

External Reviews and Green Bond Credibility

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Abstract: In an effort to alleviate greenwashing concerns, firms are increasingly commissioning voluntary external reviews and certifications of their green bond issues. This paper examines the role of external parties in reducing information asymmetry in the green bond market and the ensuing effects on green bond pricing. Initial evidence does not suggest that external reviews, on average, provide issuers with at-issue funding cost reductions. In subsequent analyses, we find that external reviews reduce at-issue costs for green issuers domiciled in common law countries, including the United States. Specifically, these issuers benefit from a 0.5 percentage point lower greenium (i.e., the difference between the yield on a green bond and the yield on a similar conventional bond). Funding costs are lowest when issuers obtain external reviews from audit firms or rating agencies. Overall, our results suggest that the pricing implications of green bond external reviews depend crucially on both the location of the green issuer and the reputation of the external reviewer.

Keywords: Green Bonds, Sustainable Investing, Information Intermediaries

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Introduction

Green bonds have grown dramatically in the past few years, with a record amount of \$270 billion issued in 2020, according to the Climate Bonds Initiative (CBI).¹ Accompanying this growing demand for sustainable investments are rising concerns about the credibility of green bonds as successful tools to mitigate climate change. Some question whether green bonds are “really green” (Milhench, 2017), while others alert that “as green bonds boom, so do greenwashing worries” (Pronina and Freke, 2019).

To address green credibility concerns, green bond issuers are increasingly commissioning third parties to provide independent reviews of their green credentials. The market for these green reviews and certification schemes is booming. In 2019, over 480 green bonds issued by companies and governments were accompanied by some form of external review or assurance (Mutua, 2019), representing about 80% of green debt sold. External reviews are a market-based solution that reduce information asymmetries between issuers and investors, based on independent third-party evaluations of the compliance to green bond principles (Fatica et al., 2020). They can take multiple forms, including second-party opinions (SPOs), third-party assurances, and ratings (Ehlers and Packer, 2017). Although they are recommended by the Green Bond Principles, external reviews are voluntary. Issuers considering an external review for their green bonds face a trade-off between the cost of additional reporting versus the potential gains in terms of green reputation, better financing conditions, and access to sustainable investors.² However, the market for external reviews is both complex and opaque. The multitude of reviews available, coupled with a lack of transparency on the methodologies used, make it difficult for investors to differentiate between external reviewers, and it remains unclear to what extent issuers benefit from these reviews.

In this study, we examine the role of external parties in reducing information asymmetry in green bond markets and the subsequent effects on the at-issuance pricing of green bonds. In particular, we analyze the role of rating agencies, audit firms, and independent reviewers in establishing the credibility of green bonds as sustainable investments, as well as the importance of the legal and regulatory framework of the country of

¹Green bonds aim at funding green projects that have a positive environmental or climate benefit (Baker et al., 2018; Flammer, 2021). Whereas traditional bonds are used to raise capital for general purposes based on the risk profile of the issuer and specified returns, green bonds' proceeds are required to be earmarked for green projects generally relating to renewable energy, green buildings, or resource conservation. However, there is no single definition of what makes a bond “green”. Although green bonds may adhere to general guidelines such as the Green Bond Principles (GBP), many issuers self-label their bonds without procuring any form of external validation or verification.

²The CBI charges 1/10th of a basis point of the size of the bond for pre-issuance certification, and the cost charged by verifiers varies, ranging between \$10,000 and \$150,000 (Chaudhary, 2020).

issuance. We focus on corporate green bond issuers who represent over 44% of the green bond market (CBI, 2019) and are also the most exposed to greenwashing concerns (Kapraun and Scheins, 2019).³

If investors are willing to pay higher prices for green bonds compared to their brown bond equivalents due to preferences for green investments (Baker et al., 2018), then this green premium should be increasing in the quality or credibility of the green bonds. External reviewers play a role as information intermediaries in green bond markets by certifying the quality of green bonds. To the extent that these external review services increase the credibility of green bonds, i.e., signal higher quality environmental investments and outcomes, sustainable investors may prefer externally reviewed green bonds and be willing to accept lower yields for them than their non-externally reviewed green bond counterparts. On the other hand, the absence of standardization and transparency in the nascent market for green assurance may make it difficult for investors to differentiate between different reviewers. Therefore, ex-ante it is not clear whether the voluntary use of external reviews allows green bond issuers to benefit from lower at-issue yields. Furthermore, we also expect legal origin to play a role in establishing green credibility. Differences in corporate social responsibility (CSR) practices across countries can be explained by a country's legal origin Liang and Renneboog (2017). Whereas common law origin is a more shareholder-oriented system that supports private market outcomes, civil law origin is associated with a stakeholder view and widespread state intervention in economic life (La Porta et al., 1999, 2008). We predict that green bond issuers domiciled in common law countries will benefit the most from external reviews, as they are less credible green issuers. Finally, we argue that the quality and reputation of reviewers may affect green issuers' credibility. In particular, we expect that external reviews from Big Four auditing firms, which are the most visible in the sustainability assurance market (Verdantix, 2013), will provide green bond issuers with larger at-issue cost reductions.

We begin our empirical analysis by providing a comprehensive overview of the parties involved in the external review and certification process. We construct a sample of 1,242 corporate green bonds issued between January 2013 and December 2020, that are both in Bloomberg and the Climate Bonds Initiative, and for which we have information on the external review type chosen by the issuer. On average, 72% of corporate green bond issuers commission an external review and 8% obtain a certification from CBI. The market is dominated by second-party opinions (57%) provided by sustainability experts such as Sustainalytics, Vigeo

³Besides reputational risks, potential violations of green commitments create a legal risk relating to allegations of the mis-selling of financial products (Shishlov et al., 2018).

Eiris, ISS-Oekom and Cicero, especially in recent years (Figure 3). Rating agencies such as Moody's and S&P account for 10% of the review market, followed by assurances provided by audit companies such as Deloitte and Ernst & Young (8.3%). Furthermore, we observe that firms domiciled in civil law countries (53%) tend to commission more external reviews than firms domiciled in common law countries (37%).

To examine the consequences of choosing certain types of intermediaries relative to others, and whether the reputation of these parties impacts green bond credibility, we compare the at-issue pricing implications of issuing green bonds with and without external reviews. To control for differences in credit risk among issuers, our research design compares green bonds by their green premium, i.e., the difference between the yield on a green bond compared with a similar conventional bond. To do this, we construct a matched sample of 817 corporate green bonds. Each green bond is first matched with a conventional bond with the same issuer, maturity type and coupon type. Nearest neighbor matching is then conducted using the Mahalanobis distance computed based on the amount issued, coupon, maturity and number of days between the two issues (Flammer, 2021). On average, green bonds are issued at a premium of 10 basis points (i.e., at a lower yield). However, we cannot reject the null hypothesis that average green yields (2.24%) are equal to average conventional yields (2.34%), which is consistent with the findings of Flammer (2021).⁴

On average, we find no evidence that external reviews significantly affect the green bond premium, irrespective of the choice of external review type (SPOs, assurance, rating) or CBI certification. However, we predict and find that external reviews impact at-issue bond prices for issuers domiciled in common law countries, including the United States, which are *a priori* less credible green issuers. On average, green bond issuers from common law countries reduce their greenium by 0.5 percentage points when they commission an external review. Furthermore, we find that green bond assurance providers, especially those provided by Big Four auditing firms, and external reviews by rating agencies, significantly reduce the cost of green bonds relative to non-externally reviewed green bonds. These benefits disappear for green issuers domiciled in civil law countries, even though they dominate the external review market. Our results are robust to different matching methodologies, and inverse probability weighing which controls for potential confounding factors that affect both the choice of getting an external review and the price of a green bond. In particular, we model the probability of getting a review using a logit regression controlling for firm-level characteristics,

⁴Focusing on a sample of 152 corporate bonds, Flammer (2021) finds a statistically insignificant greenium of 2 basis points.

and country-level factors including regulatory quality and environmental performance, and find consistent evidence.

This study adds to the nascent literature on the pricing of green bonds. Prior studies find mixed evidence supporting the existence of a green premium (e.g., [Karpf and Mandel, 2017](#); [Zerbib, 2019](#); [Bachelet et al., 2019](#); [Baker et al., 2018](#); [Larcker and Watts, 2020](#); [Flammer, 2021](#)). Focusing on a large sample of corporate green bonds, we find that green bonds are issued at a premium of 10 basis points, although it is not significantly different from zero. In addition, some studies have found that external reviews and certification play a role in establishing the credibility of green bonds and that investors are willing to pay a premium for these bonds, but evidence is limited. [Bachelet et al. \(2019\)](#) argue that external reviews are essential to reducing informational asymmetries, avoid suspicion of greenwashing, and improving financing conditions. [Kapraun and Scheins \(2019\)](#) document that investors are more willing to pay a premium when bonds are certified by a third party or listed on a green exchange. Contrary to these studies, we focus our attention on corporates and find that independent reviews alleviate greenwashing concerns for issuers domiciled in common law countries. Our study suggests that the pricing implications of green bond certification and reviews depend crucially on both the reputation of the external reviewer, and the location of the issuer, from which investors may infer the credibility of the green bonds. We also shed light on the role of the various types of external reviewers in this rapidly growing market.

More recently, [Dorfleitner et al. \(2020\)](#) find that investors reward green bonds that are approved by external reviews with a pricing premium on the secondary market. Focusing on a sample of 250 matched bond triplets issued by multiple issuer types between 2011 to 2020, they find that SPOs and assurances (also called verifications) enjoy significantly lower yields.⁵ In contrast to their results, we find that on average, external reviews do not lead to a significant green bond premium for corporate issuers, but that assurances reduce the financing costs of issuers domiciled in common law countries. Our focus is on at-issue pricing, which determines both the funding cost for companies investing in green projects and long-term investors' return, whereas secondary market prices mostly affect investors trading these bonds.

We also contribute to the literature that examines how voluntary assurance affect debt capital markets. [Mansi et al. \(2004\)](#) find that through their dual roles of providing information and insurance, auditor

⁵Their sample consists of 47 corporates and 67 financials, as well as green bonds from agencies, municipals, sovereigns and supranationals.

quality and tenure matter to capital market participants, and are negatively related to the cost of debt financing. [Simnett et al. \(2009\)](#) argue that assurance of CSR reports is related to a desire to improve the credibility of information disclosed, and [Ioannou and Serafeim \(2017\)](#) show that credibility of ESG information disclosed increases when companies seek assurances. Complementing these findings, our results indicate that green bond assurances may strengthen corporate green bond issuers' credibility, especially in countries with shareholder-oriented views which are less invested in CSR.

The rest of the paper is organized as follows. Section 1 provides background information on green bond labelling and describes the market of external reviews. Section 2 reviews the green bond literature. Section 3 develops our hypothesis. Section 4 presents the data, sample construction and summary statistics. Before concluding, section 5 presents our results and robustness analysis.

1. Green Bonds and External Reviews

Green bonds have known a spectacular growth in the past decade, as corporates, sovereigns, and municipalities have turned to debt markets to fund climate solutions. Although the first green bonds were issued in 2007 by two multilateral institutions, the European Investment Bank and the World Bank, their growth substantially picked up in 2014, following the publication of the Green Bond Principles. In 2020, the green bond market surpassed \$1 trillion in total amount issued, with corporate green bonds breaking a record amount issued in 2020 (Figure 1). In this section, we review green bond labeling schemes and discuss the variety of external reviews used by green bond issuers to establish their green credibility.

[Figure 1 about here]

1.1. Green Bond Labeling

In the absence of a standardized definition, there exists a variety of approaches to green bond labelling. Bonds labelled green by issuers are required to earmark their use of proceeds for climate or environmental projects. Most labelled green bonds follow the Green Bond Principles (GBP), which are voluntary best practice guidelines established by the International Capital Market Association (ICMA). Their introduction in January 2014 was a key catalyst for subsequent market development and they served as a basis for many of the existing green labels. In these guidelines, green bonds are defined as "any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible

Green Projects that are aligned with the four core components of the GBP”. These four pillars are 1) use of proceeds, 2) process for project evaluation and selection, 3) management of proceeds, and 4) reporting. The principles promote transparency by recommending a “clear process and disclosure for issuers, which investors, banks, underwriters, placement agents and others may use to understand the characteristics of any given Green Bond” (ICMA, 2018).

In spite of these principles, disagreements can arise as to what projects are deemed environmentally friendly or whether the proceeds of green bonds are actually used to fund the specified projects. Bartels et al. (2015) describe four situations in which issuers may face accusations of greenwashing. First, investors may believe that bond proceeds are used to fund activities that are not “green” enough. Second, the core business of green bond issuers may be seen as unsustainable, such as the case of oil and gas companies issuing green bonds. Third, green proceeds may not be sufficiently well tracked or managed to ensure they are used only for the intended project. Finally, issuers may be unable to prove that proceeds have been used to meet green objectives and that the project has had a meaningful impact on the environment.

