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The Green Bond Premium: An Extension with Use of Proceeds

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Master of Science in Business Major in Finance

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Abstract

We compare the yields of green bonds to those of their constructed conventional twins while controlling for liquidity to address the green bond premium, defined as the yield differential between a green bond and a conventional twin. In the period from January 2017 to April 2019, we find that green bonds on average trade with a negative premium of -1.74 bps. Further, we find that the use of proceeds labelled energy have a differentiating effect on the premium, and indications of a premium that converges to zero over time. Implications of our findings are that there still is a green bond premium present, but, whether it will persist over time as the market segment matures remains to be a an unanswered question.

Acknowledgement

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Contents

1 Introduction

Climate change and low-carbon goals are important goals in society today, even though many deny human-made climate change the general consensus is that human-made climate change is real. Stern (2008) states that greenhouse gas emissions are externalities that represent the greatest market failure the world has seen and represent three-quarters of the human-generated effect on global warming. The international energy agency expects that in the period from 2016 to 2050 $ 3.5 trillion would need to be invested in the energy sector with a rapid escalation in low-carbon energy supply to reach the 2°C goal in The Paris Agreement (IEA, 2017). Green bonds were created to use debt capital markets to fund environment and climate friendly solutions (CBI, n.d.-a). The green bond market has experienced a rapid growth since the first issuance in 2007 and the development of the voluntary Green Bond Principal in 2014. From 2014 until 2018 we can observe a market with exponential growth, promoting transparency, integrity with an increasing interest from every developed part of the world (Nyamongo, 2017).

A green bond is a fixed-income financial instrument where the characteristics compared to a conventional bond is that the issued debt's purpose is to finance an environmental friendly change in the company's operations or investments. Previous studies (Zerbib, 2019; Schmitt, 2017; Schestag, Schuster, & Uhrig-Homburg, 2016) have found evidence of a negative premium for green bonds, which is defined as the difference in the yield of a green bond in comparison to a conventional bond with the same attributes except that the use of proceeds (UoP) are earmarked for environmental friendly investments. As far as we know, previous research on the green bond premium has generalized all green bonds use of proceeds as just the definition and not taking into account that there are different purposes and categories which defines the bond's intent. We divide the use of proceeds into 7 main categories; energy, buildings, transport, water, waste, land use and adaptation.

Energy is one of the largest categories and cover energy production such as solar, wind, geothermal and hydro. Green bonds in this category are also issued for production of biofuel, bioenergy and energy storing.

Buildings account for almost 40 % of the global carbon dioxide emissions (Abergel, Dean, & Dulac, 2017). The green bonds in this category are issued to counter the high emissions from buildings by funding low carbon buildings such as a "Powerhouse" which produce more energy than it uses (Thyholt, Dokka, & Jenssen, 2013).

Transportation is often a large part of industry and society, hence there is important to have clean electric cars, trucks and ships to transport people, shipment and cargo. The green bonds in this category finance companies and governments with improving the emission of transportation.

Water covers the projects and investments that contain sustainable water, water saving, infrastructure for clean and drinkable water, and urban drainage and river systems.

The waste management category includes the disposal from a product's complete life cycle: Disposal, recycling, reuse, prevention and pollution control. This includes reduction in pollution by improving waste management and improving use of resources.

Land use bonds are issued to provide reduction for the emission and deforestation which is affected by companies and governments through industry and production.

The main objective of this paper is to address the abnormal premium in green bonds. We are not investigating the cause of the premium, but rather if the premium is still present or if it has been temporary due to excess demand. Hence, establishing an end or prolonging to this phenomenon is an important contribution to the literature on social and responsible investments (SRI). The base of this study rests on the methodology in (Zerbib, 2019), to compare the green bonds' yield to the conventional bonds' yield by creating a synthetic conventional twin that has the same characteristics as the respective green bond.

In this study we also consider the green bond premium based on the underlying objectives of the projects (UoP). To acknowledge the significance of the green bond premium, we separate the bonds by *buildings, waste, adaptation, water, transport, land use, and energy*.

