



# Social bonds and the “social premium”

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## Abstract

Social bonds (SB) have witnessed an unprecedented increase especially since the outburst of the Covid-19 pandemic, but their performance vs. conventional bonds (CB) has not yet attracted attention in the academic literature. As far as we know, this is the first paper to test the existence, the sign and the determinants of a “social premium”, which we propose here to define as the yield differential between a SB and an otherwise identical CB. To this end we set up a sample of 64 SB aligned with the International Capital Market Association principles and 64 (exactly) matched CB, from October 2020 to October 2021 so as to focus on the peak of SB issuances. Regressions are based on the hypothesis that daily yield differentials between SB and CB may be determined by differences in non-perfectly matched characteristics. Based on the FE specification, which turns out to be preferred vs. OLS and RE both theoretically and empirically, two main results emerge. First, the social premium is significantly explained by differences in liquidity and in volatility, which are, respectively, negatively and positively correlated with the yield differential. Second, on the whole sample, the analysis of the fixed effects proves the existence of a significant and positive social premium that amounts to 1.242 bps. This result is robust to outliers, but differences emerge on subsamples especially in relation to issuer sector, thus pointing to the relevance of the use of proceeds, an issue that deserves further investigation as the SB market becomes more mature.

**Keywords** Social bonds · Sustainable finance · Yield to maturity · Social premium

**JEL Classification** C22 · G11 · G12

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## 1 Introduction

Sustainable finance has become a mainstream field of finance in the latest years, and within it the ESG (Environmental, Social and Governance) investments are playing a relevant role.<sup>1</sup> However, the ESG trend is often focused solely on the “E” label, with Green finance and its instruments – in particular green bonds – becoming the main focus of attention and research. This trend is due to a particular sensitivity towards environmental issues, also supported by non-financial movements (e.g. Friday for Futures), and by the attention of public institutions and financial organizations to a more ecological economic system (e.g. Cop26 in November 2021) accompanied by regulatory requirements for the financial industry and worries for financial stability (e.g. BCBS (2021a, b), ECB 2021).

The recent Covid-19 pandemic put to the forefront the need for funds to support the economic and health recovery with attention to both firms and households. This has in turn boosted the issuances of Social Bonds (SB), which are fixed-income securities whose proceeds are allocated to social initiatives. According to Lester (2021), social bonds represent about 27% of the total sustainable investments.

Notwithstanding this rapid market drift, the academic literature on social bonds is still very scant, in comparison with the vast literature on green bonds, and the financial performance of social bonds with respect to conventional ones has not been investigated yet. As far as we know, this is the first paper to propose a definition of “*social premium*” and to test its existence, sign, and determinants. Using a methodology implemented by Bachelet et al. (2019) and Zerbib (2019) for analysing green bonds and the green premium, we analyse the existence of a social premium and its determinants by means of regression analyses.

The paper is organised as follows. After outlining in Section 2 the definition and the features of SB as well as possible investment drivers, in Section 3 we illustrate the empirical methodology and the sample with a focus on the matching process between SB and their conventional counterpart. Section 4 discusses the model specification, both theoretically and empirically, and investigates the determinants of the spread differential between social and conventional bonds, while Section 5 examines the existence and the sign of the social premia. Final Section concludes.

## 2 Social bonds and investment drivers

According to the guidelines set by the International Capital Market Association (ICMA), SBs are defined as “*any type of bond instrument where the proceeds, or an equivalent amount, will be exclusively applied to finance or re-finance in part or in full new and/or existing eligible Social Projects and which are aligned with the four core components of the Social Bond Principle*” **Invalid source specified.**

<sup>1</sup> The Global Sustainable Investment Alliance (2021) reports that in 2020 sustainable investments reached \$35.3 trillion, growing by \$13 trillion from 2016.

In 2009, the International Finance Facility for Immunisation issued a vaccine bond for increasing vaccinations in developing countries. Even though the issuance is not aligned with ICMA principles, it may be considered a first attempt of SB. Some years later, in 2013, the International Finance Corporation (IFC) issued the “*Banking on Women*” bond in order to support female entrepreneurship, followed by another social initiative called “*Inclusive Business*” programme in 2014 (Peeters et al. 2020). Before the Social Bond Principles (SBP) publication in 2017 by ICMA, the issuance of social bonds was sporadic.<sup>2</sup> This new voluntary framework provided the market tools for issuing these innovative debt instruments (Peeters et al. 2020). Danone was the first corporation to issue a social bond in 2018 with the aim to finance food security development and social integration in the supply chain (\$355 million of proceeds), and it was followed in 2019 by Bank of America with a SB with proceeds (around \$500 million) to be invested in affordable housing projects. The turning point came in 2020 with the Covid-19 pandemic, which hit directly firms and households with a sudden reduction in economic activities, a drop in consumer demand and disruption in global supply chain reflected on employments and salaries. To face these economic challenges arising from the Covid-19 pandemic, social bonds appear a powerful instrument with issuances increased up to 420% between 2019 and 2020 (Dax 2020).

The recent development of the SB market has not yet fostered the academic literature as much as the growth of green bonds, although both belong to the category of thematic bonds. This type of bonds are connected to two main related research-questions that have been investigated in the field of sustainable finance: why do investors include in their portfolios assets whose characteristics go beyond the financial return and, accordingly, what is the profile of this type of investors? How do these assets perform in comparison to conventional ones?