1.2. External Reviews and Certification

To assess the credibility of green bonds, investors rely on information disclosed by issuers as well as on third-party reviews (World Bank, 2015). Although external reviews are not mandatory, the Green Bond Principles recommend that “issuers use external assurance to confirm their alignment with the key features of Green Bonds” (ICMA, 2015).⁶ External reviews can take various forms, including second-party opinions (SPOs), third-party assurances, and ratings (Ehlers and Packer, 2017). In addition, certain issuers obtain a certification from the Climate Bonds Initiative. In 2018, almost 90% of green bonds were externally reviewed (by amount issued), the most common form being SPOs (CBI, 2018). In particular, corporate green bond issuers have increasingly obtained external reviews. In 2020, 86% of corporate green bonds were either externally reviewed or certified (Figure 2, Panel B). Among external reviews, SPOs were dominating the market.

[Figure 3 about here]

Second-party opinions (SPOs) or “second opinions” provide a view of the green aspects of a green bond or an issuer’s green bond framework. Generally, a sustainability external expert provides an assessment

⁶The 2015 GBP referred previously to “external assurance”, before modifying its wording in 2018 to “external review”.

of the issuer's green bond framework and confirms whether it complies with the Green Bond Principles. These services are provided by consultants or institutions with recognized expertise in environmental sustainability, including Environmental Social Governance (ESG) service providers such as Oekom, Sustainalytics, Vigeo Eiris, or DNV GL, or scientific experts such as CICERO, a climate research institute based in Oslo. CICERO is one of the leading global providers of SPOs on green bond (Figure 4). It has gained popularity by developing "Shades of Green" in 2015 (Dark Green, Medium Green and Light Green) which offer investors better insight into the environmental quality of green bonds.⁷ Overall, conclusions or opinions provided in SPOs vary depending on the provider. While CICERO opines on the level of green commitment, other providers may simply state whether or not a green bond framework complies with the GBP, or whether the framework is aligned with the issuer's sustainability strategy.

[Figure 4 about here]

In addition, SPOs are limited in that they provide only a forward-looking view and cannot address whether or not green bonds' use of proceeds have been managed as intended ex-post (Bartels et al., 2015). Opinion providers can lack consistency or transparency in their assessment methodology, and the results of their consultation is not always made public. However, in spite of these limitations, SPOs have known a spectacular growth in the past few years, as can be seen in Figure 3.

Third-party assurances (or verifications) are issued by accounting or audit firms, such as KPMG and Deloitte, to assess if a green issuance is aligned with a reputable international framework such as the Green Bond Principles. Assurances can focus on the green bond's criteria, project selection and evaluation, internal processes for tracing proceeds, non-financial data on environmental outcomes, and processes for preparing progress reports (Bartels et al. (2015)). Assurances represent about 8% of the corporate green bond market, with Big Four firms accounting for 7.7%. According to a survey conducted by Verdantix (2013), the Big Four accounting firms (Deloitte, Ernst & Young, KPMG and PwC) are most visible in the assurance market. In particular, Deloitte ranked first in brand preference for sustainability assurance worldwide, based on the interview of over 250 heads of sustainability located in 13 different countries. Deloitte dominates the assurance market for green bond, holding over 50% of the market share (Figure 4).

Issuers may also obtain green bond ratings (or scores). Although generally issued by credit rating

⁷See <https://www.cicero.green/latestnews/2018/11/27/featured-two> for an overview of CICERO SPOs.

agencies, these ratings are distinct from traditional credit ratings as they focus on green credentials. Two examples of such rating schemes are Moody's Green Bond Assessment (GBA) and S&P's Green Evaluations, which dominate the market (see Figure 4). Moody was the first rating agency to publish a methodology for the assessment of green bonds, broadly in line with the Green Bond Principles (Moody, 2016). Moody's GBA provides an "evaluation of an issuer's approach to managing, administering, allocating proceeds to and reporting on environmental projects financed with green bond proceeds." Green bonds are ranked using a scale ranging from GB1 (excellent) to GB5 (poor), based on the assessment of five broad factors: use of proceeds, ongoing reporting, organization, management of process, and disclosure on use of proceeds. S&P introduced Green Evaluations in 2017. Their focus is broader than Moody's GBA as they incorporate a technical environmental impact assessment component, along with governance and transparency components (Ehlers and Packer, 2017). Ratings are scaled from 0 to 100 and aim at evaluating "the environmental impact of the projects financed by the bond's proceeds over their lifetime, relative to a local baseline". Compared to Moody, S&P does not provide an ex-post assessment of the use of proceeds. Overall, almost 10% of corporate green bonds are rated.

Finally, issuers also have the possibility of certifying green bonds against a recognised external green standard or label, such as the CBI's climate bond standards and certification scheme. In 2019, 17% of green bonds were certified by the CBI (CBI, 2019). The Climate Bond Certification requires pre- and post-issuance third-party verification confirming that the asset adheres to the Climate Bond Standards, which integrates the GBPs. An approved external verification is conducted with one of the "Approved Verifiers" to assess that the bond meets environmental standards and that the issuer has the proper controls and processes in place. On average, CBI certification is obtained by 8% of corporate green bonds issued between 2013 and 2020. The top three CBI certifiers are ISS-Oekom, Sustainalytics, and EY (Figure 4).

2. Literature Review

The literature on green bonds has primarily focused on pricing characteristics and whether or not they are traded at a premium in comparison to conventional bonds ("greenium"). Theoretical models provide a framework where investors with a taste for environmentally friendly or socially responsible assets are willing to forfeit financial gains (Friedman and Heinle, 2016). In particular, Baker et al. (2018) show, in a standard asset pricing framework, how a clientele for green bonds (or more broadly a non-financial objective) can affect

asset prices and portfolio choices. They add to the broader asset pricing literature exploring how investor's tastes for assets can affect prices (Fama and French, 2007; Hong and Kacperczyk, 2009). In addition, empirical studies have shown evidence that investors value sustainability (Hartzmark and Sussman, 2019; Ceccarelli et al., 2020; Ammann et al., 2019) and that they are willing to pay for non-financial benefits provided by socially or environmentally friendly investments (Barber et al., 2020; Riedl and Smeets, 2017; Bauer et al., 2019).

Empirical evidence relating to the existence of a green premium is so far mixed, both at issuance and on secondary markets. Some studies document the existence of a premium, whereby green bonds trade at lower yields in comparison to conventional bonds (Zerbib, 2019; Baker et al., 2018; Ehlers and Packer, 2017). However, others find evidence of higher yields for green bonds (Karpf and Mandel, 2017; Bachelet et al., 2019) or no significant difference between green and matching conventional bonds (Flammer, 2021; Tang and Zhang, 2018; Larcker and Watts, 2020).

These studies vary substantially in terms of sample construction and methodological design, which is one reason for mixed findings. Larcker and Watts (2020) argue that these differences are “the result of methodological designs misspecifications that produce biased estimates”. In particular, they state that the pooled fixed-effects model used by Baker et al. (2018) does not adequately control for nonlinearities and issuer-specific time variation, leading to a spurious inference of a significant premium of 8 basis points when examining U.S. municipal green bonds. They argue that issuer matching should be preferred when focusing on corporate green bonds, to better control for firm characteristics, and find no such premium when examining a similar sample of municipal bonds. These results are corroborated by Flammer (2021) for corporate issuers. Focusing on a limited sample of 152 corporate bonds (corresponding to 65 unique issuers) with available pricing information in Bloomberg, Flammer (2021) applies matching and finds no yield difference between green and matched conventional bonds.

Kapraun and Scheins (2019) argue that only certain types of bonds are issued at a premium as they are viewed as more credible. Focusing on 1,500 green bonds, they find that bonds issued by governments or supranational entities, denominated in EUR or USD, or corporates with very large issue sizes exhibit lower yields. They argue that the green label credibility is particularly important for corporate issues that are more at risk of greenwashing concerns. Bachelet et al. (2019) put forward the role of issuer characteristics (e.g. public

vs. private issuers) while [Fatica et al. \(2020\)](#) find that green bonds issued by supranationals and corporates are traded at a premium. However, they find no such premium when green bonds are issued by financial institutions, which they argue is due to the impossibility for investors to identify at issuance a clear link between the green bond issued and a green project.

Other studies have also discussed the role of external reviews and certification schemes in explaining discrepancies in terms of green premium. [Kapraun and Scheins \(2019\)](#) document that investors are more willing to pay a premium when bonds are certified by a third party or listed on a green exchange. [Baker et al. \(2018\)](#) find that the green premium doubles or triples for bonds that are externally certified as green by a third-party. CBI certified municipal green bonds, which represent 6.6% of their U.S. municipal bond sample, are issued at a higher premium. Focusing on all types of green bonds (supranationals, municipals and corporates, [Bachelet et al. \(2019\)](#) puts forward the role of issuer characteristics (e.g. public vs. private issuers) and third-party verification when explaining the “green bonds premium puzzle”. The authors argue that external reviews are essential to reduce informational asymmetries, avoid suspicion of greenwashing, and improve financing conditions.

In addition to examining green bond credibility and effects on the greenium, some studies have shown that shareholder benefits are associated to the issuance of corporate green bonds. Examining 1,510 international corporate green bonds from 2007 to 2017, [Tang and Zhang \(2018\)](#) find that stock prices and institutional ownership of stocks positively respond to green bond issuance. [Glavas \(2018\)](#) finds a positive stock price reaction to green bond issuance announcement for 780 corporate bond issues in 18 countries between 2013 and 2018. [Flammer \(2021\)](#) also documents that green bond issues induce an increase in stock ownership by long-term and green investors. Overall, these studies show that green bond issuance attracts investors’ attention, improves the firm’s visibility, increases the investor base and stock liquidity.

3. Hypothesis Development

Prior studies argue that a green premium may exist because some investors value securities beyond their expected risk and return and additionally incorporate non-pecuniary factors into their investment decisions such as environmental and social consequences (e.g., [Friedman and Heinle, 2016](#); [Baker et al., 2018](#)). We argue that if investors are willing to pay higher interest rates for green bonds compared to their brown bond equivalents due to preferences for green investments, then this green premium should be increasing in

the quality or credibility of the green bonds. Because of information asymmetry between investors and issuers, the "greenness" or quality of green bonds is difficult to observe. External reviewers can play a role as an information intermediary in this market by certifying high quality green bonds, thereby confirming their alignment with Green Bond Principles and in some cases providing further assurance on green bonds' project selection, evaluation, and post issuance reporting. To the extent that these external review or assurance services increase green bond credibility, i.e., signal higher quality environmental investments and outcomes, environmentally sensitive investors may prefer externally reviewed green bonds to their non-externally reviewed green bond counterparts. Thus, externally reviewed green bonds may be issued at a larger green bond premium compared to green bonds that are not externally reviewed.

On the other hand, contrary to the financial auditing market, which is a highly regulated and well-established market, the green assurance and review space is a new market plagued with the absence of standardization and transparency. Green bond certification and other forms of external reviews face numerous challenges due to the absence of a unique green labeling framework. Issuers have many options available when it comes to choosing a green framework and reviewer type. Lack of information makes it difficult to understand the trade-offs that exist between different external review processes, as well as their potential pricing advantages or disadvantages. It also makes it difficult for investors to differentiate among green bonds based on whether it is certified, or whether it has a second-party opinion, for example. If investors are not differentiating between bonds with and without reviews, companies may obtain no benefit in terms of at-issue cost reduction when they engage an external reviewer, even though the review process can be costly. Therefore, a first hypothesis, stated in null form, is that the voluntary use of external reviews does not permit green bond issuers to obtain lower at-issue yields compared to green bonds that are not externally reviewed.

Hypothesis 1: All else equal, externally reviewed green bonds are NOT issued at lower yields compared to green bonds that are not externally reviewed.

Corporate social responsibility and green commitments are also fundamentally related to not only a firm's own choice but also regulations, institutional arrangements, and societal preferences (Liang and Reneboog, 2017), which are themselves likely to be shaped by the legal rules and enforcement mechanisms that differ across countries. Extensive evidence shows that legal origins have significant consequences for the legal and regulatory framework of society, as well as for economic outcomes (La Porta et al., 2008). In particular,

legal rules protecting investors vary systematically among legal traditions or origins, with the laws of common law countries (originating in English law) being more protective of outside investors than the laws of civil law (originating in Roman law), especially French civil law countries (La Porta et al., 1999).

The link between the legal origin of the country where a green bond issuer is domiciled, and the effect of external reviews on the firm's at-issue cost of debt is *a priori* unclear. On the one hand, external reviews could be most beneficial to firms located in civil law countries which are more stakeholder-oriented. Simnett et al. (2009) find that companies from civil law countries are most likely to obtain assurance for their CSR reports. Similarly, Holder-Webb et al. (2009) show that U.S. companies lag behind international companies with respect to social responsibility reporting as they operate in a cultural environment that has a greater shareholder orientation.

