Green finance sources in Iberian listed firms: A socially responsible investment approach

João Leitão,
UBI, NECE, CEG-IST, ICS

Outline

Motivation and purpose

Literature overview and hypotheses

Model and estimation

Results and discusion

Concluding remarks and implications

Limitations and future research

Motivation and purpose

Climate change and implementation of the European Green Deal have raised the demand for ecologically friendly financial products and green finance, particularly fixed-income instruments such as green bonds.

Given the scarcity of research on the simultaneous effects of market and accounting-based characteristics when combined with green business innovation ability, the purpose of this study is to determine whether market-based and firm accounting variables, as well as environmental technological innovation, play a role in the decision to issue green bonds.

Literature overview and hypotheses

Where do we stand?

Green bonds are a financial innovation product that aims to fund environmentally friendly projects (Bhutta *et al.*, 2022).

The financing of institutions has emerged as an important mechanism in the energy transition (Jakubik and Uguz, 2021), as it has the potential to intensify the mitigation of greenhouse gas effects, particularly in institutions financed by green bonds (Fatica and Panzica, 2021).

The greater interest observed in green products is due to agents' increased sensitivity to the effects of climate change in three dimensions: economic, environmental, and social (Gianfrate and Peri, 2019), indicating institutions' greater commitment to this problem (Flammer, 2021), in response to regulatory changes introduced by the European Green Deal (Leitão *et al.*, 2021).

Green bonds may be used as a signaling mechanism for markets and society, allowing for more attention from investors and consumers (Maltais and Nykvist, 2020; Tang and Zhang, 2020; Flammer, 2021; Sangiorgi and Schopohl, 2021).

Literature overview and hypotheses

Market size effects

A firm's market size indicates its valorization (expected future value for investors), and valorization in the market diminishes a firm's participation in the bond or credit market, which may result in it being identified as leveraged because it failed to obtain capital funds owing to weak market assessment (Baker and Wurgler, 2002). In a bullish market context, managers direct their financing decisions to the share market rather than the debt market (Antoniou *et al.*, 2008).

From a corporate social responsibility and sustainability perspective, firms with greater market capitalization have more reason to invest in projects oriented toward energy transition (Ahmed and Jahanzeb, 2021; Raghutla *et al.*, 2021; Zhang, 2022), aiming for sustainable development of production and exports (Ahmed and Jahanzeb, 2021). Notably, firms with strong market capitalization that adopt sustainable practices arouse greater investor and stakeholder interest, which contributes to developing socially responsible investment portfolios (Nelling and Webb, 2009; Garcia *et al.*, 2017).

H1: Market size contributes to a significant increase in green bond issuance.

Literature overview and hypotheses

Market size effects

Pecking order theory asserts that financing costs increase with greater information asymmetry between market agents and managers. Additionally, financing through equity is preferable for external funding. Although information asymmetry is related to size, it facilitates external financing with a longer maturity (Zeitun and Goaied, 2021), especially in a bearish share market context (Hovakimian *et al.*, 2001). In the domain of environmental sustainability and energy transition, the existing literature indicates that firm size contributes to increased funds originating from green bonds (Barua and Chiesa, 2019; Chiesa and Barua, 2019).

H2: Firm size contributes to a significant increase in the issue of green bonds.

Although market size and firm size are usually strongly correlated, their effects on the dependent variable are not interchangeable (Dang *et al.*, 201).

H3: The size factor contributes to a significant increase in the issue of green bonds, but can have opposite effects.

Literature overview and hypotheses

Performance effects

The nature of the relationship between market performance and corporate policies on sustainability and the environment (including social responsibility) is similar to that of market and firm performance. That is, a firm showing robust, sustained performance is associated with sustainable, environmentally friendly corporate policies, and has a positive effect on investor interest (Yu *et al.*, 2018), meaning greater profits and financial stability (Gao and Zhang, 2015).

Adopting socio-environmental policies provides a greater investment opportunity for firms with great maturity and reputation (Elsayed and Paton, 2009), although inverted U-shaped relationships can be found (Lahouel *et al.*, 2020).

H4: Market performance contributes to a significant increase in the issue of green bonds.

