

The pricing of green bonds

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Introduction

- Green bonds are fixed income securities which usually differ from conventional debt instruments only in that they finance environmental or climate-related activities
 - market-based solution to channel funds to environmentally beneficial projects.
- Rapidly expanding market since its inception in 2007, notwithstanding the absence of a commonly agreed definition of 'greenness'

Green Bonds and their pricing

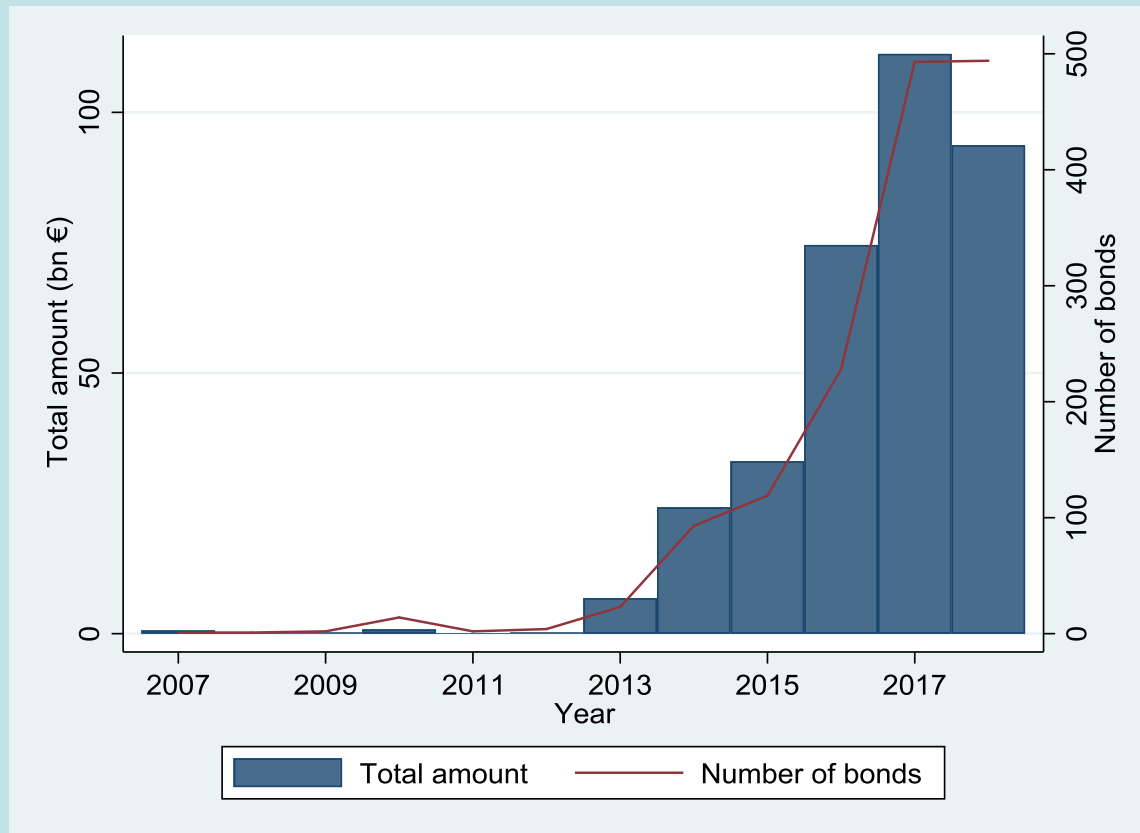
- Why do investors hold green bonds? Non-pecuniary motives, pro-environmental preferences
- If the appetite for certain types of assets enters the utility function of investors in addition to their return/risk expectations, investors' tastes modify equilibrium prices (Fama & French, 2007).
- Empirical evidence:
 - Schiereck (2018): no significant price differences between green and similar ordinary bonds;
 - Zerbib (2018) and Baker et al. (2018) find a moderate green bond premium;
 - Karpf & Mandel (2017) find a green bond discount on secondary market yields.