As for the first question, Rossi et al. (2019) underscore that the answers rest on a theoretical framework, i.e. whether the utility function upon which the investment decision is taken depends on both wealth and non-wealth returns, whereby the latter capturing the socially responsible dimensions of the decision and essentially. In particular, Beal et al. (2005) provide three non-exhaustive and non-exclusive motivations for ethical investments: superior financial returns (consistently with traditional finance theory), non-wealth returns, and social change. In general, investors in the field of sustainable finance are driven by responsible and environmental considerations (e.g. Bauer and Smeets 2015; Gutsche and Ziegler 2019; Rossi et al. 2019), but assets such as green and social bonds may also help investors to realize diversification objectives. Following the traditional paradigm, retail and institutional investors may prefer social bonds with respect to conventional instruments because their expected financial returns are higher. Otherwise, investors may prefer social bonds because of their social commitment, and they are willing to sacrifice part of their return to obtain social impacts. Basiglio et al. (2020) point out how the traditional theory of finance is not able to explain the investments rationale in this field.

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<sup>2</sup> The Social Bond Principles (SBP) are “*voluntary process guidelines that recommend transparency and disclosure and promote integrity in the development of the Social Bond market by clarifying the approach for issuance of a Social Bond*” (ICMA 2021) developed by the International Capital Market Association (ICMA), a non-for-profit association based in Switzerland.

As for the second question, the answer requires gauging the performance of sustainable assets w.r.t. conventional ones. The issue has so far received much attention in relation to one specific type of thematic bonds, i.e. green bonds, where a vast empirical literature tests the existence of a green premium, defined as the yield difference between a green bond and a similar conventional bond (generally called “*greenium*” when negative). Results are quite disparate, since the sign and the existence of the *greenium* depends on the market (primary vs. secondary), the issuer (e.g. Government, municipal, corporate), the time horizon of the analysis (short vs. long). For instance Zerbib (2019) analyses 110 green bonds on the secondary market between 2013 and 2017 and, based on matching pairs of a green and a conventional bond, finds an average green bond yield premium of -2 bps, while Bertelli et al. (2021) based on a sample of 92 Euro denominated bonds over the period October 2014—December 2019 compare a green and a synthetic conventional portfolio finding a very low but negative green premium, which is however increasing to positive over time together with the number of bonds in both the green and the conventional portfolio.

As far as we know, no research has so far analysed the performance of social bonds with respect to conventional bonds and this represents the aim of this piece of research and the original contribution of the present paper to the literature on thematic bonds. Specifically, we first propose a definition of “social premium” and then we test its existence, sign and determinants.

### 3 Methodology and sample construction

First of all, we propose to define “social premium” the yield differential between a social bond and an identical equivalent conventional bond:

$$\Delta y_{i,t} = y_{i,t}^{SB} - y_{i,t}^{CB} \quad (1)$$

Where:

$\Delta y_{i,t}$  Social premium at date  $t = 1, 2, \dots, T$  for each comparable pair of bonds

$y_{i,t}^{SB}$  Yield to maturity of the social bond  $i = 1, 2, \dots, N$  at time  $t = 1, 2, \dots, T$

$y_{i,t}^{CB}$  Yield to maturity of the conventional bond  $i = 1, 2, \dots, N$  at time  $t = 1, 2, \dots, T$

In order to investigate whether there is a social premium in the social bond market, we need to match each social bond with a comparable conventional one. The matching approach is a useful technique for analysing the intrinsic value of a specialized financial instrument. This method, also known as a model-free approach or a direct approach, consists of matching a pair of securities with the same properties except for the one property whose effects are to be investigated. It has been widely used in finance to assess the return of ethical funds w.r.t. identical conventional funds or indices (Kreander et al. 2005; Renneboog et al. 2008; Bauer et al.

2005) and to test the existence of liquidity premia by matching and comparing pairs of bonds issued by the same firm (Helwege et al. 2014), or to control for credit risk (Helwege and Turner 1999). Within the literature on thematic bonds, the matching approach is the dominant one used to assess the existence and the sign of a green premium in the green bond markets. To this end, two are the possible alternatives: exact matching or matching through a synthetic bond. Exact matching (e.g. Bachelet et al. (2019) requires, for each green bond in the dataset, to search for a conventional (or brown) bond that is the nearest neighbour in terms of selected crucial characteristics (e.g. bond structure, coupon type, issuer, currency, issuer). When exact matching conditions are too stringent, green bonds are matched to an equivalent synthetic conventional bond obtained through a linear interpolation (or extrapolation) of two conventional bonds (e.g. Zerbib (2019) and Bertelli et al. 2021). Matching through synthetic bonds requires a sufficiently big dataset since for each thematic bond two conventional bonds are needed (i.e. instead of pairs as for the exact matching, tri-plets are needed), which are still chosen based on similarity restrictions.

Based on the pros and cons of the above alternatives and, specifically, the need of a large dataset for synthetic bonds matching that is not yet available for social bonds (w.r.t. the more mature green bond market), we go for exact matching. Thus, we match pair of securities with the same characteristics except for the one property to be investigated, which for the present analysis is the “social” label, whereby a crucial point is defining “closeness”, i.e. different measures and thresholds to evaluate whether a security is a good match for another (Stuart 2010), as detailed below in Section 3.1.

To set up the dataset, we start by identifying 580 social bonds aligned with ICMA principles at the date of 23<sup>rd</sup> September 2021. SBs are retrieved from Bloomberg Platform and this set encompasses different kind of bonds: corporate, government, sovereign as well as financials.<sup>3</sup> We consider only fixed-rate bullet bonds with no optionality features and we exclude SBs with missing characteristics such as ID Bloomberg, maturity, amount issued and coupon rate.<sup>4</sup> Within the 459 SBs left, in order to control for liquidity only those with an amount issued higher or equal to \$100 million enter the final set. The final sample consists of 252 SBs which represent 43,45% of initial social bond universe aligned with ICMA principles.

