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FINAL RESEARCH REPORT

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1. Current project title

Shades of green in the bonds market: the role of the external verification reports

2. Grant applicants

Developing researcher (#14698): Dr. Luiz Fernando Distadio

Established researcher (#10113): Professor Shireenjit Johl

3. Funds granted and the category of grant involved

$6,631 (Developing researcher)

4. Abstract

Climate change is one of greatest risks shared by nations, where the allocation of financing to environmentally-friendly projects is essential for the transition to a low-carbon economy. This exploratory study focuses on the rapidly growing niche of green bonds, which is an emerging market for third party verifiers hired to confer greater confidence in the issuing company's alignment with principles governing green bonds. Using an international sample of 774 green bonds issued from 2013 through 2021, we identify the dominance of "Big 4 third parties" that comprise non-accounting verification providers in the sustainability setting. We perform an event study and find that positive share returns are associated with green bond issues that are accompanied by an external verification report. Consistent with the literature on signalling, we argue that companies that issue verified-green bonds benefit from conveying a signal to the market about their commitments to using the bonds' proceeds in low-carbon, climate-friendly projects. Our results provide evidence of the importance of the verification of non-financial information by a third party in the green bonds setting.

5. Project dissemination and research output

The working paper resulting from the aforementioned project was presented in the following research seminars:

1. Face-to-face research seminar at ANU – Australia National University's accounting school on 30/Sep/2022;
2. Online research seminar at AFE – Griffith University on 02/Sep/2022;

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3. Online research seminar at UNIFESP, Brazil on 30/June/2022.

The manuscript will be submitted to a highly ranked publication outlet in the coming weeks prior to the end of this current year.

In the acknowledgement section of the paper, we explicitly highlight the support of this research grant as follows:

"We thank the seminar participants at the ANU – Australia National University, Griffith University and UNIFESP for helpful comments. This work was supported by the 2021 Accounting and Finance Association of Australia and New Zealand (AFAANZ) Research Grant."

6. Budget

Grant resources were fully allocated to cover research assistant costs as per the original budgeted submitted to AFAANZ.

The full-text working paper follows as attachment.

My sincere thanks to AFAANZ's for supporting this research project.

Kindest regards,

Dr. Luiz Fernando Distadio

Shades of green in the bonds market: the role of the external verification reports

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Abstract

Climate change is one of greatest risks shared by nations, where the allocation of financing to environmentally-friendly projects is essential for the transition to a low-carbon economy. This exploratory study focuses on the rapidly growing niche of green bonds, which is an emerging market for third party verifiers hired to confer greater confidence in the issuing company's alignment with principles governing green bonds. Using an international sample of 774 green bonds issued from 2013 through 2021, we identify the dominance of "Big 4 third parties" that comprise non-accounting verification providers in the sustainability setting. We perform an event study and find that positive share returns are associated with green bond issues that are accompanied by an external verification report. Consistent with the literature on signalling, we argue that companies that issue verified-green bonds benefit from conveying a signal to the market about their commitments to using the bonds' proceeds in low-carbon, climate-friendly projects. Our results provide evidence of the importance of the verification of non-financial information by a third party in the green bonds setting.

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Keywords: green bonds, external verification, Big 4 third parties, assurance, signalling theory

JEL classification: G14, G32, Q56, M14, M42, K22

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1. INTRODUCTION

Climate change is one of greatest risks shared by nations and has been widely discussed in international forums like the United Nations' 2021 climate change summit COP26[1] in Glasgow. Amongst the countries' collective commitments is a clear direction to divert financing from fossil fuel projects to carbon-neutral, environmentally friendly initiatives. As such, COP26 sheds light on the key role of sustainable finance in supporting the urgent transition to a low-carbon economy. One of the main contributions of these international events is the increasing exposure of companies environmental, social and governance (ESG) practices, such as the inclusion of matters related to climate risk and energy transition matters in major oil companies' audit reports, which shows the important role of external verifiers in the transition to a lower-carbon economy. Taken collectively, these commitments contribute to the integration of ESG factors into regulation, market policies and corporate environmental strategy. However, little is known about the existing mechanisms that underpin green and climate securities.

To address this issue, we explore the rapidly growing niche of green and climate debt securities known as "green bonds", whose issuing firms are committed to investing the bonds' proceeds in environmentally friendly projects. The functioning of the green bonds market is centred on the issuers' green commitment, a *de facto* market-based regulation (Park 2018), where voluntary mechanisms can be used to confer greater credibility and transparency to the use of green bonds' proceeds. One of these governance mechanisms is the external verification of the company's green bond framework, where a third-party attests to

[1] 26th United Nations Climate Change Conference of the Parties (COP26).

the framework's alignment with the green bond principles (GBPs)[2,3]. As far as we are aware, no study documents empirically the role of these external verification reports in the green bonds setting. This paper examines the relationship of external verification reports to green bonds' market reaction.

Attestation to green bonds' alignment with these principles is voluntary, as are assurances on other non-financial information (Coram, Monroe, and Woodliff 2009) . Despite the uncertainty about the green use of the bonds' proceeds, there is no detailed evidence about the role of third-party verifiers in the green bonds setting. Hiring an entity to attest to the alignment of a bond's framework with GBPs results in a costlier process, so one would expect issuers to benefit from voluntary provision of this external review. The role of verification reports can be linked to signalling theory (Akerlof 1970) because of the information asymmetry between firm insiders and external stakeholders. Using signalling theory to explain green-bond-issuing companies' voluntarily provision of external verification reports, we find evidence that investors reward verified-green-bond issuances. The market reactions reported in this study are consistent with studies that document the positive relationship between corporate social responsibility (CSR) and stock market performance (Edmans 2011, 2012; Flammer 2013, 2021; Krüger 2015; Wong and Zhang 2022). Consistent with this strand of the literature, we perform an event study on green bond issuances and document positive market reactions that are associated with the issuers' formal commitments to verifying externally their green bonds programs' alignment with the GBPs after the bonds are issued.

[2] Two entities set forth principles to guide stakeholders in the green bond market: the International Capital Market Association (ICMA), which is responsible for developing the green bond principles (GBPs), and the Climate Bonds Initiative (CBI), which develop the Climate Bonds Standards (CBS). Four pillars underpin the issuance of green bonds: the use of proceeds, the process for project evaluation and selection, the management of proceeds, and reporting.

[3] The terms 'verification', 'attestation' and 'review' are employed interchangeably to indicate when the issuing company hires a third party to assess the alignment of its green bond framework with the green bond principles. Whereas the term 'certification' refers exclusively to CBI's governance scheme, this study focuses on the issuer's provision of verification reports, which are usually publicly available on its website.

With ESG bonds as an international trend for underpinning sustainable projects, we use a comprehensive sample of green bonds issued by listed companies between 2013 and 2021. We extract the bonds from Bloomberg's fixed-income database that have the green label indicator for publicly listed firms and augment this data with manually collected data from third-party verification reports that accompany green bond programs, resulting in a final sample of 774 observations.

Our event study finds evidence that green bond issuances that are accompanied by a third-party verification report attract a positive cumulative average return of 0.30 percent over a three-day event window. Consistent with the literature on signalling, we find evidence of green-bond-issuing firms' benefiting from conveying a stronger signal to the market about their commitments to using their bonds' proceeds in low-carbon, climate friendly projects.

Next, we investigate the share returns that are associated with the issuers' commitments to providing post-issuance verification reports.

Finally, we examine the association between share returns and green bond issues that are accompanied by an external verification report with an assurance statement and find limited results. We interpret this limited finding as being the result of the relatively homogeneous review process performed by verifiers in the green bonds setting.

Further tests reveal no evidence of decreasing event-window returns while controlling for run-up in the share price. In addition, evidence on the association between the verification and post-verification of green bonds with greater cumulative-abnormal returns holds regardless of the corporate environmental performance in the year prior to the bond issuance. These additional tests are based on an ESG variable that controls for the company's positive (negative) performance. These findings indicate that investors reward the provision of a verification report no matter how good (bad) the firm's ESG performance in the year prior to

its green bond issuance. Mixed results for the commitment to post-issuance verification also hold under these conditions.

This study contributes to the literature on green and climate financing in several ways. First, we extend prior studies on green bonds to a more comprehensive set of issuances from 2013 through 2021 in multiple countries. Considering the evolving nature of the green bonds market, we benefit from using issuances that were made over recent years, when significant increases are observed. Second, our study focuses on the underexplored external verification reports that have been provided voluntarily by companies that issue green bonds. Given the increasing importance of third parties' attestation of non-financial information in the ESG space, we fill this gap by examining a comprehensive sample of green bond issues that were accompanied by external verification reports. Third, this study provides evidence of market reactions based on two- and three-day event windows. Prior studies adopt longer event windows (Flammer 2021; Tang and Zhang 2020) despite the potential confounding effects arising from concurrent corporate events. We also triangulate announcement dates from Bloomberg with news searches on Factiva to identify earlier disseminations of the issuers' green bond programs.

The remainder of this study is organized as follows. The next section reviews the literature and develops the hypotheses. The third section discusses data, research methods and results. Concluding remarks follow in the fourth section.

II. RELATED LITERATURE AND HYPOTHESES DEVELOPMENT

The emerging green bond market is comprised of corporate issuers (e.g. utilities, automakers and banks), and non-corporate issuers (e.g. supranational entities and municipalities) that are committed to using their bonds' proceeds in environmentally friendly projects. Market participants expect issuers to earmark this green capital to avoid diverting the proceeds to non-green projects, as doing so can result withdrawal of a green label. Therefore, companies'

commitment to low-carbon, climate-friendly projects is paramount in this niche of the bond market. Few studies address this setting because of the nascent stage of the green bonds market, and those that do examine the asset pricing properties of green bonds, where there is mixed evidence about these bonds' 'greenium'. For example, Baker, Bergstresser, Serafeim, and Wurgler (2018), Karpf and Mandel (2018), and Zerbib (2019) find support for the presence of a small premium in the green bond market, indicating that issuers benefit from a lower bond yield, whereas Larcker and Watts (2020), Tang and Zhang (2020), and Flammer (2021) find no yield differential between green and regular bonds, indicating that green bond investors do not forgo financial return for the positive externality related to the green use of proceeds. Therefore, despite green bonds' environmental commitment, bond investors price green and regular bonds similarly. From the perspective of an equity holder, limited evidence indicates that green-bond-issuing firms experience a positive market reaction to the issue announcement (Flammer 2021; Tang and Zhang 2020), while regular bond issuances attract no significant market reactions (Eckbo 1986, 2008). We shed light on this underexplored market reaction to the issuance of green bonds by determining whether the reaction is associated with the issuing company's green commitment. More specifically, we investigate whether a positive market reaction is associated with green bond issuances that are accompanied by external verification reports. Unlike regular bonds, the green bonds setting features intermediaries that provide external reviews of the issuers' green bond frameworks. Consistent with assurances about non-financial information, the green bonds niche is an ideal setting to test signalling theory, where firms can voluntarily convey their commitment to ESG through a credible sign to the market. The reputational risks of greenwashing can provide an incentive for firms to hire third parties to verify their use of green proceeds, despite the costs. Lyon and Montgomery (2015) discuss the lack of information investors have to assess firms' commitment to ESG. In addition, myriad metrics and related labels compromise the

communication and accountability process in the ESG space (Berg 2020; Chiang 2017; Grene 2015).