Literature overview and hypotheses

Performance effects

A highly profitable firm tends to finance itself through equity (internal finance), with retained profits over time contributing to its need to obtain funds from financial markets, which is consistent with pecking order theory forecasts (Friend and Lang, 1988; Rajan and Zingales, 1995; Baker and Wurgler, 2002; Frank and Goyal, 2003; Chen, 2004; Huang and Song, 2006; Flannery and Rangan, 2006; Antoniou *et al.*, 2008; de Jong *et al.*, 2008; Udomsirikul *et al.*, 2011; McMillan and Camara, 2012; Fernández-Cuesta *et al.*, 2019; Huang and Shang, 2019; Machokoto *et al.*, 2020; Tascón *et al.*, 2021; Zeitun and Goaied, 2021).

The environmental and responsible viewpoint asserts that larger, profitable firms are likely to communicate and highlight their corporate policy and ESG strategy (Yu *et al.*, 2018) above all, because of their reputation and visibility in the market (Elsayed and Paton, 2009). Obtaining sustainable returns over time facilitates issuing (green) debt in higher monetary amounts, and greater persistence in acquiring this type of debt security with a fixed income (Barua and Chiesa 2019; Chiesa and Barua 2019).

H5: *Firm performance contributes to a significant increase in the issue of green bonds.*

H6: *The performance factor contributes to a significant increase in the issue of green bonds.*

Literature overview and hypotheses

Liquidity effects

The negative relationship between market liquidity and leverage is explained by firms with liquidity preferring finance through share markets, leading to a greater incentive to increase capital rather than take on more debt (Lipson and Mortal, 2009; Udomsirikul *et al.*, 2011; Ahangar, 2021), which contributes to greater financial flexibility (Shang, 2020). Share liquidity allows shareholders to monitor management more closely and mitigates conflicts of interest between agents (Marks and Shang, 2021).

From a corporate sustainability perspective, this study emphasizes two lines of empirical evidence. First, firms with greater liquidity demonstrate more limited socially responsible behavior (Chang *et al.*, 2019). Second, firms presenting greater socially responsible performance and ESG show greater liquidity because of their reputation and visibility, which attracts more investors (Egginton and McBrayer, 2019; Luo, 2022; Roy *et al.*, 2022).

However, firms with greater visibility related to carbon emissions show greater repercussions through disinvestment (Mama and Mandaroux, 2022). Lower share liquidity equates to higher green bond yield spreads (Chang *et al.*, 2021).

H7: Market liquidity contributes to a significant increase in the issue of green bonds.

Literature overview and hypotheses

Liquidity effects

Financial liquidity allows firms with greater gains to use internal cash flow to reduce debt or leverage (Frank and Goyal, 2003; de Jong *et al.*, 2008; Dell'Acqua *et al.*, 2013; Zeitun and Goaied, 2021; Nnadi *et al.*, 2022). Corporate level adoption of this financial policy is based on: (i) diminishing debt, implying reduced liquid financial position in relation to liabilities (Dell'Acqua *et al.*, 2013) and the risk of future liquidity (Nnadi *et al.*, 2022); and (ii) attracting foreign cap.

Considering the relationship between cash holdings and adopting corporate sustainability policies, previous research suggests that firms with internal cash reserves or internal savings have less need for external finance sources for their investments (Barua and Chiesa 2019; Chiesa and Barua 2019; Zhang *et al.*, 2020). This does not invalidate the possibility of enjoying feedback between financial and socially responsible performance (Arouri and Pijourlet, 2017). Atif *et al.* (2022) showed that ESG firms present low cash flow owing to moral capital, and the ESG becomes an instrument of market safety.

H8: Firm liquidity contributes to a significant reduction in the issue of green bonds.

H9: The liquidity factor contributes to a significant reduction in the issue of green bonds.