What we do

In this paper, we investigate:

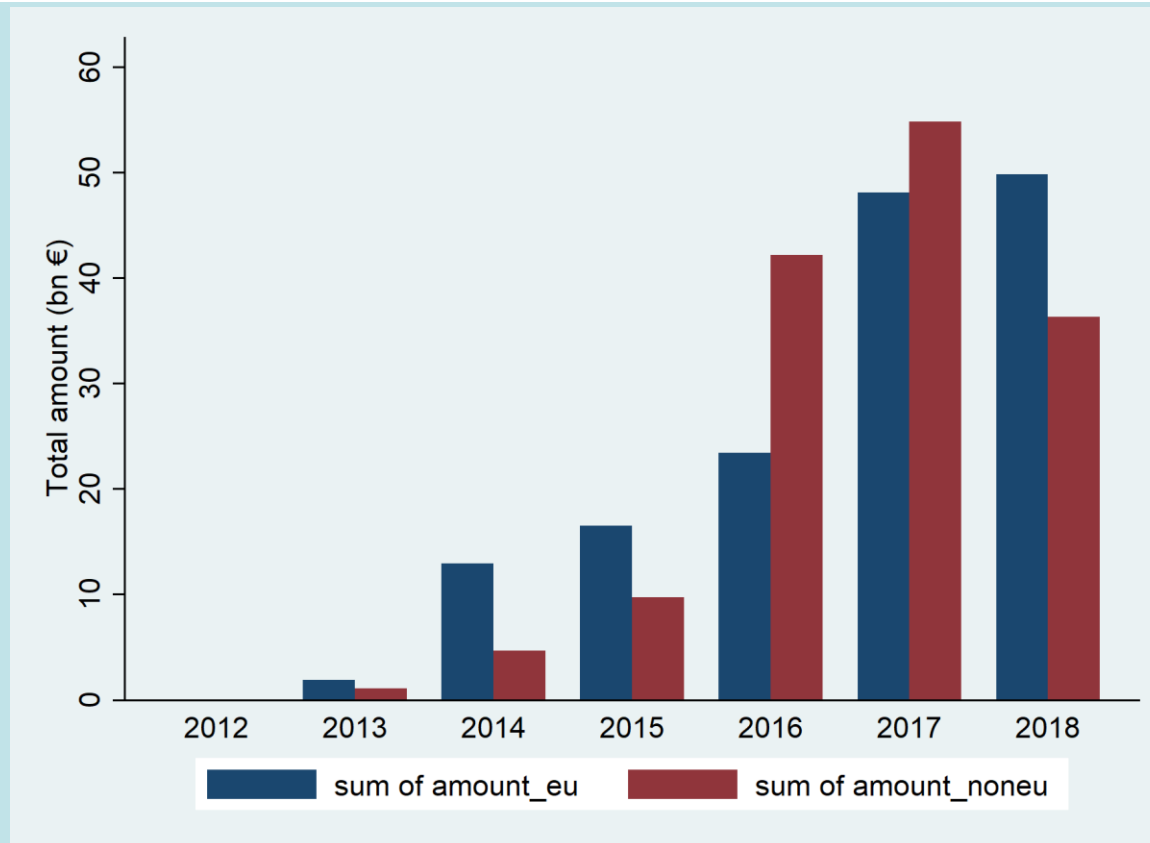
- the pricing implications of the green label on the primary market for bond issuances;
- if certification has an impact on equilibrium prices;
- if there is a reputational effect associated with recurring green issuances

