just affect the value of the issuing firm as documented previously (Flammer, 2021; Tang and Zhang, 2020), but also the value of other firms in the issuer's industry.

Our study provides evidence of how sustainability-linked financial decisions by a firm can affect its industry as a whole. While prior work shows that green bond issuance can lower the issuer's cost of capital, attract specialized climate-motivated investors, and improve firms' environmental performance (Flammer, 2021; Baker et al., 2022; Bedendo et al., 2022; Giglio et al., 2021), this literature has largely interpreted green bonds as issuer-specific instruments. We extend this perspective by showing that the capital market impact of green financing extends well beyond the issuing firm. We show that green bond announcements trigger a reassessment of climate-related expectations at the industry level, generating valuation effects for rival firms that vary with the issue type (i.e., whether it is the first issue or seasoned issue), the size of the issue, and the position of the issuing firm in its industry.

Additionally, our study also contributes to the literature that examines the spillover effects of financing decisions. Prior studies have primarily examined the effects of a firm's equity financing decisions on its industry rivals. We complement the prior literature by studying the spillover effects of debt financing decisions whose proceeds are intended for environmentally friendly projects. Importantly, unlike prior literature that predominantly documents the competitive valuation effects of equity financing decisions (Slovin et al., 1992; Hsu et al., 2010; Bradley and Yuan, 2013), we show that, on average, announcements of green bond issuance decisions by a firm have a contagion effect on its rivals.

The remainder of this paper is organized as follows. In Section 2, we review the relevant literature on green bonds as well as intra-industry spillover effects and develop our hypotheses. Section 3 describes the data used in the study. We present the empirical methodology and results in 4, followed by alternative explanations and robustness checks in Section 5. Finally, Section 6 concludes the paper.

2 Related literature and hypothesis development

2.1 Green bonds

While corporate green bonds were virtually non-existent before 2013 (Flammer, 2021; Baker et al., 2022), the market has since skyrocketed, reaching a cumulative value of over $1.3 trillion by 2022 (Aswani and Rajgopal, 2025). The literature on green bonds has expanded rapidly alongside the market's growth. It has examined questions including why green bonds are issued, how investors behave around the announcement or issuance of green bonds, whether green bonds are issued and trade at higher prices or lower yields relative to conventional bonds (commonly known as *green premium* or *greenium*), and what happens to the environmental and social performance of issuing firms, among other questions.

Prior literature documents that the decision to issue green bonds is driven by various firm-level and external factors. Specifically, firms with board-level ties with previous green-bond issuers (Wang et al., 2026), higher reputational stakes (Sangiorgi and Schopohl, 2023; Dutordoir et al., 2024), and a focus on eco-innovation (Dutordoir et al., 2024) are more likely to issue green bonds. Additionally, external factors such as national culture (Mertzanis and Tebourbi, 2024) and geopolitical risk (Mertzanis and Tebourbi, 2025) also influence green bond issuance.

Early evidence indicates that green bond announcements by firms, on average, are associated with positive stock price reactions, and that the announcement effects are stronger for first-time issuers and for bonds certified by independent third parties (Tang and Zhang, 2020; Flammer, 2021; Yu et al., 2024; Distadio and Johl, 2025). This phenomenon is often explained through signaling theory (Spence, 1973) – by issuing green

bonds, firms provide a credible signal of their commitment to environmental stewardship and this signal is stronger for first-time as well as certified issues. However, later evidence shows that the positive announcement effects are limited to financial firms and specific issuers (Aswani and Rajgopal, 2025). Further, the announcement effects have become increasingly negative from 2019 onward, consistent with rising investor skepticism regarding greenwashing and the use of green bonds as a cover for poor performance (Bhagat and Yoon, 2023; Lam and Wurgler, 2024; Dutordoir et al., 2025).[6]

As far as the pricing of green bonds is concerned, there is limited evidence that green bonds command a greenium. While some studies do not observe any significant greenium in the primary market (Tang and Zhang, 2020; Flammer, 2021), some others document a small but significant premium ranging between 2 - 18 basis points (Zerbib, 2019; Caramichael and Rapp, 2024; Liang et al., 2025), especially for financial sector firms and in the secondary market (Aswani and Rajgopal, 2025). Further, the greenium appears to vary over time and also with certification of bonds' greenness by external reviews (Ghitti et al., 2025).

Studies examining the environmental and social performance of green-bond-issuing firms document that these firms experience an improvement in environmental ratings and meaningful reductions in carbon emissions (Flammer, 2021; Liu et al., 2025; Battaglia et al., 2025), especially when these firms are financially constrained or have high credit risk (ElBannan and Löffler, 2024). Further, green bond issuance has a positive impact on social performance (Battaglia et al., 2025) and green innovation, as measured by the number of green invention patents (Liu et al., 2025).

Overall, while the literature on green bonds has examined many interesting questions,

[6]Greenwashing refers to the deceptive practice of an issuer making misleading claims about its environmental commitment (Flammer, 2021).

it is not clear whether announcements of green bonds result in any information spillovers on other stakeholders such as industry rivals and supply chain partners.

2.2 Intra-industry spillover effects

The announcement of a firm-level decision may convey not only information content about the announcing firm but also about the firm's rivals in the industry. Such an announcement can have (i) *positive spillovers* or *contagion effects* in which good (bad) news for the event firm is also good (bad) news for its rivals, (ii) *negative spillovers* or *competitive effects* in which good (bad) news for the event firm is bad (good) news for its rivals, or (iii) little or no spillovers in which the news for the event firm is irrelevant for its rivals.

Extant literature documents that corporate announcements related to IPOs (Hsu et al., 2010; Chod and Lyandres, 2011; Li and Zhang, 2021), SEOs (Slovin et al., 1992; Bradley and Yuan, 2013), dividend changes (Firth, 1996), mergers and acquisitions (Davis et al., 2021; Derrien et al., 2023; Mataigne et al., 2021; Yilmaz, 2024), capital investments (Chen et al., 2007), earnings (Foster, 1981), layoffs (Bordeman et al., 2021), bankruptcy (Lang and Stulz, 1992), and cybersecurity breaches (Islam et al., 2022) among others, reveal new information not just about the event firms but also about shared industry fundamentals and competitive positioning. Therefore, these announcements not only affect the value of the event firm but also other players that share the same industry with the event firm.[7] Figure 1 summarizes the different corporate action announcements that result in spillover effects on the intra-industry rivals of the event firm, as documented in

[7] In addition to intra-industry spillover effects, prior literature has also looked at spillover effects along the supply chain (Pandit et al., 2011), within business groups (Bae et al., 2008; Joe and Oh, 2018; Chen and Chang, 2020; Cumming et al., 2024; Cai et al., 2025), and on strategic alliance partners (Boone and Ivanov, 2012; Gleason et al., 2026).

the prior literature.

[INSERT FIGURE 1 ABOUT HERE]

While it is possible for an announcement to result in both contagion and competitive effects, we can empirically observe only the effect that tends to me more pronounced or dominant. Prior literature documents that several firm-level financing decisions lead to competitive effects, while some others result in contagion effects, on average, on industry rivals. Specifically, the completion (withdrawl) of large IPOs by firms leads to negative (positive) stock price reactions for issuing firms' industry rivals, indicating that IPOs allow issuing firms to complete more effectively with other firms in the same industry and therefore result in competitive effects on rivals (Hsu et al., 2010).[8] Similar to IPOs, SEO announcements by commercial banks also lead to competitive effects for other commercial banks (Slovin et al., 1992). However, primary and secondary SEOs carry different information content and that primary SEO announcements by non-financial firms lead to a competitive effect on the stock prices of industry rivals, while secondary SEO announcements result in a contagion effect (Bradley and Yuan, 2013).

Overall, corporate financing decisions transmit economically meaningful information about industry conditions, and investors update rivals' valuations based on whether the event implies shared opportunities or competitive threats.

[8]Spillover effects of IPOs are not similar across geographies and time period. For example, Li and Zhang (2021) and Jiang et al. (2025) document that IPOs by Chinese firms, unlike those by US firms, result in contagion valuation effect for industry rivals and that the effect declines over time.

2.3 Hypothesis development

2.3.1 Spillover effects of green bond announcements

A green bond issue announcement by a firm can convey either good or bad news for the firm. It can be good news if it credibly signals the firm's commitment to the environment (Flammer, 2021; Dutordoir et al., 2024), lowers its cost of capital (Fatica et al., 2021; Caramichael and Rapp, 2024; Aswani and Rajgopal, 2025), or improves stock liquidity (Tang and Zhang, 2020). Alternatively, the announcement can be bad news if investors perceive it as disproportionately increasing the costs of disclosure, constraining the firm's investment policy, or merely an act of greenwashing. Irrespective of whether it is good or bad news, such an announcement is likely to not only convey new information about the event firm but also about its industry rivals to investors. It can, therefore, potentially result in spillover effects on the value of its rivals.