On the other hand, it could be argued that common law countries, which are more shareholder oriented, are also less credible green issuers. When examining the role of legal origin in explaining firms' corporate social responsibility rating, Liang and Renneboog (2017) find that firms from common law countries have lower CSR compared to companies from civil law countries, with firms from Scandinavian civil law countries having the highest CSR ratings. In light of this evidence, it appears that green bond issuers from civil law countries are more credible green bond issuers relative to issuers from common law countries. Therefore, the effect of external reviews and certification may be stronger for firms domiciled in common law countries, which are less expected to commit to CSR projects. In particular, given that assurance is a costly process, we can expect that the companies that have their green bonds assured will be those for which the net benefits are the greatest. We therefore define the following second hypothesis:

Hypothesis 2: Green bond issuers domiciled in common law countries are less credible green issuers and will benefit the most from external reviews in terms of at-issue cost.

Some studies have put forward the role of audit quality in establishing the credibility of financial disclosures and reducing the cost of capital (Jensen and Meckling, 1976; Watts and Zimmerman, 1981). In particular, Mansi et al. (2004) find that auditor characteristics such as quality (size) and tenure, impact the cost of debt financing in the bond market. In addition Simnett et al. (2009) hypothesize that members of the auditing profession are the higher quality providers of sustainable assurance. Given these findings, it is possible that the quality and reputation of the external reviewer will affect green credibility, especially in countries where

the business culture is less prone to CSR. According to [Bartels et al. \(2015\)](#), third-party independent assurance is recognized by the Green Bond Principles as the most rigorous form of assessment. In addition, Big Four auditing firms are becoming prominent actors in the sustainable debt market, and they benefit from an overall strong reputation in terms of audit quality that extends to green matters. Therefore, we argue that green bonds externally reviewed by Big Four companies will benefit from enhanced green credibility for issuers located in common law countries which are more shareholder-oriented.

Hypothesis 3: Green bonds assured by Big Four auditing firms will benefit the most from external reviews in terms of at-issue cost.

4. Data, Sample and Summary Statistics

4.1. Sample Selection

To construct a sample of corporate green bonds issued between January 1st 2013 and December 31st 2020, we combine data from Bloomberg and the Climate Bonds Initiative. Following ([Flammer, 2021](#)) and ([Baker et al., 2018](#)), green bonds are identified in Bloomberg's fixed income database as bonds for which the field "use of proceed" is "Green Bond/Loan". As of the 1st of January 2021, there were 3,247 corporate green bonds issued. Bloomberg tags bonds with the green label in the use of proceeds field either when the issuer self-labels its bonds as green, or when the issuer provides a clear commitment to allocate funds towards projects in line with the use of proceeds categories specified in the Green Bond Principles. This allows Bloomberg to provide a more comprehensive database compared to the Climate Bonds Initiative.

Green bonds from Bloomberg are merged with a sample of 2,051 corporate green bonds provided by the Climate Bonds Initiative, issued during the same sample period, for which there are non-missing ISINs.⁸ CBI screens self-labelled green bonds based on its Climate Bonds Taxonomy which is based on two key aspects: eligible sectors and use of proceeds.⁹ The CBI database provides data on external reviewers and allows us to determine which type of reviewer is chosen by the issuer. The final sample consists of 1,242 bonds representing 489 unique issuers with data available in both datasets (Table 2, Panel A).¹⁰

In addition, we obtain at-issue bond prices and yields from Capital IQ and Datastream, to complete the dataset when yields and prices are missing in Bloomberg. When the yield is missing but a price is available,

⁸Issuer types included are financial and non-financial corporates, as well as government-backed entities.

⁹Please refer to the CBI website: <https://www.climatebonds.net/market/green-bond-database-methodology>.

¹⁰We exclude bonds missing maturity and coupon frequency required for matching.

we compute a theoretical yield for at maturity bonds with fixed coupons (i.e. we exclude callable or convertible bonds), based on the issue date, maturity date, coupon, price, and coupon frequency.¹¹

4.2. Matched Sample

In addition to the full sample, we construct a matched sample of green bonds (Table 2, Panel B), for which we compute the greenium as the difference between the green bond yield and the yield of a matched conventional (non-green or brown) bond. Each green bond is matched with a conventional bond following (Flammer, 2021) and (Larcker and Watts, 2020). We first obtain potential matches from Bloomberg's fixed income database. For each of the 489 green issuers, we select all conventional bonds issued between January 1st 2010 and December 31st 2020 with non-missing yields available in Bloomberg. This reduces the sample of matched issuers to 106, for which there are both green and brown bonds issued. We then match each green bond with a brown bond from the same issuer and with the same coupon type (e.g., fixed vs. variable) and maturity type (e.g., at maturity, callable, convertible, sinkable).¹²

Contrary to (Flammer, 2021), we do not require the credit rating of the bond to be the same, as this would substantially reduce the sample of green bonds to 325 bonds for which ratings are available. After conducting this exact match, each green bond is matched to its nearest neighbor obtained using the Mahalanobis distance based on four bond characteristics: logged issuance amount, coupon, maturity, and the number of days in between the issue date of the green and conventional bond. Finally, we only keep green bonds for which key firm characteristics are available (i.e. size and leverage). The final sample consists of 817 matched green bonds.

We report the results from the covariate balance in Table 4. On average, green bonds have a coupon of 2.22% and are issued for 8.82 years. Matched conventional bonds have a 2.30% coupon and maturity of 8.32 years. Overall, matching is relatively good as can be seen from Figure 5, with absolute standardised mean differences (SMD) very close to 0. More specifically, we reject the null hypothesis that the two means are equal with p-values much larger than 0.1% for coupon, maturity and log amount. However, the number of days between the issue date of a green bond and a matched conventional bond is on average 410, which is significantly different from 0, but remains reasonable.

¹¹For bonds with non-missing yields, we verify that the correlation between observed yields and computed yields is 0.9998.

¹²This is more restrictive than (Flammer, 2021) but allows to capture differences in pricing stemming from embedded options of coupon variability.

4.3. Summary Statistics

Summary statistics for the full sample (Panel A) and the matched sample (Panel B), are provided in Table 2. The full sample consists of 1,242 green bonds issued between 2013 and 2020. On average, the yield of green bonds is 2.71%, with a coupon of 2.68% and maturity of 8.3 years. A few green bonds issued by European issuers have negative yields. In addition, most green bond issuers are private companies (72%) which makes it more challenging to obtain balance sheet data. The debt of green issuers represents on average 42% of their assets and their ROA 1.4%. We also find that ratings of both issuers and bonds themselves are generally missing. However, on average, the credit quality of green issuers and green bonds is above A- in the S&P scale. Most green bonds have an external review (72%) or certification (8%), with SPOs dominating the market (57%). Finally, we note that firms from civil law countries (53%) tend to issue more green bonds than firms from common law countries (37%).

The matched sample is composed of 817 green bonds. The greenium (-0.10%) is obtained as the difference between the average green bond yield (2.24%) and the average yields of conventional bonds (2.34%). As we can see from Table 4, we cannot reject the null hypothesis that the two means are equal, with a p-value of 0.32. In other words, the greenium, on average, is not significantly different from zero. In addition, the bond characteristics of the matched sample are similar to those from the full sample. Green bonds have coupons of 2.22% and maturities of 8.8 years. Green issuers are mostly private companies (70%) with high leverage. The matched sample also exhibits similar proportions in terms of external reviews (67%) and certification (8%).

As can be seen from Table 3, Panel B, the sample of 817 matched bonds represents 255 unique corporate issuers. On average, green bond yields with a review are 1.83% compared to 3.42% for bonds without a review, which appears to reflect coupon differences (1.82% vs 3.41%). Bonds with SPOs have the highest yields (1.93%), followed by those with assurances (1.84%) and those rated by credit rating agencies (0.66%), which also appears to follow heterogeneous coupon structures. Bonds certified by CBI on average have yields of 2.10%, and coupons of 2.03%. In addition, we note cases of bonds issuers choosing to obtain multiple forms of reviews (17 issuers).

Panel C and D of Table 3 report summary statistics for the the subsample of issuers located in civil law countries (Panel C) and common law countries (Panel D), by type of review. A majority of issuers are located in civil law countries (169) compared to common law countries (76). In addition, whereas a majority

of green bonds are reviewed when issued by civil law issuers (471), the number of reviewed green bonds is much lower for common law issuers (61). In addition, we note that only a small number of common law issuers obtain assurance and ratings, compared to their civil law counterparts, which implies caution when inferring the impact of the types of reviews on the greenium for this subsample.

5. Results

In this section, we examine the effect of external reviews on green bonds' cost relative to matched conventional bonds. We first focus on the average effects of reviews on the greenium focusing on the entire matched sample of corporate green bonds. We then examine the relationship separately for issuers domiciled in common law and civil law countries, and in particular, for U.S. green bond issuers. Finally, we assess the impact of audit quality, focusing on assurances from Big Four audit firms, which we hypothesize are those with the best reputation.

5.1. The Effect of External Reviews on the Greenium

This section examines the role of external parties in reducing information asymmetry in the green bond market and the subsequent effects on the pricing of green bonds relative to conventional bonds. To examine the effect of external reviews on the green bond premium, we estimate the following OLS regression:

$$Greenium_{i,t} = \alpha ExternalReview_{i,t} + \beta' X_{i,t} + \theta_t + \gamma_d + \lambda_c + \epsilon_{i,t} \quad (1)$$

where $Greenium_{i,t}$ is the green bond premium, computed as the difference between issuer i 's green bond yield, issued at date t , and a matching conventional bond's at-issue yield. The main explanatory variable is $ExternalReview_{i,t}$, an indicator variable equal to one if green bond issuer i obtains an external review at issue date t . External reviews are either second-party opinions (*SPO*), assurances (*Assurance*), reviews by rating agencies (*RatingAgency*). $X_{i,t}$ is a vector of control variables including bond characteristics (coupon, maturity, amount), firm characteristics (whether the company is private, size, and leverage), and interest rate by accounting for the yield of a U.S. treasury bond as of date t with matching maturity, while θ_t , γ_d and λ_c are year, industry and country fixed effects. Standard errors are clustered at the issuer level.

The results of this OLS regression are presented in Table 5 column (1). On average, we find that the impact of getting an external review reduces the greenium by 0.16 percentage points, but the coefficient is not significant. In columns (2) to (6), we interact *ExternalReview* with the legal origin of the country where the issuer is domiciled. Legal origin captures the legal tradition of the country where the green bond

issuer is domiciled. Following [La Porta et al. \(1999\)](#), we first distinguish between common law and civil law countries.¹³ Civil law countries are expected to have less secure investor rights, stricter regulation, and more inefficient governments and courts than countries that inherited common law. Civil law countries can be further separated in three categories: French, German and Scandinavian civil origin. Common law countries include countries from Asia (e.g., India, Malaysia, Thailand), Europe (e.g., UK, Ireland) and North America (e.g., U.S., Canada, Bermuda) as well as Australia and New Zealand.

Focusing on column (2) of [Table 5](#) indicates that, we find that green bond issuers from common law countries, relative to civil law and socialist countries, which obtain an external review, reduce their greenium by 0.63 percentage points, significant at the 5% level. However, we find no significant reduction of the cost of green debt for corporate issuers domiciled in civil law countries (column 3). Issuers from countries with French, German or Scandinavian, relative to other legal origins, do not appear to significantly reduce their cost when they obtain reviews.

To examine the effect of legal origin by type of external review and certification, we partition the matched sample of green bonds into two sub-samples: one focusing on common law countries ([Table 6](#)), and one focusing on civil law countries ([Table 7](#)). Focusing on column (1), our results indicate that on average, green bond issuers from common law countries reduce their greenium by 0.5 percentage points when they commission an external review, significant at the 10% level. However, we note substantial differences in terms of effects, depending on the choice of external review. The effects are strongest when firms obtain green ratings (-2.25 percentage points) or assurances (-1.42 percentage points), for which we find highly significant results. However, SPOs which are the most commonly used form of external review, do not appear to reduce the cost of green bonds at issuance, relative to conventional bonds. In addition, CBI certification appears to be more costly (1.53%). Focusing on civil law countries ([Table 7](#)), we find no evidence that external reviews alleviate the cost of issuing green debt, whether firms choose SPOs, assurances, ratings, or CBI certification.

Finally, we examine the effect of different reviewer types and certification on U.S. green issuers which represent 22% of the matched sample and 69% of the subsample of common law countries. The results presented in [Table 8](#) indicate that, on average, external reviews reduce the cost of green bonds relative to conventional bonds by 0.6 percentage points. The results are significant at the 1% level. This effect appears

¹³A remaining category is Socialist Origin, which includes both current and former socialist countries.

to be essentially driven by assurances, which are all provided by Big 4 auditing companies in the U.S.

