

Online Appendix

of

“Rethinking the Value and Emission Implications of Green Bonds”

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Appendix B

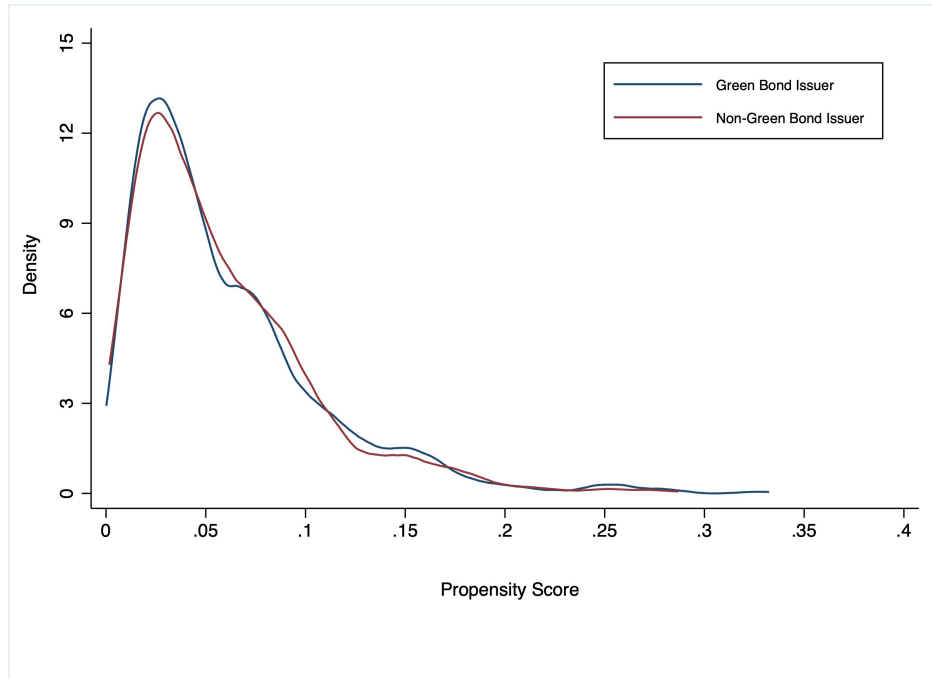


Figure 6: Kernel Density of Propensity Score: Green Bond Issuer vs Non-Green Bond Issuer. This figure shows the kernel density of propensity score for green bond issuer and matched firms. The green bonds are issued from 1st January 2013 to 31st December 2022.

Table B1: Impact of green bonds on Carbon Intensity – Disclosed vs. Estimated

This table reports the regression estimates of carbon intensity for green bond issuer with respect to a matched firm from 1st January 2013 to 31st December 2022. The green bond issuer matched with comparable firms based on industry, year, and firm characteristics. Carbon Intensity is ratio of carbon emissions to revenue measured as tonnes per USD. Estimated is an indicator variable which takes value 1 if the carbon emissions value is vendor-estimated and 0 for disclosed. *Green Bond Issuer* is a dummy variable which takes value 1 if the firm has issued at least one green bond in that year and 0 for matched firm. Country-year denotes country-by-year fixed effects, industry-year denotes industry-by-year fixed effect, and cluster (industry) denotes clustering errors at the industry (BICS level 2) level. *Size* is firm size measured as natural logarithm of total assets. *Leverage* is firm's leverage measured as total debt to equity ratio. *ROE* is return of equity measured as net income to total common equity value. *Sales Growth* is growth in sales with respect to last year. All variables are as defined in Appendix A. Standard errors are reported in parentheses. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the two-tailed 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
	Full Sample	Disclosed	Estimated
VARIABLES	Carbon Intensity	Carbon Intensity	Carbon Intensity
Green Bond Issuer	5.017 (5.003)	5.143 (7.343)	13.093** (6.109)
Size	8.245*** (1.668)	10.676*** (2.372)	-0.701 (2.486)
Leverage	-0.016 (0.132)	-0.160 (0.193)	0.285* (0.163)
ROE	-0.133 (0.107)	-0.407** (0.164)	0.175 (0.213)
Sales Growth	0.015 (0.062)	0.084 (0.106)	-0.078 (0.058)
Constant	-35.483* (20.411)	-45.284 (29.755)	28.111 (29.640)
Observations	3,761	2,610	1,151
R-squared	0.660	0.703	0.820
Industry-Year	Yes	Yes	Yes
Country-Year	Yes	Yes	Yes