On the one hand, good (bad) news for the event firm is likely to be good (bad) news for its rival firms if investors are likely to extrapolate this news for the event firm's industry as a whole. For example, when a firm announces issuing green bonds, it may not only signal its own commitment but also the industry's commitment to the environment. This news may, therefore, result in a reassessment of investors' perceptions toward the industry. Thus, both the event firm and its rivals may benefit from the good news. Alternatively, when a firm in an industry is forced to issue green bonds, despite their costs exceeding benefits, for reasons such as regulatory push, investors may perceive this as bad news for the event firm as well as its rivals. In this case, investors may move away from firms in such industries.

On the other hand, good news for the event firm can be bad news for its rival firms if the announcement signals a competitive advantage for the event firm that comes at the

expense of its rivals. For example, a green bond announcement by a firm also reveals the presence of green investment projects with the firm. If the supply of such projects is limited, it is likely to convey a strengthened competitive position of the event firm, relative to its rivals. Alternatively, bad news for the event firm can be good news for its rival firms if investors believe that rivals are going to learn from the mistakes of the event firm.

While it is possible that green bond announcements result in both contagion and competitive effects, we only get to observe the effect that is dominant. Therefore, it remains an empirical question whether announcements of green bonds by firms, on average, are associated with a contagion or competitive effect on the value of their rivals. This allows us to state our first hypothesis below.

Hypothesis 1 *The announcements of green bonds by event firms are associated with a spillover effect on the value of their rivals.*

2.3.2 The role of the time of issue

A firm's first green bond announcement is likely to carry greater information content than subsequent ones. First-time announcements are not only novel but they also attract greater media attention.[9] Investors are more likely to rebalance their portfolios after the first announcement than subsequent ones by the same firm. Consistent with this view, prior literature documents that green bonds issued for the first time show stronger positive announcement effects than subsequent ones (Flammer, 2021; Aswani and Rajgopal, 2025).

[9]For instance, when Apple Inc. issued its first-ever green bond in February 2016, it was widely covered by major global media, including Reuters, The Guardian, Financial Times, and CNBC, among others. However, the second green bond announcement did not garner as much attention. Specifically, *Google Trends* shows that the query " "Green bond" + "Apple Inc" " received substantially higher interest during Apple's first green bond issuance in February 2016 (with a score of 75 out of 100) relative to the second issuance in July 2017 (with a score of 55 out of 100). Source: https://trends.google.com/trends/explore?date=2015-01-01%202025-12-31&geo=US&q=%22Green%20bond%22%20%2B%20%22Apple%20INC%22&hl=en.

Further, these announcements are likely to revise investor beliefs about not only the event firm but also the firm's industry as a whole. Put differently, first-time issues may carry greater information content for the event firm as well as its industry rivals. Therefore, to the extent that green bond announcements by an event firm are associated with spillover effects on industry rivals, the effect should be stronger for first-time issues than subsequent ones. Based on these arguments, we state our next hypothesis below.

Hypothesis 2 *The spillover effect of event firms' green bond announcements on their rivals is stronger for the first-time issues.*

2.3.3 The role of the issue size

In addition to first-time issues, the extent of spillover of a green bond announcement by a firm on its rivals may depend on the size of the issue. Announcements related to relatively large issues of green bonds are likely to have greater information content for not only the event firm but also its industry rivals. Large green bond issues, for example, may signal a greater firm-level as well as industry-level commitment to the environment. Further, large issues tend to also attract heightened attention from investors, analysts, regulators, and other stakeholders, thereby amplifying their impact on the market (Braun and Larrain, 2009).[10] These announcements can, therefore, influence investor expectations regarding industry standards for sustainability and green financing. Thus, we postulate that if green bond announcements result in spillovers for rivals, this effect should be higher for relatively large issues of green bonds.

Hypothesis 3 *The spillover effect of event firms' green bond announcements on their*

[10]For instance, the first green bond amounting to USD 1.5 billion issued by Apple Inc. grabbed substantial attention, and was termed as "the largest green bond to be issued by a U.S. corporation" (Source: https://www.climatebonds.net/news-events/blog/feb-media-digest-lots-green-bonds-media-coverage-ft-south-china-morning-post-bloomberg-reuters-wsj-ftse (last accessed on Dec 6, 2025)). A more recent example is the largest corporate green bond issuance in July 2025 by Electrica in Romania, which again received high media attention.

rivals is stronger for relatively large issues.

2.3.4 The role of the issuing firm's market share

Firms with a higher market share dominate and often act as industry leaders, and their strategic moves are closely monitored by investors and stakeholders. A green bond announcement by a firm with a relatively high market share may serve as a strong signal of commitment to environmental sustainability, potentially setting a new benchmark for industry practices. Additionally, event announcements by leading firms in an industry garner more media coverage and investor attention than those by smaller firms. Rivals often mimic the financial behavior of their industry leaders (Leary and Roberts, 2014), which, in turn, may push rivals to adopt similar sustainability practices to maintain legitimacy and competitiveness. Based on these arguments, we conjecture that green bonds announced by dominating firms in an industry have stronger spillover effects on other rivals. Thus, we state our final hypothesis below.

Hypothesis 4 *The spillover effect of event firms' green bond announcements on their rivals is stronger when event firms have a relatively high market share.*

3 Data

We obtain our initial sample of green bond announcement data from Refinitiv Eikon (presently known as LSEG Workspace).[11] We select corporate green bonds announced by US firms between 2013 and 2023.[12] Our sample starts in 2013 because green bonds

[11] Recent literature on green bonds uses the Bloomberg fixed income database for extracting issue-level data on green bonds (Tang and Zhang, 2020; Flammer, 2021). Eikon is an alternative database to extract data on green bonds. For instance, Zheng (2021) uses green bond data from Eikon to understand its association with climate policy.

[12] Eikon labels green bonds according to their uses of proceeds. The "Advance Search - Government and Corporate Bonds" section in Eikon provides detailed issue-level data on green bonds. Specifically, in the GOVSRCH app of Eikon, we set the 'Search' to be "Corporate Bonds" and include the bonds

were virtually nonexistent prior to this period (Flammer, 2021; Baker et al., 2022). When the announcement is made on a non-trading day, we treat the next trading day as the announcement date. We combine the green bond announcement data with stock price and accounting data from Compustat North America.[13] When we find a green bond issued by the same firm on the same day, we club all such issuances together. We exclude sample unique issuer-day observations if the stock price of the issuer is unavailable during the estimation window. We also exclude announcements for which we do not find any close industry rivals corresponding to our event firms. The final sample comprises 201 unique issuer-day announcements. Table 1 presents the sample selection procedure.

[INSERT TABLE 1 ABOUT HERE]

Table 2 summarizes the distribution of green bond announcements in our sample by year and industry. We observe that green bond announcements become more prevalent during the latter half of our sample period. Further, these announcements are dominated by firms from the finance and utilities industries. The higher representation of firms from these industries in our sample is consistent with prior literature (see, for example, Flammer (2021) and Aswani and Rajgopal (2025)).

[INSERT TABLE 2 ABOUT HERE]

To identify rival firms, we employ the Text-based Network Industry Classifications (TNIC), as proposed by Hoberg and Phillips (2010, 2016). These classifications are based on how similar one firm is to another using text analysis of product descriptions from

that meet the following filters. 'Issuer Type' is "Corporate"; 'Bond Type' is "Bonds," "Certificate of Deposits," and "Commercial Papers"; 'Status' is "Active" and "Inactive"; and 'Green Bond' is "Yes." In addition, we choose bonds that are issued by US firms. In particular, we apply the filter on 'Country of Issue' to be 'United States.'

[13]Our approach is consistent with Flammer (2021), who also uses Compustat North America for extracting both accounting and stock price data for the US firms.

annual 10-K filings by firms with the Securities and Exchange Commission (SEC). Under these classifications, a firm's rivals vary annually depending on firm pairwise similarity scores. Thus, this approach allows us to identify multiple rivals as well as the closest rival for each firm in each year. Importantly, this approach is in contrast to identifying rivals using traditional industry classifications that are static. Further, this approach more accurately reflects how firms identify their rivals in practice.