Green Bond Market: evolution



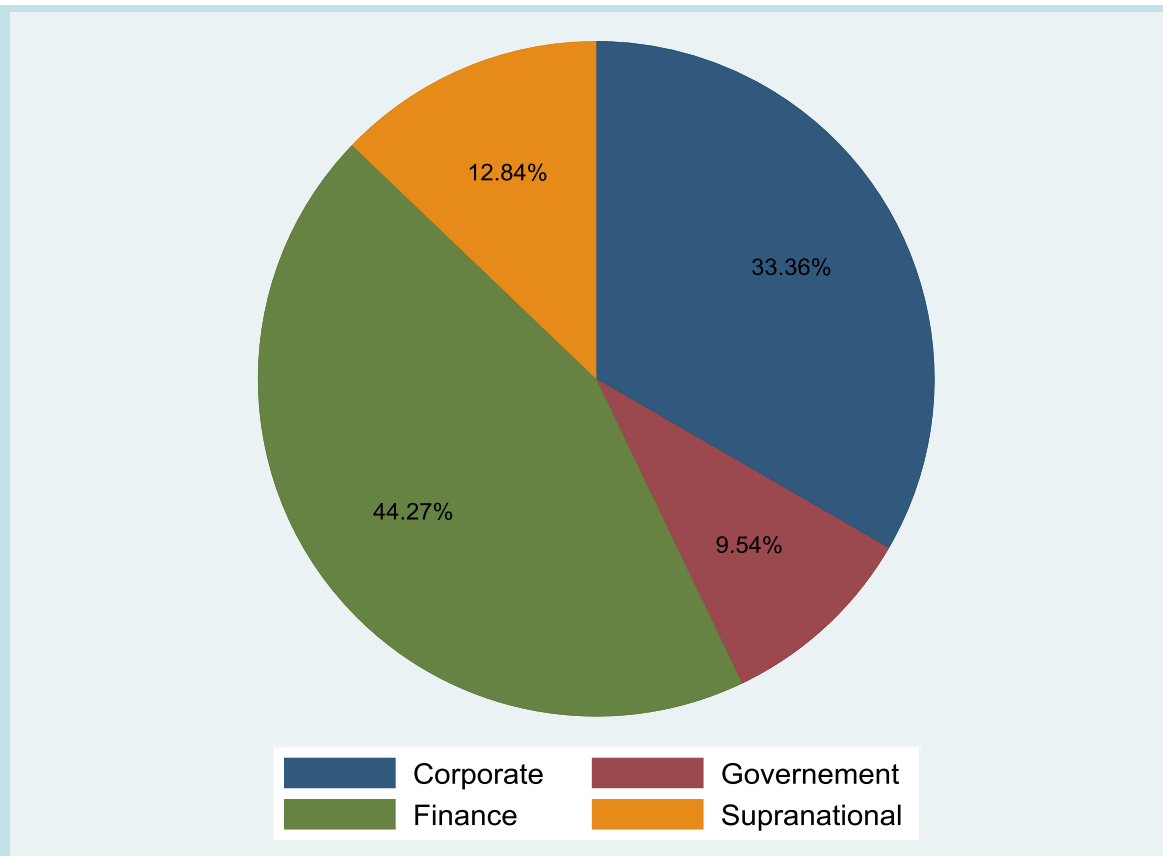
Source: Dealogic DCM, Green Bond Notional Amount and Contracts, Period 2007-2018.