The mechanisms of the green bond label rely on private governance regimes and no significant interference from market regulators or governmental policy. In other words, the functioning of the green bonds market that centres on the issuer's green commitment is based on a *de facto* market-based regulation (Park 2018) in most jurisdictions. However, there are five exceptions to the *de facto* market-based regulation, namely, China, India, Hong Kong and Singapore (Flammer 2021; OECD 2015). In China, the People's Bank of China (PBOC, 2015) had its regulation breadth extended to include green bonds. Specifically, PBOC developed guidelines relating to the issuer qualifications, related materials, and the role of certification agencies. While in India, the securities regulator, Securities and Exchange Board, plays a critical role in the governance of the green bonds market.

Green bonds issuers are expected to develop a framework that abides by the GBPs set forth by the International Capital Market Association (ICMA). Alignment of the issuer's framework with the GBPs involves four components[4]: the use of proceeds, the process for project evaluation and selection, the management of proceeds, and reporting. In addition, the GBPs recommend providing external verification to attest that the issuer's green commitment is credible and is in conformity with the GBPs' core components. Unlike Flammer (2021), who examines certified green bond issuances, we investigate verification reports in this setting without restricting them to a specific governance scheme. The certification of green bonds is granted by the Climate Bond Initiative (CBI) to firms that have green bond programs that are aligned with its criteria. However, a market for external verification providers has flourished beyond the certification scheme[5]. Not surprisingly, the attestation of green bonds

[4] Sourced from Green Bond Principles' Voluntary Process Guidelines issued in June 2021.
[5] For example, Vodafone PLC issued its first green bonds on 24 May, 2019, backed by a third-party verification report from Sustainalytics. Despite not being certified under the CBI certification scheme, Vodafone's green bond framework is aligned with ICMA Green Bond Principles 2018.

is voluntary, as are assurances about non-financial information (Coram et al. 2009). The relationship of verification reports to bonds' value can be linked to the signalling theory Akerlof (1970), based on the information asymmetry between firm insiders and external stakeholders. While the former has better access to information about their firms, the latter can interpret additional information beyond the financial reports as a market sign (Jones and Murrell 2001; Malik 2015; Wong and Zhang 2022). First-time green bond issuances offer an ideal setting in which to investigate external verification reports' effect on bonds' value. Therefore, we argue that a green bond issuer can use a green bonds verification report to signal to the market its commitment to the proper use of this source of financing. Consistent with this perspective, we present the following hypothesis:

Hypothesis 1.a (H1.a): First-time green bond issuances that are accompanied by an external verification report are associated with higher market reactions.

(Corbett, Montes-Sancho, and Kirsch 2005) find evidence on the importance of ISO 9000 certification by manufacturing firms in the US that experienced superior financial performance in the post-accreditation period. Using a sample of 554 firms that have disclosed their ISO 9000 certifications, the authors document improvements in the performance of certified firms. In a survey-based study, Schelluch and Gay (2006) support the presence of a gap in the expectations of the company's stakeholders regarding assurances about greenhouse emissions. The study finds that stakeholders did not regard the emissions-related assurances as useful in making decisions. Specifically, Schelluch and Gay (2006) suggest that uncertainty surrounding the assurances leads shareholders to rate that information as less reliable than the assurers do. Clarkson, Li, Richardson, and Tsang (2019) find evidence about the value of assurances in CSR reports by Big 4 accounting firms. One benefit of the green bonds setting is the ability to hire independent verifiers to attest to green bonds' alignment

with related principles based on an assurance standard[6]. The market for the verification of green bonds includes a variety of attestation reports provided by accounting firms (the Big 4) and other players (e.g. agency ratings and ESG-related service providers). Following Simnett, Vanstraelen, and Chua (2009), we test whether auditing firms that are hired to verify green bonds convey a stronger signal to the market than non-auditing firms do because the audit profession features a well-established work methodology and overall compliance with ethical standards and internal controls, so assurance by an audit firm can address information asymmetry related to issuers' green commitment. Consistent with these studies, we expect that green bonds that are backed by a verification report with an assurance statement are associated with positive share returns.

Hypothesis 1.b (H1.b): Green bond issuances that are backed by a verification report with an assurance statement are associated with more positive market reactions.

Another feature of the green bonds setting is the presence of issuing companies that commit to providing a post-issuance verification report to strengthen transparency in the use of proceeds until the bond matures. This commitment is likely to confer greater credibility to the firm regarding its efforts to transition to a more environmentally orientated approach. Accordingly, we predict that companies that provide a post-issuance verification report attract positive market reactions:

Hypothesis 2 (H2): Green bond issuances with the provision of a post-issuance verification are associated with higher market reactions.

III. DATA AND RESEARCH METHOD

To construct a comprehensive dataset of international green bonds, we extract all of the bonds from Bloomberg's fixed income database that have a green label indicator. We chose

[6] See Appendix A for an example of an external verification report conducted by EY following ISAE (NZ) 3000.

Bloomberg to source this data based on its wide coverage of fixed-income securities. The sample comprises green bonds that were issued between 2013 and 2021, as most issuances made prior to 2013 are related to supranational and other non-corporate organisations. For example, the inception of the green bond market in 2008 was marked by two significant issues by the European Investment Bank (EUR600 million) and the International Bank for Reconstruction and Development[7] (SEK3.35 million).

Table 1 shows 5,681 green bond issuances whose proceeds were earmarked to (re)finance environmentally friendly projects. We deleted 1,301 issuances by supranational and government-related entities and 3,021 issuances by private firms. The advantage of restricting the sample to public firms is the availability of share price data so we can use an event study approach. Based on the intermediary role of financial institutions, which can issue green bonds to generate green loans and other financial instruments to their clients, we exclude 355 issues by listed banks, funds, and trusts. Deleting 48 observations with missing data at the firm level results in a final sample of 956 green bonds. We summed multiple bond tranches issued by a firm on the same day, resulting in 774 unique days on which listed companies issued green bonds (green bond issuer-days). We manually collected the green bonds framework and third-party verification reports that were available in Bloomberg. Additionally, bonds framework and third-party verification reports are sourced from the issuing firm's or the third-party's website. We identified 415 issues that were backed by an external verification report that was signed no later than one year prior to the date the security was issued[8]; the 359 green bond issues that do not match this criterion are classified as non-verified.

[7] The International Bank for Reconstruction and Development operates as a financial service firm that is focused on financial assistance to emerging countries with the aim of reducing poverty and promoting sustainable development (Bloomberg).

[8] Green-bond-issuing companies can argue that verification reports have no expiration date despite changes in the green bond principles over time. As such, they can argue that the status of a verified emission should be granted to all green bonds issued after the attestation report's sign-off date. As a counter-argument, we support

(Table 1 about here)

Figure 1 plots the number of green-bond-issue days by geographic region over the sample period. The number of green-bond-issue days for companies based in the Asian-Pacific region surpassed the number of issues by European firms for the first time in 2021, suggesting that green bonds are becoming more prevalent in Asia. The table also shows that the number of green-bond-issuer days of companies based in the Americas excluding the US was greater than the number of issues by the US firms in 2018 and 2021. This figure also shows the evolution of value of green bond issues in US dollars, this study is the first to show its continuing growth over the COVID-19 period, most notably in 2021, when a record USD109 billion were issued by the sample firms.

(Figure 1 about here)

Table 2's Panel A reports the distribution of green bond issues by country. Listed companies from the US and France issued $46.6 and $46.3 billion in green bonds, respectively. Issuing firms from Japan and Sweden that are active in the green bonds market accounted for 133 ($12.9 b) and 121 ($10.1 b) green-bond-issuer days, respectively. Germany and South Korea held issues of $25.9 billion and $18.3 billion, respectively. This geographic breakdown of green bonds issuers confirms existing evidence about the predominance of green debt in the US, Europe, and Asia's large economies (China, Japan and South Korea).

Table 2's Panel B reports the distribution of green bonds that were accompanied by a verification report dated no later than one year before the issuance. The trend in the frequency of verification increases significantly over the sample period. For example, in 2021, 39.28 percent of green bonds were verified, compared to 23.86 percent (20.24%) in 2020 (2019), indicating a growing market for the verification providers. To the best of knowledge, this is

the adoption of an expiration date in the construction of this proxy, given the evolving nature of principles and guidelines in the green bonds setting.

the first study to explore the characteristics of the attestation of non-financial information using a comprehensive sample of green bonds.

(Table 2 about here)

Table 3 shows the industry classification of green bonds issuers based on Bloomberg's Industry Classification System. Industrials accounted for 435 green bond issues (56.2%), while non-industrial companies issued 339 (43.8%). The breakdown of industrials indicates that 186 and 58 green bonds issues were by listed firms that operate in utilities and consumer discretionary, respectively, while real estate companies accounted for 320 issues.