5.2. Robustness Analysis

According to [Larcker and Watts \(2020\)](#), mixed results relating to the existence of a greenium are due to “methodological design misspecifications that produced biased estimates”. More specifically, they argue that using a pooled fixed-effects model is insufficient to adequately control for nonlinearities and issuer-specific time variation. They propose instead the use of exact matching methods to better control for key factors that affect bond yields. Focusing on corporate green bonds, [Flammer \(2021\)](#) implements this method and finds no significant difference between the yields of a green and conventional bond based on a sample of 152 green bonds. Matching is based on exact matches by issuer with the same credit rating, and the computation of the Mahalanobis distance based on four bond characteristics (log amount, maturity, coupon and number of days between issue dates). In our baseline results, we implement a similar methodology except that we do not require the credit rating to be the same, but we additionally conduct exact matching by coupon type and maturity type. This allows accounting for pricing effects of embedded call options, which may be priced at a premium ([Larcker and Watts, 2020](#)).

To verify that our results are not driven by the matching methodology we employ, we test whether our results are robust for different matched samples. First, we start by requiring exact matching by bond-level credit ratings, with non-rated green bonds matched to non-rated conventional bonds (Match 2). Second, we further require exact matching by coupon frequency, but drop the credit rating requirement (Match 3). Finally, we require both exact matching by credit rating and coupon frequency, in addition to the exact matching used in the baseline matched sample (by issuer, maturity type and coupon type). Our results are presented in Table 9. For green bond issuers domiciled in common law countries, we find that external reviews in the form of assurances or ratings, significantly increase the greenium (i.e., reduce the cost of green bonds). The effects range from -1.4% for the baseline sample, to -3.8% for the Match 4 sample, with the average greenium for the baseline sample equal to -0.1% and the average green bond yield equal to 2.2%.

Another concern is that the choice to engage an external reviewer may be driven by unexplained confounding factors that impact green bond yields and the greenium. To control for factors that may explain the endogenous choice to obtain a review, we use inverse probability weighting. Results are presented in Table 10. We find that assurance or ratings significantly reduces the cost of green bonds, even after applying inverse

propensity weights. Propensity scores are obtained from a logit regression relating the probability of getting an assurance or rating with firm characteristics (size, leverage, ESG disclosure score, ROA, ESG assurance), country-level characteristics (rule of law and the environmental performance index). In particular, we attempt to control for observable factors that may explain firm's and country's preference for sustainability. Rule of law attempts to capture a measure of the quality of governance of a country. Results are presented in column (1). In column (2) we include country dummy variables, and in column (3) industry dummy controls. Overall, weighting does not affect our baseline computations and indicate that assurance or ratings allow firms domiciled in common law countries to reduce significantly the greenium. In addition, in untabulated results, we verify that the weighing is robust to other country governance included in the Worldwide Governance Indicators (Kaufmann et al., 2011), including voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, and Control of Corruption.

Conclusion

Amidst growing concerns of greenwashing in the green bond market, issuers are turning towards external parties to strengthen their credibility, and in particular second-party opinions. However, on average, we find no evidence that external reviews reduce the financing cost of green projects, relative to conventional bonds. When examining cross-sectional effects, we find that firms domiciled in common law countries, which are potentially less credible green issuers, benefit from external reviews. The effects are strongest for assurances obtained from Big 4 auditing firms and green ratings, such as those provided by S&P and Moody's. However, on average, SPOs do not significantly reduce the cost of green bonds, for issuers domiciled in common law and civil law countries alike. More generally, there is no evidence that corporate green issuers located in civil law countries, which are the most susceptible of obtaining reviews, benefit from lower financing costs.

As the green bond market continues to grow and mature, we can expect issuers to come under more and more pressure to disclose information relating to their green credentials. Third-party reviews play a key role in establishing green credibility, but it is unclear whether the lack of standardization and the variety of certification and reviewing schemes allow investors to differentiate between green bonds. Our study contributes to this debate by examining the potential for reviewers to reduce financing costs of green projects.

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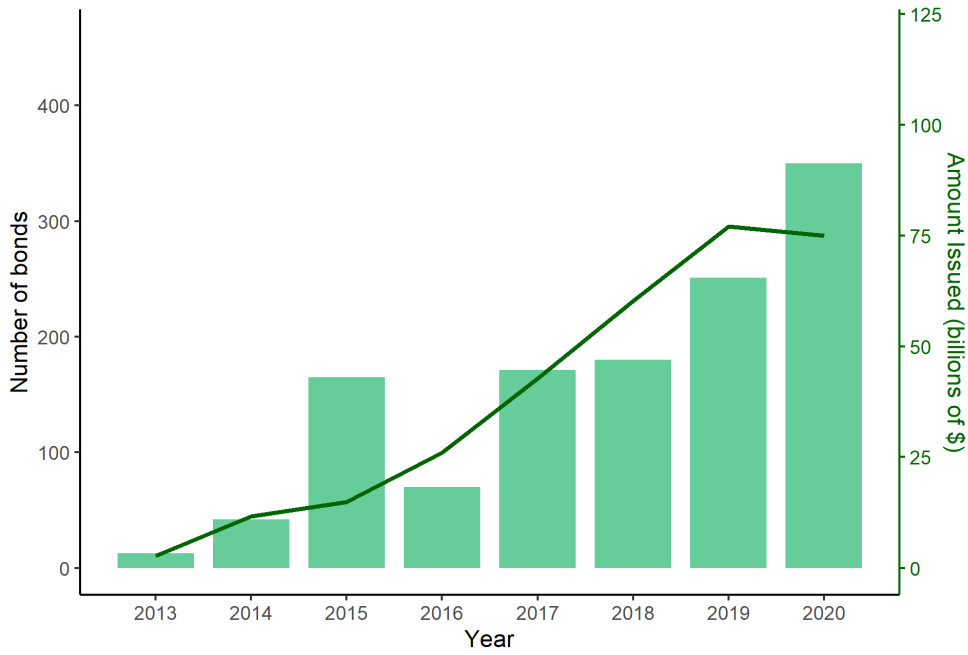
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Figure 1: The Growth of Green Bonds

This figure plots the annual growth of corporate green bonds (Panel A) and, the growth of externally reviewed or certified corporate green bonds (Panel B). Each figure combines a bar plot, which shows the number of bonds issued each year, and a line graph which provides the amount issued in billions of dollars. Green bonds are identified in Bloomberg and the Climate Bonds Initiative database, constituting a sample of 1,242 corporate bonds. External reviews include SPOs, assurances. Certification is provided by CBI.

A: Corporate Green Bonds



B: Corporate Green Bonds With External Reviews and Certification

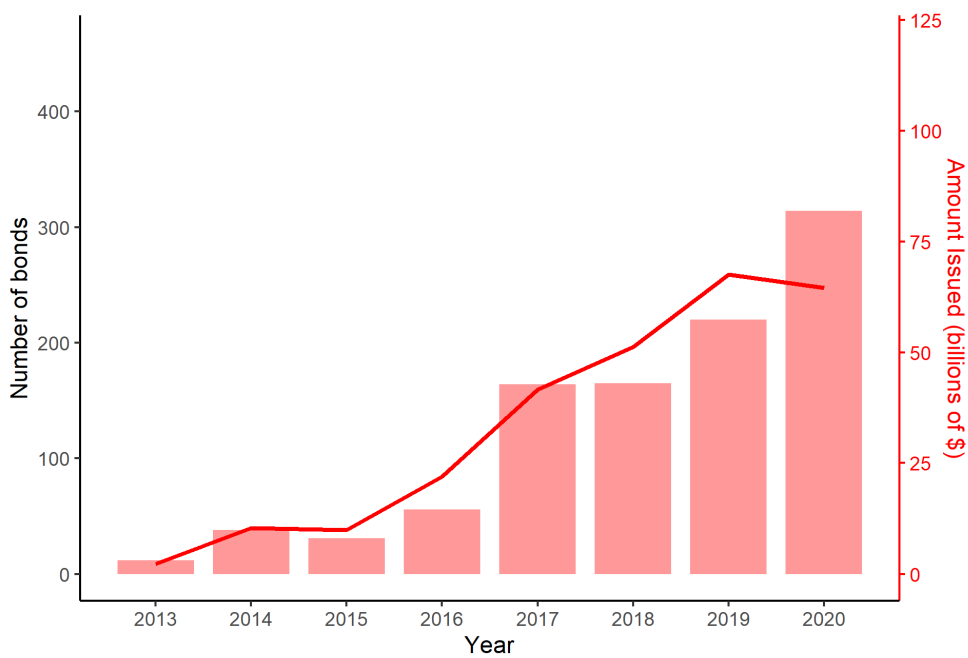
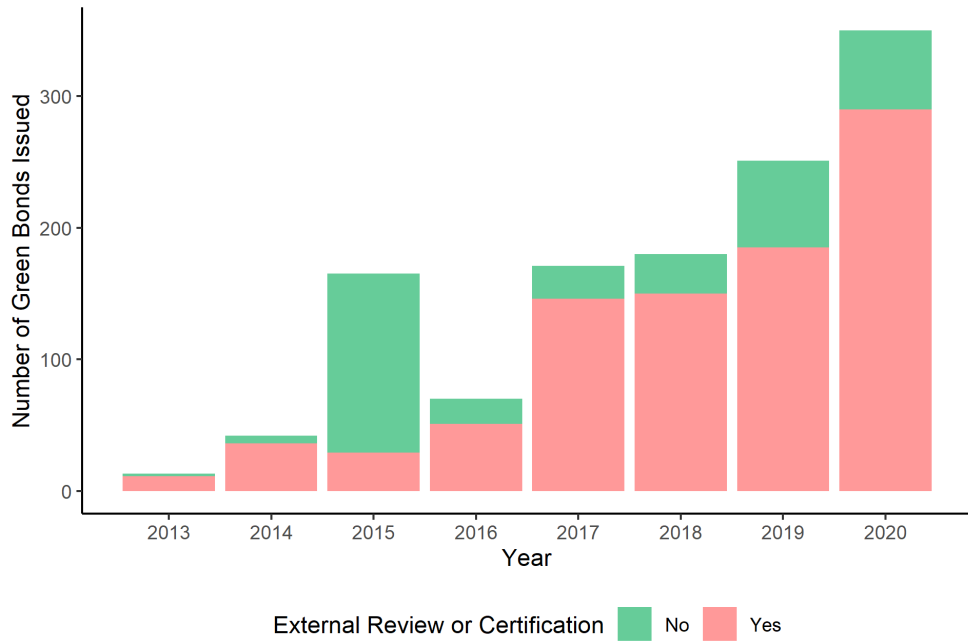


Figure 2: Green Bonds' Credibility Boost

This figure presents the annual share of corporate green bonds with and without an external review or certification. Panel A plots the share in terms of number of green bonds issued, and Panel B in terms of amount issued. Green bonds are identified in Bloomberg and the Climate Bonds Initiative database, constituting a sample of 1,242 corporate bonds. External reviews include SPOs, assurances. Certification is provided by the Climate Bonds Initiative.

A: Number of Corporate Green Bonds Issued with and without a Review or Certification



B: Amount of Corporate Green Bonds Issued with and without a Review or Certification