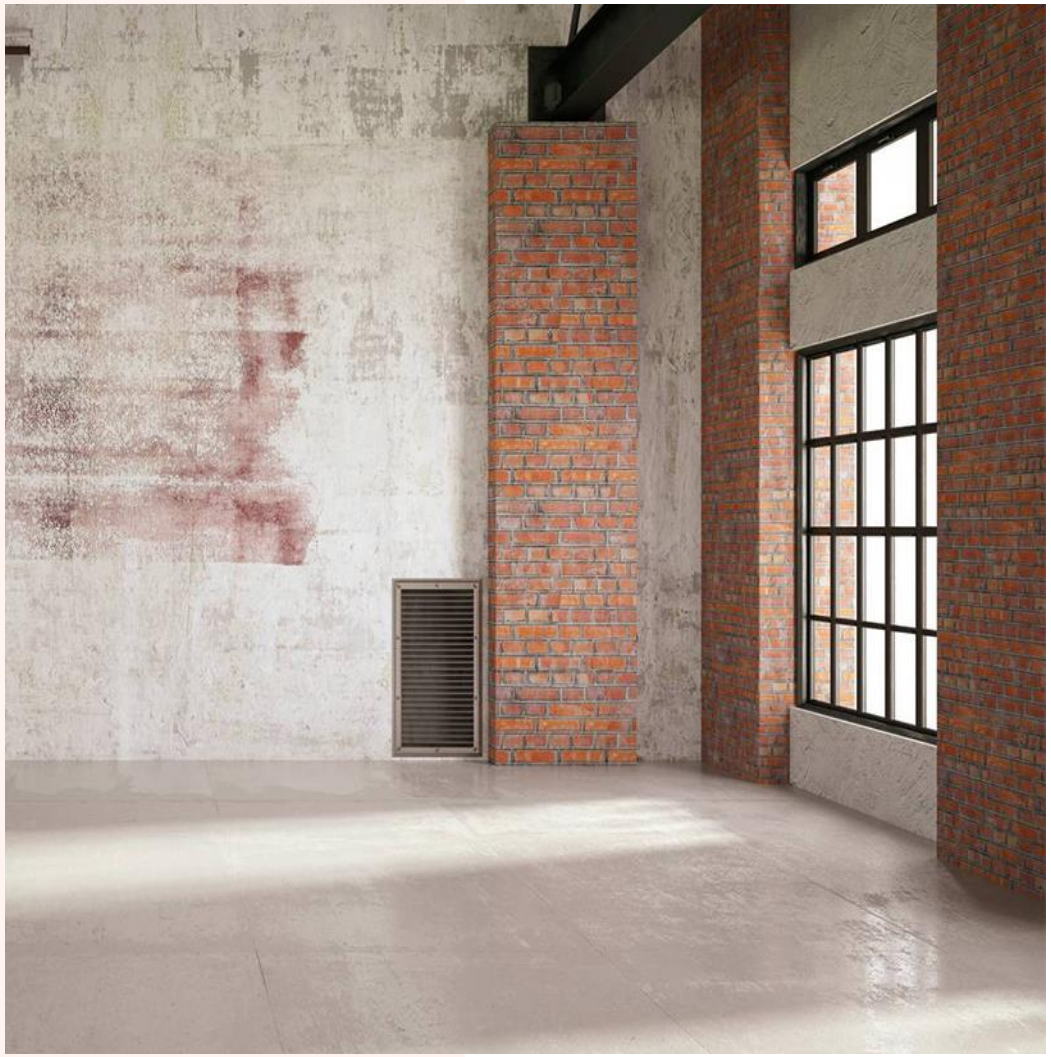
Literature overview and hypotheses

Environmental technological innovation effects

Technological innovation promotes increased greenium (Agliardi and Agliardi, 2019), which means reducing production's environmental costs, implying more robust competitiveness and economic performance (Wang *et al.*, 2021).

Thus, green bonds' performance is related to environmental technological innovation development (Russo *et al.*, 2021), which conveys to the market that scientific and technological innovation are connected to green growth (Zhou *et al.*, 2022). However, investing in green projects, including intangible assets, increases the likelihood of firms applying their own funds because these latent assets cannot be used as collateral (Xiang *et al.*, 2022).

H10: Environmental technological innovation contributes to a significant increase in the issue of green bonds.



Model and estimation

This study adopted market- and accounting-based factors and environmental technological innovation approaches to examine effects associated with the probability of issuing green bonds.

A panel probit model is used, because the linear probability model (i.e., least squares) operates probabilities below zero and above one (Wooldridge, 2020), making it unsuitable for this study because it does not have the properties of a limited dependent variable model (LDV).

To compensate for this disadvantage, other LDV models were used as alternatives to confirm better estimate consistency.

Model and estimation: Variables

Variables	Description	Source	Unit
Dependent variable			
Green Bonds (GB)	Green Bonds Issuance (1=True; 0 = False)	Climate Bonds Initiative; Euronext ESG Bonds; Frankfurt börse Green bonds; Luxembourg Boerse Green Bonds Exchange; Press release	Binary
Market-based variables			
Market Capitalization (Market_Size)	Stock Price * Shares Outstanding	Amadeus Bureau Van Dijk	Euro
Tobin's Q (Market_performance)	Market value + Total assets – Book value of common equity /(Total Assets)		
Share Turnover (Market_liquidity)	Trading Volume/Shares Outstanding		
Firm accounting-based variables			
Log Total Assets (Firm_size)	Log (Total Assets)	Amadeus Bureau Van Dijk	Euro
Profitability (Firm_performance)	EBITDA/ Total Assets		
Cash Holdings (Firm_liquidty)	Cash and Cash Equivalent / Total Assets		
Environmental technology innovation			
Green Patents (Green_tech)	Number of Green Patents	WIPO Green Database	Counting