(Table 3 about here)

Table 4 reports the correlation matrix for the explanatory variables[9] used in the main analysis. The correlation coefficients of *VERIFY* and *FIRST* are positive and significantly associated with the related interaction term, *VER_FIRST*. The correlation coefficient on *POST_VERIFY* is positively associated with the interaction term *VER_FIRST* and with *VERIFY*, indicating that first-time verified-green bonds issuances are accompanied by a commitment to providing a third-party attestation after the issuance. *ISSUE_SIZE* is positive and significantly correlated with the interaction term *VER_FIRST*, and with *VERIFY* and *POST_VERIFY*, suggesting that larger green bonds issuances are commonly accompanied by a double verification process—one contemporaneous with the issuance and another over the time the bond's proceeds are used. The variables *ISSUE_SIZE* and *MATURITY* are positive and significantly correlating, indicating that the larger green bond issue the longer its maturity. The issuer size (*SIZE*) is positive and significantly correlated with *POST_VERIFY*, *MATURITY* and *ISSUE_SIZE*, suggesting that the larger the firm, the longer the maturity of its green bonds. *SIZE* is also correlated with ISSUE_SIZE, indicating that the larger the firm, the larger is the green bonds issuance. *SIZE* is also correlated with the firm's commitment to

[9] Appendix B presents the description of variables.

providing a post-issuance verification. *ROA* is positively associated with *POST_VERIFY*, indicating that issuing firms that have good financial performance tend to be committed to providing post-issuance verification reports. Issuer leverage (*LEV*) is negative and significantly correlated with *VER_FIRST*, *VERIFY*, *POST_VERIFY*, *ISSUE_SIZE*, *SIZE* and *ROA*, indicating that highly leveraged green bond issuers are unlikely to provide a verification report either around the issuance or during the time the bond's proceeds are used, and that these issuers raise lower amounts of green debt, are smaller in terms of total assets, and are less profitable. *LNEWS* is positive and significantly correlated with *VERIFY*, *POST_VERIFY*, *ISSUE_SIZE* and *SIZE*, while it is negatively correlated with *LEV*, suggesting that firms with high media visibility commonly provide a third-party verification report around the time of a bond's issuance, commit to a post-issuance verification report, issue large amounts of green bonds, and are large in terms of total assets. *LNEWS* is negatively correlated with *LEV*, suggesting high visibility firms have low leverage.[10] *ASSURANCE* is positive and significantly correlated[11] with *POST_VERIFY*, indicating that green bonds issuances that have verification reports containing assurance statements are commonly committed to providing verification reports over the time that the bonds' proceeds are used.

(Table 4 about here)

Table 5's Panel A reports bond-level and firm-level variables[12]. Bond-level data is sourced from Bloomberg. *ISSUE_SIZE* is the natural logarithm of the green bond's issue amount, and the issued amounts of verified-green bonds are greater than those of non-verified

[10] Despite the relatively low levels of correlation, we check the variance inflation factors (VIFs) for the independent variables in the main regression to reduce concerns about multicollinearity. The variables *POST_VERIFY*, *MATURITY*, *ISSUE_SIZE*, *COUPON, SIZE*, *ROA*, *TOBINQ*, *LEV*, and *LNEWS* have VIFs in the range of 1-2, while the VIFs of *VERIFY* and *FIRST* are within the range of 2-3. Unsurprisingly, the interaction term *VER_FIRST* has the highest VIF, 4.18.

[11] As expected, *ASSURANCE* is correlated with *VER_FIRST* and *VERIFY*, given that the latter is a subcategory of the green bonds verification.

[12] Appendix B presents a list of variable definitions.

issuances (significant at the $p < 0.01$ level). *MATURITY* is the maturity of green bonds in years, and both verified and non-verified-green bonds have similar maturities. *COUPON* is the bond coupon rate.

Accounting data is retrieved from Refinitiv for each firm one year prior to its green bond issuance. *SIZE* is the natural logarithm of the issuer's total assets in US dollars in the year prior to issuing a green bond. The *SIZE* of verified-green-bond issuers is greater than non-verified issuers (significant at the $p < 0.10$ level). *ROA* is the ratio of the issuer's operating income to the book value of its total assets in the year prior to issuing a green bond. Verified-green-bond issuers are more profitable in the year prior to issuing a green bond than are firms that issue non-verified-green bonds (significant at the $p < 0.05$ level). *TOBINQ* is the ratio of the market value of the issuer's total assets to the book value of its total assets in the year prior to issuing a green bond. *LEV* is the leverage ratio of the issuer's total debt to the book value of its total assets in the year prior to issuing a green bond. Verified-green-bond issuers have less leverage in the year prior to the issuance than companies that issue non-verified-green bonds do (significant at the $p < 0.01$ level). *ENV_SCORE* is the issuer's environmental score in the year prior to issuing a green bond (retrieved from Refinitiv).

In Table 5's Panel B, *FIXED_RATE* indicates whether the bond has a fixed payment, which is more commonly issued in verified-green bonds than it is in non-verified-green bonds (significant at the $p < 0.01$ level). *CONTROV* is an environmental controversies dummy variable that indicates whether the issuer was involved in incidents with negative environmental implications in the year prior to issuing a green bond. This data is retrieved from Sustainalytics' controversies database. *POST_VERIFY* indicates whether the company is committed to a post-issuance external verification of their use of the green bond's proceeds. Specifically, we require a statement indicating the green bond issuer's commitment to provide a periodic attestation of the use of bonds proceeds. This post-issuance verification

commitment is more common amongst issuers of verified-green bonds than it is amongst issuers of non-verified-green bonds (significant at the $p < 0.01$ level). *ASSURANCE* indicates whether the verification report has an assurance statement. Thirty-two verification reports are classified as assurance, representing 4.13 percent (7.75%) of the sample of (verified) green bonds, of which seven observations have the same assurer for both green bonds and financial statements[13].

Table 5's Panel C exhibits the top verification providers per year across geographic regions over the sample period based on the number of issues, and issue size in dollar amount. In the top position of verifiers in Europe based on the number of issues (issue size in dollar amount)[14], CICERO (Sustainalytics) is the most common third party in 2017, 2018, 2019, and 2021 (2015, 2019, 2020, and 2021). In the Americas, Sustainalytics dominates this market in all years[15] based on either criterion except in 2018 when CICERO ranks first. In the Asia-Pacific region, the market for the verification of green bonds emerged later than it did in Europe and the Americas, and despite the early presence of KPMG, one of the BIG 4 accounting firms, the market is also dominated by non-accounting verifiers, notably Sustainalytics based on either criterion. A similar trend is seen in Africa and the Middle East, where KPMG and Sustainalytics are the most common verifiers of green bonds based on either criterion in 2018, and 2021, respectively. Overall, we can observe the emergence of "Big 4 third parties" in the market of verification of non-financial information of green bonds, namely Sustainalytics, Vigeo Eiris (V.E.), CICERO and DNV GL.

(Table 5 about here)

Event study methodology

[13] We check the independent auditor report on the financial statements for the fiscal year prior to the green bond announcement date.

[14] In 2014, V.E. and ISS ESG share the first position in Europe based on the number of green bonds issues, while V.E. also ranks first based on the issue size in dollar amount. Therefore, only V.E. is listed in the table considering the limited number of verified issues in this year (5).

[15] In 2016, Sustainalytics and CICERO share the top position based on the number of green bonds issues.

We employed the multi-country event study method to analyse the market reactions to the announcements of green bonds issues (Brown and Warner 1980, 1985; Park 2004). The date on which the company announces to the market that it is issuing a green bond is considered the event date (t_0), where the abnormal return ($AR_{i,t}$) is the difference between the firm's actual daily share return and its expected return. We used the market model to calculate the firm's expected returns based on Eq. (1), an ordinary least square (OLS) regression:

$$R_{i,t} = \alpha_{i,t} + \beta_i R_{m,t} + \varepsilon_{i,t}, \quad (1)$$

where $R_{i,t}$ and $R_{m,t}$ are the returns of company i and market m, respectively, in period t. The estimation windows are 300 days and 50 days before the event date (t_0). Average abnormal returns are calculated for the green-bond-issuing companies. Cumulative abnormal returns (CARs) are computed over a three-day event window centred on the bond event date as follows:

$$CAR(-1,+1) = \sum_{t=-1}^{1} AR_{i,t} \quad (2)$$

The average of the CAR for the announcing firms are calculated for the three-day [-1,0,1] event window, and the two-day ([-1,0] and [0,1]) windows. We obtained share prices and the local market index for each country from Refinitiv. Following Tang and Zhang (2020), we triangulated this data using Factiva to identify any early dissemination of the company's green bond program. In 24 observations, the Bloomberg event date is replaced by an earlier date because of the issuers' earlier dissemination of their green bond programs. Confounding effects from firms' announcements that are unrelated to the event of interest can be an issue in event studies (Capelle-Blancard and Laguna 2010). To mitigate the confounding effects from firm's announcement of events not related to green bonds, we used Factiva to identify significant corporate events that were announced ten days around the event date. Following Park (2004), we excluded 45 observations with concurrent announcements[16]. We also

[16] The significant events are 29 earnings announcements, 5 capital-related announcements (e.g. public follow-on offering), 4 corporate misconduct announcements (e.g. SEC subpoena) and 7 other announcements (e.g. business divestitures, cost savings plans and weather-related disruptions in the firm's operations).

controlled for market noise using the count of news articles based on the search on Factiva, where 19 observations did not include the company name.

Analysis of the event-study outcomes

Table 6 reports the mean (median) CAR for three event windows [0,1], [-1,0], and [-1,1] as well as for two event windows to account for any potential run-up in the share prices before [-20,-11] and after [11,20] the event study[17]. For all green bond events, we observed a mean (median) CAR of 0.14 percent (0.04%), significant at $p<0.05$, and 0.12 percent (0.12%), significant at $p<0.10$, over the two-day event window [-1,0], and over the three-day event window centred on the event date [-1,1]. Following (Distadio and Ferguson 2021; Serafeim and Yoon 2022), who also use an event study approach, our empirical analysis focuses on the three-day market-model cumulative abnormal return centred on the event date [-1,1] to measure the potential short-term effects of the green bond announcement in the issuing firm's share price. We fill the gap in studies that document market reactions to climate-related financing events by investigating evidence of wealth effects on the announcement of verified-green and non-verified-green bonds, based on a comprehensive international sample. The mean (median) CAR over the three-day event window [-1,1] is 0.30 percent (0.36%), significant at $p<0.01$ for verified-green bonds, while the subsample of non-verified issuances yields a non-significant mean (median) CAR of -0.09 percent (-0.015%). We also found evidence confirming the value of green bond issuances that are accompanied by an external verification report. For the event window before the event date [-20, -11], the mean (median) CAR is -0.26 percent (-0.24%), significant at $p<0.05$. While there is no significant evidence of CAR before the event date for the verified-green bond issues, we found a significant negative mean (median) CAR of -0.03 percent (-0.29%) for the non-verified sample ($p<0.10$).

[17] Section 3.3. presents additional tests for the run-up in the share price of the green bond issuer based on cross-sectional results for models that are augmented with these CARs.

For the post-event period [11, 20], the mean (median) CAR is negative and non-significant across the entire sample and subsamples of verified and non-verified-green-bond issues. Univariate tests indicate that companies that issue verified-green bonds experience significantly higher cumulative returns than those that issue non-verified green bonds do (p<0.05). Overall, the CAR is relatively aligned with the prior literature on green bonds.