### 3.1 The matching process

Following an exact matching method as in Bachelet et al. (2019), for each social bond in the dataset, we select a conventional bond, whereby “closeness” is defined by the measures and the thresholds in Table 1. In particular, the two bonds must be issued by the same institution, in the same currency, with the same bond structure (bullet bond), the same payment rank and same coupon type (fixed rate with a difference in coupon  $\pm 70$  bps), the maximum mismatch in maturity dates is two-year lead/lag whereas

<sup>3</sup> No municipal bonds are included in our analysis since they have specific characteristics as also in the literature about greenium, where municipal bonds are generally considered separately (i.e., Karpf and Mandel 2018; Baker et al. 2018).

<sup>4</sup> Callable and puttable bonds present multiple yield measures such as yield to call and yield to worst which complicate comparison between SB and conventional bonds.

**Table 1** Matching method thresholds

Social Bond characteristic	One closest traditional bond characteristic
Issuer	The same
Coupon Type	The same (Fixed rate)
Maturity Type	The same (Bullet)
Amount Issued	> = 100 millions
Currency	The same
Payment Rank	The same
Issuance Date	$\pm 6$ years
Maturity Date	$\pm 2$ years
Coupon	$\pm 70$ bps
Amount Issued	Between $\frac{1}{4}$ and 4 times the social bonds' issued amount

the maximum mismatch in issuance dates is six-year lead/lag, and the issue amount between  $\frac{1}{4}$  and 4 times the social bond's issued amount. We cannot place restriction on the rating since very few SBs have one, but given other restrictions (same issuers and extremely similar bond structure) we can assume that creditworthiness of both bonds is the same. When more than one conventional bond meets the criteria, we select the bond with the closest maturity date. When no conventional bond respects the properties, we exclude the social bond from the final set.

The matching process provides 64 pairs of bonds, namely 64 social bonds and their respective matched conventional bonds. The final set counts for 25.39% of the initial sample of 252 SBs and for 11.03% of the SBs aligned with ICMA principles retrieved from Bloomberg. The loss in data is mainly due to the liquidity requirement, since it leads to exclude many issuances below \$100 million, which highlights that the SB market is in a different stage with respect to the green bond market. With respect to the latest research on *greenium*, the dataset appears less representative, but it is in line with the earliest studies about green premium (Preclaw and Bakshi 2015), when the green bond market was in its early stage.

The analysis is performed based on bid daily yields from October 16, 2020 to October 18, 2021. The choice of the period is motivated by the high number of SB issuances occurred between 2020 and 2021, during the Covid-19 pandemic, which also implies a less unbalanced panel.

### 3.2 The final sample: descriptive statistics

The main features of the final sample of social bonds are represented in Fig. 1. Bonds are issued by 30 different issuers from 11 countries. South Korea counts for 35.94%, followed by Japan and Supranational authorities (SNAT), while other countries count for lower quotes.<sup>5</sup> They are issued in 7 different currencies: Euro (26),

<sup>5</sup> The reason for absence of United States in the set is due to the optionality features of SBs issued on the US market.

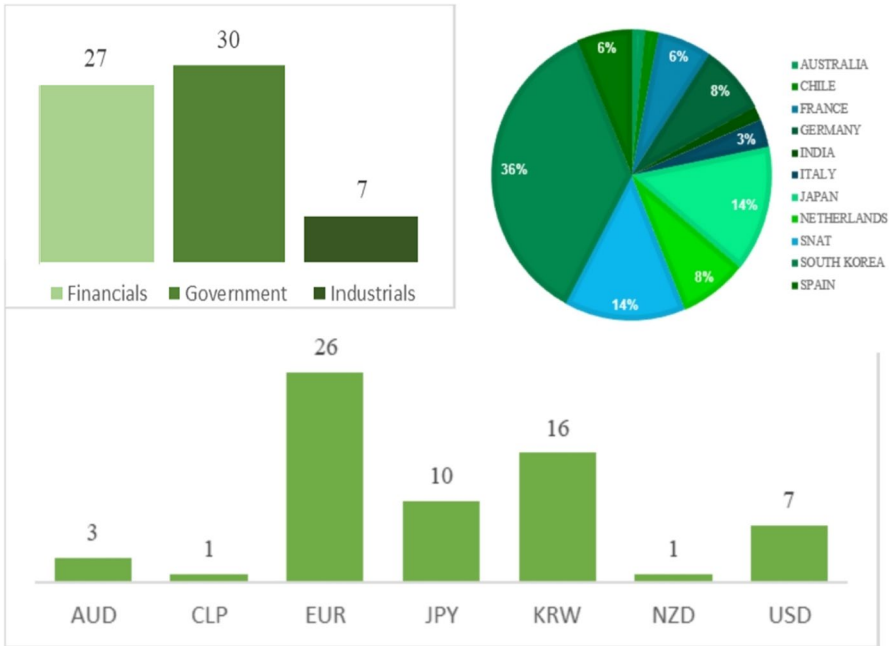


Fig. 1 Bond sample by sectors, countries, and currency

South Korean won (16), Yen (10), US dollar (7), Australian dollar (3), New Zealand dollar (1) and Chilean peso (1). All amounts are expressed in US dollar.

Table 2 reports descriptive statistics of social bonds sample. On average, SBs have 4.72 years to maturity although the range of value is quite wide, from 0.43 to 18.98 years, the average issue amount is \$795.8 million, and the average bid yield to maturity is 0.42. Breakdown by sector (Industrials, Financials and Government) highlights bonds issued by the industrial sector have a higher maturity on average (5.78 years), while those issued by financials and government sectors present have more variation around the average values. Concerning the amount issued, as expected, issuances from government entities have a higher average amount (\$831.70 million) with more variation (from a minimum of \$100 million to a maximum of \$10 billion).