For each green bond announcement, we identify the event firm's closest rival as the firm with the highest TNIC-2 similarity score in the announcement year, subject to the availability of daily stock-return data for analyses. This provides a one-to-one match between each event firm and its closest rival.[14] Our approach on identifying rivals is consistent with prior literature on spillover effects (see, for example, Rind et al. (2021) and Islam et al. (2022)).

Table 3 presents the descriptive statistics for our sample of event firms, all rival firms[15], and closest rival firms. It also reports differences between event firms and all rival firms and also between event firms and their closest rival firms for several characteristics. We observe that the group of event firms is significantly different from the group of all rival firms in both mean and median differences in many firm-level characteristics. However, these differences become mostly insignificant if we instead consider only closest rival firms. Since event firms and their closest rival firms are comparable, we consider only closest rival firms for our multivariate analyses. Our approach reasonably dispels the concern that our results could be driven by differences in firm characteristics between event firms and their rivals.

[14]Due to the unavailability of TNIC-2 classifications for 2022 – 2023 at the time of extracting our data, we assume that the rivals of event firms that announced issuing green bonds during 2022 – 2023 remain the same as those in 2021.

[15]In the group of all rival firms, we include all rival firms corresponding to each event firm.

[INSERT TABLE 3 ABOUT HERE]

4 Empirical methodology and results

4.1 Estimating announcement effects

We use the event study methodology (Brown and Warner, 1985) to examine the effect of green bond announcements on event firms and their closest rivals. In particular, we use the market model, as given by the following equation, to estimate the expected return on the stock of firm i on day t ($\hat{R}_{it}$).

$$\hat{R}_{it} = \hat{\alpha}_i + \hat{\beta}_i R_{mt} \tag{1}$$

where R_{mt} represents the observed return on the S&P 500 Index (our proxy for the market) on day t, and $\hat{\alpha}_i$ and $\hat{\beta}_i$ are parameters of the market model estimated by regressing stock returns on the S&P 500 Index returns over a 200-trading-day estimation window ending 20 trading days before the green bond issue announcement date.

We then calculate the abnormal return for firm i on day t (AR_{it}) as follows.

$$AR_{it} = R_{it} - \hat{R}_{it} \tag{2}$$

where R_{it} denotes the observed return for firm i on day t.

Finally, we compute the cumulative abnormal returns (CAR) of firm i for the period ranging from T_1 to T_2 using the following equation.

$$CAR_i(T_1, T_2) = \sum_{T_1}^{T_2} AR_{it} \tag{3}$$

Following Chen et al. (2007), we use (-1, 0) as our event window for calculating CAR. We also assess the robustness of our main results to alternative event windows, including (-2, 2), (-1, 1), (0, 1), (0, 2), and (0, 3).

4.2 Univariate results on spillover effects of green bond announcements

In Table 4, we report CARs around the announcement of green bonds for event firms, their closest rivals, and equal-weighted portfolios of the closest two rivals. While Panel A focuses on the overall sample, Panel B (Panel C) corresponds to a subsample where the CARs of event firms are positive (negative). In each panel, we report CARs using multiple event windows.

[INSERT TABLE 4 ABOUT HERE]

In Panel A of Table 4, which shows results for the overall sample, we do not find the average CAR for either event firms or rival firms to be significant. Put differently, we find no clear evidence of the spillover effect of green bond announcements on rivals in Panel A. This could be due to the aggregation of two subsamples with opposite spillover effects.

To check the presence of spillover effects, we turn our attention to subsamples based on the direction of the market reaction for the event firms, as shown in Panels B and C of Table 4. Panel B reveals that when the average CAR for the event firms is positive and significant, the average CAR for rival firms (both closest rivals and portfolios of the closest two rivals) is also positive and significant. Similarly, Panel C brings out that the average rival CAR is negative and significant when the average event CAR is negative

and significant. In other words, CARs for rival firms are positively correlated with those of rivals firms.

We plot the average CAR of event firms as well as their closest rivals over the event window (-2,2) for the two subsamples in Figure 2. We again observe that the average CAR for rival firms exhibits a positive association with that for the event firms. The average CAR for rival firms, however, is smaller in magnitude compared to that of event firms. Overall, our univariate results indicate a contagion effect of green bond announcements on the value of event firms' rivals.

[INSERT FIGURE 2 ABOUT HERE]

4.3 Multivariate results on spillover effects of green bond announcements

To test **Hypothesis 1**, which states that the announcement of green bond issuance by a firm affects the stock price of its industry rivals, we model the CAR of the rival firm as a function of the event firm CAR using the following euqation.

$$Rival\ CAR_j(T_1,T_2) = \beta_0 + \beta_1 Announcer\ CAR_i(T_1,T_2) + \sum \gamma_p Announcer\ Control_i^p + \sum \delta_q Rival\ Control_j^q + u_{ij} \tag{4}$$

Here, the dependent variable, $Rival\ CAR_j(T_1,T_2)$, is the CAR of the event firm's closest industry rival j for the period ranging from T_1 to T_2. Our primary variable of interest, $Announcer\ CAR_i(T_1,T_2)$, is the CAR of the event firm i for the period ranging from T_1 to T_2. Following the prior literature on intra-industry spillover effects (see, for example, Chen et al. (2007)), we also control for event and rival firm characteristics (represented

as *Announcer Control* and *Rival Control* in Equation (4), respectively), in addition to including fixed effects. Table A.1 in the appendix provides the definitions of all variables employed in our analyses. The coefficient on *Announcer CAR*, β_1, indicates whether green bond announcements have any spillover effects on a firm's industry rivals. While a positive and significant β_1 indicates the presence of contagion or positive spillover effects, a negatively significant β_1 implies competitive or negative spillover effects.

In Table 5, we report the results of our multivariate analyses. While models (1) – (2) include only the explanatory variable of interest, models (3) – (4) additionally include the control variables related to event and rival firm characteristics. Models (2) and (4) also include year and industry-fixed effects to account for unobserved heterogeneity related to time and industry, respectively.[16]

[INSERT TABLE 5 ABOUT HERE]

We find that the coefficient on *Announcer CAR* is positive and significant at the 1% level across all models. In particular, the coefficient on *Announcer CAR* in the last model is +0.383, indicating that, on average, every one percentage point change in the event firm's CAR is associated with a 38 basis points (bps) change in the rival firm's CAR in the same direction around the announcement of green bonds, after controlling for event and rival firm characteristics as well as year and industry-fixed effects. Thus, we observe that, on average, good (bad) news for the event firm is good (bad) news for its rival firms as well. Put differently, we observe a contagion (or positive spillover) effect of green bond announcements on the value of event firms' rivals. Our results are consistent with the view that investors, on average, extrapolate the information content of a green bond announcement by an event firm to other firms in the same industry.

[16] We use the four-digit SIC code of the event firm for including industry fixed effects.

4.4 The role of the first-time issue

To test **Hypothesis 2**, which predicts a stronger spillover effect of green bond announcements for first-time issues than subsequent ones, we use the following equation.

$$\begin{aligned} \textit{Rival } CAR_j(T_1,T_2) = \beta_0 &+ \beta_1 \textit{Announcer } CAR_i(T_1,T_2) + \beta_2 \textit{First time indicator}_i \\ &+ \beta_3\big(\textit{Announcer } CAR_i(T_1,T_2) \times \textit{First time indicator}_i\big) \\ &+ \sum \gamma_p \textit{Announcer Control}_i^p + \sum \delta_q \textit{Rival Control}_j^q + u_{ij} \end{aligned} \tag{5}$$

where *First time indicator* is an indicator variable that takes the value one if a green bond issue is announced by an event firm for the first time in our sample, and zero otherwise.

To the extent that first-time green bond announcements have a greater information content relative to other announcements for an event firm's rivals, we expect a positive and significant coefficient on the interaction between *Announcer CAR* and *First time indicator*.

Table 6 presents the results of our analyses. We observe a positive and significant coefficient on *Announcer CAR*. More importantly, the coefficient on the interaction between *Announcer CAR* and *First time indicator* turns out as positive and significant in the model that includes all controls and fixed effects. This result implies that the contagion effect of green bond announcements on the value of the event firm's rivals is stronger for first-time issues. In particular, a statistically significant coefficient of +0.369 on the interaction term suggests, on average, a one percentage point increase (decrease) in the event firm's CAR for first-time issues is associated with an additional 37 bps increase (decrease) in the rival firm's CAR, relative to seasoned or repeat issues. Thus, the total spillover effect for first-time issues is materially larger than for repeat issues, consistent

with the view that novelty increases informational content and investor re-weighting of industry prospects.