(Table 6 about here)

Model specification and cross-sectional results

To determine how the wealth effects of green bond announcements are associated with bonds' and firms' characteristics, we specify a cross-sectional OLS model:

$$CAR(-1,+1) = \beta_0 + \beta_1 VERIFY_{i,t} * FIRST_{i,t} + \beta_2 VERIFY_{i,t} + \beta_3 FIRST_{i,t} + \beta_4 POST_{VERIFY\,i,t} + \beta_5 MATURITY_{i,t} + \beta_6 ISSUE_{SIZE\,i,t} + \beta_7 COUPON_{i,t} + \beta_8 SIZE_{i,t-1} + \beta_9 ROA_{i,t-1} + \beta_{10} TOBINQ_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} LNEWS_{i,t} + YEAR\ FE + e_{i,t}, \quad (3)$$

where the dependent variable is the three-day [-1,1] market-model cumulative-abnormal return. The first test variable is the interaction term between the dummy variable that indicates that the green bond issue is accompanied by an external verification report that was signed off no later than one year prior to issuing the security (*VERIFY*), and the dummy variable that indicates the first time a company issues a green bond (*FIRST*). The second test variable is *POST_VERIFY*, which indicates whether the company is committed to reporting an external verification of the bonds issue, in alignment with green bonds principles, after the issuance.

Bond-level and firm-level control variables are *MATURITY*, the maturity of green bonds in years; *ISSUE_SIZE*, the natural logarithm of the issue amount; *COUPON*, the bond coupon rate; *SIZE*, the natural logarithm of the issuer's total assets in US dollars in the year prior to issuing a green bond; *ROA*, the ratio of the issuer's operating income to the book value of its total assets in the year prior to issuing a green bond; *TOBINQ*, the ratio of the

issuer's market value of total assets to the book value of total assets in the year prior to issuing a green bond, *LEV* is the leverage ratio of the issuer's total debt to the book value of its total assets in the year prior to issuing a green bond, and *ENV_SCORE* is the issuer's environmental score in the year prior to issuing a green bond. Continuous variables are standardised (Serafeim and Yoon 2022; Fan and Michalski 2020), and winsorised at 1% and 99%.

Table 7 reports the OLS regression results for the pooled sample of green bond issues. The coefficient on the interaction term *VER_FIRST*, which indicates the first time a green bond is issued by a public company and is accompanied by a third-party verification report, is positive (0.527) and significant (p<0.01), suggesting that investors value a public company that launches its first green bond program with an external attestation. However, the coefficient on *FIRST* is negative (-0.398) and significant (p<0.01), indicating adverse effects on the issuer's return on a first-time green bond issuance without a verification report. The coefficient on *VERIFY* is positive and significant (p<0.05) in Columns 2 and 3, where results are based on the model without the interaction term. Similarly, the coefficient on *POST_VERIFY* is positive (0.173 and 0.170 in Columns 2 and 3, respectively) and significant (p<0.05). These results indicate that larger share returns are associated with externally verified-green-bond issues and suggest that issuing companies benefit from a pre-issuance third-party review of their alignment with green bonds' principles. Similarly, we found evidence that issuing firms' commitment to providing a post-issuance verification of how the green proceeds are used is associated with higher CARs. In other words, investors value a green bond issuing firm's providing a third-party attestation of its adherence to green bonds' principles and its commitment to providing a post-issuance verification report. Column 4 reports the coefficient for the model that tests *H1.c*, where *ASSURANCE* indicates verified-green-bond issues that have an assurance provision. Limited evidence supports the

association between share price returns and verified-green-bond issues that have an assurance statement.

Table 7 also reports in Columns 5 to 7 (8 and 9) the coefficients for green bonds that are issued in unregulated (regulated) jurisdictions. The coefficient on *VER_FIRST* is positive (0.564) and significant (p<0.01) in non-regulated countries, confirming that cumulative share returns are associated with verified-first-time issuances of green bonds. The coefficient on *VERIFY* is positive (0.213) and significant in Column 6 (p<0.05). The coefficient on *ASSURANCE* in Column 7 reports a positive (0.423) and significant (p<0.05) in unregulated countries, suggesting that investors value verified-green-bond issues that have assurance provisions in jurisdictions with no regulation of green bonds. The results in Columns 8 and 9 for green bond issuances in regulated jurisdictions indicate no evidence of wealth effects that are associated with an external (post-issuance) verification report.

Columns 10 to 12 report the coefficients for green bonds issued under British or US law. The coefficient on *VER_FIRST* is positive (0.846) and significant (p<0.05), supporting verified-first-time issuances of green bonds' association with greater cumulative-abnormal returns when the bonds are issued under British or US law. The coefficients on *VERIFY* are positive (0.477 and 0.492 in Columns 11 and 12, respectively) and significant (p<0.05), while the coefficient on *POST_VERIFY* is positive (0.323) and significant (p<0.10) in Column 11. These results indicate that investors value green bonds that are accompanied by verification reports when these securities are governed by laws with strong investor protections. Evidence that investors value green bond issuing companies' commitment to providing third-party post-issuance reports when the bonds program is under British or US law is weak. Similar results are observed in Columns 13 to 15, when the sample is restricted to green bonds that are not governed by British or US law. The coefficients on *VER_FIRST* and *VERIFY* are positive (0.477, 0.251 and 0.210 in Columns 13 to 15, respectively) and significant (p<0.05).

In contrast, the results for the coefficient on *POST_VERIFY* across these models are not significant. These results indicate that (i) green bond issues that are accompanied by external verification reports are associated with larger CARs, regardless of the laws that govern the security issuance, and (ii) investors value issuers' commitment to providing post-issuance external verification reports only if the bonds are issued under British or US law. We can interpret these findings as suggesting that the high level of investor protection conferred by these two security laws are not related to the green use of bond proceeds but to the investor's claim on the issuing firm's cash flow.

(Table 7 about here)

Additional Tests

Run-up Controls

To control for a potential run-up in the share prices before and after a green bond announcement, Table 8 shows Columns 1 to 3, where shows the results when we add to the model a control variable based on the pre-event window [-20, -11]. The coefficient on *VER_FIRST* (*VERIFY* and *POST_VERIFY*) is positive and significant at $p<0.01$ ($p<0.05$) across these columns. Similar results are observed in Columns 4 through 6, when a control variable based on the post-event window [11, 20] is included in the model.

Table 8, Columns 7 to 9, also reports the results for main models that are augmented with both pre-event [-20, -11] and post-event [11, 20] run-up controls. The coefficient on *VER_FIRST* (*VERIFY* and *POST_VERIFY*) is positive and significant at $p<0.01$ ($p<0.05$) across these columns. Results reported in Columns 10 through 12 for the subsample of green bonds issued in unregulated countries show positive and significant ($p<0.05$) coefficients on *ASSURANCE* that range from 0.421 to 0.427.

These additional results yield similar results to those of the main tests discussed in the section 3.2 in that they reveal no evidence of decreasing event window returns when we control for run-up in the share price.

(Table 8 about here)

Environmental Performance

To control for the issuing firm's environmental performance prior to issuing a green bond, we use two proxies: (i) an environmental controversies dummy variable indicating the issuer's involvement in incidents with negative environmental implications in the year prior to issuing a green bond, and (ii) a continuous variable based on the environmental score, where a higher score the corporate environmental profile in the year prior to the green bond issuance is better.

Table 9 reports results for the issuing companies' environmental performance. Columns 1 to 3 (4 to 6) show the coefficients based on the main model, augmented with the control variable *ENV_CONTROV* (*ENV_SCOR)*, which is the issuing company's negative environmental incidents in the year prior to issuing the green bond, and *ENV_SCOR*, which is the issuing company's environmental score in the year prior to issuing the green bond. The coefficients on *VER_FIRST* (*VERIFY* and *POST_VERIFY*) are positive and significant at $p<0.01$ ($p<0.05$) across these columns, while the coefficient on *VER_FIRST* is positive and significant at $p<0.05$ in Column 5, and the coefficient on *VERIFY* is positive and significant at $p<0.01$ in Column 6.

Compared to the main results, these additional tests, which control for the issuing firms' either negative (*ENV_CONTROV*) or positive (*ENV_SCOR*) environmental performance, yield coefficients that are consistent with the results discussed in section 3.2, as they suggest an association between the verification and post-verification of green bonds with

greater cumulative-abnormal returns holds in the model controlling for the corporate environmental profile in the year prior to issuing the bond.

(Table 9 about here)

Addressing Endogeneity Concerns

This study's empirical design may be subject to endogeneity if, for example, omitted variables affect the firm's choice to hire a third party to verify its green bonds issuance or the CARs. Self-selection bias related to the voluntary nature of the verification of green bonds may also be a concern. We conducted additional tests to address these endogeneity concerns.

First, in addressing the self-selection concern, we used propensity score matching (PSM) approach to estimate the probability that a firm will choose to verify its green bond. We used a probit model, employing a one-to-one non-replacement nearest-neighbour matching approach with a caliper of 0.03. Results for the matched sample of 486 observations are reported in Table 10's Panel A. Consistent with the main results for the entire sample, the coefficient on *VER_FIRST* (*VERIFY*) is positive and significant at $p<0.01$ ($p<0.05$) in Column(s) 1 (2 and 3).

Second, we conducted Heckman's two-stage analysis, where the first stage is based on the probit model shown in Eq. (4) to examine the determinants of a firm's voluntarily hiring an external verification provider:

$$VERIFY = \beta_0 + \beta_1 EPI_{c,t} + \beta_2 SIZE_{i,t-1} + \beta_3 ROA_{i,t-1} + \beta_4 TOBINQ_{i,t-1} + \beta_5 LEV_{i,t-1} + \beta_6 BOND\_LAW_{j,t} + \beta_7 REGULATION_{c,t} + YEAR\ FE + INDUSTRY\ FE \quad (4)$$

The dependent variable, *VERIFY*, is a dummy variable that is coded 1 if the bond issue is backed by an external verification report, and *EPI* is an environmental performance index at the country level. Consistent with Obeng, Ahmed, and Cahan (2021), we expect firms to experience a strong demand for environmental disclosure and transparency in countries that have good environmental profiles. However, the proxy for country-level environmental quality

is not related to the firm's returns. Therefore, EPI is likely to satisfy the exclusion restriction (Lennox, Francis and Wang 2012). The remaining variables are based on related literature (Green and Taylor 2013; Frias-Aceituno 2014; Zhou, Simnett and Green 2016). Table 10's Panel B reports the results for the first-stage model, where the coefficient on *EPI* of 0.035 is significant at $p<0.01$. This result confirms that firms incorporated in countries with high environmental quality are more likely to issue verification-backed green bonds than firms in other countries are. Table 10's Panel C presents the results for the second-stage model based on the regression shown in Eq. (3). The results show a positive coefficient on *VER_FIRST* that is significant at $p<0.01$. Consistent with the main results, the coefficient on *VERIFY* is positive and significant at $p<0.05$. The coefficient on *IMR* is positive and insignificant in Columns (1) and (2). However, Column (3) reports a positive coefficient on *IMR* of 0.0329, significant at $p<0.05$. The results from the main analysis hold for the models that address endogeneity issues.