Descriptive statistics of the social bonds, conventional bonds and their main differences are presented in Table 3, where liquidity is measured by the bid-ask spread ( $\Delta L_{i,t}$ ), defined as:

$$\Delta L_{i,t} = \frac{(Askprice_{i,t} - Bidprice_{i,t})}{Askprice_{i,t}} \tag{2}$$

The panel is unbalanced: the average number of days for each bond is 171. However, for some bonds there are only 21 days of data available and a

**Table 2** Information about sectors is retrieved from Bloomberg. Amounts are in million, Yield in percentage points, Average maturity is expressed in years (365 days) with reference to October 18, 2021

Sector	Min	1st Quart.	Mean	Median	3rd Quart.	Max	SD
<b>Total</b>							
Amount	\$100.0	\$274.2	\$795.8	\$541.1	\$905.3	\$10,710.0	\$1,242.5
Yield	-0.62	-0.19	0.42	0.16	0.57	7.20	0.13
Maturity	0.43	2.15	4.72	3.56	5.67	18.98	4.06
N° Bonds	64						
<b>Industrials</b>							
Amount	\$186.1	\$274.2	\$339.0	\$332.9	\$368.4	\$651.4	\$153.6
Yield	0.02	0.08	0.12	0.11	0.16	0.31	0.06
Maturity	3.18	3.18	5.78	5.67	7.79	8.75	2.28
N° Bonds	7						
<b>Financials</b>							
Amount	\$112.8	\$451.9	\$885.2	\$564.5	\$1,090.0	\$4,490.0	\$1,018.7
Yield	-0.43	-0.15	0.66	0.18	1.20	7.20	1.28
Maturity	0.43	2.33	3.94	3.72	5.10	14.43	2.19
N° Bonds	27						
<b>Government</b>							
Amount	\$100.0	\$177.8	\$831.7	\$541.1	\$1,080.0	\$10,710.0	\$1,460.6
Yield	-0.62	-0.37	0.33	0.24	0.80	6.74	0.85
Maturity	0.51	2.03	5.06	2.64	5.61	18.98	5.06
N° Bonds	30						

Average maturity is expressed in years (365 days) with reference to October 18, 2021. Information about sectors is retrieved from Bloomberg. Amounts are in million

maximum of 258. SBs have an average time to maturity higher than the conventional bonds (4.72 versus 4.63 years). The amount of coupon is almost the same in the two groups: average coupon for social bonds is 0.89 while for conventional is 0.93. Conventional bonds have a larger amount issued than SBs on average (\$865.1 versus \$795.8 million) and smaller standard deviation. SBs appear to have a slightly higher yield with respect to CBs: on average 0.421 vs. 0.4057 of conventional bonds pointing to a positive social premium. Since CBs register a broader amount issued on average, it is possible that the higher yield required for SBs is due to illiquidity, as confirmed by the bid-ask spread liquidity measure.

In order to derive information on the distribution of main variables, Table 4 reports information about skewness and kurtosis, whereby the two measures point to a rejection of normality.

Finally, Table 5 shows the correlation coefficients, which appear in general low thus excluding multicollinearity. The highest values are registered between yield and liquidity



**Table 3** Social Bonds and Conventional Bonds: statistics of main features and differentials

Column1	Min	1st Quart.	Mean	Median	3rd Quart.	Max	SD
<b>SBs</b>							
N° of days	21	80	200	171	258	258	
Coupon	0.01	0.14	0.89	0.625	1.21	5.1	1.04
Amount	\$100.0	\$274.2	\$795.8	\$541.1	\$905.3	\$10,710	\$1,242.5
Maturity	0.43	2.15	4.72	3.56	5.67	18.98	4.06
Yield	-0.62	-0.19	0.42	0.16	0.57	7.20	0.13
Liq	0.00%	0.00%	0.13%	0.15%	0.21%	1.18%	0.15%
<b>CBs</b>							
N° of days	21	80	171	200	258	258	
Coupon	0.01	0.25	0.93	0.5	1.13	5.7	1.08
Amount	\$100.0	\$221.3	\$865.1	\$531.8	\$1,200.0	\$11,780	\$1,242.1
Maturity	0.36	1.94	4.63	2.79	6.10	19.72	4.37
Yield	-0.63	-0.23	0.41	0.17	0.61	7.34	0.96
Liq	0.00%	0.00%	0.09%	0.13%	0.20%	1.21%	0.13%
<b>Δ</b>							
Δ Coupon	-0.63	-0.1	-0.04	0	0.08	0.47	0.26
Δ Amount	-\$3,500.0	-\$170.0	-\$69.3	\$0.0	\$50.7	\$4,210.0	\$702.7
Δ Maturity	-2.28	-0.37	0.09	0.01	0.88	2.00	0.97
Δ Yield	-0.85	-0.03	0.01	0.00	0.05	1.50	0.13
Δ Liq	-0.77%	-0.02%	0.02%	0.00%	0.02%	1.12%	0.00%
Δσ	-0.43	0.00	0.00	0.00	0.00	0.26	0.01

The Table reports descriptive statistics of main features of SB and CB and of the differentials in the main features between SB and CB. Descriptive analysis are conducted separately between the two groups. Liquidity is calculated as the bid-ask spread. Amounts are expressed in million, coupon and yields in percentage points.. Differences between bonds are calculated as SB characteristic – CB characteristic. Variable  $\Delta\sigma$  is the difference between variance of SB yield and variance of CB yield calculated in a 10-day rolling window

(0.542) and yield and maturity (0.630). Other coefficients range from 0.371 to -0.379. Furthermore, the higher correlation values between yield and maturity and yield and liquidity point to the relevance of these two regressors in determining the spread yield.