Green Bond Market: EU versus Non-EU Issuers



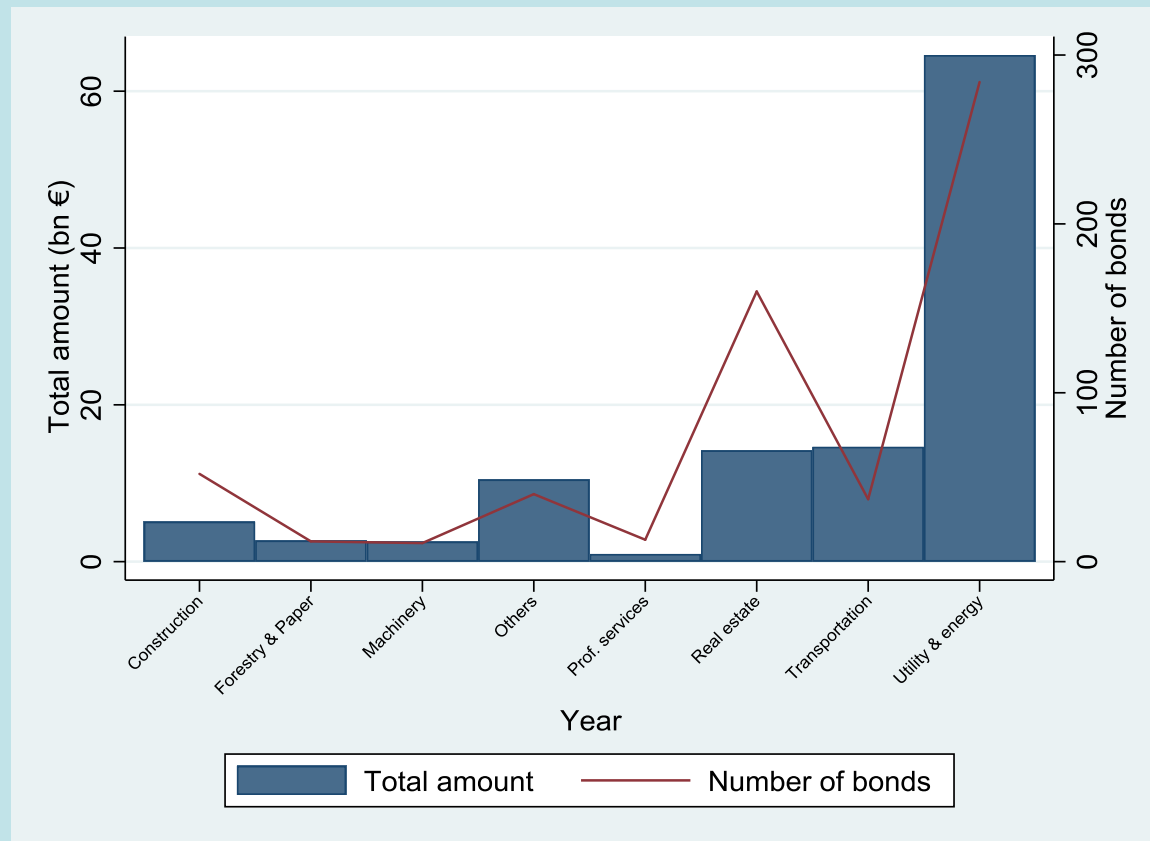
Source: Dealogic DCM, Green Bond Notional Amount, Period 2007-2018.

Green Bond Market: breakdown by type of issuer



Source: Dealogic DCM, Green Bond Notional Amount, 2007-2018.

Green Bond Market: breakdown by Sector



Source: Dealogic DCM, Green Bond Notional Amount and Contracts, Period 2007-2018.

Data and sample descriptives

- Data on bond tranches issued by corporations and supranational institutions worldwide in the period 2007-2018 (November), taken from Dealogic DCM
- Out of 268,083 fixed income securities issued, 1,131 are classified as 'green', of which 483 are certified

Panel A.

| Issuer | Green | | | Ordinary | | |
|----------------------------|--------------|-----------------|-------------------|----------------|------------------|-------------------|
| | Number | Amount (EUR bn) | Average yield (%) | Number | Amount (EUR bn) | Average yield (%) |
| Supranational institutions | 222 | 42.17 | 3.56 | 7,443 | 1,429.16 | 5.18 |
| Financial firms | 401 | 135.45 | 3.08 | 181,284 | 25,321.83 | 3.26 |
| Non Financial firms | 508 | 109.33 | 3.77 | 78,225 | 17,799.63 | 4.82 |
| Total | 1,131 | 287 | 3.48 | 266,952 | 44,550.62 | 3.77 |

Panel B.

| Issuer | Certified | | | Non-Certified | | |
|----------------------------|------------|-----------------|-------------------|---------------|-----------------|-------------------|
| | Number | Amount (EUR bn) | Average yield (%) | Number | Amount (EUR bn) | Average yield (%) |
| Supranational institutions | 79 | 10.91 | 4.37 | 143 | 31.25 | 3.12 |
| Financial firms | 187 | 61.60 | 2.87 | 214 | 73.86 | 3.27 |
| Non Financial firms | 217 | 64.79 | 3.08 | 291 | 44.54 | 4.27 |
| Total | 483 | 137 | 3.21 | 648 | 149.65 | 3.76 |

Source: Dealogic DCM

Econometric strategy

- Specification:

$$Yield_{b,i,t} = \beta_0 + \beta_1 \mathbf{Green}_{b,i,t} + \beta_2 \mathbf{X}_{b,i,t} + \delta_i + \epsilon_{b,i,t}$$

- Dependent variable: Yield at issuance of bond b issued by firm i at time t
- Independent variables:
 - **Green**: dummy variable equal to 1 if a bond is classified as green
 - **X**: vector of bond characteristics
 - Callable
 - Puttable
 - Collateralized
 - Currency dummies
 - Use of proceeds dummies
 - Size dummies
 - Maturity×rating×time
 - Issuer fixed effects (δ_i)