[INSERT TABLE 6 ABOUT HERE]

4.5 The role of the issue size

For testing **Hypothesis 3**, which predicts that the spillover effect of announcements on rivals is stronger for relatively large issues of green bonds, we use the following equation.

$$\begin{aligned} Rival\ CAR_j(T_1,T_2) = \beta_0 &+ \beta_1 Announcer\ CAR_i(T_1,T_2) + \beta_2 Large\ issue\ indicator_i \\ &+ \beta_3\big(Announcer\ CAR_i(T_1,T_2) \times Large\ issue\ indicator_i\big) \\ &+ \sum \gamma_p Announcer\ Control_i^p + \sum \delta_q Rival\ Control_j^q + u_{ij} \end{aligned} \tag{6}$$

where *Large issue indicator* is an indicator variable that takes the value of one if the issue size is more than the median issue size in the sample, and zero otherwise.

To the extent that announcements of relatively large issues of green bonds have a greater information content relative to announcements of smaller ones for rivals, we expect a positive and significant coefficient on the interaction between *Announcer CAR* and *Large issue indicator*. In our results shown in Table 7, we continue to find a positive and significant coefficient on *Announcer CAR*. Notably, the coefficient on the interaction between *Announcer CAR* and *Large issue indicator* is positive and significant at the 1% level in both models. This result shows that the contagion effect of green bond announcements on rivals is stronger for relatively large issues. In terms of economic significance, a coefficient of +0.343 on the interaction term in model (2) suggests that, on

average, a one percentage point increase (decrease) in the event firm's CAR for relatively large issues of green bonds is associated with an extra 34 bps increase (decrease) in the closest rival firm's CAR, relative to smaller ones. Our results are consistent with the view that large issues of green bonds carry greater informational content than smaller ones and therefore have a greater effect on the value of the event firm's rivals.

[INSERT TABLE 7 ABOUT HERE]

4.6 The role of the event firm's market share

Our final hypothesis (i.e., **Hypothesis 4**) predicts a stronger spillover effect on rivals when green bond announcements are made firms by with a relatively large market share. We test this hypothesis using the following equation.

$$\begin{aligned} \textit{Rival } CAR_j(T_1,T_2) = \beta_0 &+ \beta_1 \textit{Announcer } CAR_i(T_1,T_2) + \beta_2 \textit{Large market share indicator}_i \\ &+ \beta_3\big(\textit{Announcer } CAR_i(T_1,T_2) \times \textit{Large market share indicator}_i\big) \\ &+ \sum \gamma_p \textit{Announcer Control}_i^p + \sum \delta_q \textit{Rival Control}_j^q + u_{ij} \end{aligned} \tag{7}$$

where *Large market share indicator* is an indicator variable that takes the value of one if the green bond issuing firm's market share is more than the median market share in the sample, and zero otherwise.[17]

If green bonds announced by firms with a large market share indeed result in greater spillovers on the value of their rivals, this should translate to a positive and significant coefficient on the interaction between *Announcer CAR* and *Large market share indica-*

[17]For this test, we do not include *Announcer market share*, a continuous variable representing the market share of the event firm, as a control variable so as to avoid multicollinearity issues. Nonetheless, our results continue to hold even if we include *Announcer market share* as an explanatory variable.

tor. We report the results of our analyses related to the role of the event firm's market share in Table 8. In both models, we observe a positive and significant coefficient on *Announcer CAR*. Further, consistent with our hypothesis, the coefficient on the interaction term, *Announcer CAR* × *Large market share indicator*, is positive and significant in both models. Specifically, a coefficient of +0.411 on the interaction term in Model (2) suggests that, on average, a one percentage point change in the event firm's CAR is associated with an additional 41 bps change in the closest rival's CAR, when the issuer is an industry leader. Thus, our results are consistent with the notion that green bonds announced by market leaders possess higher information content for the industry, resulting in greater spillovers on their rivals.

[INSERT TABLE 8 ABOUT HERE]

5 Alternative explanations and robustness checks

5.1 Placebo test

While we control for correlation in stock returns between the event firms and their closest rivals in our multivariate analyses, we cannot rule out the possibility that unobserved shocks coinciding with announcements of green bonds drive our results. To mitigate this concern, we conduct a placebo (or falsification) test using pseudo-event dates, shifting the event dates 40 days prior to the actual announcement of the green bond issues. This approach enables us to determine whether the observed spillover effects are driven by green bond announcements, rather than other confounding factors. If our results are not driven by any confounding factors, we should not observe a significant coefficient on our variable of interest in the placebo test.

Table 9 reports the results of our placebo test. We observe that the coefficient on *Announcer CAR* is statistically insignificant, suggesting that the observed spillover effect is attributable to green bond announcements rather than any confounding factors.

[INSERT TABLE 9 ABOUT HERE]

5.2 Using different event windows

In our multivariate analyses, we have employed an event window (-1, 0), which comprises the announcement day and the day prior to the announcement, to examine announcement-period abnormal returns for event firms and their closest rivals. To evaluate the robustness of our findings and mitigate the concern that our results are driven by any single event window, we test whether the observed patterns persist across multiple alternative event windows.

In Table 10, we report the results of multivariate analyses for five different event windows. In particular, we re-estimate the regression models (3) and (4) of Table 5 for several event windows: (-2, 2), (-1, 1), (0, 1), (0, 2), and (0, 3). We continue to find statistically significant results across all chosen event windows, indicating that the contagion effect of green bond announcements remains robust irrespective of the choice of the event window.

[INSERT TABLE 10 ABOUT HERE]

5.3 Employing alternative methods of rival selection

In our analyses reported earlier, for each green bond announcement, we have chosen a rival firm that is closest to the event firm based on the highest TNIC-2 similarity score in the announcement year (see Section 3). While our approach to identifying rivals

captures economically meaningful product-market proximity, it is possible that investors may perceive competition differently or rely on other industry indicators. To address potential issues arising from our approach, we employ an alternative method of rival selection.

Our alternative approach relies on selecting rivals based on the following two steps. As a first step, we use a traditional industry classification to create a pool of rivals that share the same four-digit SIC code as the event firm.[18] In the second step, we refine rival selection within the four-digit SIC industry using propensity score matching (PSM) to ensure that the chosen rival is also similar to the event firm in terms of key firm characteristics. Specifically, for each event firm, we estimate propensity scores using a logit model in which the matching covariates include the firm's Tobin's Q, market share, R&D intensity, and cash flow ratio (i.e., free cash flow scaled by book value of total assets) measured in the fiscal year preceding the green bond announcement. We then match each event firm to its nearest neighbor within the same four-digit SIC category based on the estimated propensity score (1:1 nearest-neighbor matching). The matched firm is treated as the closest rival for the event firm.

Our results based on the alternative approach to identifying rivals are shown in Table Table 11. Notably, we continue to observe the coefficient on *Announcer CAR* as statistically and economically significant, suggesting that the spillover effect of green bond announcements remains robust to using our alternative approach to identifying rivals.

[INSERT TABLE 11 ABOUT HERE]

[18] Our results, which are not reported in the paper in the interest of brevity, are qualitatively similar if we instead use the three-digit or two-digit SIC code of the event firm to create our pool of rivals. The results are available from the authors upon request.

5.4 Estimating announcement effects using Fama-French five-factor model

In our results reported thus far, we have employed the market model to estimate the announcement effects of green bonds for event firms and their closest rivals. While the choice pertaining to the model of expected returns is less important in short-run event studies (Kothari and Warner, 2007), we still test the validity of our results to using the Fama-French five-factor model (Fama and French, 2015).

Our results based on the alternative approach to estimating announcement effects using the Fama-French five-factor model are shown in Table 12. The results suggest that the spillover effects of green bond announcements are not driven by the choice of the model of expected returns.

[INSERT TABLE 12 ABOUT HERE]

6 Discussion and conclusion

In this paper, we examine whether green bond announcements by firms have any spillover effects on their industry rivals. Based on announcements of green bonds by US firms between 2013 and 2023, we document a contagion valuation effect (i.e., positive spillover effect) of these announcements on the closest rivals of event firms. Notably, the contagion effect is more pronounced when the green bond is issued for the first time by the event firm, the issue size is relatively large, and the event firm has a relatively large market share in the industry. Our results remain qualitatively unchanged to using a variety of event windows, alternative methods of identifying closest rivals, a different model of expected returns, and other checks.

Our results on contagion valuation effects of green bond announcements are based in the US setting. These results may not directly extend to other countries due to their different institutional and legal contexts. Examining the spillover effects of green bond announcements across different countries could reveal important insights on the role of institutional, legal, and other factors in explaining spillover effects. Furthermore, extending the sample period to incorporate any political regime changes and shifts in climate policies, including the one following the 2024 US presidential elections, could be another fruitful avenue for future research. Additionally, future research work could also explore the long-term implications of green bond issuance for rival firms.