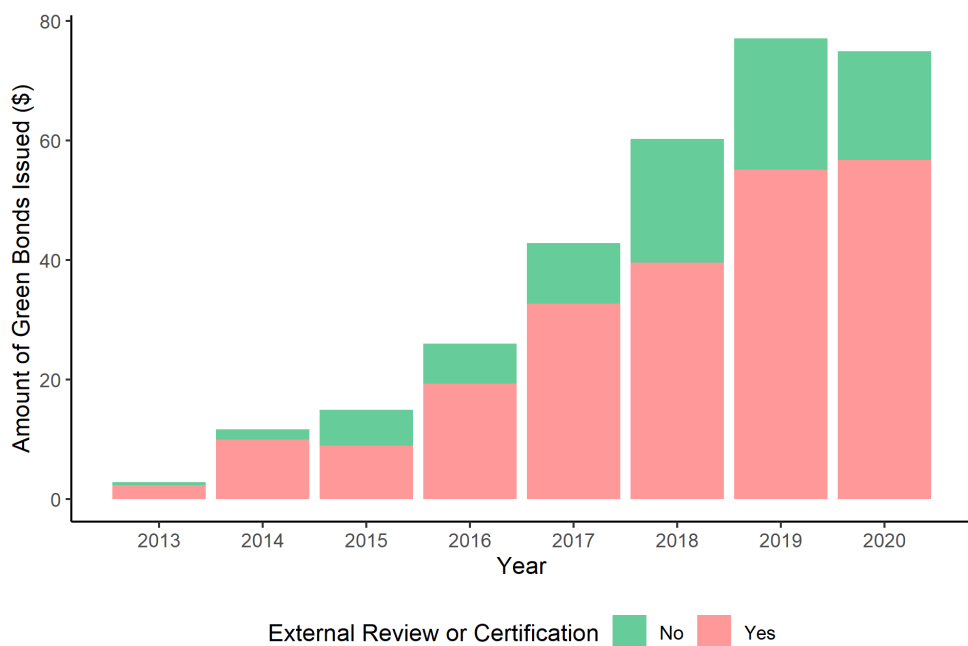
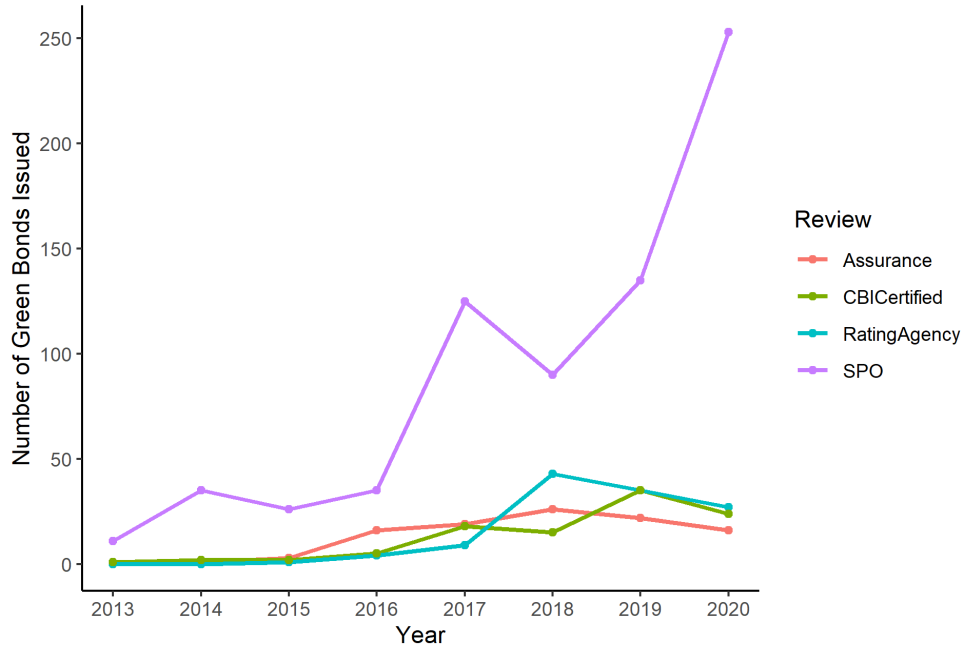


Figure 3: The Growth of External Reviews by Review Type

This figure plots the annual number and amount of green bonds issued with an external review, by type of review (SPOs, assurances, ratings) and certification. Panel A plots the number of green bonds issued while Panel B focuses on the amount issued. Green bonds are identified in Bloomberg and the Climate Bonds Initiative database, constituting a sample of 1,242 corporate bonds. External reviews include SPOs, assurances. Certification is provided by CBI.

A: Number of Corporate Green Bonds Issued by Review Type



B: Amount of Corporate Green Bonds Issued by Review Type

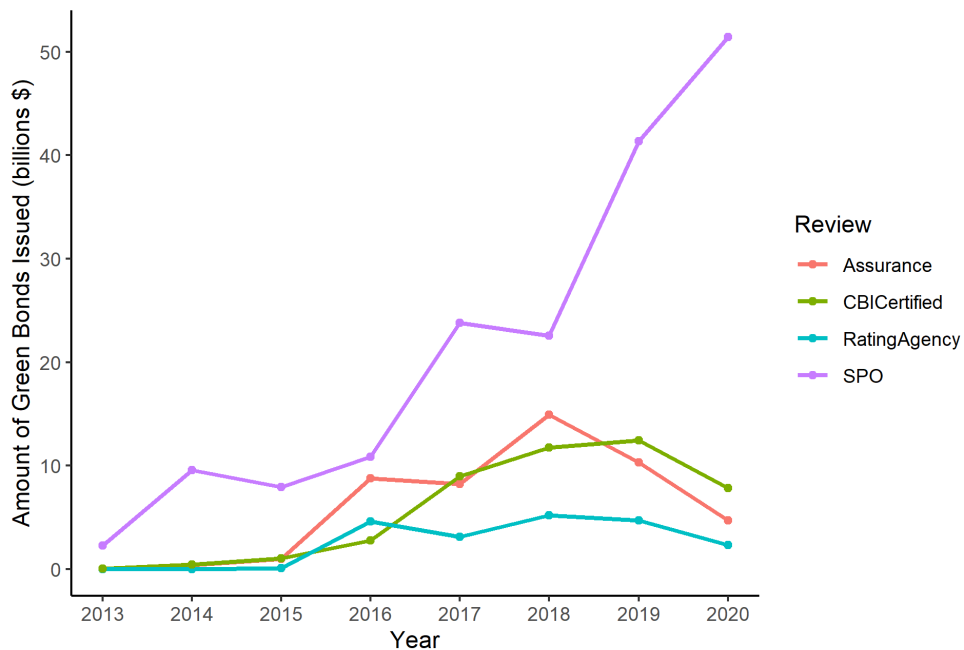
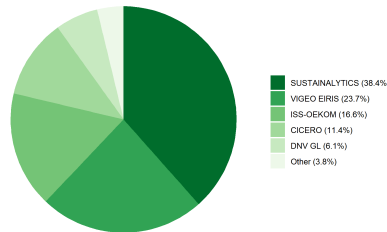


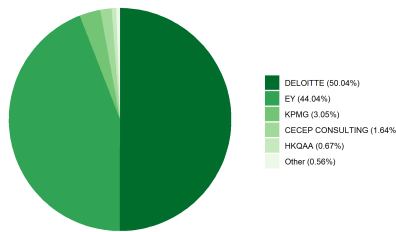
Figure 4: Top 5 Reviewers by Review Type

This figure presents the market share of the top 5 reviewers by type of external review (SPOs, assurances, ratings) and for CBI certification. Green bonds are identified in the Bloomberg and Climate Bonds Initiative databases, constituting a sample of 1,242 corporate bonds.

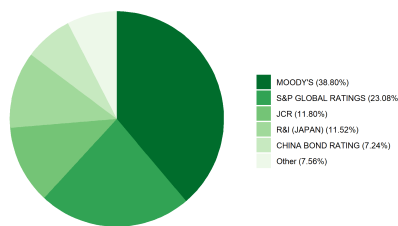
A: Top 5 SPO Reviewers



B: Top 5 Assurance Reviewers



C: Top 5 Rating Agency Reviewers



D: Top 5 CBI Verifiers

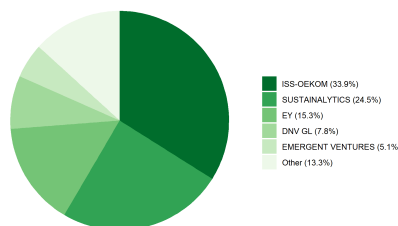


Figure 5: Matching Green and Conventional Bonds

This love plot displays standardized mean differences (SMD) for all variables included in the computation of the Mahalanobis distance used to match green and conventional bonds. Nearest neighbor matching is conducted using exact matching at the issuer level, for bonds with the same maturity type and coupon type, and using Mahalanobis distance based on the log amount issued, coupon, maturity, and the number of days between the issue date of the green bond and the matched conventional bond. The plot shows average covariate values before and after matching.

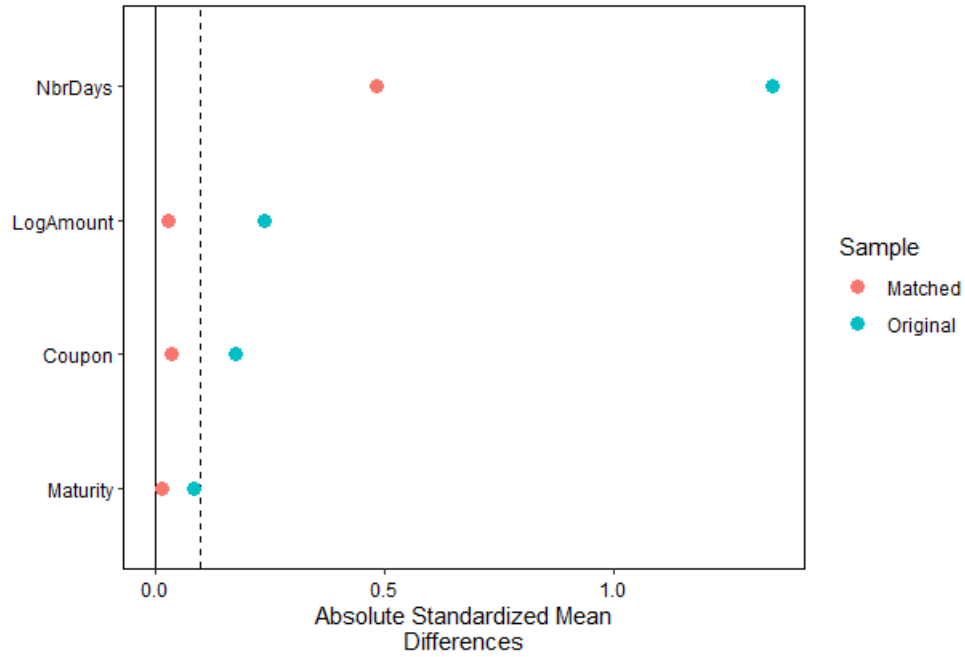


Table 1: Variables and Data Sources

Variable	Definition	Data Source
<i>A: At-Issue Bond and Company Characteristics</i>		
$Greenium_{i,t}$	The difference between bond i 's yield at issue date t , and a matching conventional bond issued by the same issuer, coupon type and maturity type, with the smallest Mahalanobis distance computed using coupon, maturity, amount issued and the number of days between the two issues.	Bloomberg, Datastream and Capital IQ
$TreasuryYield_{i,t}$	The yield of a treasury bond with matching maturities to bond i on issue date t , expressed in percentage.	Bloomberg
$Coupon_{i,t}$	Bond i 's coupon at issue date t , expressed in percentage.	Bloomberg
$Maturity_{i,t}$	Bond i 's maturity at issue date t , expressed in years.	Bloomberg
$Amount_{i,t}$	Bond i 's amount at issue date t , expressed in millions of U.S. dollars.	Bloomberg
$Private_{i,t}$	A dummy variable equal to 1 if the issuer of bond i is a private company, and 0 if it is a public company.	Bloomberg
$Size_{i,t}$	The log of total assets of the issuer of bond i during the year of issue.	Bloomberg
$Leverage_{i,t}$	The ratio of debt to assets of the issuer of bond i during the year of issue.	Bloomberg
$ROA_{i,t}$	The return on assets of the issuer of bond i during the year of issue.	Capital IQ
$IssuerRating_{i,t}$	The rating of the issuer of bond i during the year of issue. It is based on either S&P's rating, or Moody's rating, or Fitch's rating, or Bloomberg's composite rating, in order of availability.	Bloomberg and Capital IQ
$BondRating_{i,t}$	Bond i 's rating at issue date t , expressed in numerical scale. It is based on either S&P's rating, or Moody's rating, or Fitch's rating, or Bloomberg's composite rating, in order of availability.	Bloomberg and Capital IQ
$ESG_Disclosure_{i,t}$	The ESG disclosure score of the issuer of bond i in year t . It captures the amount and quality of ESG data a company reports publicly, but does not capture the company's ESG performance	Bloomberg
$ESGAssurance_{i,t}$	A dummy variable equal to 1 if the issuer of bond i is a private company has an ESG framework that includes a statement to the effect that the issuer includes the name and type of assurance provider for their ESG initiative, and 0 otherwise.	Bloomberg
<i>B: External Review and Certification</i>		
$ExternalReview_i$	A dummy variable equal to 1 if green bond i is reviewed by an independent third party, and 0 otherwise. External reviews include SPOs, assurances or ratings.	CBI
SPO_i	A dummy variable equal to 1 if green bond i 's external review is a "Second-party Opinion", and 0 otherwise.	CBI
$Assurance_i$	A dummy variable equal to 1 if green bond i 's external review is a third-party assurance (i.e. conducted by an audit firm), and 0 otherwise.	CBI
$RatingAgency_i$	A dummy variable equal to 1 if green bond i 's external reviewer is a rating agency, and 0 otherwise.	CBI
$Big4_i$	A dummy variable equal to 1 if one of the assurance audit firms is among the Big Four (Deloitte, KPMG, E&Y, PwC), and 0 otherwise.	CBI
$CBICertified_i$	A dummy variable equal to 1 if green bond i is certified by CBI, and 0 otherwise.	CBI
<i>C: Legal Origin and Country-level Variables</i>		
$CommonLaw_{i,t}$	A dummy variable equal to 1 if the issuer of bond i located in a country where the legal origins are the common law (e.g. the UK and US), and 0 otherwise.	Bloomberg and La Porta et al. (1999)
$CivilLaw_{i,t}$	A dummy variable equal to 1 if the issuer of bond i located in a country where the legal origin is civil law, and 0 otherwise.	Bloomberg and La Porta et al. (1999)
$French_{i,t}$	A dummy variable equal to 1 if the issuer of bond i located in a country where the legal origin is French civil law, and 0 otherwise.	Bloomberg and La Porta et al. (1999)
$German_{i,t}$	A dummy variable equal to 1 if the issuer of bond i located in a country where the legal origin is German civil law, and 0 otherwise.	Bloomberg and La Porta et al. (1999)
$Scandinavian_{i,t}$	A dummy variable equal to 1 if the issuer of bond i located in a country where the legal origin is Scandinavian civil law, and 0 otherwise.	Bloomberg and La Porta et al. (1999)
$RuleOfLaw_{i,t}$	Country-level index that captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. It ranges from -2.5 to 2.5, with higher values corresponding to stronger perceptions.	World Governance Index
$EPI_{i,t}$	The Environmental Performance Index is an index that provides a summary of the state of sustainability of a country, i.e. the environmental health and ecosystem vitality. It ranges from 0 to 100.	Yale Center for Environmental Law & Policy

Table 2: Summary Statistics

This table presents the descriptive statistics for a sample of corporate green bonds issued between 2013 and 2020, obtained from Bloomberg and the Climate Bonds Initiative database (Panel A), and a matched sample of green bonds (Panel B) for which a greenium can be computed. The matched sample is obtained by matching each green bond with a conventional (non-green) bond with the same issuer, coupon type and maturity type, and which is the closest neighbor based the Mahalanobis distance computed using coupon, maturity, log amount and number of days in between issues. All variables are defined in Table 1.