Model and estimation: Specification

The selected specification models are:

$$Probit: \Pr\left(\begin{matrix} GB_{it} = 1 | X_{it} = Market\_SIZE_{it}, Market\_PERFORMANCE_{it}, Market\_LIQUIDITY_{it}, \\ Firm\_SIZE_{it}, Firm\_PERFORMANCE_{it}, Firm\_LIQUIDITY_{it}, Green\_TECH_{it} \end{matrix}\right) =$$

$$G(X_{it}\beta + \nu_i + \varepsilon_i) \quad (1)$$

In which $i = 1, \dots, 129$ firms, $t = 2010, \dots, 2020$, ν_i represents the random effects, and ε_i the error term.

$$Logit: \Pr\left(\begin{matrix} GB_{it} = 1 | X_{it} = Market\_SIZE_{it}, Market\_PERFORMANCE_{it}, Market\_LIQUIDITY_{it}, \\ Firm\_SIZE_{it}, Firm\_PERFORMANCE_{it}, Firm\_LIQUIDITY_{it}, Green\_TECH_{it} \end{matrix}\right) =$$

$$G(X_{it}\beta + \nu_i + \varepsilon_i) = 1 + \exp\{-(X_{it}\beta + \nu_i + \varepsilon_i)\}^{-1} \quad (2)$$

In which $i = 1, \dots, 129$ firms, $t = 2010, \dots, 2020$, ν_i represents the random effects, and ε_i the error term.

$$Cloglog: \Pr\left(\begin{matrix} GB_{it} = 1 | X_{it} = Market\_SIZE_{it}, Market\_PERFORMANCE_{it}, Market\_LIQUIDITY_{it}, \\ Firm\_SIZE_{it}, Firm\_PERFORMANCE_{it}, Firm\_LIQUIDITY_{it}, Green\_TECH_{it} \end{matrix}\right) =$$

$$G(X_{it}\beta + \nu_i + \varepsilon_i) = 1 - \exp\{-\exp(X_{it}\beta + \nu_i + \varepsilon_i)\} \quad (3)$$

In which $i = 1, \dots, 129$ firms, $t = 2010, \dots, 2020$, ν_i represents the random effects, and ε_i the error term.

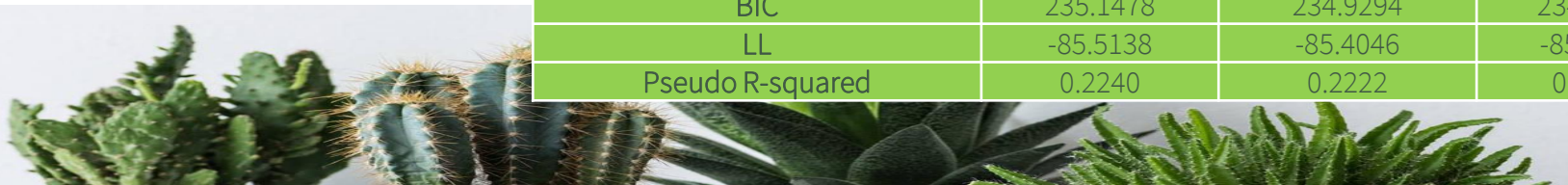
$$Poisson: \Pr\left(\begin{matrix} GB_{it} = 0,1 | X_{it} = Market\_SIZE_{it}, Market\_PERFORMANCE_{it}, Market\_LIQUIDITY_{it}, \\ Firm\_SIZE_{it}, Firm\_PERFORMANCE_{it}, Firm\_LIQUIDITY_{it}, Green\_TECH_{it} \end{matrix}\right) =$$

$$E(Y_{it}|X_{it}, \mu_i) = \mu_i . \exp(X_{it}\beta + \varepsilon_i) \quad (4)$$

In which $i = 1, \dots, 129$ firms, $t = 2010, \dots, 2020$, μ_i represents the random effects, and ε_i the error term.