Results - baseline

| | (1) All | (2) Financial and Supranational | (3) Financial | (4) Non-financial |
|---------------------------|-----------------------|---------------------------------------|-----------------------|-----------------------|
| Green | -0.4387*** (0.046) | -0.5193*** (0.058) | -0.1175* (0.071) | -0.2747*** (0.069) |
| Callable | 0.2060*** (0.008) | 0.2207*** (0.009) | 0.2671*** (0.009) | 0.0173 (0.019) |
| Puttable | -0.0845*** (0.017) | -0.1685*** (0.039) | -0.2091*** (0.035) | -0.0636*** (0.016) |
| Collateralized | 0.0217 (0.020) | 0.1521*** (0.025) | 0.0726*** (0.023) | -0.2171*** (0.032) |
| Use of proceeds: | | | | |
| Refinancing | 0.0378** (0.017) | -0.0135 (0.029) | 0.0256 (0.027) | 0.0154 (0.020) |
| General Corporate Purpose | 0.1652*** (0.013) | 0.0789*** (0.024) | 0.0817*** (0.022) | 0.2468*** (0.013) |
| Securitisation | 0.5212*** (0.047) | 0.3716*** (0.055) | 0.4210*** (0.050) | 1.1516*** (0.125) |
| Constant | 3.4336*** (0.013) | 3.0821*** (0.024) | 2.9846*** (0.022) | 4.5132*** (0.013) |
| Observations | 258,430 | 186,261 | 178,684 | 71,575 |
| R-squared | 0.7816 | 0.7367 | 0.7717 | 0.8760 |
| Adjusted R-squared | 0.762 | 0.722 | 0.758 | 0.844 |
| Bond size cat FE | Yes | Yes | Yes | Yes |
| Issue size cat FE | Yes | Yes | Yes | Yes |
| Currency FE | Yes | Yes | Yes | Yes |
| Maturity×Rating×Time FE | Yes | Yes | Yes | Yes |
| Issuer FE | Yes | Yes | Yes | Yes |

- Green bonds are issued at a significantly lower yield compared to 'conventional' bonds
- There are differences across types of issuer

Results - robustness

Panel A. Country fixed effect

| | (1) All | (2) Financial and Supranational | (3) Financial | (4) Non-financial |
|--------------|-----------------------|---------------------------------------|----------------------|-----------------------|
| Green | -0.4372*** (0.046) | -0.5221*** (0.058) | -0.1421** (0.069) | -0.2708*** (0.069) |

Panel B. Developing vs emerging countries

| | (1) Financial Developed | (2) Financial Emerging | (3) Non-financial Developed | (4) Non-financial Emerging |
|--------------|-------------------------------|------------------------------|-----------------------------------|----------------------------------|
| Green | -0.3902*** (0.085) | 0.2092 (0.130) | -0.3388*** (0.087) | -0.1552 (0.111) |

Panel C. Industry fixed effect

| | (1) Non-financial |
|--------------|-----------------------|
| Green | -0.2747*** (0.069) |

- Our results are robust to:
 - Issuer's country fixed effect (panel A)
 - Issuer's industry fixed effect (panel C)
- Results are mainly driven by bonds issued by borrowers in developed countries (panel B)

Results – certification

| | (1) All | (2) Financial and Supranational | (3) Financial | (4) Non-financial |
|-------------------------|-----------------------|---------------------------------------|---------------------|-----------------------|
| Green | -0.5340*** (0.063) | -0.6786*** (0.079) | -0.0548 (0.105) | -0.1822* (0.095) |
| Certified green | -0.3350*** (0.065) | -0.3361*** (0.084) | -0.1679* (0.094) | -0.3613*** (0.093) |
| Other controls | Yes | Yes | Yes | Yes |
| Observations | 258,430 | 186,261 | 178,684 | 71,575 |
| R-squared | 0.7816 | 0.7367 | 0.7717 | 0.8760 |
| Adjusted R-squared | 0.762 | 0.722 | 0.758 | 0.844 |
| Bond size cat FE | Yes | Yes | Yes | Yes |
| Issue size cat FE | Yes | Yes | Yes | Yes |
| Currency FE | Yes | Yes | Yes | Yes |
| Maturity×Rating×Time FE | Yes | Yes | Yes | Yes |
| Issuer FE | Yes | Yes | Yes | Yes |