Table B2: Green Bond Issuances and Institutional Ownership

This table reports the regression results of institutional ownership on green bond issuer with respect to matched firm from 1st January 2013 to 31st December 2022. The green bond issuer matched with comparable firms based on industry, year, and firm characteristics. *Institutional Ownership* is ratio of institutions ownership in a firm. *Chg. Institutional Ownership* is change in institutional ownership between contemporaneous and one-year ahead. *Percent Chg. Institutional Ownership* is percentage change in institutional ownership between contemporaneous and one-year ahead. *Green Bond Issuer* is a dummy variable which takes value 1 if the firm has issued at least one green bond in that year and 0 for matched firm. Country denotes country level fixed effects, industry-year denotes industry-by-year fixed effect, and cluster (industry) denotes clustering errors at the industry (BICS level 2) level. *Size* is firm size measured as natural logarithm of total assets. *Leverage* is firm's leverage measured as total debt to equity ratio. *ROE* is return of equity measured as net income to total common equity value. *Sales Growth* is growth in sales with respect to last year. All variables are as defined in Appendix A. Standard errors are reported in parentheses. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the two-tailed 1%, 5%, and 10% level, respectively.

VARIABLES	(1) Inst. Ownership	(2) Chg. Inst. Ownership	(3) (Percent Chg. Inst. Ownership (%))
Green Bond Issuer	0.013*** (0.004)	0.006*** (0.002)	-0.831 (2.594)
Size	0.027*** (0.001)	-0.002*** (0.000)	-1.138 (0.721)
Leverage	-4.139*** (0.892)	0.405 (0.376)	214.141 (599.135)
ROE	0.057*** (0.007)	0.008** (0.003)	0.050 (4.929)
Sales Growth	-0.004 (0.003)	0.002 (0.001)	2.442 (2.095)
Constant	-0.130*** (0.012)	0.018*** (0.005)	14.908* (8.137)
Observations	6,459	5,369	5,369
R-squared	0.805	0.238	0.329
Industry_Year	Yes	Yes	Yes
Country	Yes	Yes	Yes

Table B3: Sector Classification

This table reports the univariate cumulative abnormal returns (CARs) using a different sector classification. Rather than classifying the sectors based on financial and polluting (energy, utility, materials, and industrials), traditional sector classification is used i.e., financial and non-financial. Columns (1) – (3) show the results using 2013-2022 sample and columns (4) – (6) show the results using the sample 2013-2018. N is number of unique events. All variables are as defined in Appendix A. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the two-tailed 1%, 5%, and 10% level, respectively.

Variable\Events	Sample: 2013-2022			Sample: 2013-2018 (Flammer – 2021)		
	Full Sample	Financial Sector	Non-Financial Sector	Full Sample	Financial Sector	Non-Financial Sector
	N=2081	N=1274	N=807	N=405	N=253	N=152
	(1)	(2)	(3)	(4)	(5)	(6)
CAR (-1,1)	-0.048 (0.070)	0.024 (0.079)	-0.159 (0.130)	0.059 (0.105)	0.088 (0.139)	0.009 (0.158)
CAR (-2,2)	-0.040 (0.087)	-0.010 (0.107)	-0.086 (0.147)	-0.022 (0.141)	0.092 (0.185)	-0.212 (0.217)
CAR (-3,3)	-0.028 (0.103)	0.044 (0.127)	-0.137 (0.173)	0.010 (0.163)	0.212 (0.218)	-0.327 (0.236)
CAR (-4,4)	0.034 (0.118)	0.027 (0.148)	0.045 (0.194)	0.102 (0.177)	0.193 (0.220)	-0.050 (0.296)
CAR (-5,5)	0.149 (0.129)	0.216 (0.161)	0.040 (0.216)	0.231 (0.195)	0.437* (0.236)	-0.111 (0.340)
CAR (-5,10)	0.274* (0.157)	0.330* (0.194)	0.186 (0.266)	0.539** (0.239)	0.872*** (0.292)	-0.015 (0.409)