A: Sample of Corporate Green Bonds

<i>Bond and Firm Characteristics</i>							
Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Yield	1,242	2.710	2.284	-0.665	0.700	4.248	15.500
Price	1,242	99.950	0.825	93	100.0	100	116
Coupon	1,242	2.684	2.278	0	0.7	4.2	16
Maturity	1,242	8.269	28.798	0.994	4.000	9.999	999.978
Amount	1,242	0.250	0.382	0.00001	0.020	0.399	4.333
TreasuryYield	1,242	1.552	0.869	0.100	0.710	2.280	3.340
Private	1,242	0.716	0.451	0	0	1	1
TotalAssets	1,173	4.057	26.688	0.00002	0.034	0.512	311.139
Size	1,173	11.826	2.305	2.898	10.443	13.145	19.556
Leverage	1,173	42.112	18.734	0.000	29.753	52.991	123.423
NbrBonds	1,242	33.084	50.350	1	2	33	141
ROA	1,074	1.347	2.775	-24.646	0.042	2.083	16.323
IssuerRating	541	16.342	2.295	5.000	15.000	18.000	22.000
BondRating	476	16.168	3.066	7.000	15.000	18.000	22.000
<i>External Reviews and Certification</i>							
Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
ExternalReview	1,242	0.723	0.448	0	0	1	1
SPO	1,242	0.572	0.495	0	0	1	1
Assurance	1,242	0.083	0.276	0	0	0	1
RatingAgency	1,242	0.096	0.294	0	0	0	1
Big4	1,242	0.077	0.267	0	0	0	1
CBICertified	1,242	0.082	0.275	0	0	0	1
NbrExternalReview	1,242	0.750	0.481	0	0	1	2
<i>Legal Origin and Country Characteristics</i>							
Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
CommonLaw	1,242	0.367	0.482	0	0	1	1
CivilLaw	1,242	0.534	0.499	0	0	1	1
RuleOfLaw	892	1.202	0.720	-0.487	0.769	1.618	2.038
EPI	847	65.139	19.153	27.600	45.400	83.950	90.430

B: Matched Sample of Corporate Green Bonds

<i>Bond and Firm Characteristics</i>							
Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Greenium	817	-0.102	1.068	-4.602	-0.510	0.319	4.578
Yield	817	2.239	2.153	-0.279	0.497	3.499	11.710
Price	817	99.918	0.635	93	99.9	100	112
Coupon	817	2.224	2.150	0.000	0.500	3.410	11.710
Maturity	817	8.823	35.297	1.002	4.485	9.999	999.978
Amount	817	0.243	0.358	0.00001	0.016	0.400	2.905
TreasuryYield	817	1.524	0.863	0.110	0.710	2.220	3.240
Private	817	0.694	0.461	0	0	1	1
TotalAssets	817	5.553	31.798	0.001	0.034	0.591	311.139
Size	817	12.335	2.131	6.816	10.443	13.289	19.556
Leverage	817	41.450	16.877	2.795	31.621	49.437	97.980
NbrBonds	817	46.621	57.239	1	2	96	141
ROA	735	1.321	2.669	-5.614	0.023	2.107	16.323
IssuerRating	417	16.851	1.858	8.000	16.000	18.000	22.000
BondRating	325	17.018	2.517	7.000	16.000	18.000	22.000
<i>External Reviews and Certification</i>							
Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
ExternalReview	817	0.673	0.469	0	0	1	1
SPO	817	0.576	0.494	0	0	1	1
Assurance	817	0.054	0.226	0	0	0	1
RatingAgency	817	0.076	0.265	0	0	0	1
Big4	817	0.051	0.221	0	0	0	1
CBICertified	817	0.083	0.276	0	0	0	1
NbrExternalReview	817	0.706	0.514	0	0	1	2
<i>Legal Origin and Country Characteristics</i>							
Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
CommonLaw	817	0.326	0.469	0	0	1	1
CivilLaw	817	0.644	0.479	0	0	1	1
RuleOfLaw	596	1.426	0.529	-0.477	1.435	1.618	2.038
EPI	571	71.540	15.164	30.410	62.350	84.720	90.430

Table 3: Bond Characteristics by Type of External Review and Legal Origin

This table provides key statistics by external review type for a sample of corporate green bonds issued between 2013 and 2020, obtained from Bloomberg and the Climate Bonds Initiative database (Panel A), and a matched sample of green bonds (Panel B, C, D) for which a greenium can be computed. Panel C and D provide statistics for issuers from civil law and common law countries. The matched sample is obtained by matching each green bond with a conventional (non-green) bond with the same issuer, coupon type and maturity type, and which is the closest neighbor based the Mahalanobis distance computed using coupon, maturity, log amount and number of days in between issues. External reviews include SPOs, assurances, and ratings. All variables are defined in Table 1.

Panel A: Sample of Corporate Green Bonds

	All	No Review	Review	SPO	Assurance	Rating Agency	Multiple	CBI Certified
NbrBonds	1242	242	898	710	103	119	27	102
NbrIssuer	489	72	382	271	64	80	21	60
Amount	310.48	40.73	224.44	169.77	48.30	20.10	11.16	45.31
Yield	2.71	3.61	2.46	2.38	2.98	2.28	1.40	2.73
Price	99.95	99.90	99.98	99.94	99.96	100.21	100.01	99.81
Coupon	2.68	3.60	2.44	2.35	2.95	2.28	1.38	2.67
Maturity	8.27	8.73	8.33	8.73	5.38	7.95	6.42	6.65

Panel B: Matched Sample of Corporate Green Bonds

	All	No Review	Review	SPO	Assurance	Rating Agency	Multiple	CBI Certified
NbrBonds	817	199	550	471	44	62	23	68
NbrIssuer	255	38	196	148	24	46	17	36
Amount	198.44	27.87	137.25	116.20	20.23	12.33	10.03	33.32
Yield	2.24	3.42	1.83	1.93	1.84	0.66	1.13	2.10
Price	99.92	99.91	99.94	99.94	99.91	99.97	100.02	99.77
Coupon	2.22	3.41	1.82	1.92	1.83	0.66	1.12	2.03
Maturity	8.82	8.70	9.10	9.36	6.81	7.68	6.50	6.91
Greenium	-0.10	0.11	-0.16	-0.15	-0.43	0.00	-0.05	-0.23

Panel C: Civil Law Matched Sample of Corporate Green Bonds

	All	No Review	Review	SPO	Assurance	Rating Agency	Multiple	CBI Certified
NbrBonds	526	26	471	414	22	59	20	29
NbrIssuer	169	10	151	115	12	44	15	17
Amount	123.26	3.68	96.49	91.44	4.24	7.77	5.47	23.09
Yield	1.62	1.24	1.69	1.83	0.97	0.42	0.50	0.92
Price	99.94	99.98	99.95	99.94	100.05	99.98	100.05	99.69
Coupon	1.61	1.27	1.67	1.82	0.97	0.42	0.50	0.81
Maturity	9.09	9.85	9.07	9.30	5.59	7.91	6.97	8.67
Greenium	-0.14	-0.04	-0.13	-0.13	-0.27	-0.01	-0.09	-0.47

Panel D: Common Law Matched Sample of Corporate Green Bonds

	All	No Review	Review	SPO	Assurance	Rating Agency	Multiple	CBI Certified
NbrBonds	266	173	61	52	9	1	1	32
NbrIssuer	73	28	35	31	4	1	1	14
Amount	60.74	24.20	28.41	22.91	5.50	0.20	0.20	8.13
Yield	3.45	3.75	2.77	2.72	3.09	9.88	9.88	3.14
Price	99.88	99.90	99.85	99.90	99.56	99.56	99.56	99.82
Coupon	3.43	3.74	2.75	2.70	3.04	9.62	9.62	3.11
Maturity	8.84	8.53	11.10	10.47	14.75	2.00	2.00	6.20
Greenium	0.00	0.13	-0.41	-0.26	-1.27	0.38	0.38	0.10

Table 4: Covariate Balance of Green and Matched Conventional Bonds

This table presents average statistics of variables included in the computed of the Mahalanobis distance used for matching green bonds with conventional bonds. It provides mean values and standard deviations in parentheses, for green and matched conventional bonds separately, as well as p-values for the t-test of mean differences and standardized mean differences (SMD). The matched sample is obtained by matching each green bond with a conventional (non-green) bond with the same issuer, coupon type and maturity type, and which is the closest neighbor based the Mahalanobis distance computed using coupon, maturity, log amount and number of days in between issues.

	Conventional Bonds	Green Bonds	p-value	SMD
N	817	817		
Coupon (mean (SD))	2.30 (1.98)	2.22 (2.15)	0.442	0.038
Maturity (mean (SD))	8.32 (35.13)	8.82 (35.30)	0.772	0.014
LogAmount (mean (SD))	-2.77 (1.75)	-2.83 (2.09)	0.514	0.032
NbrDays (mean (SD))	409.61 (452.59)	0.00 (0.00)	<0.001	1.280
Yield (mean (SD))	2.34 (1.99)	2.24 (2.15)	0.320	0.049

Table 5: External Reviews, Legal Origin, and the Greenium

This table provides the estimation results of our baseline OLS regression defined in Equation 1 in column (1). The dependent variable is the green bond premium, computed as the difference between the yield of a green bond, and the yield of a matched conventional bond. The matched sample is obtained by matching each green bond with a conventional (non-green) bond with the same issuer, coupon type and maturity type, and which is the closest neighbor based the Mahalanobis distance computed using coupon, maturity, log amount and number of days in between issues. *ExternalReview* is equal to 1 if the green bond issuer has either an SPO, assurance or rating, and 0 otherwise. In columns (2) to (6), we interact *ExternalReview* by the legal origin of the issuers' country of domicile. All variables are defined in Table 1.

Dependent Variable:	Greenium					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
<i>Variables</i>						
ExternalReview	-0.1602 (0.1500)					
ExternalReviewxCommonLaw		-0.6316** (0.2716)				
ExternalReviewxCivilLaw			-0.0702 (0.1769)			
ExternalReviewxFrench				-0.1133 (0.2881)		
ExternalReviewxGerman					-0.1521 (0.1955)	
ExternalReviewxScandinavian						0.9955 (0.7743)
Coupon	0.3109*** (0.0460)	0.3077*** (0.0461)	0.3090*** (0.0461)	0.3098*** (0.0458)	0.3076*** (0.0462)	0.3077*** (0.0463)
Maturity	0.0004 (0.0006)	0.0004 (0.0006)	0.0004 (0.0006)	0.0004 (0.0006)	0.0004 (0.0006)	0.0004 (0.0006)
Amount	0.0665 (0.1457)	0.0758 (0.1471)	0.0621 (0.1471)	0.0608 (0.1472)	0.0658 (0.1477)	0.0751 (0.1458)
TreasuryYield	0.6175** (0.2635)	0.6201** (0.2652)	0.6206** (0.2637)	0.6182** (0.2640)	0.6241** (0.2642)	0.6229** (0.2640)
Private	-0.3198* (0.1756)	-0.3263* (0.1737)	-0.3213* (0.1750)	-0.3176* (0.1742)	-0.3243* (0.1755)	-0.3088* (0.1756)
Size	0.0047 (0.0395)	0.0132 (0.0402)	0.0059 (0.0399)	0.0071 (0.0401)	0.0049 (0.0406)	0.0094 (0.0403)
Leverage	0.0028 (0.0030)	0.0037 (0.0029)	0.0029 (0.0030)	0.0031 (0.0030)	0.0028 (0.0031)	0.0036 (0.0029)
<i>Fixed-effects</i>						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
<i>Fit statistics</i>						
Observations	817	817	817	817	817	817
R ²	0.44402	0.44764	0.44281	0.44284	0.44303	0.44456
Within R ²	0.33883	0.34312	0.33738	0.33742	0.33764	0.33946

Issuer standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 6: Common Law Countries and External Reviews

This table provides the estimation results of our baseline OLS regression defined in Equation 1 for a sample of green bond issuers domiciled in countries with common law legal origins. The dependent variable is the green bond premium, computed as the difference between the yield of a green bond, and the yield of a matched conventional bond. The matched sample is obtained by matching each green bond with a conventional (non-green) bond with the same issuer, coupon type and maturity type, and which is the closest neighbor based the Mahalanobis distance computed using coupon, maturity, log amount and number of days in between issues. External reviews include SPOs, assurances, and ratings. *Big4* is an indicator variable equal to 1 if the assurance provided is obtained from one of the four major auditing firms. All variables are defined in Table 1.