(Table 10 about here)

IV. CONCLUSION

This study uses an international sample of public companies to examine market reaction to green bond issues. The results indicate that green bond issues that are accompanied by third-party verification reports attract a positive cumulative average return of 0.30 percent over a three-day event window. Consistent with the literature on signalling, we found evidence that firms that issue green bonds benefit by conveying a strong signal to the market about their commitments to using the bonds' proceeds in low-carbon, climate-friendly projects. We measured the market reaction to green bond issues that were accompanied by an external attestation of their alignment with the GBPs and found positive CARs for both the first green bond issue and subsequent ones. We found mixed evidence suggesting that investors value green-bond-issuing firms' commitment to providing post-issuance verification reports upon announcing the bond issuance to the market. We also explored whether a third-party

attestation report with an assurance statement increases the market reaction but found evidence only for green bonds that were issued in countries with no rules governing this market. This finding suggests that investors are unlikely to reward an assurance statement as part of the green bond verification report. Further tests reveal no evidence that event window returns decrease while controlling for run-up in the share price. In addition, evidence on the association between the verification and post-verification of green bonds with greater cumulative-abnormal returns holds regardless of the corporate environmental profile in the year prior to a bond's issuance.

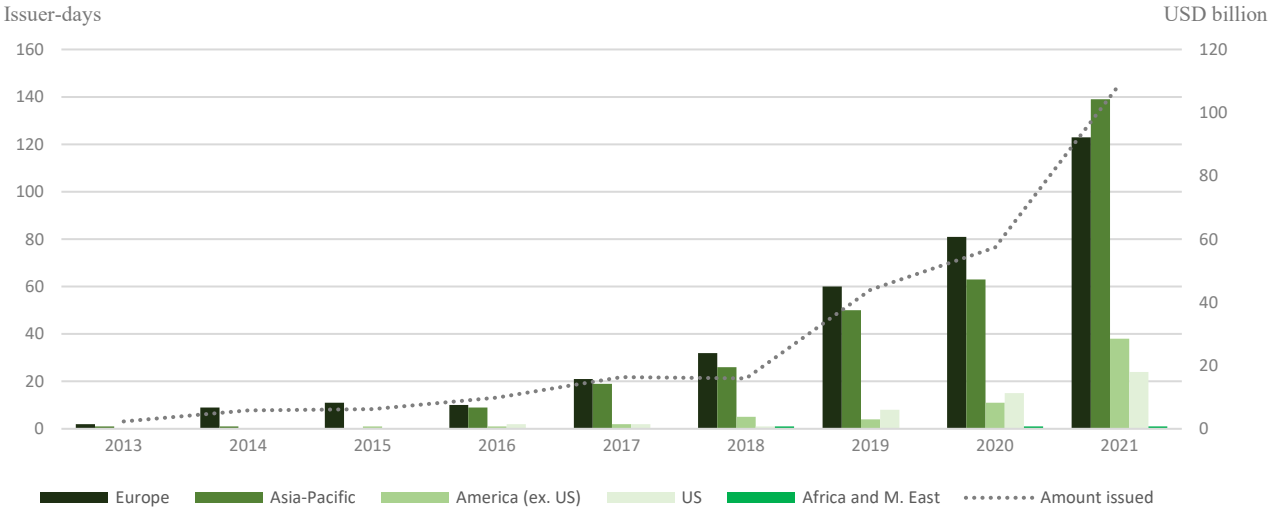
In terms of limitations, we acknowledge the varying degree at which issuing firms make their ESG-related reports available on their websites, including the availability of the green bond issuer's verification reports, which may bias our results. Another limitation is that efforts to mitigate the confounding effects from firm's contemporaneous events around issuing their green bond are limited to news about the issuer that is reported in English on Factiva and does not include news that was only disseminated in other languages or local press channels. Also, the lack of result on assurance might be due to power as only a small number of observations are assured.

Table 1 – Sample identification

Green bonds		5,681
(-) Non-corporate green bonds		-1,301
(=) Corporate green bonds		4,380
(-) Green bonds by private issuers		- 3,021
(=) Corporate green bonds by public firms		1,359
(-) Banking, funds and trusts		- 355
(-) Missing financial data		- 48
(=) Green bonds final sample		956
# Green bond issuer-days		774
Verified green bonds	*415*	
Non-verified green bonds	*359*	

This table reports details on the sample selection process. Green bonds are retrieved from Bloomberg's fixed income dataset comprising the period between 2013 and 2021. Bonds issued by supranational and governmental entities are excluded from the sample. Issuances by private firms, banking, funds and trusts are also removed. A further reduction in the sample is due to 48 observations with missing data at firm-level. 956 green bond issues result in 774 green bond issuer-days because one company can have multiple bond tranches on a day. Further breakdown of 774 green bond issuer-days shows that 415 (359) are classified as verified (non-verified).

Figure 1 – Issuance of green bonds per geographic region



This figure plots the green bonds issuer days, and the total issuance converted into USD per geographic region.

Table 2 – Panel A – Green bonds issuance per country

Country	Total issuance (USD billion)	Total issuance (%)
US	46.6	17%
France	46.3	17%
Germany	25.9	10%
South Korea	18.3	7%
Italy	14.6	5%
Cayman Islands	13.3	5%
China	13.0	5%
Japan	12.9	5%
Sweden	10.1	4%
UK	7.0	3%
Denmark	5.6	2%
Finland	5.4	2%
Portugal	5.2	2%
Canada	4.4	2%
Norway	4.2	2%
Chile	3.5	1%
Spain	3.2	1%
Austria	2.8	1%
Hong Kong	2.5	1%
Luxembourg	2.4	1%
Belgium	2.2	1%
Thailand	2.1	1%
Others	15.9	6%
Total	267.4	100%

This table shows the total amount of green bonds issuance in US dollars, and the number of issues by listed companies per jurisdiction.

Panel B – Verification of green bonds

	Entire sample			Verified			Non-verified		
Year	Freq.	Percent	Cum.	Freq.	Percent	Cum.	Freq.	Percent	Cum.
2013	3	0.39	0.39	0	-	-	3	0.84	0.84
2014	10	1.29	1.68	5	1.2	1.2	5	1.39	2.23
2015	12	1.55	3.23	3	0.72	1.93	9	2.51	4.74
2016	22	2.84	6.07	11	2.65	4.58	11	3.06	7.8
2017	44	5.68	11.76	19	4.58	9.16	25	6.96	14.76
2018	65	8.4	20.16	31	7.47	16.63	34	9.47	24.23
2019	122	15.76	35.92	84	20.24	36.87	38	10.58	34.82
2020	171	22.09	58.01	99	23.86	60.72	72	20.06	54.87
2021	325	41.99	100	163	39.28	100	162	45.13	100
Total	774	100	-	415	100	-	359	100	-

This table reports the distribution of green bonds for the entire sample, and the subsamples of verified and non-verified green bonds across the sample period 2013-2021.

Table 3 - Green bond issues by industry

Industry	Freq.	Percent	Cum.
Industrials	*435*	*56.2%*	
Utilities	186	24.0%	24.0%
Consumer Discretionary	58	7.5%	31.5%
Materials	42	5.4%	37.0%
Energy	30	3.9%	40.8%
Consumer Staples	21	2.7%	43.5%
Technology	21	2.7%	46.3%
Waste and environmental services	18	2.3%	48.6%
Communications	12	1.6%	50.1%
Others	47	6.1%	56.2%
Non-industrials	*339*	*43.8%*	
Real estate	320	41.3%	97.5%
Others	19	2.5%	100.0%
Total	774	100%	-

This table reports the number of green bonds issues based on the issuer's Bloomberg Industry Classification System code.

Table 4 – Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)VER_FIRST	1												
(2)VERIFY	**0.6808**	1											
(3)FIRST	**0.6905**	**0.2534**	1										
(4)POST_VERIFY	**0.1868**	**0.3016**	-0.0572	1									
(5)MATURITY	-0.0128	-0.0209	-0.0418	0.0689	1								
(6)ISSUE_SIZE	**0.1594**	**0.2105**	0.0869	**0.2059**	**0.1096**	1							
(7)COUPON	-0.0513	-0.0375	0.0087	**-0.1595**	-0.0376	0.0596	1						
(8)SIZE	-0.0113	0.0618	-0.09	**0.1230**	0.078	**0.5455**	**-0.0966**	1					
(9)ROA	0.0797	0.0764	0.0242	**0.1102**	0.0458	0.047	-0.0628	-0.0207	1				
(10)TOBINQ	0.0657	0.0447	0.0469	0.0483	0.0279	0.0816	0.0286	-0.0213	0.0228	1			
(11)LEV	**-0.1389**	**-0.1331**	**-0.1136**	**-0.1091**	-0.064	**-0.2661**	0.0022	**-0.3060**	**-0.1017**	0.0061	1		
(12)LNEWS	0.0684	**0.1195**	0.0176	**0.1640**	-0.0154	**0.5157**	0.069	**0.5070**	0.043	0.0273	**-0.2718**	1	
(13)ASSURANCE	**0.1035**	**0.1893**	0.0235	**0.1209**	-0.0079	-0.0304	0.0267	-0.0304	0.0492	-0.0102	-0.0371	0.0391	1

This table reports the Pearson correlation coefficients for the explanatory variables used in the main model. All continuous variables are winsorised at the 1% and 99% levels, and correlations significant at 1% are shown in bold.