Results and discussion: Baseline models

Dependent Variable =GB	Probit RE (1)	Logit RE (2)	Cloglog RE (3)	Poisson RE (4)
Market_SIZE	0.7706** [2.30]	1.3929** [2.13]	1.0164* [1.95]	1.0540** [2.18]
Market_PERFORMANCE	-0.2281 [-1.16]	-0.4196 [-1.02]	-0.2895 [-0.83]	-0.4136 [-1.16]
Market_LIQUIDITY	-0.1575** [-2.17]	-2.5598** [-2.26]	-2.3622** [-2.40]	-1.4419** [-2.04]
Firm_SIZE	-0.1575 [-0.45]	-0.1541 [-0.22]	0.1217 [0.20]	-0.14107 [-0.27]
Firm_PERFORMANCE	-0.8831 [-0.79]	-1.7317 [-0.74]	-1.4095 [-0.59]	-1.2347 [-0.69]
Firm_LIQUIDITY	2.2138 [1.31]	3.7131 [1.02]	2.8287 [0.81]	1.6775 [0.52]
Green_TECH	0.5406*** [3.08]	0.9994*** [3.04]	0.7817*** [3.16]	0.6452*** [3.18]
C	-14.9542*** [-3.92]	-29.9532*** [-4.18]	-27.9124*** [-4.55]	-22.1978*** [-5.60]
Wald Test for joint significance	18.46**	21.43***	26.91***	37.85***
BIC	235.1478	234.9294	234.8221	247.9145
LL	-85.5138	-85.4046	-85.3509	-91.8971
Pseudo R-squared	0.2240	0.2222	0.2230	0.1928



Results and discussion: Size, Performance and Liquidity Aggregate

Dependent Variable =GB	Probit RE (1)	Logit RE (2)	Cloglog RE (3)	Poisson RE (4)
Size_factor	0.7111*** [3.95]	1.5112*** [4.37]	1.4329*** [4.54]	1.2719*** [5.06]
Performance_factor	-0.0411 [-0.28]	-0.1133 [-0.36]	-0.1065 [-0.36]	-0.1490 [-0.55]
Liquidity_factor	0.2624 [1.44]	0 .4590 [1.18]	0.3973 [1.10]	0.3307 [0.94]
Green_TECH	0.2107** [2.18]	0.4073** [2.29]	0.3622** [2.39]	0 .3070** [2.15]
C	-3.2573*** [-7.22]	-6.3866*** [-7.38]	-6.2259*** [-7.95]	-5.2680*** [-11.06]
Wald Test for joint significance	17.30***	21.24***	23.23***	28.28***
BIC	225.8089	225.3792	225.2881	234.6571
LL	-91.5310	-91.3162	-91.2706	-95.9551
Pseudo R-squared	0.1694	0.1684	0.1691	0.1571

Results and discussion: Baseline models' Robustness checks

	Pooled	Endogeneity	
Dependent Variable =GB	Pooled Probit (cluster-robust) (1)	IV Probit (cluster-robust) (2)	IV Probit (cluster-robust) (3)
Market_SIZE	0.7033*** [2.79]	0.7901** [2.20]	0.7944** [2.22]
Market_PERFORMANCE	-0.3051* [-1.84]	-0.4427 [-1.58]	-0.4453 [-1.56]
Market_LIQUIDITY	-0.6386** [-2.10]	-0.4775* [-1.71]	-0.4802* [-1.67]
Firm_SIZE	-0.2563 [-1.02]	-0.2913 [-0.84]	-0.2955 [-0.87]
Firm_PEFORMANCE	-0.6964 [-1.13]	-0.3586 [-0.71]	-0.3619 [-0.63]
Firm_LIQUIDTY	1.4544 [1.21]	1.5722 [1.23]	1.5698 [1.10]
Green_TECH	0.3884*** [3.57]	0.3847*** [2.88]	0.3870*** [2.88]
C	-10.8345*** [-6.60]	-11.9057*** [-5.65]	-11.9029*** [-5.84]
Wald Test for joint significance	76.14***	87.27***	109.65***
BIC	241.016	1897.354	1895.238
LL	-92.0101	-846.9753	-831.8893
Pseudo-R Squared	0.2927		
Endogenous Variables		Market_SIZE Firm_SIZE	Market_SIZE Firm_SIZE
Instruments		Lagged Market_SIZE Lagged Firm_SIZE	Lagged Market_SIZE Lagged Firm_SIZE Lagged Market_LIQUIDITY
χ^2Wald Test for exogeneity (p-value)		4.50 (0.1052)	4.27 (0.1185)