A comprehensive glance at the comparison between YTM of SB and CB is given by Fig. 2. The two returns follow a common trend during the period under analysis, but SBs appear to be more volatile with peaks between September and October 2021.

**Table 4** Variables: skewness and kurtosis

	Skewness	Kurtosis
Δ Coupon	-0.57	3.2
Δ Amount	0.62	19.11
Δ Maturity	-0.12	2.48
Δ Yield	2.21	20.65
Δ Liq	4.61	31.49
Δσ	-10.83	353.84

**Table 5** Variables: Correlation matrix

	$\Delta$ Amount	$\Delta$ Coupon	$\Delta$ Liq	$\Delta$ Maturity	$\Delta\sigma$	$\Delta$ Yield
$\Delta$ Amount	1					
$\Delta$ Coupon	-0.105	1				
$\Delta$ Liq	0.022	-0.370	1			
$\Delta$ Maturity	0.114	-0.371	0.352	1		
$\Delta\sigma$	0.022	0.051	-0.176	-0.019	1	
$\Delta$ Yield	0.113	-0.379	0.542	0.630	-0.019	1

To sum up, the descriptive analysis of our sample of SB and CB highlights differences in yields and in some of the matched characteristics, and this call for the next multivariate analysis of the determinants of the yield spreads.

### 4 The determinants of the yield spread in social bonds

The regression model is based on the idea that differences in yields may be determined by differences in un-matched characteristics, which is not possible to control for in the matching method phase. To test this hypothesis, in line with the study by Bachelet et al. (2019) on green bonds, we assume the following specification<sup>6</sup>:

$$\Delta y_{i,t} = \alpha_0 + \beta_1 \Delta Liq_{i,t} + \beta_2 \Delta \sigma_{i,t} \sum_j \beta_j \Delta B_{ji} + \eta_i + \varepsilon_{i,t} \tag{3}$$

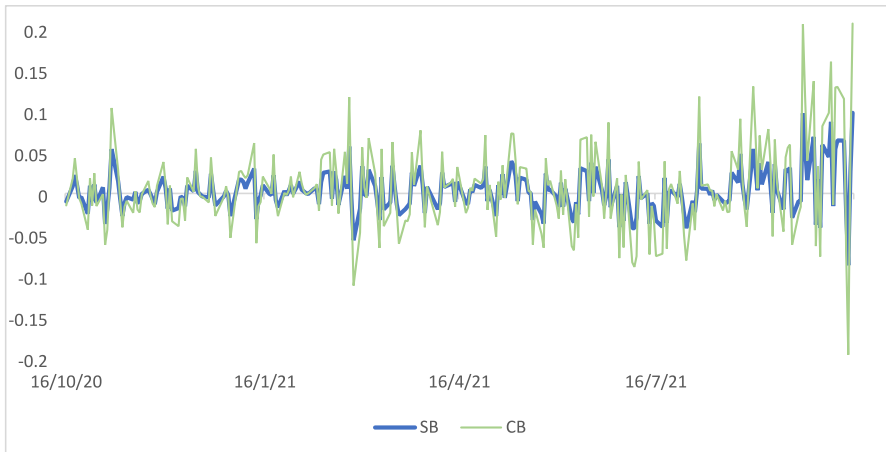
Where:

$\Delta y_{i,t}$  is the daily yield to maturity spread between the  $i$ th pair of matched bonds at time  $t=1,2,\dots,T$ , namely the difference between the  $i$ th social bond yield and its equivalent comparable conventional one

$\alpha_0$  is the intercept of the regression and the main parameter we want to investigate. It captures the social effect on the yield spread, namely the sign, value, and relevance of social effect

$\Delta Liq_{i,t}$  is the daily bid-ask spread between the  $i$ th pair of bonds at time  $t=1,2,\dots,T$ , namely the difference between the  $i$ th social bond bid-ask and its equivalent comparable conventional one

<sup>6</sup> A few changes are made with respect to Bachelet et al. (2019): first, to control for liquidity, for parsimony only bid ask spreads are used, whereby Bachelet et al. (2019) uses also the difference in number of trading days; second, since several bonds employed in the present analysis have a short time series, variances are here calculated in a 10-days rolling window, whereby in the original econometric model  $\Delta\sigma$  is calculated in a 20-days rolling window.



**Fig. 2** Daily YTM: SBs and CBs

$\Delta\sigma_{i,t}$  is the difference in bond yield variance computed ex post in a 10-day moving window

$\Delta B_{ij}$  are the three bond features not perfectly matched during the matching method, namely coupon, maturity and amount issued. The differences in the  $i$ th pair of bonds at time  $t=1,2,\dots,T$ , always calculated as difference between social bond characteristic and conventional bond ones

$\eta_i$  fixed effects to control for unobservable time invariant characteristic in FE regression

The equation is estimated in three ways: with ordinary least squares (OLS), with Random Effects (RE) and with Fixed Effects (FE) ( $\eta_i$ ) in order to control the unobservable time invariant characteristics for any bond couple. In this latter case,  $\Delta B_{ij}$  variables disappear as the considered differences in bond characteristics are time invariant for each bond couple. To test for the existence of a social premium the variable of interest is the intercept of OLS and RE regression and the estimated Fixed Effects from FE regression, which can be interpreted as a social premium.