Dependent Variable:	Greenium					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
<i>Variables</i>						
ExternalReview	-0.4897*					
	(0.2671)					
SPO		0.4541				
		(0.2968)				
Assurance			-1.421***			
			(0.3577)			
RatingAgency				-2.246***		
				(0.4362)		
CBICertified					1.532**	
					(0.7031)	
Big4						-1.324***
						(0.3634)
Coupon	0.5654***	0.5503***	0.5533***	0.5663***	0.5651***	0.5436***
	(0.1308)	(0.1346)	(0.1280)	(0.1333)	(0.1256)	(0.1292)
Maturity	-0.0198	-0.0200	-0.0170	-0.0206	-0.0224*	-0.0160
	(0.0127)	(0.0136)	(0.0128)	(0.0133)	(0.0130)	(0.0132)
Amount	0.4741	0.5155	0.7419	0.4361	0.5242	0.7447
	(0.5371)	(0.5555)	(0.6121)	(0.5382)	(0.4841)	(0.6034)
TreasuryYield	0.6767***	0.7130***	0.7011***	0.6875***	0.7106***	0.7032***
	(0.1359)	(0.1404)	(0.1327)	(0.1411)	(0.1348)	(0.1321)
Private	-0.5812	-0.5709*	-0.4852	-0.5325	-0.5950**	-0.4832
	(0.3587)	(0.3328)	(0.3142)	(0.3505)	(0.2977)	(0.3165)
Size	-0.0313	-0.0521	-0.0362	-0.0411	-0.0842	-0.0442
	(0.1163)	(0.1161)	(0.1051)	(0.1163)	(0.1041)	(0.1055)
Leverage	0.0036	0.0003	0.0055	-3.829×10^{-5}	-0.0014	0.0048
	(0.0089)	(0.0079)	(0.0073)	(0.0083)	(0.0079)	(0.0073)
<i>Fixed-effects</i>						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
<i>Fit statistics</i>						
Observations	266	266	266	266	266	266
R ²	0.74317	0.74172	0.77186	0.74363	0.76209	0.76328
Within R ²	0.69885	0.69714	0.73248	0.69938	0.72102	0.72243

Issuer standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 7: Civil Law Countries and External Reviews

This table provides the estimation results of our baseline OLS regression defined in Equation 1 for a sample of green bond issuers domiciled in countries with civil law legal origins. The dependent variable is the green bond premium, computed as the difference between the yield of a green bond, and the yield of a matched conventional bond. The matched sample is obtained by matching each green bond with a conventional (non-green) bond with the same issuer, coupon type and maturity type, and which is the closest neighbor based the Mahalanobis distance computed using coupon, maturity, log amount and number of days in between issues. External reviews include SPOs, assurances, and ratings. *Big4* is an indicator variable equal to 1 if the assurance provided is obtained from one of the four major auditing firms. All variables are defined in Table 1.

Dependent Variable:	Greenium					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
<i>Variables</i>						
ExternalReview	0.0398 (0.1668)					
SPO		-0.0891 (0.1511)				
Assurance			0.4008 (0.3309)			
RatingAgency				0.1243 (0.0914)		
CBICertified					-0.2234 (0.1979)	
Big4						0.3781 (0.3360)
Coupon	0.2355*** (0.0437)	0.2396*** (0.0418)	0.2451*** (0.0415)	0.2366*** (0.0427)	0.2354*** (0.0431)	0.2449*** (0.0417)
Maturity	0.0006 (0.0006)	0.0005 (0.0006)	0.0005 (0.0006)	0.0006 (0.0006)	0.0006 (0.0006)	0.0005 (0.0006)
Amount	0.1275 (0.1859)	0.1254 (0.1821)	0.1384 (0.1714)	0.1270 (0.1866)	0.1626 (0.1871)	0.1366 (0.1720)
TreasuryYield	0.2864** (0.1415)	0.2845** (0.1406)	0.2659* (0.1424)	0.2846** (0.1421)	0.2882** (0.1410)	0.2652* (0.1430)
Private	-0.3400 (0.2097)	-0.3342 (0.2130)	-0.3541* (0.2078)	-0.3382 (0.2128)	-0.3463* (0.2078)	-0.3599* (0.2085)
Size	0.0096 (0.0377)	0.0081 (0.0378)	0.0103 (0.0380)	0.0118 (0.0386)	0.0091 (0.0383)	0.0096 (0.0380)
Leverage	0.0045 (0.0034)	0.0042 (0.0033)	0.0055 (0.0034)	0.0045 (0.0033)	0.0045 (0.0032)	0.0055 (0.0034)
<i>Fixed-effects</i>						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
<i>Fit statistics</i>						
Observations	526	526	526	526	526	526
R ²	0.35125	0.35191	0.35485	0.35204	0.35294	0.35445
Within R ²	0.1871	0.18792	0.1916	0.18809	0.18921	0.19111

Issuer standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 8: U.S. Issuers and External Reviews

This table provides the estimation results of our baseline OLS regression defined in Equation 1 for a sample of green bond issuers domiciled in the U.S. The dependent variable is the green bond premium, computed as the difference between the yield of a green bond, and the yield of a matched conventional bond. The matched sample is obtained by matching each green bond with a conventional (non-green) bond with the same issuer, coupon type and maturity type, and which is the closest neighbor based on the Mahalanobis distance computed using coupon, maturity, log amount and number of days in between issues. External reviews include SPOs, assurances, and ratings. *Big4* is an indicator variable equal to 1 if the assurance provided is obtained from one of the four major auditing firms. All variables are defined in Table 1.

Dependent Variable:	Greenium				
Model:	(1)	(2)	(3)	(4)	(5)
<i>Variables</i>					
ExternalReview	-0.5606*** (0.1975)				
SPO		-0.5121 (0.3743)			
Assurance			-0.6280*** (0.2189)		
CBICertified				0.3464 (0.3519)	
Big4					-0.6280*** (0.2189)
Coupon	0.8719*** (0.1550)	0.8804*** (0.1673)	0.8405*** (0.1642)	0.8481*** (0.1788)	0.8405*** (0.1642)
Maturity	-0.0227* (0.0127)	-0.0269* (0.0137)	-0.0203 (0.0133)	-0.0251* (0.0147)	-0.0203 (0.0133)
Amount	-0.2803 (0.4828)	-0.3983 (0.5036)	-0.0915 (0.5483)	-0.2230 (0.5047)	-0.0915 (0.5483)
TreasuryYield	0.3360 (0.2708)	0.3433 (0.2852)	0.3799 (0.2888)	0.3913 (0.3079)	0.3799 (0.2888)
Private	-0.4378 (0.4514)	-0.3939 (0.4302)	-0.2379 (0.3993)	-0.2339 (0.4270)	-0.2379 (0.3993)
Size	-0.0384 (0.1549)	-0.0287 (0.1715)	-0.0891 (0.1545)	-0.0664 (0.1568)	-0.0891 (0.1545)
Leverage	-0.0085 (0.0143)	-0.0098 (0.0162)	-0.0160 (0.0140)	-0.0158 (0.0152)	-0.0160 (0.0140)
<i>Fixed-effects</i>					
Year	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
<i>Fit statistics</i>					
Observations	184	184	184	184	184
R ²	0.94036	0.93647	0.93853	0.93475	0.93853
Within R ²	0.93554	0.93133	0.93356	0.92947	0.93356

Issuer standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 9: Sensitivity to the Greenium Matching Methodology for Common Law Countries

This table provides the estimation results of our baseline OLS regression defined in Equation 1 for a sample of green bond issuers domiciled in countries with common law legal origins, focusing on assurances and ratings, and for different greenium matching methodologies. Column (1) are the baseline results. Columns (2)-(4) modify the matching methodology. Column (2) requires green bonds to be matched with conventional bonds with the same issuer, maturity type, coupon type and credit rating. A non-rated green bond is matched with a non-rated conventional bond. Column (3) requires green bonds to be matched with conventional bonds with the same issuer, maturity type, coupon type and coupon frequency. Column (4) requires green bonds to be matched with conventional bonds with the same issuer, maturity type, coupon type, coupon frequency and credit rating. *ExternalReview* is an indicator variable equal to 1 if a firm's reviewer is either an assurance or a rating. All variables are defined in Table 1.

Dependent Variable: Matched Sample: Model:	Greenium			
	Baseline (1)	Match 2 (2)	Match 3 (3)	Match 4 (4)
<i>Variables</i>				
ExternalReview	-1.442*** (0.3297)	-2.174*** (0.3116)	-1.167*** (0.3457)	-3.772*** (0.4254)
Coupon	0.5583*** (0.1271)	0.6056*** (0.1283)	0.5486*** (0.1404)	0.6501*** (0.1417)
Maturity	-0.0170 (0.0128)	-0.0218 (0.0147)	-0.0122 (0.0150)	-0.0241 (0.0176)
Amount	0.7395 (0.6090)	0.1833 (0.4773)	0.3323 (0.6410)	-0.0923 (0.5641)
TreasuryYield	0.6968*** (0.1326)	0.7274*** (0.1806)	0.6619*** (0.1436)	0.6620*** (0.2031)
Private	-0.4442 (0.3115)	-0.0621 (0.3355)	-0.3157 (0.3441)	0.3052 (0.4377)
Size	-0.0347 (0.1044)	0.0534 (0.1149)	0.0384 (0.1391)	0.2002 (0.1496)
Leverage	0.0048 (0.0072)	0.0129 (0.0084)	0.0071 (0.0083)	0.0183* (0.0100)
<i>Fixed-effects</i>				
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
<i>Fit statistics</i>				
Observations	266	249	256	236
R ²	0.77692	0.83292	0.76251	0.83359
Within R ²	0.73841	0.80787	0.71849	0.81175

Issuer standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 10: Inverse Probability Weighting for Common Law Countries

This table provides the estimation results of our baseline OLS regression defined in Equation 1 for a sample of green bond issuers domiciled in countries with common law legal origins, focusing on assurances and ratings, after applying inverse probability weights. Propensity scores are obtained from a Logit regression which includes firm-level characteristics (*Size*, *Leverage*, *ROA*, an *ESG Disclosure Score*, *ESG Assurance*), and country-level controls (*RuleOfLaw* and *EPI*). When computing propensity scores, column (2) includes country fixed effects and column (3) includes industry fixed effects. *ExternalReview* is an indicator variable equal to 1 if a firm's reviewer is either an assurance or a rating. All variables are defined in Table 1.