Table 5 –Descriptive statistics for bond-, firm-, and verifier-level variables

Panel A: Continuous variables	Entire sample				Verified green bond issuer days (1)				Non-verified green bond issuer days (2)				Diff. in means	
	N	Mean	Median	SD	N	mean	p50	sd	N	mean	p50	sd	(1)-(2)	t-stat
ISSUE_SIZE	774	18.91	18.78	1.27	415	19.16	19.12	1.25	359	18.61	18.35	1.22	0.55	6.21***
MATURITY	755	7.39	5.12	8.08	408	8.12	5.51	8.83	347	6.53	5.00	7.01	1.59	0.38
COUPON	749	2.34	1.70	2.38	408	2.23	1.50	2.37	341	2.47	1.88	2.38	-0.24	-1.40
SIZE	774	22.95	22.82	1.51	415	23.08	22.97	1.61	359	22.80	22.70	1.38	0.27	2.54*
ROA	774	0.05	0.04	0.04	415	0.05	0.04	0.04	359	0.04	0.04	0.04	0.01	2.12**
TOBINQ	774	4.12	1.11	59.59	415	6.57	1.13	81.34	359	1.29	1.07	1.14	5.28	1.32
LEV	774	0.37	0.39	0.15	415	0.35	0.36	0.15	359	0.39	0.41	0.14	-0.04	-4.24***
ENV_SCORE	547	61.84	67.91	23.88	316	63.15	69.59	22.97	231	60.06	63.74	25.02	3.09	1.48
Panel B: Indicator variables:	N	Frequency	%		*N*	Frequency	%		*N*	Frequency	%		(1)-(2)	t-stat
FIXED_RATE	774	547	70.67		415	318	76.63		359	229	63.79		0.13	3.91***
CONTROV	774	75	9.69		415	42	10.12		359	33	9.19		0.02	0.44
POST_VERIFY	774	385	49.74		415	265	63.86		359	120	33.43		0.30	8.86***
VERIFY	774	415	53.62		415	415	100		-	-	-		-	-
ASSURANCE	774	32	4.13		415	29	7.71		-	-	-		-	-
ASSURANCE_BIG4	774	13	1.68		415	13	3.13		-	-	-		-	-
SAME_AUDITOR	774	7	0.90		415	7	1.68		-	-	-		-	-

Panel A reports descriptive statistics for bond- and firm-level variables of the entire sample, and the subsamples of verified and non-verified green bonds. *Issue_size* is the natural logarithm of the green bonds issue amount. *Maturity* is the maturity of green bonds in years. *Coupon* is the bond coupon rate. *Size* is the natural logarithm of issuer's total assets in US dollars in the year prior to the issuance of green bond. *ROA* is the issuer's ratio of operating income to the book value of total assets in the year prior to the issuance of green bond. *TobinQ* is the issuer's ratio of the market value of total assets to the book value of total assets in the year prior to the issuance of green bond. *Lev* is the issuer's leverage ratio of total debt to the book value of total assets in the year prior to the issuance of green bond. *Env_Score* is the issuer's environmental score in the year prior to the issuance of green bond. Continuous variables are winsorised at 1% and 99%. Panel B reports the descriptive statistics for the categorical variables, where *Fixed-rate* indicates if the bond has a fixed payment. *controv* indicates if the issuer is involved in incidents with negative environmental implications in the year prior to the issuance of green bond. *Post-verify* indicates if the company commits to report a post-issuance external verification of the use of green bonds proceeds. *Verify* indicates if the bond issue is accompanied by an external verification report.

Panel C: Participation of third parties in the verification of green bonds

Year	Criterion	Europe	Americas (inc. US)	Asia-Pacific	Africa & M.E.	Overall
2014	# of issues	V.E.	-	-	-	V.E.
	Dollar amount	V.E.	-	-	-	V.E.
2015	# of issues	Sustainalytics/DNV GL	Sustainalytics	-	-	Sustainalytics
	Dollar amount	Sustainalytics	Sustainalytics	-	-	Sustainalytics
2016	# of issues	Sustainalytics	Sustainalytics/CICERO	KPMG	-	Sustainalytics
	Dollar amount	DNV GL	Sustainalytics	KPMG	-	DNV GL
2017	# of issues	CICERO	Sustainalytics	Sustainalytics	-	Sustainalytics
	Dollar amount	CICERO	Sustainalytics	Sustainalytics	-	Sustainalytics
2018	# of issues	CICERO	CICERO	Sustainalytics	KPMG	CICERO/V.E.
	Dollar amount	V.E.	CICERO	V.E.	KPMG	V.E.
2019	# of issues	CICERO	Sustainalytics	Japan C. R. Agency Ltd	-	Sustainalytics
	Dollar amount	Sustainalytics	Sustainalytics	DNV GL	-	Sustainalytics
2020	# of issues	Sustainalytics	Sustainalytics	Sustainalytics	-	Sustainalytics
	Dollar amount	Sustainalytics	Sustainalytics	Sustainalytics	-	Sustainalytics
2021	# of issues	CICERO	Sustainalytics	Sustainalytics	Sustainalytics	Sustainalytics
	Dollar amount	Sustainalytics	Sustainalytics	Sustainalytics	Sustainalytics	Sustainalytics

This table reports the top green bond verification provider by year across geographical regions. *# of issues* ranks the third party verifiers based on the market share of the quantity of verified green bonds issues. *Dollar amount* ranks the external verifiers using the market share of the amount issued in verified green bonds.

Table 6 –Cumulative abnormal returns

	All				Verified (1)				Non-verified (2)				Difference in means	
Event window	No. of Firms	CAAR (%)	Median CAR (%)	t test	No. of Firms	CAAR (%)	Median CAR (%)	t test	No. of Firms	CAAR (%)	Median CAR (%)	t test	Diff. (1)-(2)	t-stat
[0,1]	729	0.06	0.03	1.09	387	0.17	0.09	1.24	342	-0.06	-0.04	0.25	0.2278	1.38*
[-1,0]	729	0.14	0.04	2.03**	387	0.22	0.12	2.41**	342	0.06	-0.04	0.38	0.1619	0.8500
[-1,1]	729	0.12	0.12	1.87*	387	0.30	0.36	2.77***	342	-0.09	-0.15	-0.17	0.3957	1.79**
[-20,-11]	729	-0.26	-0.24	-2.12**	387	-0.46	-0.17	-1.30	342	-0.03	-0.29	-1.7*	-0.4300	-1.12
[11,20]	729	-0.27	-0.38	-1.13	387	0.06	-0.13	-0.44	342	-0.64	-0.78	-1.21	0.7000	1.71**

This table reports the cumulative-average of market-model abnormal returns (CAAR) for the entire sample, and the subsamples of verified and non-verified green bonds, based on five event windows centred on the bond announcement date (day 0). The t-statistics reported for the cumulative average abnormal returns follow Boehmer et al (1991). One-tailed t-statistics are reported for the difference in means. *, ** and *** indicate significance at the 10 %, 5 % and 1 % levels, respectively.

Table 7 - Main results

VARIABLES	ENTIRE SAMPLE			NON-REGULATED COUNTRIES	
	(1)	(2)	(3)	(4)	(5)
VER_FIRST		0.545***		0.586***	
		(0.18)		(0.20)	
VERIFY		-0.055		-0.044	
		(0.10)		(0.12)	
FIRST		-0.425***		-0.459***	
		(0.15)		(0.17)	
ASSURANCE			0.269		0.423**
			(0.20)		(0.21)
POST_VERIFY		0.144*	0.203**	0.164*	0.216**
		(0.08)	(0.08)	(0.09)	(0.09)
MATURITY	-0.131***	-0.140***	-0.134***	-0.132***	-0.126***
	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
ISSUE_SIZE	-0.021	-0.070	-0.037	-0.122**	-0.085
	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
COUPON	0.067	0.096**	0.085*	0.111**	0.102*
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
SIZE	0.061	0.071	0.072	0.073	0.080
	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)
ROA	0.020	0.008	0.006	0.012	0.005
	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
TOBINQ	0.008	-0.003	0.003	-0.003	0.003
	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
LEV	0.062	0.078*	0.078	0.074	0.071
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
LNEWS	-0.004	-0.019	-0.020	0.016	0.006
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
CONSTANT	-0.021	-0.031	-0.135**	-0.049	-0.141**
	(0.04)	(0.09)	(0.06)	(0.10)	(0.06)
YEAR FE	Yes	Yes	Yes	Yes	Yes
INDUSTRY FE	Yes	Yes	Yes	Yes	Yes
OBSERVATIONS	668	668	668	593	593
ADJ. R-SQUARED	0.006	0.035	0.015	0.038	0.019

This table presents the estimated coefficients from the regression of the three-day cumulative market-adjusted return CAR(-1,1) for the pooled sample of green bond issues. Column (1) shows the coefficients for the baseline model while Columns (2) and (3) perform hypothesis testing. Tests for the subsample of non-regulated are reported in Columns (4) and (5), where green bonds issues from the following jurisdictions are excluded: China, Hong Kong, India, and Singapore. *VER_FIRST* reports the interaction between first-time issuer (*FIRST*) and verification, *VERIFY* indicates if the bond issue is accompanied by an external verification report, *ASSURANCE* indicates if the green bond verification report has an assurance provision, *POST-VERIFY* indicates if the company commits to report a post-issuance external verification of the use of green bonds proceeds, *Issue_size* is the natural logarithm of the green bonds issue amount, *MATURITY* is the maturity of green bonds in years, *COUPON* is the bond coupon rate, *SIZE* is the natural logarithm of issuer's total assets in US dollars in the year prior to the issuance of green bond, *ROA* is the issuer's ratio of operating income to the book value of total assets in the year prior to the issuance of green bond, *TOBINQ* is the issuer's ratio of the market value of total assets to the book value of total assets in the year prior to the issuance of green bond, *LEV* is the issuer's leverage ratio of total debt to the book value of total assets in the year prior to the issuance of green bond, and *LNEWS* is the natural logarithm of the count of news. Continuous variables are winsorised at 1% and 99%. Standard errors clustered by firms are reported in parentheses. *, ** and *** indicate significance at the 10 %, 5 % and 1 % levels, respectively.

Table 8 - Further tests - Run-up controls

	ENTIRE SAMPLE		NON-REGULATED COUNTRIES		ENTIRE SAMPLE		NON-REGULATED COUNTRIES		ENTIRE SAMPLE		NON-REGULATED COUNTRIES	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VER_FIRST	0.541***		0.584***		0.563***		0.597***		0.559***		0.595***	
	(0.18)		(0.20)		(0.18)		(0.20)		(0.18)		(0.20)	
VERIFY	-0.052		-0.044		-0.072		-0.058		-0.070		-0.057	
	(0.10)		(0.12)		(0.11)		(0.12)		(0.11)		(0.12)	
FIRST	-0.423***		-0.460***		-0.437***		-0.468***		-0.437***		-0.467***	
	(0.15)		(0.17)		(0.15)		(0.17)		(0.15)		(0.17)	
ASSURANCE		0.254		0.421**		0.263		0.427**		0.254		0.423**
		(0.20)		(0.21)		(0.20)		(0.21)		(0.20)		(0.21)
POST_VERIFY	0.142*	0.202**	0.165*	0.217**	0.134	0.193**	0.158*	0.208**	0.135	0.195**	0.158*	0.208**
	(0.08)	(0.08)	(0.09)	(0.09)	(0.08)	(0.08)	(0.09)	(0.09)	(0.08)	(0.08)	(0.09)	(0.09)
MATURITY	-0.136***	-0.131***	-0.133***	-0.126***	-0.134***	-0.128***	-0.131***	-0.124***	-0.133***	-0.127***	-0.131***	-0.123***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
ISSUE_SIZE	-0.075	-0.042	-0.117**	-0.083	-0.074	-0.043	-0.117**	-0.083	-0.073	-0.042	-0.117**	-0.083
	(0.05)	(0.05)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.06)	(0.06)
COUPON	0.094**	0.084*	0.112**	0.103**	0.101**	0.089*	0.117**	0.107**	0.101**	0.090*	0.117**	0.107**
	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)
SIZE	0.062	0.062	0.077	0.081	0.069	0.070	0.083	0.087	0.066	0.067	0.082	0.086
	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
ROA	0.009	0.007	0.013	0.006	0.007	0.005	0.012	0.004	0.008	0.006	0.012	0.005
	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
TOBINQ	-0.003	0.002	-0.003	0.003	-0.004	0.002	-0.004	0.002	-0.004	0.001	-0.004	0.002
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
LEV	0.076	0.075	0.072	0.069	0.077*	0.077	0.073	0.070	0.074	0.074	0.071	0.069
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
CAR (-20,-11)	0.025	0.024	0.017	0.014					0.024	0.023	0.015	0.011
	(0.05)	(0.05)	(0.06)	(0.06)					(0.05)	(0.05)	(0.06)	(0.06)
CAR (11, 20)					0.067	0.063	0.051	0.052	0.067	0.062	0.051	0.051
					(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.06)	(0.06)
CONSTANT	-0.030	-0.132**	-0.050	-0.142**	-0.015	-0.128**	-0.037	-0.136**	-0.015	-0.128**	-0.037	-0.136**
	(0.09)	(0.06)	(0.10)	(0.06)	(0.09)	(0.06)	(0.10)	(0.06)	(0.09)	(0.06)	(0.10)	(0.06)
YEAR FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OBSERVATIONS	668	668	593	593	668	668	593	593	668	668	593	593
ADJ.R-SQUARED	0.035	0.015	0.038	0.019	0.039	0.019	0.041	0.021	0.038	0.018	0.039	0.020