Then, we choose the preferred specification based on both theoretical and empirical arguments. From a theoretical viewpoint, OLS and RE are more demanding in terms of assumptions: in fact, OLS estimates, which are run as Pooled OLS on panel datasets, do not consider that a same bond is observed several times and are efficient when the error terms are homoscedastic and in the absence of endogeneity, whereas

**Table 6** Different model specifications: results and tests over specification

	Panel A – Regressions results				
	Dependent Variable $\Delta Y$				
	(1) OLS	(2) OLS	(3) FE	(4) RE	(5) FE - Back Katz
$\Delta$ Amount	0.00001*** (0.0000)	0.00001*** (0.0000)		0 (0.00001)	
$\Delta$ Coupon	-0.074*** (0.004)	-0.034*** (0.004)		0.04 (0.035)	
$\Delta$ Maturity	0.081*** (0.001)	0.065*** (0.001)		0.112*** (0.01)	
$\Delta \sigma$		0.504*** (0.064)	0.507*** (0.042)	0.511*** (0.042)	0.507*** (0.054)
$\Delta$ Liq		32.225*** (0.709)	-7.366*** (1.335)	-5.652*** (1.317)	-7.366* (4.377)
Costant	0.002** (0.001)	-0.003*** (0.001)		0.011 (0.009)	
# Obs.	10938	9792		9792	
R2	0.413	0.523		0.02	
Adj. R2	0.413	0.523		0.013	
F Stat	2561.551*** (df = 3; 10934)	2148.706*** (df = 5; 9786)		97.604*** (df = 2; 9726)	311.701***
$p$ -value		Panel B - Homoscedasticity and Serial Correlation tests			
Conclusion		Breusch-Godfrey < 2.2e-16 Serial Correlation			Breusch-Pagan < 2.2e-16 Eteroschedasticity
		Panel C - Regression specification Tests			

**Table 6** (continued)

	Ftest	Honda Test	Lagrange/ Breusch- Pagan Test
<i>p</i> -value	< 2.2e-16	< 2.2e-16	< 2.2e-16
Conclusion	Individual effects	Individual effects	Individual effects
<i>p</i> -value	Panel D – Comparison FE and RE		
Conclusion	Hausmann Test 3.78e-11 FE preferred		

\**p* < 0.1; \*\**p* < 0.05; \*\*\**p* < 0.01

RE assumes that the individual effect is uncorrelated with independent variables. By contrast, FE regression does not require that the unobserved fixed effects are uncorrelated with regressors. However, we decided to run also OLS and RE regressions for two main reasons: first, they allow gauging the role of those non perfectly matched features that are not time-invariant; second, considering all possible specifications allow us to make a selection also on an empirical basis.

Regression findings are reported in Table 6. In Panel A, column (1) reports results of a Pooled OLS regression, column (2) includes liquidity and variance controls, columns (3) and (4) reports results from FE regression and RE regression, respectively. In Panel B of Table 6, we test for serial correlation and heteroscedasticity: since Breusch-Godfrey/Wooldridge test signals serial correlation in the data and, a Breusch-Pagan test assesses the presence of heteroscedasticity, in order to account for them, regression results are corrected with Beck Katz robust estimations of the standard errors (Column (5) of Panel A).<sup>7</sup>

A first look at results of the OLS and RE regressions prove the importance of all differentials in explaining the yield spread. In the OLS specification all time-invariant covariates remain significant even when the differences in liquidity and in volatilities are added: the difference in the amount issued is positively related to the premium although the effect is tiny in the OLS specification and non-significant in the RE one. As far as maturity is concerned, it is positively related to the social premium both in the OLS and RE regressions whereas the difference in coupon paid out is negatively related to the premium in case of OLS regression and non-significant in the RE one. As for the covariates representing the differences in volatility and in liquidity, while the former is positively related to the premium and highly significant for all three specifications, the latter is positively correlated with the premium for the OLS regression while correlation is negative for both FE and RE ones. These results are comparable with those presented by Bachelet et al. (2019) on GB: as in our analysis of SB, both in OLS and FE regressions, difference in maturity and volatility are significantly and positively correlated with the premium while the correlation between  $\Delta Liq$  and the premium is negative.

Given a few differences in results between the three specifications, although the theoretical preference is for FE, before going deeper into their interpretation we compare specifications empirically. Tests to choose the best specification are reported in Panel C and D. First, in order to confront OLS with FE, we conduct an F-test, a Honda test, and a Lagrange Multiplier test (Breusch-Pagan test). The null hypothesis of no individual effect is rejected in all three tests at the 1% significance level (Panel C) and we thus conclude that FE estimation is preferred. Second in order to compare FE versus RE, we run the Hausman-Test, whereby the null hypothesis is rejected at 1% significance level, which supports the choice of FE regression as the most appropriate (Panel D).

Concluding, the FE specification turns out to be preferred also from an empirical viewpoint, beside the theoretical one. The FE model has a very small adjusted  $R^2$

<sup>7</sup> Since our sample is relatively small, Beck Katz robust estimator is more efficient (Beck and Katz 1995). We also tested for the presence of cross-sectional dependence in our panel by means of the Pesaran (2015) test, which allowed us to conclude that there is no cross-sectional dependence in our data.