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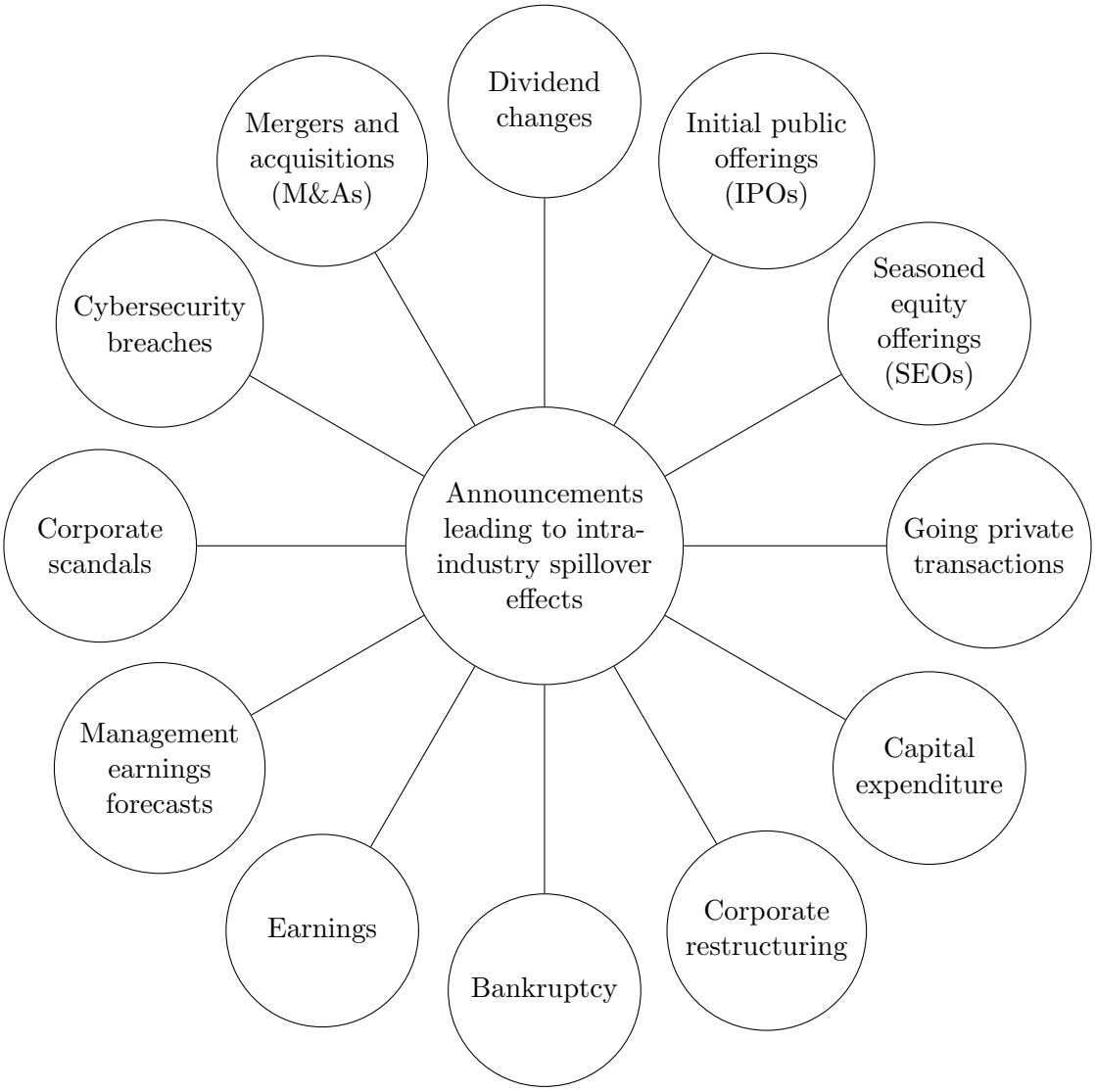
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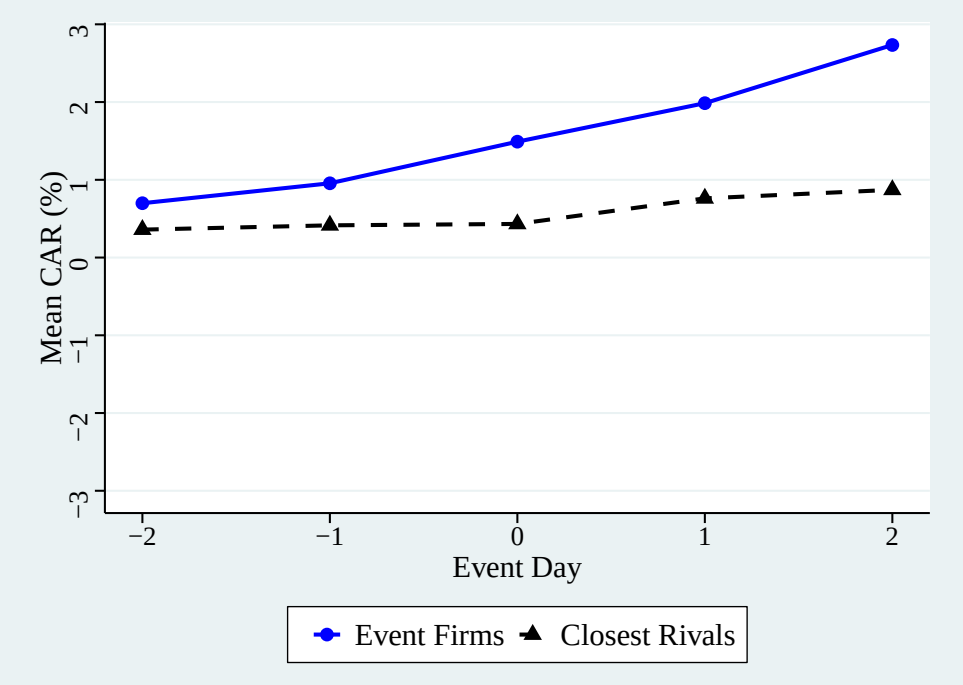
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Figure 1: Types of announcements that can trigger intra-industry spillover effects

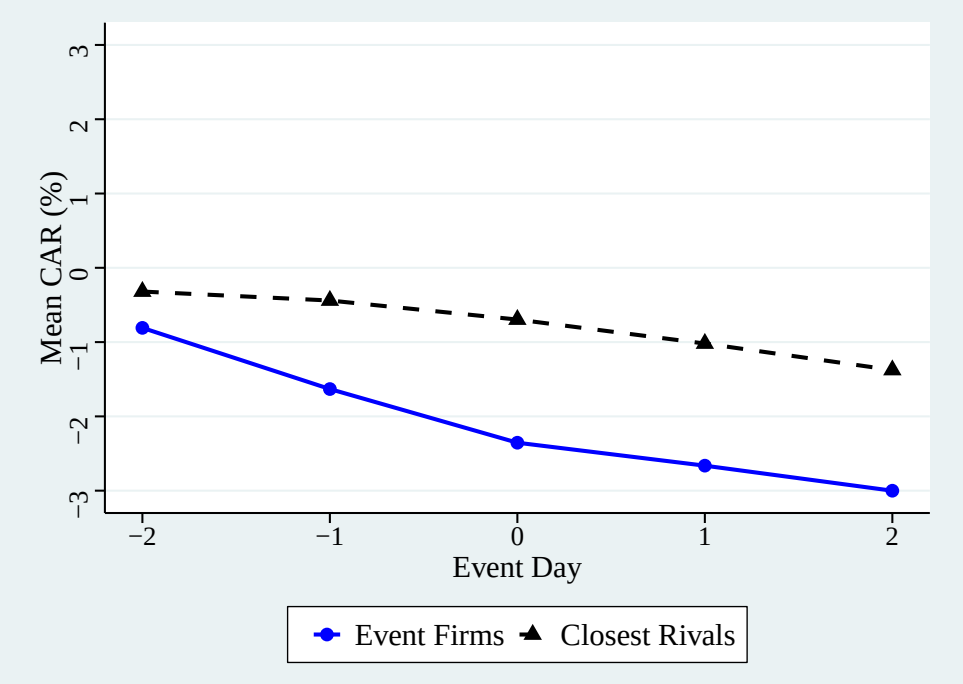


This figure represents the list of announcements on corporate decisions that lead to intra-industry spillover effects as documented in the prior literature.