Table B4: Primary Market of Green Bonds

This table reports the regression estimates of primary market yield for green bond with respect to conventional bond by the same issuer. Green Bond is indicator variable which takes value 1 if a bond is green bond and 0 if a bond is conventional bond by the same firm in the same year. Finance is indicator variable which takes value 1 if an issued bond is by finance firm, otherwise 0. Column (1) reports the results for sample 2013-2018. Column (2) reports the results for sample 2013-2022. Column (3) reports the results for sample 2013-2021. Column (4) reports the results for sample 2013-2022 for interaction between Green Bond indicator and Finance indicator. Column (5) reports the results for sample 2013-2022 (Excl. 2021) for interaction between Green Bond indicator and Finance indicator. Firm-Year is firm and year fixed effects. Industry-Year is industry and year fixed effects. Country-Year is country and year fixed effects. All variables are as defined in Appendix A. Clustering of errors are at firm-year, industry-year, and country-year level. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the two-tailed 1%, 5%, and 10% level, respectively.

Sample	2013-2018	2013-2022	2013-2022 (Excl. 2021)	2013-2022	2013-2022 (Excl. 2021)
VARIABLES	(1) Yield	(2) Yield	(3) Yield	(4) Yield	(5) Yield
Green Bond	-0.705 (0.437)	1.710*** (0.569)	0.522 (0.321)	1.660** (0.677)	0.338 (0.214)
Finance				-0.470 (0.557)	-0.103 (0.226)
Green Bond x Finance				0.286 (1.078)	0.512 (0.551)
Constant	3.032*** (0.076)	2.553*** (0.189)	2.691*** (0.100)	2.779*** (0.197)	2.736*** (0.091)
Observations	1,154	4,705	3,544	4,705	3,544
R-squared	0.588	0.549	0.525	0.368	0.409
Firm-Year	Yes	Yes	Yes	No	No
Industry-Year	Yes	Yes	Yes	No	No
Country-Year	Yes	Yes	Yes	Yes	Yes
Error Clustering	Yes	Yes	Yes	Yes	Yes

Table B5: Tesla Effect

This table reports the univariate cumulative abnormal returns (CARs) to show the Tesla Effect. Columns (1) – (3) reports the CARs for full sample, financial sector firms, and non-financial sector firms. Column (4) report the CARs for green bond announcements by the Tesla. Column (5) reports the CARs for full sample excluding Tesla. Column (6) reports the CARs for non-financial sector firms excluding Tesla. All variables are as defined in Appendix A. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the two-tailed 1%, 5%, and 10% level, respectively.

Sample: 2013-2022						
	Full Sample	Financial Sector	Non-Financial Sector	Tesla	Full Sample (Excl. Tesla)	Non-Financial Sector (Excl. Tesla)
Variable\Events	N=2081	N=1274	N=807	N=30	N=2051	N=777
	(1)	(2)	(3)	(4)	(5)	(6)
CAR (-1,1)	-0.048 (0.070)	0.024 (0.079)	-0.159 (0.130)	0.284*** (0.110)	-0.052 (0.071)	0.176 (0.135)
CAR (-2,2)	-0.040 (0.087)	-0.010 (0.107)	-0.086 (0.147)	0.373** (0.187)	-0.046 (0.088)	-0.104 (0.153)
CAR (-3,3)	-0.028 (0.103)	0.044 (0.127)	-0.137 (0.173)	0.318 (0.219)	-0.031 (0.104)	-0.155 (0.180)
CAR (-4,4)	0.034 (0.118)	0.027 (0.148)	0.045 (0.194)	0.427* (0.233)	0.029 (0.120)	0.031 (0.202)
CAR (-5,5)	0.149 (0.129)	0.216 (0.161)	0.040 (0.216)	0.373 (0.273)	0.144 (0.131)	0.027 (0.224)
CAR (-5,10)	0.274* (0.157)	0.330* (0.194)	0.186 (0.266)	0.447 (0.359)	0.271* (0.159)	0.176 (0.275)

**Table B6: Environmental Performance of Green Bond Issuers:
Post-Issuance vs. Pre-Issuance**

This table reports the regression results of environmental performance of green bond issuer, post-issuance versus the pre-issuance. The green bond issuer matched with comparable firms based on industry, year, and firm characteristics. Environment performance proxied as *Carbon Emissions Risk*, *Water Stress Risk*, *Biodiversity Risk*, *Toxic Emissions Risk*, *Overall Environment Risk Score*, *Carbon Intensity*, *Environmental Score (E Score)*, and *ESG Score* from MSCI ESG Rating, Trucost, and Refinitiv databases. Panel A show the regression results of green bond issuer for environmental risk exposures from MSCI Rating database. *Post-Issuance* is a dummy variable which takes value 1 if a firm has at least one green bond under maturity in that year; otherwise, 0. Country-year denotes country-by-year fixed effects, industry-year denotes industry-by-year fixed effect, and cluster (industry) denotes clustering errors at the industry (BICS level 2) level. All variables are as defined in Appendix A. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the two-tailed 1%, 5%, and 10% level, respectively.