(0.013), which is however in line with the literature on green bonds. The difference in liquidity turns out to be significant at 10% level and negatively correlated with the yield difference. Specifically, if the percentage price bid-ask spread increases by 1 bp,  $\Delta y_{i,t}$  decrease by 7.366 bps which is comparable with Zerbib (2019), where a 1-bp rise determines 9.88-bps decrease in  $\Delta y_{i,t}$  in the green premium. As suggested by Doronzo et al. (2021), this result may demonstrate that investors are not concerned about illiquidity of social bonds and that there is a group of investors more interested in the social label. Volatility  $\Delta\sigma_{i,t}$  is highly significant: a 1 bp increase in  $\Delta\sigma_{i,t}$  determines 0.507 bp increase in  $\Delta y_{i,t}$  suggesting that investors required higher yields when SBs are more volatile, in line from with expectations. Although both  $\Delta Liq_{i,t}$  and  $\Delta\sigma_{i,t}$  provide useful information regarding  $\Delta y_{i,t}$ , for our purpose the estimated fixed effects play a key role.

## 5 Analysis of the social premia

The main interest of this research is represented by values of 64 time-invariant fixed effects, which represent estimates of the social premium for each pair of bonds in the sample. Table 7 shows the distribution of the 64 social premia retrieved from the FE regression. The values range from -0.4897 to 0.4968. Both average and median values are positive.

Figure 3 reports the distribution of these 64 social premia and Shapiro–Wilk normality test confirms non normality at 1% confidence level and a t-test for differences in mean cannot be applied.

As an alternative, a Wilcoxon signed-rank test can be implemented without any normality of the data. The null hypothesis of no differences in the mean is rejected at 1% significance level and therefore we can state that the average 0.01242 social premium is statistically significant (Table 8). The positive significant, albeit small, social premium of 1.242 bps suggests that CBs on average require a lower yield.

### 5.1 Subsamples and outliers

In order to investigate whether different characteristics of issuers and issuance may determine higher/lower yield spread, the analysis is repeated on a few relevant subsamples.

Specifically, we break down the dataset in two main subsamples by sector and currency. For each subsample which consists of at least 10 bonds (a minimum consistent with the literature on thematic bonds), Eq. (6) is re-estimated, and the fixed effects are analysed. Through a Shapiro–Wilk normality test, the normality assumption is tested for all subsamples and according to the result, either a t test

**Table 7** Social premia distribution

Min	1st Quart.	Median	Mean	3rd Quart.	Max
-0.4896601	-0.379945	-0.0004846	0.0124189	0.0472494	0.4968425

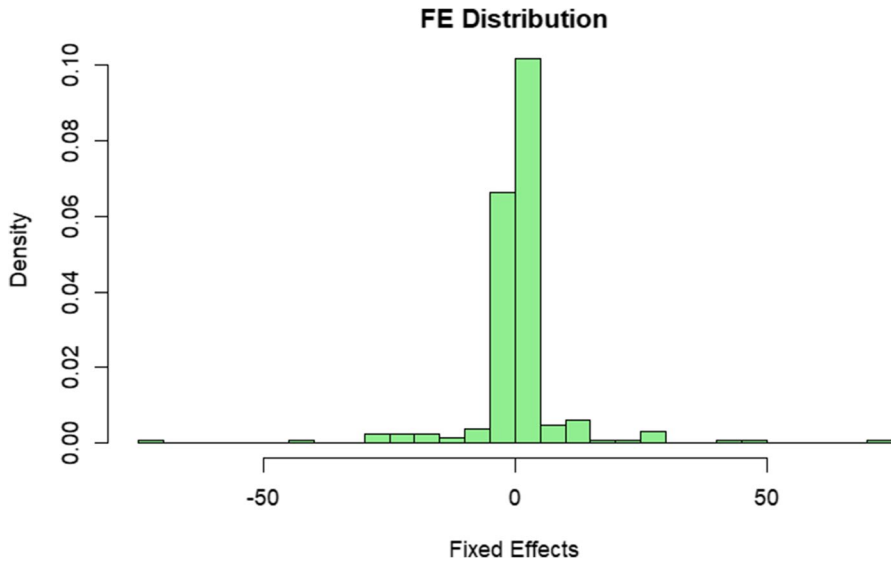


Fig. 3 Social premia distribution

Table 8 Significance of the social premium

	Shapiro Wilk-Test	Wilcoxon signed-rank
p-value	<2.2e-16	1.13e-02
Conclusion	No normality	$\mu \neq 0$

Table 9 Subsampling by sector and currency

	Mean	Median	Shapiro Wilk-test	Wilcoxon signed-rank
Sector				
Financials	0.0113	0.0419	***	**
Government	-0.0111	-0.0039	***	
Currency				
EURO	-0.0081	0.0184	***	***
KRW	0.0155	0.0014	***	***
JPY	-0.0125	-0.0106	***	

$p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

or a Wilcoxon signed-rank test is applied to investigate their statistical significance. Results are presented in Table 9. Concerning issuer’s sector, only government and financial subsamples are considered since only 7 social bonds belong to the industrial sector and the time series would be too limited for the regression analysis.



**Table 10** FE: sample winsorized for outliers

	Dependent Variable	
	$\Delta Y$	
	Fixed Effects	Beck-Katz Coefficient Test
$\Delta Liq$	-9.100*** (0.961)	-9.100** (4.316)
$\Delta \sigma$	0.566*** (0.030)	0.566*** (0.053)
Observations	9792	
R2	0.048	
Adjusted R2	0.042	
F Statistics	245.151***(df = 2;9726)	

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

**Table 11** Social premium significance: sample winsorized for outliers

Mean	Median	Shapiro Wilk-Test	Wilcoxon signed-rank
0.011	0	<2.2e-16	0.0292

An interesting result emerges from the comparison between Government and Financials yield spreads: while average and median yield spread of financial issuances is always positive, yield spread of government issuances is negative. In particular, financial subsample presents an average premium of about 1 bp while government subsample has an average social premium amounting to -1 bp: whereas for financials the social premium is statistically different from zero (at the confidence level 95% or above), the social premium in Government bonds is not so.