- Certified green = variable equal to 1 for green bonds that are certified by a third party (i.e. Cicero, Vigeo Eiris, DNV GL ...)
- *Result: the market values an 'official' green certification*

Results – return issuers

| | (1) | (2) | (3) | (4) |
|--------------------------|-----------------------|-----------------------------|----------------------|-----------------------|
| | All | Financial and Supranational | Financial | Non-financial |
| Green | -0.2347*** (0.071) | -0.2690** (0.106) | -0.2154** (0.100) | -0.2027** (0.084) |
| Experienced green | -0.5530*** (0.055) | -0.6081*** (0.066) | -0.0407 (0.090) | -0.3702*** (0.094) |
| Other controls | Yes | Yes | Yes | Yes |
| Observations | 258,430 | 186,261 | 178,684 | 71,575 |
| R-squared | 0.7816 | 0.7367 | 0.7717 | 0.8760 |
| Adjusted R-squared | 0.762 | 0.722 | 0.758 | 0.844 |
| Bond size cat FE | Yes | Yes | Yes | Yes |
| Issue size cat FE | Yes | Yes | Yes | Yes |
| Currency FE | Yes | Yes | Yes | Yes |
| Maturity×Rating×Time FE | Yes | Yes | Yes | Yes |
| Issuer FE | Yes | Yes | Yes | Yes |

- Experienced green = variable equal to 1 if the issuer is not issuing a green bond for the first time
- *Result: Having already issued a green bond matters --> reputational effect*

Further analysis: green bonds in the financial sector

- Why do financial institutions issue green bonds?
 - Green-washing, or
 - Environmentally-friendly policy
- Environmentally-friendly = dummy variable equal to 1 if the issuer is a member of the United Nations Environment Programme Finance Initiative
- *Result: Environmentally-friendly institutions issue green bonds at a lower yield*
- The issue requires further investigation, i.e. analysis of lending activities after having issued a green bond

| | (1) Financial |
|---|-----------------------|
| Green | 0.0834 (0.081) |
| Environmentally friendly | -0.0396 (0.051) |
| Green × Environmentally friendly | -0.8071*** (0.152) |

Conclusion

- We study the pricing of corporate green bonds at issuance.
- Consistent with a non-pecuniary motive for holding green assets, we find that the green label is associated with a negative yield gap with respect to ordinary bonds. The premium is heterogeneous across types of non-governmental issuers.
- Moreover, certified corporate green bonds sell for a larger premium compared to green securities that lack external certification → signaling.
- Finally, returning issuers benefit from an additional yield gap → positive reputational effects.

Thank you!

Appendix I- Summary stats

| | N | Mean | Median | St. Dev. | P. 1 | P. 99 |
|-------------------|--------|----------|---------|----------|--------|-----------|
| Yield | 268083 | 3.7663 | 3.3600 | 2.5072 | 0.0600 | 12.0400 |
| Green | 268083 | 0.0042 | 0.0000 | 0.0648 | 0.0000 | 0.0000 |
| Certified green | 268083 | 0.0018 | 0.0000 | 0.0424 | 0.0000 | 0.0000 |
| Callable | 268083 | 0.3723 | 0.0000 | 0.4834 | 0.0000 | 1.0000 |
| Puttable | 268083 | 0.0685 | 0.0000 | 0.2527 | 0.0000 | 1.0000 |
| Collateralized | 268083 | 0.1643 | 0.0000 | 0.3706 | 0.0000 | 1.0000 |
| Amount (M€) | 268083 | 167.2526 | 45.2463 | 353.7232 | 0.7006 | 1633.8801 |
| Years to Maturity | 266730 | 7.3255 | 5.0000 | 7.0855 | 0.5000 | 33.0000 |
| Rating | 268083 | 5.8554 | 5.0000 | 4.2216 | 1.0000 | 11.0000 |