This table presents the estimated coefficients from the regression of the three-day cumulative market-adjusted return CAR(-1,1) for the entire pooled sample of green bond issues controlling for the runup in the share price. Columns (1) and (2) present the coefficients for the main model augmented with a pre-event run-up control CAR(-20,-11). Columns (3) and (4) present the coefficients for the main models augmented with a post-event run-up control CAR (11, 20). Columns (7) to (9) present the coefficients for the main models augmented with both pre- and post-event run-up controls based on CAR(-20,-11) and CAR (11, 20). Columns (10) to (12) present the coefficients for the subsample restricted to countries without rules governing the issuance of green bonds (all countries except China, Hong Kong, India, and Singapore) with each (both) aforementioned run-up control. *VER_FIRST* reports the interaction between first-time issuer *FIRST* and verification, *VERIFY* indicates if the bond issue is accompanied by an external verification report, *ASSURANCE* indicates if the green bond verification report has an assurance provision, *POST-VERIFY* indicates if the company commits to report a post-issuance external verification of the use of green bonds proceeds, *ISSUE_SIZE* is the natural logarithm of the green bonds issue amount, *MATURITY* is the maturity of green bonds in years, *COUPON* is the bond coupon rate, *SIZE* is the natural logarithm of issuer's total assets in US dollars in the year prior to the issuance of green bond, *ROA* is the issuer's ratio of operating income to the book value of total assets in the year prior to the issuance of green bond, *TOBINQ* is the issuer's ratio of the market value of total assets to the book value of total assets in the year prior to the issuance of green bond, *LEV* is the issuer's leverage ratio of total debt to the book value of total assets in the year prior to the issuance of green bond. Continuous variables are winsorised at 1% and 99%. Standard errors clustered by firms are reported in parentheses. *, ** and *** indicate significance at the 10 %, 5 % and 1 % levels, respectively.

Table 9 - Further tests – Pre green bond issuance environmental performance

	ENTIRE SAMPLE		NON-REGULATED COUNTRIES		ENTIRE SAMPLE		NON-REGULATED COUNTRIES	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VER_FIRST	0.540***		0.582***		0.483**		0.548**	
	(0.18)		(0.20)		(0.22)		(0.24)	
VERIFY	-0.056		-0.047		-0.004		0.030	
	(0.10)		(0.12)		(0.12)		(0.14)	
FIRST	-0.424***		-0.458***		-0.309		-0.399*	
	(0.15)		(0.17)		(0.19)		(0.22)	
ASSURANCE		0.258		0.410**		0.336		0.439**
		(0.20)		(0.21)		(0.21)		(0.21)
POST_VERIFY	0.147*	0.207**	0.166*	0.219**	0.211**	0.267***	0.255**	0.322***
	(0.08)	(0.08)	(0.09)	(0.09)	(0.09)	(0.10)	(0.10)	(0.10)
MATURITY	-0.136***	-0.130***	-0.128***	-0.122***	-0.143***	-0.144***	-0.133***	-0.134***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
ISSUE_SIZE	-0.066	-0.032	-0.117**	-0.080	-0.118*	-0.066	-0.195***	-0.142**
	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)
COUPON	0.094*	0.083*	0.109**	0.099*	0.027	0.016	0.028	0.017
	(0.05)	(0.05)	(0.05)	(0.05)	(0.09)	(0.09)	(0.10)	(0.09)
SIZE	0.069	0.070	0.071	0.078	0.074	0.066	0.062	0.065
	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)
ROA	0.009	0.007	0.013	0.006	0.028	0.022	0.018	0.010
	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)	(0.06)
TOBINQ	-0.003	0.002	-0.003	0.003	-0.008	-0.002	-0.007	-0.002
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
LEV	0.079*	0.078	0.075	0.072	0.113**	0.106**	0.105**	0.094*
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
LNEWS	-0.012	-0.011	0.024	0.016	0.020	0.005	0.066	0.043
	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
ENV_CONTROV	-0.077	-0.103	-0.088	-0.106				
	(0.15)	(0.16)	(0.15)	(0.16)				
ENV_SCOR					0.072	0.079	0.089	0.099
					(0.06)	(0.06)	(0.07)	(0.06)
CONSTANT	-0.023	-0.125**	-0.038	-0.131**	-0.171	-0.214***	-0.193	-0.246***
	(0.09)	(0.06)	(0.10)	(0.06)	(0.12)	(0.08)	(0.14)	(0.09)
YEAR FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OBSERVATIONS	668	668	593	593	475	475	430	430
ADJ. R-SQUARED	0.034	0.014	0.037	0.018	0.042	0.031	0.070	0.054

This table presents the estimated coefficients from the regression of the three-day cumulative market-adjusted return CAR(-1,1) for the entire pooled sample of green bond issues based on the main models augmented with either of the following environmental performance control: (i) *ENV_CONTROV* is a dummy variable indicating the issuer involvement with incidents with negative environmental implications in the year prior to the issuance of green bond (Columns 1 through 4), and (ii) *ENV_SCOR* is a continuous variable based on the environmental score (Columns 5 through 8). The subsample of non-regulated countries excludes green bonds issues from the following jurisdictions: China, Hong Kong, India, and Singapore *VER_FIRST* reports the interaction between first-time issuer *FIRST* and verification, *VERIFY* indicates if the bond issue is accompanied by an external verification report, *ASSURANCE* indicates if the green bond verification report has an assurance provision, *POST_VERIFY* indicates if the company commits to report a post-issuance external verification of the use of green bonds proceeds, *ISSUE_SIZE* is the natural logarithm of the green bonds issue amount, *MATURITY* is the maturity of green bonds in years, *COUPON* is the bond coupon rate, *SIZE* is the natural logarithm of issuer's total assets in US dollars in the year prior to the issuance of green bond, *ROA* is the issuer's ratio of operating income to the book value of total assets in the year prior to the issuance of green bond, *TOBINQ* is the issuer's ratio of the market value of total assets to the book value of total assets in the year prior to the issuance of green bond, *LEV* is the issuer's leverage ratio of total debt to the book value of total assets in the year prior to the issuance of green bond. Continuous variables are winsorised at 1% and 99%. Standard errors clustered by firms are reported in parentheses. *, ** and *** indicate significance at the 10 %, 5 % and 1 % levels, respectively.

Table 10 – Endogeneity issues

PANEL A: OLS models based on matched samples	(1)
VER_FIRST	0.757***
	(0.20)
VERIFY	-0.135
	(0.12)
FIRST	-0.531***
	(0.17)
POST_VERIFY	0.084
	(0.10)
CONTROLS/CONSTANT	Yes
YEAR FE	Yes
INDUSTRY FE	Yes
OBSERVATIONS	486
ADJ. R-SQUARED	0.046
Panel B: First-stage probit model	DV=Verify
EPI	0.033***
	(0.01)
SIZE	0.038
	(0.07)
ROA	0.011
	(0.10)
TOBINQ	4.514
	(4.96)
LEV	-0.144**
	(0.07)
REGULATED	0.099
	(0.14)
CONSTANT	-1.053
	(0.75)
YEAR FE	Yes
INDUSTRY FE	Yes
OBSERVATIONS	618
PSEUDO-RSQUARED	0.110

PANEL C: Second-stage OLS model	(1)	(2)
VER_FIRST	0.551***	
	(0.18)	
VERIFY	-0.044	
	(0.11)	
FIRST	-0.427***	
	(0.15)	
ASSURANCE		0.264
		(0.20)
POST_VERIFY	0.151*	0.208**
	(0.08)	(0.09)
IMR	0.110	-0.003
	(0.20)	(0.19)
CONTROLS/CONSTANT	Yes	Yes

YEAR FE	Yes	Yes
INDUSTRY FE	Yes	Yes
OBSERVATIONS	663	663
ADJ. R-SQUARED	0.037	0.016

Panel A presents results for the OLS models based on matched samples using PSM-Propensity Score Matching. Panels B, and C report the Heckman two-stage tests. Panel B reports the first stage, where the dependent variable is *VERIFY*. Panel C reports the second-stage for the OLS model augmented with the independent variable *IMR*, inversed Mills ratio calculated in the first stage model. See Appendix B for variable definitions. Continuous variables are winsorised at 1% and 99%. Standard errors clustered by firms are reported in parentheses. *, ** and *** indicate significance at the 10 %, 5 % and 1 % levels, respectively.

Appendix A – Example of a verification report with an assurance statement

Assurance conclusion

Based on our limited assurance procedures, as described in this statement as of 22 July 2021, nothing came to our attention that caused us to believe that the following outstanding Green Bonds ('the Bonds or "the Green Bonds"') issued by Precinct Properties Limited ("Precinct"):

- PCT 17/12/21 Precinct Properties New Zealand Ltd Bonds (PT010)
- PCT 27/11/2024 Precinct Properties New Zealand Limited Bonds (PT020)
- PCT 28/05/2027 Precinct Properties New Zealand Limited Bonds (PT030)

have not been presented, in all material respects, fairly and in accordance with the International Capital Market Association ("ICMA") Green Bond Principles (June 2021) and Precinct's Sustainable Debt Framework ("Criteria").