Figure 2: Market reaction to announcements of green bond issuance



(a) Subsample with positive market reactions of event firms



(b) Subsample with negative market reactions of event firms

This figure compares the cumulative abnormal returns (CARs) to green bond announcements for event firms (i.e., announcers) and their closest rivals over the event window (-2, +2) for two different subsamples. While Panel 2a corresponds to a subsample event firms with a positive market reaction (i.e., *Announcer CAR* > 0), Panel 2b corresponds to a subsample with a negative market reaction (i.e., *Announcer CAR* < 0). Across both panels, the mean CAR for the closest rivals exhibits positive correlation with that for the event firms, indicating a contagion effect in market reactions to green bond announcements.

Table 1: Sample selection

This table details the step-by-step procedure to arrive at the final sample of unique green bond announcements in the US during 2013 – 2023.

Step	Count
Initial number of green bond announcements	682
Less: reduction in observations due to clubbing of green bond announcements made by the same firm on the same day	(178)
Less: announcements by private firms	(235)
Less: announcements with stock price data unavailable for estimation window for issuing firms	(9)
Less: announcements with green bond issuing firms without any close rivals	(40)
Less: announcements with fundamental data unavailable for green bond issuing firms	(19)
Final sample	201

Table 2: Distribution of green bond announcements

This table lists the sample distribution of green bond announcements made by firms in the US during 2013 – 2023. Panel A reports the number, as well as the percentage, of green bond issues by US public companies. Panel B provides the distribution of green bond issues based on the industry classification of the issuing firms. The industry classification is based on the Fama-French 12-industry codes.

Panel A: Distribution of green bond announcements by year

Year	Number	Percentage (%)
2013	1	0.50
2014	4	1.99
2015	31	15.42
2016	5	2.49
2017	1	0.50
2018	10	4.98
2019	25	12.44
2020	26	12.94
2021	46	22.89
2022	33	16.42
2023	19	9.45
Total	201	100.00

Panel B: Distribution of green bond announcements by industry

Industry	Number	Percentage (%)
Consumer Non-Durables	3	1.49
Consumer Durables	31	15.42
Manufacturing	6	2.99
Energy	1	0.50
Chemicals	2	1.00
Business Equipment & Software	10	4.98
Telecommunication	6	2.99
Utilities	60	29.85
Wholesale & Retail	3	1.49
Healthcare	1	0.50
Finance	72	35.82
Other	6	2.99
Total	201	100.00

Table 3: Descriptive statistics

This table presents descriptive statistics for groups of event firms, all rival firms, and closest rival firms. Event firms refer to firms that announce issuing green bonds in the US during the sample period. Rivals of event firms have been identified using 10-K Text-based Network Industry Classifications (TNIC) given by Hoberg and Phillips (2010, 2016). The table also reports differences between event firms and all rival firms and also between event firms and their closest rival firms for several characteristics. A two-sample t-test (Wilcoxon-Mann-Whitney rank sum test) has been used to determine whether the difference in means (medians) of a variable between two groups is significantly different from zero. *Market share* is measured as total sales of the firm divided by total industry sales. *Growth opportunities* is the ratio of the market value of the firm's assets to its book value of assets. *ROA* refers to return on assets, defined as the firm's earnings before interest, taxes, depreciation, and amortization divided by its total assets. *Cash holdings* refers to cash plus marketable securities of the firm divided by its total assets. *Size* is proxied by the natural logarithm of the firm's book value of total assets in millions of US dollars adjusted for inflation. *Financial leverage* is computed as the ratio of the book value of the firm's total debt to its market value of total assets. *Cash flow ratio* refers to operating income before depreciation minus interest expense, taxes, preferred dividends, and common dividends of the firm divided by its book value of total assets. *R&D intensity* is the ratio of research and development expenditure of the firm to its net sales. All firm characteristics correspond to the fiscal year immediately prior to the announcement. All continuous variables have been winsorized at the top and bottom 1% of their distributions. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. 'NS' indicates not significant.

Variable	Event firms (A)			All rival firms (B)			Closest rival firms (C)			Test of difference (B-A)		Test of difference (C-A)	
	N	Mean	Median	N	Mean	Median	N	Mean	Median	t-test (p-value)	Wilcoxon z test (p-value)	t-test (p-value)	Wilcoxon z test (p-value)
Market share	198	0.08	0.02	2605	0.04	0.01	184	0.04	0.02	***	***	***	NS
Growth opportunities	201	1.55	1.00	3631	1.20	0.90	201	0.89	0.82	***	***	***	***
ROA	201	0.06	0.05	3631	0.06	0.07	201	0.06	0.07	NS	**	NS	NS
Cash holdings	201	0.09	0.03	3631	0.11	0.04	201	0.08	0.03	**	**	NS	NS
Size	200	10.30	10.27	3091	8.67	8.61	200	10.13	10.23	***	***	NS	NS
Financial leverage	201	0.28	0.08	3572	0.33	0.23	201	0.32	0.23	**	***	NS	NS
Cash flow ratio	201	0.03	0.03	3633	0.03	0.04	201	0.04	0.05	NS	*	NS	*
R&D intensity	201	0.03	0.00	3547	0.04	0.00	201	0.02	0.00	*	NS	NS	NS

Table 4: Univariate results

This table presents stock market reactions around green bond announcements for event firms, their closest rivals, and equal-weighted portfolios of the closest two rivals. Rivals have been identified using 10-K Text-based Network Industry Classification (TNIC) given by Hoberg and Phillips (2010, 2016). Cumulative abnormal returns (CAR) for firm i for the period ranging from T_1 to T_2 has been computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return on the stock of firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date. We use the above equation to compute CAR for event firms and their rivals. While Panel A focuses on the overall sample, Panel B (Panel C) corresponds to a subsample where the CARs of event firms are positive (negative). In each panel, we report average CARs using multiple event windows. All continuous variables have been winsorized at the top and bottom 1% of their distributions. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Announcements by event firms

	Event firms			Closest rival firms			Portfolios of closest two rival firms		
Event window	N	CAR (%)	p-value	N	CAR (%)	p-value	N	CAR (%)	p-value
(-2, 2)	201	0.07	0.84	201	-0.16	0.53	201	-0.31	0.23
(-2, 1)	201	-0.18	0.54	201	-0.07	0.81	201	-0.01	0.98
(-2, 0)	201	-0.30	0.27	201	-0.09	0.71	201	-0.12	0.69
(-1, 1)	201	-0.18	0.44	201	-0.11	0.62	201	-0.10	0.47
(-1, 0)	201	-0.30	0.14	201	-0.14	0.47	201	-0.26	0.20
(0, 1)	201	0.07	0.73	201	-0.08	0.64	201	-0.16	0.50
(0, 2)	201	0.32	0.20	201	-0.18	0.34	201	-0.33	0.11
(0, 3)	201	0.33	0.23	201	-0.17	0.46	201	-0.22	0.20

Panel B: Announcements by event firms with positive market reaction

	Event firms			Closest rival firms			Portfolios of closest two rival firms		
Event window	N	CAR (%)	p-value	N	CAR (%)	p-value	N	CAR (%)	p-value
(-2, 2)	108	2.73***	0.000	108	0.87**	0.011	108	0.98***	0.002
(-2, 1)	105	2.35***	0.000	105	0.92**	0.011	105	0.93***	0.003
(-2, 0)	92	2.23***	0.000	92	1.02***	0.002	92	1.07***	0.000
(-1, 1)	107	1.77***	0.000	107	0.57*	0.071	107	0.64**	0.014
(-1, 0)	93	1.65***	0.000	93	0.59**	0.021	93	0.59***	0.004
(0, 1)	111	1.60***	0.000	111	0.68***	0.003	111	0.64***	0.000
(0, 2)	116	2.16***	0.000	116	0.68***	0.004	116	0.68***	0.001
(0, 3)	110	2.61***	0.000	110	0.64**	0.036	110	0.54*	0.051

Panel C: Announcements by event firms with negative market reaction

	Event firms			Closest rival firms			Portfolios of closest two rival firms		
Event window	N	CAR (%)	p-value	N	CAR (%)	p-value	N	CAR (%)	p-value
(-2, 2)	93	-3.03***	0.000	93	-1.36***	0.000	93	-1.73***	0.000
(-2, 1)	96	-2.94***	0.000	96	-1.15***	0.003	96	-1.35***	0.000
(-2, 0)	109	-2.43***	0.000	109	-1.02***	0.001	109	-1.28***	0.000
(-1, 1)	94	-2.40***	0.000	94	-0.90***	0.005	94	-1.17***	0.000
(-1, 0)	108	-1.98***	0.000	108	-0.76***	0.004	108	-0.98***	0.000
(0, 1)	90	-1.81***	0.000	90	-1.02***	0.000	90	-1.02***	0.000
(0, 2)	85	-2.20***	0.000	85	-1.35***	0.000	85	-1.45***	0.000
(0, 3)	91	-2.41***	0.000	91	-1.15***	0.000	91	-1.22***	0.000