Panel A: Environmental Risks Exposure

Panel A reports the regression estimates of environmental risks exposure for a green bond issuer in pre-issuance period compared to post-issuance period. for environmental risk exposures from MSCI Rating database. *Post-Issuance* is a dummy variable which takes value 1 if a firm has at least one green bond under maturity in that year; otherwise, 0. Column 1 provides the regression results of the Carbon Emissions Risk on the *Post-Issuance* indicator, Column 2 provides the regression results of the Water Stress Risk on the *Post-Issuance* indicator, Column 3 provides the regression results of the Biodiversity Risk on the *Post-Issuance* indicator, Column 4 provides the regression results of the *Post-Issuance*, Column 5 provides the regression results of the Overall Environment Risk Score on the *Post-Issuance* indicator.

VARIABLES	(1) Carbon Emissions Risk	(2) Water Risk	(3) Biodiversity Risk	(4) Toxic Emissions Waste	(5) Overall Environment Risk Score
Post-Issuance	-0.270*** (0.063)	-0.182*** (0.067)	-0.094** (0.041)	-0.166*** (0.059)	0.217*** (0.033)
Size	0.037 (0.023)	-0.017 (0.024)	-0.034** (0.015)	0.052** (0.021)	0.052*** (0.012)
Leverage	-0.001 (0.002)	-0.010*** (0.002)	0.002 (0.001)	-0.012*** (0.002)	0.002 (0.001)
ROE	-0.003** (0.001)	-0.002* (0.001)	0.003*** (0.001)	-0.003** (0.001)	0.000 (0.001)
Sales Growth	-0.000 (0.001)	-0.002** (0.001)	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.000)
Constant	2.997*** (0.286)	4.573*** (0.301)	2.901*** (0.183)	3.178*** (0.265)	0.964*** (0.148)
Observations	3,036	3,036	3,036	3,036	3,036
R-squared	0.715	0.710	0.860	0.806	0.795
Industry-Year	Yes	Yes	Yes	Yes	Yes
Country-Year	Yes	Yes	Yes	Yes	Yes

Panel B: Carbon Intensity, Environmental Score, and ESG Score

Panel B reports the regression estimates of green bond issuer for carbon intensity, environmental score (E Score), and esg score (ESG Score). *Post-Issuance* is a dummy variable which takes value 1 if a firm has at least one green bond under maturity in that year. Column 1 provides the regression results of the Carbon Intensity Scope 1 on the *Post-Issuance* indicator, Column 2 provides the regression results of the Carbon Intensity Scope 2 on the *Post-Issuance* indicator, Column 3 provides the regression results of the Environmental Score on the *Post-Issuance* indicator, ESG Score provides the regression results of the *Post-Issuance*.

VARIABLES	(1) Carbon Intensity Scope 1	(2) Carbon Intensity Scope 2	(3) Environmental Score	(4) ESG Score
Post-Issuance	2.980 (6.646)	8.471 (6.851)	5.094*** (1.095)	4.135*** (0.923)
Size	7.347*** (2.419)	5.956** (2.521)	7.977*** (0.431)	6.765*** (0.363)
Leverage	-0.184 (0.198)	-0.192 (0.206)	-0.107*** (0.033)	-0.075*** (0.028)
ROE	0.085 (0.147)	0.285** (0.135)	-0.011 (0.021)	-0.020 (0.018)
Sales Growth	0.010 (0.087)	0.195* (0.115)	-0.056*** (0.015)	-0.045*** (0.013)
Constant	-22.940 (29.983)	-11.357 (31.295)	-46.035*** (5.451)	-36.067*** (4.595)
Observations	2,575	2,496	2,476	2,476
R-squared	0.582	0.586	0.631	0.657
Industry-Year	Yes	Yes	Yes	Yes
Country-Year	Yes	Yes	Yes	Yes