As regards currencies, only Euro, Japanese Yen and South Korean Won subsamples are considered, with 26, 10 and 16 couple of bonds, respectively. Euro-denominated pairs of bonds have a negative premium of about 0.8 bp that is statistically different from zero, whereas South Korean won-denominated ones have on average a social premium of 1.5 bp statistically different from zero at 99% level. By contrast, Japanese Yen-denominated bonds do not have a statistically relevant social premium.

As a final robustness check, to test whether our result regarding social premium is influenced by possible outliers in the dataset since  $\Delta y_{i,t}$  presents a right-skewed distribution which indicates possible extreme values. For this reason,  $\Delta y_{i,t}$  is winsorized above 99% percentile, keeping in mind that it is an invasive method, and it is applied only for the robustness check and not on the main study. Table 10 shows the results from the FE regression, also with robust error correction.  $\Delta \sigma_{i,t}$  remains highly significant in both determinations and perfectly in line with previous results.  $\Delta Liq_{i,t}$  slightly decrease, from -7 to -9.1. However, the analysis of the fixed effects, representing social premia are unchanged. The average social premium is 1-bp and it is statistically significant at 99% level (Table 11).

## 6 Conclusions

Social bonds have witnessed an unprecedented increase especially since the outburst of the Covid-19 pandemics. However, in contrast to green finance where a vast empirical literature investigates green premia, as far as we know, no research has so far analysed the performance of social bonds with respect to conventional bonds and this represents the aim of this piece of research and the original contribution of the present paper to the literature on thematic bonds. Specifically, we first propose a definition of social premium and then we test the existence, the sign and the determinants of such a social premium. Thus, our results on social bonds can be compared only with results the other most studies thematic bond, and specifically with results on the green premium based on an analogous approach (i.e. Bachelet et al. (2019), Zerbib 2019).

Primarily, we define the “social premium” as the yield differential between a social bond and an otherwise identical conventional bond and we set up a sample of bonds for the period October 16, 2020—October 18, 2021 so as to focus on the peak of SB issuances occurred after the outburst of Covid-19. The sample consists of 64 SB aligned with ICMA principles and 64 CB chosen according to an exact matching approach, i.e. with the same (or as close as possible) characteristics of SB except for the social label. Then, in line with Bachelet et al. (2019), we then run a regression based on the idea that differences in daily yields between SB and CB may be determined by differences in non-perfectly matched characteristics. Our results can be compared only with the green bond literature given no other study is available on social premia.

We test 3 main specifications: OLS, FE and RE. Although OLS and RE are theoretically more demanding in terms of assumptions and do not allow to account for omitted variables and endogeneity, we decided to run them because they allow gauging the role of not time-invariant non perfectly matched features and we want to make a selection also on an empirical basis.

Main insights from results of the OLS and RE regressions prove the importance of all differentials in explaining yield spread. In the OLS specification all time-invariant covariates remain significant even when the differences in liquidity and in volatilities are added: the difference in the amount issued is positively related to the premium although the effect is tiny in the OLS specification and non-significant in the RE one. As far as maturity is concerned, it is positively related to the social premium both in the OLS and RE regressions whereas the difference in coupon is negatively related to the premium in case of OLS regression and non-significant in the RE one. As for the covariates representing the differences in volatility and in liquidity, in line with Bachelet et al. (2019) on GB, while the former is positively related to the premium and highly significant for all three specifications, the latter is positively correlated with the premium for the OLS regression while correlation is negative for both FE and RE ones.

Based on the FE specification, which turns out to be preferred vs. OLS and RE both on a theoretical and an empirical ground, two main results emerge. First, as for the determinants, the difference in liquidity turns out to be significant and negatively correlated with the yield differential. Specifically, if the percentage bid-ask spread increases by 1 bp, the

yield differential decreases by 7.366 bps, a result comparable with Zerbib (2019), where a 1 bp rise determines 9.88 bps decrease in the green premium. The difference in volatility is also highly significant: a 1 bp volatility increase determines 0.507 bp increase in the yield differential suggesting, in line with expectations, that investors require higher yields when SBs are more volatile than their conventional counterpart. Second, on the whole sample the analysis of the fixed effects, which represents the social premium, proves the existence of a significant social premium, which is positive, although small and amounting to 1.242 bps. This result, which is robust to outliers, is consistent with the market attaching higher riskiness to SBs with respect to CBs. However, differences emerge on subsamples. The two main ones are Financials and Government: Financial SBs present an average significant social premium of about 1 bp, while the social premium of Government bonds is not statistically different from zero. Across currencies, the social premium remains very small, but it is significant only for Euro-denominated SB (about -0.8 bp) and South Korean won-denominated SB (1.5 bp).

Overall, the small magnitude of the social premium emerging from our analysis over the latter two years points to a (perhaps more mature) phase of the SB market, whereby the social feature does not make otherwise comparable bonds any different in terms of yield. However, more research is needed especially because SB may differ broadly not only in terms of issuers but also in terms of use of proceeds (ranging, e.g., from social housing or social benefit to loans for SMEs), and hence they may attract very different investor profiles. Moreover, as well as green washing, also the risk of “*social washing*” exists and the need of developing regulations to avoid it should be high on the agenda. A step in the right direction is the EU initiative of developing a Social Taxonomy as illustrated in the Final Report on Social Taxonomy by the Platform for Sustainable Finance in February 2022.

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**Data availability statement** Data will be supplied upon request.

#### Declarations

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