Table 5: Multivariate results

This table presents multivariate results on intra-industry spillover effects of green bond announcements. Cumulative abnormal returns (CAR) for firm i for the period ranging from T_1 to T_2 have been computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return on the stock of firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date. We use the above equation to compute *Announcer CAR*, CAR for event firms, as well as *Rival CAR*, CAR for event firms' closest rivals that have been identified using 10-K Text-based Network Industry Classifications given by Hoberg and Phillips (2010, 2016). All variables are defined in Table A.1 in the appendix. Industry fixed effects are based on four-digit SIC codes pertaining to industries of event firms. All continuous variables have been winsorized at the top and bottom 1% of their distributions. The standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	Rival CAR (-1, 0)	*Rival CAR (-1, 0)*	*Rival CAR (-1, 0)*	*Rival CAR (-1, 0)*
Announcer CAR (-1, 0)	0.423***	0.418***	0.416***	0.383***
	(0.095)	(0.125)	(0.098)	(0.125)
Announcer cash holdings			0.043	0.139
			(0.055)	(0.111)
Announcer growth opportunities			-0.003	-0.005
			(0.003)	(0.004)
Announcer market share			0.010	0.141
			(0.013)	(0.143)
Announcer ROA			0.054	0.130
			(0.054)	(0.104)
Announcer size			-0.001	-0.001
			(0.002)	(0.003)
Returns correlation			0.006	0.005
			(0.008)	(0.012)
Rival cash holdings			-0.019	-0.004
			(0.025)	(0.044)
Rival financial leverage			-0.000	0.011
			(0.007)	(0.015)
Rival free cash flow ratio			0.041	0.095
			(0.044)	(0.090)
Rival growth opportunities			0.004	0.003
			(0.003)	(0.005)
Rival R&D intensity			0.037	0.141**
			(0.032)	(0.070)
Rival ROA			-0.112*	-0.072
			(0.059)	(0.114)
Rival size			-0.001	0.002
			(0.002)	(0.002)
Constant	-0.000	0.008	0.006	-0.160*
	(0.001)	(0.005)	(0.024)	(0.095)
Industry FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
R^2	0.221	0.423	0.286	0.499
N	201	201	197	197

Table 6: The role of the first-time issue

This table presents multivariate results on the role of the first-time issue in intra-industry spillover effects of green bond announcements. Cumulative abnormal returns (CAR) for firm i for the period ranging from T_1 to T_2 have been computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return on the stock of firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date. We use the above equation to compute *Announcer CAR*, CAR for event firms, as well as *Rival CAR*, CAR for event firms' closest rivals that have been identified using 10-K Text-based Network Industry Classifications given by Hoberg and Phillips (2010, 2016). *First time indicator* equals one if the issue is a first-time issue of the event firm, and zero otherwise All variables are defined in Table A.1 in the appendix. Industry fixed effects are based on four-digit SIC codes pertaining to industries of event firms. All continuous variables have been winsorized at the top and bottom 1% of their distributions. The standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Rival CAR (-1, 0)	*Rival CAR (-1, 0)*
Announcer CAR (-1, 0)	0.354***	0.279**
	(0.116)	(0.120)
First time indicator	0.001	0.008
	(0.004)	(0.005)
First time indicator × *Announcer CAR (-1, 0)*	0.183	0.369**
	(0.154)	(0.178)
Constant	0.008	-0.155
	(0.026)	(0.094)
Controls	Yes	Yes
Industry FE	No	Yes
Year FE	No	Yes
R^2	0.294	0.532
N	197	197

Table 7: The role of the issue size

This table presents multivariate results on the role of the issue size in intra-industry spillover effects of green bond announcements. Cumulative abnormal returns (CAR) for firm i for the period ranging from T_1 to T_2 have been computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return on the stock of firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date. We use the above equation to compute *Announcer CAR*, CAR for event firms, as well as *Rival CAR*, CAR for event firms' closest rivals that have been identified using 10-K Text-based Network Industry Classifications given by Hoberg and Phillips (2010, 2016). *Large issue indicator* equals one if the issue size is more than the median issue size in the sample, and zero otherwise. All variables are defined in Table A.1 in the appendix. Industry fixed effects are based on four-digit SIC codes pertaining to industries of event firms. All continuous variables have been winsorized at the top and bottom 1% of their distributions. The standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Rival CAR (-1, 0)	*Rival CAR (-1, 0)*
Announcer CAR (-1, 0)	0.289**	0.249**
	(0.110)	(0.122)
Large issue indicator	0.005*	0.000
	(0.002)	(0.004)
Large issue indicator × *Announcer CAR (-1, 0)*	0.296***	0.343***
	(0.108)	(0.126)
Constant	0.006	-0.140
	(0.027)	(0.103)
Controls	Yes	Yes
Industry FE	No	Yes
Year FE	No	Yes
R^2	0.316	0.523
N	196	196

Table 8: The role of the event firm's market share

This table presents multivariate results on the role of the event firm's market share in intra-industry spillover effects of green bond announcements. Cumulative abnormal returns (CAR) for firm i for the period ranging from T_1 to T_2 have been computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return on the stock of firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date. We use the above equation to compute *Announcer CAR*, CAR for event firms, as well as *Rival CAR*, CAR for event firms' closest rivals that have been identified using 10-K Text-based Network Industry Classifications given by Hoberg and Phillips (2010, 2016). *Large market share indicator* equals one if the event firm's market share is more than the median market share in the sample, and zero otherwise All variables are defined in Table A.1 in the appendix. Industry fixed effects are based on four-digit SIC codes pertaining to industries of event firms. All continuous variables have been winsorized at the top and bottom 1% of their distributions. The standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Rival CAR (-1, 0)	*Rival CAR (-1, 0)*
Announcer CAR (-1, 0)	0.279***	0.246**
	(0.102)	(0.107)
Large market share Indicator	0.005	0.002
	(0.003)	(0.005)
Large market share Indicator × Announcer CAR (-1, 0)	0.328***	0.411**
	(0.120)	(0.192)
Constant	0.010	-0.062
	(0.025)	(0.043)
Controls	Yes	Yes
Industry FE	No	Yes
Year FE	No	Yes
R^2	0.317	0.531
N	201	201

Table 9: Placebo check

This table presents multivariate results for falsification test using pseudo-event dates that fall 40 trading days prior to actual green bond announcement dates. Cumulative abnormal returns (CAR) for firm i for the period ranging from T_1 to T_2 have been computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return on the stock of firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the pseudo-event date. We use the above equation to compute *Announcer CAR*, CAR for event firms, as well as *Rival CAR*, CAR for event firms' closest rivals that have been identified using 10-K Text-based Network Industry Classifications given by Hoberg and Phillips (2010, 2016). All variables are defined in Table A.1 in the appendix. Industry fixed effects are based on four-digit SIC codes pertaining to industries of event firms. All continuous variables have been winsorized at the top and bottom 1% of their distributions. The standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Rival CAR (-1, 0)
Announcer CAR (-1, 0)	0.349
	(0.220)
Constant	-0.024
	(0.134)
Controls	Yes
Industry FE	Yes
Year FE	Yes
R^2	0.440
N	190

Table 10: Robustness of results to using alternative event windows

This table presents the robustness of our multivariate results on intra-industry spillover effects of green bond announcements to using alternative event windows. Cumulative abnormal returns (CAR) for firm i for the period ranging from T_1 to T_2 have been computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return on the stock of firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date. We use the above equation to compute *Announcer CAR*, CAR for event firms, as well as *Rival CAR*, CAR for event firms' closest rivals that have been identified using 10-K Text-based Network Industry Classifications given by Hoberg and Phillips (2010, 2016). All variables are defined in Table A.1 in the appendix. Industry fixed effects are based on four-digit SIC codes pertaining to industries of event firms. All continuous variables have been winsorized at the top and bottom 1% of their distributions. The standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Rival CAR (-2, 2)		*Rival CAR (-1, 1)*		*Rival CAR (0, 1)*		*Rival CAR (0, 2)*		*Rival CAR (0, 3)*	
Announcer CAR (-2, 2)	0.316***	0.262*								
	(0.119)	(0.139)								
Announcer CAR (-1, 1)			0.363**	0.343*						
			(0.157)	(0.178)						
Announcer CAR (0, 1)					0.403***	0.445***				
					(0.137)	(0.168)				
Announcer CAR (0, 2)							0.430***	0.471***		
							(0.133)	(0.154)		
Announcer CAR (0, 3)									0.422***	0.462**
									(0.153)	(0.202)
Constant	-0.025	-0.250	-0.028	-0.251**	-0.022	-0.118	-0.030*	-0.140	-0.039	-0.189*
	(0.044)	(0.158)	(0.037)	(0.125)	(0.019)	(0.082)	(0.016)	(0.088)	(0.028)	(0.108)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.180	0.485	0.185	0.405	0.239	0.448	0.302	0.518	0.284	0.524
N	197	197	197	197	197	197	197	197	197	197