Dependent Variable:	Greenium		
Model:	(1)	(2)	(3)
<i>Variables</i>			
ExternalReview	-1.114** (0.4216)	-1.114** (0.4216)	-1.114** (0.4216)
Coupon	0.5960*** (0.1342)	0.5960*** (0.1342)	0.5960*** (0.1342)
Maturity	-0.0165 (0.0156)	-0.0165 (0.0156)	-0.0165 (0.0156)
Amount	0.0860 (0.7285)	0.0860 (0.7285)	0.0860 (0.7285)
TreasuryYield	0.7251*** (0.1758)	0.7251*** (0.1758)	0.7251*** (0.1758)
Private	0.2828 (0.5821)	0.2828 (0.5821)	0.2828 (0.5821)
Size	0.2866* (0.1689)	0.2866* (0.1689)	0.2866* (0.1689)
Leverage	0.0277** (0.0113)	0.0277** (0.0113)	0.0277** (0.0113)
<i>Fixed-effects</i>			
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Country	Yes	Yes	Yes
<i>Fit statistics</i>			
Observations	209	209	209
R ²	0.8105	0.8105	0.8105
Within R ²	0.79188	0.79188	0.79188
<i>Issuer standard-errors in parentheses</i>			
<i>Signif. Codes: ***: 0.01, **: 0.05, *: 0.1</i>			

Appendix

Table A.1: Reviewers by Review Type

A: Second-party Opinions

	SPO Reviewers	Amount	NbrBonds	Maket Share
1	SUSTAINALYTICS	65.24	252.00	38.43%
2	VIGEO EIRIS	40.19	73.00	23.67%
3	ISS-OEKOM	28.18	129.00	16.60%
4	CICERO	19.33	189.00	11.38%
5	DNV GL	10.41	36.00	6.13%
6	LIANHE EQUATOR	1.69	8.00	1.00%
7	CARBON TRUST	1.11	2.00	0.65%
8	CECEP	0.81	3.00	0.48%
9	R&I (JAPAN)	0.56	3.00	0.33%
10	SITAWI	0.55	1.00	0.32%
11	CCXI	0.51	4.00	0.30%
12	JCRA	0.40	1.00	0.24%
13	CHINA BOND RATING	0.29	1.00	0.17%
14	SHANGHAI BRILLIANCE	0.17	1.00	0.10%
15	RFU	0.13	4.00	0.08%
16	ZHONGCAI GREEN FINANCING	0.09	1.00	0.05%
17	THE IGREENBANK	0.07	1.00	0.04%
18	GOLDEN CREDIT	0.04	1.00	0.02%

B: Assurance

	Assurance Reviewers	Amount	NbrBonds	Maket Share
1	DELOITTE	24.17	27.00	50.04%
2	EY	21.27	51.00	44.04%
3	KPMG	1.47	11.00	3.05%
4	CECEP CONSULTING	0.79	4.00	1.64%
5	HKQAA	0.32	2.00	0.67%
6	PWC	0.17	7.00	0.35%
7	DNV GL	0.10	1.00	0.21%

C: Rating Agencies

	Rating Agencies	Amount	NbrBonds	Maket Share
1	MOODY'S	7.80	12.00	38.80%
2	S&P GLOBAL RATINGS	4.64	14.00	23.08%
3	JCR	2.37	28.00	11.80%
4	R&I (JAPAN)	2.31	15.00	11.52%
5	CHINA BOND RATING	1.45	6.00	7.24%
6	LIANHE EQ (CHINA)	0.60	4.00	3.01%
7	JCRA	0.60	16.00	2.96%
8	RAM HOLDINGS (MALAYSIA)	0.11	19.00	0.57%
9	CECEP (CHINA)	0.09	1.00	0.47%
10	GOLDEN CREDIT (CHINA)	0.08	3.00	0.41%
11	CCXI (CHINA)	0.03	1.00	0.14%

D: CBI Verifiers

	CBI Verifiers	Amount	NbrBonds	Maket Share
1	ISS-OEKOM	15.38	16.00	33.94%
2	SUSTAINALYTICS	11.11	26.00	24.52%
3	EY	6.94	20.00	15.32%
4	DNV GL	3.55	17.00	7.83%
5	EMERGENT VENTURES	2.33	6.00	5.13%
6	KPMG	2.32	8.00	5.12%
7	VIGEO EIRIS	1.75	3.00	3.86%
8	MULTICONSULT	1.24	1.00	2.74%
9	ZHONGCAI GREEN FINANCING	0.40	1.00	0.88%
10	CCX MANAGEMENT	0.15	2.00	0.33%
11	JCRA	0.10	1.00	0.21%
12	LIANHE EQUATOR	0.06	1.00	0.12%

Table A.2: Green Bond Issuance by Country and Review Type

	Country	NbrBonds	NbrIssuers	Amount	ExternalReview	SPO	Assurance	RatingAgency	CBICertified
1	United states	217	55	54.65	41.48%	35.90%	5.58%	0.00%	0.73%
2	China	120	77	51.92	87.29%	11.51%	71.82%	12.46%	8.30%
3	France	130	28	35.54	75.77%	75.21%	6.20%	0.00%	22.47%
4	Netherlands	37	18	28.14	68.97%	68.97%	0.00%	1.99%	31.03%
5	Germany	111	11	19.14	89.39%	86.30%	0.00%	3.09%	10.61%
6	Japan	112	75	13.35	93.01%	65.38%	0.00%	37.13%	2.90%
7	Sweden	117	29	10.89	100.00%	100.00%	0.00%	2.70%	0.00%
8	Spain	21	9	8.73	100.00%	89.44%	0.00%	10.56%	0.00%
9	Norway	21	14	8.62	33.63%	33.63%	13.59%	14.40%	66.37%
10	Canada	24	15	8.05	90.51%	84.91%	0.00%	5.61%	4.59%
11	Cayman islands	23	11	7.83	79.13%	75.18%	3.96%	13.72%	14.48%
12	Italy	12	7	7.52	89.56%	89.56%	0.00%	7.52%	10.44%
13	Australia	12	8	5.05	7.41%	0.00%	7.41%	0.00%	92.59%
14	Austria	18	8	5.01	100.00%	100.00%	0.00%	0.00%	0.00%
15	Hong kong	14	8	4.85	93.82%	54.28%	36.45%	3.09%	0.00%
16	United kingdom	15	9	3.81	82.53%	65.75%	0.00%	16.78%	17.47%
17	Korea, rep.	15	7	3.76	58.56%	50.57%	7.99%	0.00%	0.00%
18	India	14	8	3.56	0.00%	0.00%	0.00%	8.39%	91.82%
19	Virgin islands	11	8	3.19	90.58%	78.03%	12.56%	0.00%	0.00%
20	Denmark	7	4	2.91	100.00%	100.00%	0.00%	0.00%	0.00%
21	Luxembourg	5	5	2.44	79.52%	79.52%	0.00%	0.00%	20.48%
22	Finland	6	4	2.44	100.00%	100.00%	0.00%	0.00%	0.00%
23	Mauritius	5	5	2.30	43.48%	43.48%	0.00%	0.00%	56.52%
24	Bermuda	5	4	2.01	65.17%	65.17%	0.00%	9.95%	0.00%
25	Switzerland	8	6	2.00	100.00%	100.00%	0.00%	26.35%	0.00%
26	Taiwan	21	13	1.84	36.09%	0.00%	36.09%	0.00%	0.00%
27	Thailand	24	5	1.50	27.94%	10.70%	17.24%	0.00%	72.06%
28	Belgium	5	3	1.36	15.99%	15.99%	0.00%	0.00%	84.01%
29	New zealand	9	4	1.22	64.20%	46.55%	17.65%	0.00%	35.80%
30	Ireland	3	3	1.12	76.42%	76.42%	0.00%	0.00%	23.58%
31	Singapore	10	8	0.97	72.12%	7.65%	31.11%	33.36%	7.35%
32	Mexico	1	1	0.70	100.00%	100.00%	0.00%	0.00%	0.00%
33	United Arab Emirates	2	1	0.68	100.00%	100.00%	0.00%	0.00%	0.00%
34	Brazil	2	2	0.61	91.84%	91.84%	0.00%	0.00%	8.16%
35	Peru	2	1	0.60	100.00%	0.00%	0.00%	100.00%	0.00%
36	Malaysia	73	7	0.58	99.18%	79.52%	0.00%	19.66%	0.00%
37	Philippines	2	1	0.40	100.00%	100.00%	0.00%	0.00%	0.00%
38	Lithuania	1	1	0.34	100.00%	100.00%	0.00%	0.00%	0.00%
39	Panama	1	1	0.26	0.00%	0.00%	0.00%	0.00%	0.00%
40	Georgia	1	1	0.25	100.00%	100.00%	0.00%	0.00%	0.00%
41	Jersey	1	1	0.12	100.00%	100.00%	0.00%	0.00%	0.00%
42	Latvia	1	1	0.11	100.00%	100.00%	0.00%	100.00%	0.00%
43	Portugal	1	1	0.07	100.00%	100.00%	0.00%	0.00%	0.00%
44	Indonesia	2	1	0.03	100.00%	100.00%	0.00%	0.00%	0.00%

Table A.3: Green Bond Issuance by Industry and Review Type

	Industry	NbrBonds	NbrIssuers	Amount	ExternalReview	SPO	Assurance	RatingAgency	CBICertified
1	Financials	673	267	181.96	76.35%	53.24%	22.53%	6.68%	15.11%
2	Utilities	251	104	71.18	68.14%	56.77%	8.49%	3.97%	3.74%
3	Industrials	62	38	16.72	50.83%	39.71%	0.19%	13.72%	47.03%
4	Consumer Discretionary	53	28	15.12	64.05%	52.72%	4.74%	8.45%	29.02%
5	Energy	161	24	7.45	38.65%	31.09%	3.02%	18.27%	35.03%
6	Technology	9	5	5.71	94.74%	89.49%	5.26%	1.71%	0.00%
7	Materials	21	12	5.40	90.31%	88.87%	0.00%	1.44%	0.00%
8	Communications	6	5	4.32	76.84%	76.84%	0.00%	0.00%	0.00%
9	Consumer Staples	5	5	2.04	86.11%	86.11%	0.00%	0.00%	13.89%
10	Health Care	1	1	0.58	100.00%	100.00%	0.00%	0.00%	0.00%

Table A.4: The Impact of External Reviews on the Greenium

Dependent Variable:	Greenium							
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Variables</i>								
ExternalReview	0.1430 (0.1259)	0.1025 (0.1530)	-0.2537* (0.1465)	0.0938 (0.1384)	-0.1719 (0.1390)	-0.1854 (0.1531)	-0.1602 (0.1500)	0.1005 (0.1526)
Coupon	0.2020*** (0.0326)	0.2020*** (0.0533)	0.3403*** (0.0694)	0.2081*** (0.0336)	0.3111*** (0.0456)	0.3402*** (0.0709)	0.3109*** (0.0460)	0.2104*** (0.0350)
Maturity	-0.0012*** (0.0004)	-0.0004 (0.0006)	0.0008 (0.0007)	-0.0010** (0.0004)	0.0002 (0.0005)	0.0010 (0.0008)	0.0004 (0.0006)	-0.0010** (0.0004)
Amount	-0.2323* (0.1384)	-0.1862 (0.1468)	0.0413 (0.1407)	-0.1833 (0.1451)	0.0464 (0.1442)	0.1335 (0.1530)	0.0665 (0.1457)	-0.1624 (0.1578)
TreasuryYield	0.6166* (0.3171)	0.1710 (0.1308)	0.2351** (0.1073)	0.6251* (0.3234)	0.6005** (0.2606)	0.2414** (0.1086)	0.6175** (0.2635)	0.6391** (0.3214)
Private	-0.2579* (0.1435)	-0.2126 (0.1603)	-0.3357** (0.1616)	-0.2247 (0.1466)	-0.3678** (0.1640)	-0.3043* (0.1743)	-0.3198* (0.1756)	-0.2189 (0.1405)
Size	0.0146 (0.0302)	-0.0052 (0.0265)	-0.0078 (0.0413)	0.0126 (0.0262)	0.0014 (0.0416)	-0.0028 (0.0399)	0.0047 (0.0395)	0.0077 (0.0359)
Leverage	0.0064** (0.0032)	0.0074** (0.0036)	0.0029 (0.0031)	0.0058* (0.0032)	0.0025 (0.0029)	0.0028 (0.0031)	0.0028 (0.0030)	0.0057* (0.0033)
<i>Fixed-effects</i>								
Year	Yes			Yes	Yes		Yes	Yes
Industry		Yes		Yes		Yes	Yes	Yes
Country			Yes		Yes	Yes	Yes	
Continent								Yes
<i>Fit statistics</i>								
Observations	817	817	817	817	817	817	817	817
R ²	0.26242	0.206	0.39604	0.27903	0.43453	0.40663	0.44402	0.29255
Within R ²	0.23668	0.18102	0.32003	0.24069	0.3383	0.31776	0.33883	0.247

Issuer standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table A.5: The Impact of External Reviews on the Greenium by Geographic Region

Dependent Variable:	Greenium			
Model:	(1)	(2)	(3)	(4)
<i>Variables</i>				
ExternalReviewxEurope	0.1820 (0.1501)			
ExternalReviewxAsia		0.0242 (0.1653)		
ExternalReviewxNorthAmerica			-0.2074 (0.1777)	
ExternalReviewxUS				-0.6469*** (0.1912)
Coupon	0.2073*** (0.0333)	0.2067*** (0.0344)	0.2088*** (0.0340)	0.2088*** (0.0337)
Maturity	-0.0011** (0.0004)	-0.0009** (0.0004)	-0.0010** (0.0004)	-0.0010** (0.0004)
Amount	-0.1854 (0.1444)	-0.1925 (0.1561)	-0.1782 (0.1434)	-0.1573 (0.1459)
TreasuryYield	0.6312* (0.3236)	0.6259* (0.3244)	0.6270* (0.3229)	0.6260* (0.3231)
Private	-0.2630* (0.1418)	-0.2142 (0.1486)	-0.2106 (0.1497)	-0.2178 (0.1474)
Size	0.0248 (0.0274)	0.0095 (0.0296)	0.0076 (0.0265)	0.0082 (0.0263)
Leverage	0.0053 (0.0032)	0.0056* (0.0032)	0.0050 (0.0033)	0.0057* (0.0032)
<i>Fixed-effects</i>				
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
<i>Fit statistics</i>				
Observations	817	817	817	817
R ²	0.28176	0.2782	0.2797	0.28344
Within R ²	0.24357	0.23982	0.2414	0.24534

Issuer standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*