Results and discussion: Aggregate models' Robustness checks

	Pooled	Endogeneity	
Dependent Variable =GB	Pooled Probit (cluster-robust) (1)	IV Probit (cluster-robust) (2)	IV Probit (cluster-robust) (3)
Size_factor	0.5794*** [6.18]	0.6680*** [4.80]	0.6659*** [4.70]
Performance_factor	-0.1022 [-1.16]	-0.1033 [-1.42]	-0.1049 [-1.54]
Liquidity_factor	0.1497 [1.05]	0.0111 [0.04]	0.0204 [0.10]
Green_TECH	0.1421** [2.50]	0.1495*** [4.91]	0.1496*** [5.26]
C	-2.6056*** [-14.85]	-2.7657*** [-11.49]	-2.7641*** [-10.84]
Wald Test for joint significance	49.26***	47.02***	45.76***
BIC	230.74	1133.81	1144.85
LL	-97.5570	-496.7637	-488.2583
Pseudo-R Squared	0.2500		
Endogenous Variables		Size_factor Liquidity_factor	Size_factor Liquidity_factor
Instruments		Lagged Size_factor Lagged Liquidity_factor	Lagged Market_SIZE Lagged Firm_SIZE Lagged Market_LIQUIDITY Lagged Firm_LIQUIDITY
χ^2Wald Test for exogeneity (p-value)		2.29 (0.3183)	2.88 (0.2365)
First-Stage F-statistic			

Results and discussion: Summing-up

Hypotheses	Covariates	Expected	Outcomes	Hypotheses testing
H1	Market_SIZE	+	+	NR
H2	Firm_SIZE	+	-	R
H3	Size_factor	+	+	NR
H4	Market_PERFORMANCE	+	-	R
H5	Firm_PERFORMANCE	+	-	R
H6	Performance_factor	+	-	R
H7	Market_Liquidity	+	-	R
H8	Firm_LIQUIDITY	-	+	R
H9	Liquidity_factor	-	+	R
H10	Environmental Technology innovation	+	+	NR

Concluding remarks

Bearing in mind the research gap previously identified in the literature, concerning the lack of studies on the still unexplored simultaneous effects of accounting-based and market characteristics (that is, size, performance and liquidity) and environmental technological innovation, both in aggregate and specific terms, this study makes unique contributions adding new insights to advance knowledge about companies' decision to issue green bonds, namely:

(i) the size factor, in aggregate terms, expressed through high asset value and stock market capitalization, increases the likelihood of issuing green bonds;

(ii) companies' market performance and profitability, both as an aggregate and specifically, do not have a significant influence on issuing green bonds;

(iii) the firm's greater liquidity in the market, in specific terms, tends to affect green bond issuance negatively; and

(iv) strengthening environmental technological innovation, both as an aggregate and specifically, increases the probability of firms issuing green bonds.

Implications

For future policy action, it is suggested that a green tax package be released, which would serve as a foundation for future tax credits to companies with certified environmental, social, and sustainable governance; vulgo ESG certification. This package should result in a reduction in profit taxes or sales taxes, subject to the condition that these tax credits be invested in green technological advancement activities based on R&D, green innovation, and green intellectual capital strengthening.

It is predicted that the economic burden would be increased to support decarbonization and energy transition issues. However, as a compensatory incentive mechanism, the state's additional tax receipts must be transferred to companies that issue green bonds, subject to a ceiling value in relation to the activities; that is, companies will benefit from tax breaks if they reach the ceiling value.

The implementation of the green tax package will result in changes in the capital structure of businesses, transferring capital from non-certified businesses to ESG-certified businesses. This new event will contribute to an increased demand for green bonds, as well as bonds issued by companies with ESG certification, resulting in a shift in the selection of asset classes with more diversification and transparency.

Limitations and future research

The study's main limitation is the limited data available to include other indicators, such as green capex, ownership concentration, and investment in R&D. These indicators may be useful in determining whether companies are investing in environmental capital and resources geared toward future ESG certification, via equity or debt, and how this decision affects the likelihood of issuing green bonds. In addition, it would be possible to determine whether the shareholder structure is focused on reducing carbon emissions through issuing green bonds and whether technological intensity is predominant in relation to the number of patents registered, that is, identifying the effects of R&D investment or patent registration on green bond issuance.

Future research could be focused in identifying and contrasting the determinant factors in decisions to issue green, sustainable, and social bonds. Alternatively, in comparative terms, to investigate the dominance of performance, liquidity, and dimension factors in various ESG bond types. An additional topic may be determining whether the currency used in issuing ESG bonds has an impact on how their performance evolves.

Obrigado

João Leitão

UBI, NECE, CEG-IST, ICS

jleitao@ubi.pt

https://orcid.org/0000-0002-6229-6148