Table 11: Robustness of results to alternative way of identifying closest rivals using 4-digit SIC codes

This table presents the robustness of our multivariate results on intra-industry spillover effects of green bond announcements to identifying rivals in an alternative way. Cumulative abnormal returns (CAR) for firm i for the period ranging from T_1 to T_2 have been computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return on the stock of firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date. We use the above equation to compute *Announcer CAR*, CAR for event firms, as well as *Rival CAR*, CAR for event firms' closest rivals. We identify the closest rival of an event firm as the one that shares the same four-digit SIC code with the event firm and is also the nearest neighbor to the event firm on Tobin's Q, market share, R&D intensity, and cash flow ratio in the year preceding the green bond issue announcement. All variables are defined in Table A.1 in the appendix. Industry fixed effects are based on four-digit SIC codes pertaining to industries of event firms. All continuous variables have been winsorized at the top and bottom 1% of their distributions. The standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Rival CAR (-2, 2)		*Rival CAR (-2, 0)*		*Rival CAR (-1, 1)*		*Rival CAR (-1, 0)*		*Rival CAR (0, 1)*	
Announcer CAR (-2, 2)	0.485**	0.551**								
	(0.216)	(0.275)								
Announcer CAR (-2, 0)			0.464**	0.492*						
			(0.215)	(0.264)						
Announcer CAR (-1, 1)					0.484**	0.497*				
					(0.194)	(0.256)				
Announcer CAR (-1, 0)							0.421**	0.399*		
							(0.170)	(0.202)		
Announcer CAR (0, 1)									0.332**	0.328*
									(0.148)	(0.185)
Constant	-0.017	-0.014	-0.006	0.012	-0.008	-0.180*	0.004	-0.106	-0.015	-0.132
	(0.030)	(0.125)	(0.022)	(0.084)	(0.020)	(0.094)	(0.017)	(0.077)	(0.015)	(0.084)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.084	0.133	0.139	0.205	0.138	0.224	0.158	0.241	0.098	0.191
N	231	231	231	231	231	231	231	231	231	231

Table 12: Robustness of results to estimating announcement effects using the Fama-French five-factor model

This table presents the robustness of our multivariate results on intra-industry spillover effects of green bond announcements to using the Fama-French five-factor model for estimating announcement effects. Cumulative abnormal returns (CAR) for firm i for the period ranging from T_1 to T_2 have been computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(ER_{it} - (\alpha_i + \beta_{1i}(R_{mt} - R_{ft}) + \beta_{2i}SMB + \beta_{3i}HML + \beta_{4i}RMW + \beta_{5i}CMA))$ where R_{ft} represents the risk-free return, ER_{it} denotes the excess return on the stock of firm i, and $(R_{mt} - R_{ft})$, SMB, HML, RMW, and CMA are five factors of the Fama–French five-factor model (Fama and French, 2015), representing the market risk premium, size, value, profitability, and investment factors, respectively. α and β are parameters of the Fama-French five-factor model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date. We use the above equation to compute *Announcer CAR*, CAR for event firms, as well as *Rival CAR*, CAR for event firms' closest rivals that have been identified using 10-K Text-based Network Industry Classifications given by Hoberg and Phillips (2010, 2016). All variables are defined in Table A.1 in the appendix. Industry fixed effects are based on four-digit SIC codes pertaining to industries of event firms. All continuous variables have been winsorized at the top and bottom 1% of their distributions. The standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Rival CAR (-2, 2)		*Rival CAR (-2, 0)*		*Rival CAR (-1, 1)*		*Rival CAR (-1, 0)*		*Rival CAR (0, 1)*	
Announcer CAR (-2, 2)	0.520***	0.443***								
	(0.093)	(0.095)								
Announcer CAR (-2, 0)			0.581***	0.474***						
			(0.126)	(0.118)						
Announcer CAR (-1, 1)					0.496***	0.450***				
					(0.096)	(0.111)				
Announcer CAR (-1, 0)							0.526***	0.453***		
							(0.106)	(0.105)		
Announcer CAR (0, 1)									0.499***	0.490***
									(0.117)	(0.159)
Constant	0.005	-0.335*	-0.001	-0.185	0.036	-0.298**	0.026	-0.144	0.015	-0.234**
	(0.047)	(0.170)	(0.032)	(0.174)	(0.028)	(0.121)	(0.023)	(0.127)	(0.018)	(0.110)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.547	0.745	0.532	0.702	0.532	0.686	0.553	0.692	0.535	0.644
N	197	197	197	197	197	197	197	197	197	197

Table A.1: Variable definitions

Variable	Definition	Source
Dependent variable		
Rival CAR	Cumulative abnormal returns of the rival firm centered at the green bond announcement date and computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return of the rival firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date	Compustat, Eikon
Explanatory variables of interest		
Announcer CAR	Cumulative abnormal returns of the event firm centered at the green bond announcement date and computed using the following equation: $CAR_i(T_1, T_2) = \sum_{T_1}^{T_2}(R_{it} - (\alpha_i + \beta_i R_{mt}))$, where R_{mt} represents the return on the S&P 500 index, R_{it} denotes the observed return of the event firm i, and α_i and β_i are parameters of the market model estimated using a 200-trading-day estimation window ending 20 trading days prior to the green bond issue announcement date	Compustat, Eikon
First time indicator	Equal to 1 if the issue is a first-time issue of the event firm, and 0 otherwise	Eikon
Large issue indicator	Equal to 1 if the issue size is more than the sample median, and 0 otherwise	Eikon
Large market share indicator	Equal to 1 if the event firm's market share is more than the sample median, and 0 otherwise	Eikon
Control variables		
Announcer cash holdings	Cash plus marketable securities of the event firm, scaled by its total assets, for the fiscal year prior to the announcement	Compustat
Announcer growth opportunities	Tobin's Q: Ratio of the market value of the event firm's assets to its book value of assets for the fiscal year prior to the announcement, where the market value of assets equals the market value of equity plus the liquidating value of preferred stock plus the book value of long-term debt minus the net working capital	Compustat
Announcer market share	Total sales of the event firm divided by total industry sales for the fiscal year prior to the announcement	Compustat

Continued

Table A.1 – Continued

Variable	Definition	Source
Announcer ROA	Earnings before interest, taxes, depreciation, and amortization of the event firm, scaled by its total assets for the fiscal year prior to the announcement	Compustat
Announcer size	Natural logarithm of total assets of the event firm adjusted for inflation for the fiscal year prior to the announcement	Compustat
Returns correlation	Correlation of stock returns between the event firm and its rivals for the year prior to the announcement	Compustat
Rival cash holdings	Cash plus marketable securities of the rival firm, scaled by its total assets, for the fiscal year prior to the announcement	Compustat
Rival financial leverage	Ratio of the book value of the rival firm's total debt to its market value of total assets for the fiscal year prior to the announcement	Compustat
Rival free cash flow ratio	Operating income before depreciation minus interest expense, taxes, preferred dividends, and common dividends of the rival firm, divided by its book value of total assets, for the fiscal year prior to the announcement	Compustat
Rival growth opportunities	Tobin's Q: Ratio of the market value of the rival firm's assets to its book value of assets for the fiscal year prior to the announcement, where the market value of assets equals the market value of equity plus the liquidating value of preferred stock plus the book value of long-term debt minus the net working capital	Compustat
Rival R&D intensity	Ratio of research and development expenditure of the rival firm to its net sales for the fiscal year prior to the announcement	Compustat
Rival ROA	Earnings before interest, taxes, depreciation, and amortization of the rival firm, scaled by its total assets, for the fiscal year prior to the announcement	Compustat
Rival size	Natural logarithm of total assets of the rival firm adjusted for inflation for the fiscal year prior to the announcement	Compustat