Other Matters

We draw attention to the use of external property valuations to determine whether the value of the total project pool exceeds the combined value of Precinct's Green Bonds. Some of these external property valuations have been prepared as at 30 June 2021 and contain paragraphs explaining the valuations have been concluded on the basis of elevated market risk due to the impact of the COVID-19 pandemic on the property market, indicating that less certainty and a higher degree of caution should be attached to the valuation than would normally be the case. Our opinion is not modified in respect of this matter.

Scope

Ernst & Young ('EY', 'we') was engaged by Precinct to undertake a limited assurance engagement, as of 3 June 2021, in relation to the subject matter and criteria detailed below.

Subject Matter and Criteria

The subject matter and associated criteria for this limited assurance engagement are set out in the table below.

Subject Matter	Criteria
The subject matter for this limited assurance engagement includes: ▸ The Precinct Green Bond Framework and its stated policies and procedures related to the selection of eligible projects and assets, use and management of proceeds, and reporting. ▸ Annual Green Bond Report and Eligible Assets Register containing disclosures of environmental performance and information relating to nominated projects and values of assets funded by the Bond.	1. The ICMA Green Bond Principles (June 2021) requirements on: ▸ Use of Proceeds ▸ Process for Project Evaluation and Selection ▸ Management of Proceeds ▸ Reporting. Criteria found at: The ICMA Green Bond Principles 2021[1]. 2. Precinct's internal policies and procedures, as documented in the Precinct Green Bond Framework.
Technical details of the assets identified as 'green' ('Green Assets')	3. Use of Proceeds and Eligibility Criteria from Precinct's Sustainable Debt Framework that eligible assets are office, industrial or retail buildings (including upgrades) that meet the following criteria: ▸ Certified as obtaining or targeting a minimum 5-Star NZGBC Green Star Built rating; or ▸ Certified as obtaining or targeting a minimum 4-Star NABERSNZ Energy Base Building Rating or Energy Whole Building Rating.

[1] https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Green-Bond-Principles-June-2021-140621.pdf

Building a better working world

Management Responsibility

The management of Precinct is responsible for the preparation and fair presentation of the Subject Matter. This responsibility includes establishing and maintaining internal controls relevant to the preparation and presentation of the Subject Matter that is free from material misstatement, whether due to fraud or error, selecting and applying appropriate accounting policies; and making estimates that are reasonable in the circumstances.

Assurance Practitioner's Responsibility

Our responsibility is to express a conclusion on whether anything has come to our attention that causes us to believe that the Subject Matter, has not been presented, in all material respects, fairly and in accordance with the criteria detailed above. Our assurance engagement has been planned and performed in accordance with the International Standard on Assurance Engagements (New Zealand) 3000: *Assurance Engagements Other than Audits or Reviews of Historical Financial Information* ('ISAE (NZ) 3000').

Level of Assurance

Procedures performed in a limited assurance engagement vary in nature and timing from, and are less in extent than for, a reasonable assurance engagement. Consequently, the level of assurance obtained in a limited assurance engagement is substantially lower than the assurance that would have been obtained had a reasonable assurance engagement been performed. While we considered the effectiveness of management's internal controls when determining the nature and extent of our procedures, our assurance engagement was not designed to provide assurance on internal controls. Our procedures did not include testing controls or performing procedures relating to checking aggregation or calculation of data within IT systems.

Our Approach

Our assurance procedures performed included, but were not limited to:

- Reviewing whether the policies and procedures established by Precinct related to the post issuance of the Green Bonds to assess whether they were aligned to the requirements of the Green Bond Principles 2021
- Confirming the eligibility of assets for inclusion in Precinct's Green Bonds use of proceeds pool against Precinct's Sustainable Debt Framework
- Interviewing selected business units and group level personnel to understand key issues related to Precinct's relevant policies and procedures
- Checking the accuracy of asset valuations against independent valuations as of 30 June 2021
- Requesting documentation supporting assertions made in the Subject Matter
- Seeking management representation on key assertions.

Limitations

There are inherent limitations in performing assurance - for example, assurance engagements are based on selective testing of the information being examined - and it is possible that fraud, error, or non-compliance may occur and not be detected. There are additional inherent risks associated with assurance over non-financial information including reporting against standards which require information to be assured against source data compiled using definitions and estimation methods that are developed by the reporting entity. Finally, adherence to ISAE (NZ) 3000 and the Green Bond Principles 2021 is subjective and will be interpreted differently by different stakeholder groups.

Our assurance was limited to Precinct's Green Bonds and did not include statutory financial statements. Our assurance is limited to policies and procedures in place as of 22 July 2021. Ernst & Young provides statutory audit services and other assurance services to Precinct. We provide an agreed upon procedures engagement recalculating the performance fee paid or payable to Precinct's manager. Ernst & Young and Precinct have entered an agreement in respect of our proposed occupancy of a Precinct property. Partners and employees may deal with Precinct on normal terms within the ordinary course of trading activities of the business of Precinct. We have no other relationship with, or interest in, Precinct.

Use of Report

Our responsibility in performing our assurance activities is to the Directors and Management of Precinct only and in accordance with the terms of reference for this engagement as agreed with them. We do not therefore accept or assume any responsibility for any other purpose or to any other person or organisation. Any reliance any such third party may place on Precinct's Green Bonds is entirely at its own risk. No statement is made as to whether the criteria are appropriate for any third-party purpose.

Our Independence and Assurance Team

In accordance with APES 110 *Code of Ethics for Assurance Practitioners*, the firm and all professional personnel involved in this engagement have met the independence requirements of New Zealand or International professional ethical requirements. Our team has the required competencies and experience for this assurance engagement.

Building a better working world

Observations on particular aspects of our engagement:

We provide selected observations aligning to the Green Bond Principles 2021 core components, to provide the reader with further understanding on how these Green Bonds meets the Criteria. These observations are not intended to detract from our conclusion provided above.

Use of Proceeds:

- Proceeds from the Green Bonds are intended to be used for financing and re-financing purposes.
- Proceeds are intended to be allocated to office, industrial and retail buildings (including upgrades) owned or undertaken by Precinct that have, or are targeting, a minimum of a 5-Star New Zealand Green Building Council (NZGBC) Green Star Built rating and/or a 4-Star NABERSNZ Energy Base Building Rating or Energy Whole Building Rating.
- Any building that fails to meet the Eligibility Criteria set out in the Sustainable Debt Framework or loses its rating during the tenor of the bond will no longer be categorised as an Eligible Asset and the total value of the Eligible Projects will be reduced by the value of the removed asset.
- The NZGBC Green Star rating (Green Star NZ) is an internationally recognised standard developed for New Zealand. Green Star NZ is aligned with the other major international building rating tools, including the British BREEAM (Building Research Establishment Environmental Assessment Method) system and the North American LEED (Leadership in Energy and Environmental Design) system. Green Star NZ assesses the overall environmental impact of a building covering the following categories: Energy, Water, Materials, Indoor Environment Quality, Transport, Land Use & Ecology, Management, Emissions, and Innovation. It rates buildings from 0 to 6 Stars. Buildings that achieve a 4, 5, or 6 Star rating receive Green Star certification.
- NABERSNZ rating is adapted from the National Australian Building Environment Rating System (NABERS) and is a national rating tool for commercial buildings administered by NZGBC. NABERSNZ rates the actual environmental operational performance of office buildings across Energy, Water, Waste and Indoor Environment. It rates buildings from 0 to 6 Stars. Buildings that achieve a 4, 5, or 6 Star rating are assessed as having excellent performance, market leading performance and aspirational performance respectively.
- The use of proceeds of these Bonds aligns with the Green Bond Principles 2021 project category "green buildings which meet regional, national or internationally recognised standards and certifications".

Process for Project Evaluation and Selection

- Precinct has developed a Sustainable Debt Framework that outlines the environmental objectives of Green Bonds, eligibility criteria for determining Green Assets and the process for project selection and evaluation. The list of Precinct's eligible Green Assets tested is included in Annex A.

Management of Proceeds

- Precinct has set-up an internal Working Group for sustainable debt to oversee the governance of Green Bonds
- Precinct has implemented processes to manage proceeds received from Green Bonds and to monitor the on-going use of proceeds. These processes include:
  - A tracking process through existing internal reporting systems to allocate funds received to Green Assets
  - A process for deploying any unallocated proceeds to temporary cash equivalent investments
  - An annual process for monitoring the on-going use of proceeds
- Precinct will obtain on-going assurance over the Green Bond portfolio to confirm that the Green Assets continue to meet the Green Bond Principles 2021 and the requirements as set out in the Sustainable Debt Framework.

Reporting

- Precinct will report on the use of proceeds of Green Bonds at least on an annual basis that will include a list of Green Assets, the amount allocated to each Green Asset and the Green Star rating and/or NABERSNZ rating of each Green Asset.

Ernst & Young Limited

Graeme Bennett
EY Assurance Partner
22 July 2021

Appendix B – Variable definitions

Variable	Definition
ASSURANCE	A dummy variable that takes a value of 1 if the green bond verification report has an assurance provision.
CAR	Cumulative market-adjusted return.
CONTROV	Environmental controversies dummy variable that takes a value of 1 if the green bond issuer is involved in incidents with negative environmental implications in the year prior to the issuance of green bond.
COUPON	Green bond coupon rate.
ENV_SCORE	Green bond issuer's environmental score in the year prior to the issuance of green bond. Continuous variables are winsorised at 1% and 99%.
EPI	Environmental performance index at a country level.
FIRST	A dummy variable that takes a value of 1 if the green bond issuing firm is launching its first green bond.
ISSUE_SIZE	Natural logarithm of the green bond issue amount.
LEV	Green bond issuer's leverage ratio of total debt to the book value of total assets in the year prior to the issuance of green bond.
LNEWS	Natural logarithm of the number of news articles relating to the issuing company around the event date.
MATURITY	Maturity of the green bond in years.
REGULATION	A dummy variable that takes a value of 1 if the green bond issuer is based on one of the following jurisdictions: China, Hong Kong, India, or Singapore.
ROA	Green bond issuer's ratio of operating income to the book value of total assets in the year prior to the issuance of green bond.
SIZE	Natural logarithm of issuer's total assets in US dollars in the year prior to the issuance of green bond.
POST_VERIFY	A dummy variable that takes a value of 1 if the company commits to report a post-issuance external verification of the use of green bonds proceeds.
TOBINQ	Green bond issuer's ratio of the market value of total assets to the book value of total assets in the year prior to the issuance of green bond.
VERIFY	A dummy variable that takes a value of 1 if the bond issue is accompanied by an external verification report.
VERIFY_FIRST	The interaction term between *VERIFY* and *FIRST*.

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