The first objective of the paper is to find evidence of a green bond premium on a general basis in the green bonds, or if there are no difference between green bonds' yield and conventional bonds'. We analyze 117 investment grade green bonds on the secondary market in the period from January 2017 to April 2019. Our results support the majority of previous studies on the topic, that in general, green bonds trade at a negative premium when compared to an identical conventional twin. We show that the green bonds on average trade with a yield of 1.74 bps lower than conventional bonds. Second, we proceed by analyzing the green bond premium within the UoP categories to observe whether there are any different levels of the green bond premium. Analyzing the use of proceeds can provide us with a perception of the green bond premium's origin. The intent of this separation is to use this information to observe the market's valuation of different use of proceeds or whether the green bond label alone triggered the valuation. We find that for use of proceeds the energy category have a higher negative impact on the yield according to our results, compared to the other categories.

Since the market has developed at such a high rate, we theorize that the increased demand for green bonds might have diluted the green bond premium. Thus, we map the development of the green bond premium over the study's time period. Our results present indications of a premium decaying over time. But, there are no conclusive evidence since the premium has not stabilized at a certain level, and the restricted time span of the green bonds make it difficult to forecast the future course.

Third, we investigate the determinants of the premium by regressing the fundamental attributes, such as; time to maturity, the issued monetary amount and currency, and other features of the green bonds such as the determined objective of the use of proceeds such as; energy, buildings, water and waste. With this regression we discover that green bonds earmarked for energy have a significant higher green bond premium in absolute terms. This is the only variable that sticks out under all our previous tests of the UoP and under the determinants of the green bond premium section.

The remaining part of this paper will be structured in the following manner. The section that follows will describe the background and review previous research on the topic. Section three describes the data collection process from our initial data to the final sample. The methodology is outlined in section four. Our results are presented in section five, while section six summarizes and concludes our findings.

2 Literature review

The effect of corporate social responsibility (CSR) and firms' economic performance have gained much attention and there is extensive evidence finding a positive relationship between the two. Researchers often attribute the effect to the resource-based view (Barney, 1991), that the increased focus on CSR leads to more efficient use of the firms' resources, (e.g lower use of electricity). Russo & Fouts (1997) found a positive relationship between environmental performance and economic performance, and that the relationship get stronger with industry growth. They had a sample of 243 firms and attributed their findings to the resource-based view. (Rao & Holt, 2005) examined the link between economic performance and green supply chain management on firms in South East Asia and found that greening phases of the supply chain ultimately leads to an increase economic performance and competitiveness. In a study of 267 US firms (Sharfman & Fernando, 2008) found that improved environmental performance by environmental risk management changed the investors risk perception of the firm. It lowered the cost of equity by lowering the volatility in the stock. Their results suggests that the financial markets perceive firms with good environmental management as less risky. Similarly, in a large sample of US firms (El Ghoul, Guedhami, Kwok, & Mishra, 2011) found that firms with a higher CSR-score have a lower cost of equity, supporting arguments in literature that socially responsible firms have a lower risk. Recent events like the Volkswagen emission scandal, known as "Diesel Gate" shows how CSR-profile can potentially be an important factor to consider in the risk assessment of a firm.

The market of social responsible investments (SRI), while still being in development, has grown rapidly due to the increased focus on environmental, social and corporate governance (ESG) from investors. In the United States assets under management using SRI strategies grew from \$8,7 trillion at the start of 2016 to \$12,0 trillion at the start of 2018, representing 26% of US assets under professional management (USSIF, 2018). In a survey of more than 3000 managers and investors from over 100 countries (Unruh et al., 2016) find that only 60% of managers in publicly traded companies believed that good sustainability performance is important to investors investment decisions. 75% of senior executives in investment firms agreed that sustainability performance is important when making an investment decision, and nearly 50% of the investors said they would not invest in a company with poor sustainability performance. Supporting claims in literature on CSR and financial performance, 60% of investors believed that solid sustainability performance reduces a companys risk and lowers its cost of capital.

While there is extensive research on the link between ESG and financial performance in equity-linked relations, the research on fixed-income is still fairly limited. Studies that evaluate the financial performance of green bonds have yielded different results, even though most have found that green bonds tends to trade at a negative premium. Ehlers & Packer (2017) and Baker et al.(2018) found a negative premium of -17bps and -7bps in the primary market, the findings suggest that in general, a green bond receives better price from an issuer perspective compared to similar conventional bonds. The findings reveals that switching to pro-environmental projects, supply chains, products, and assets can provide lower financial costs for issuers of green bonds. Similar results have been found in the secondary market. Zerbib (2019) has covered the premium from mid-2013 to the end of 2017 in a study with 110 green bonds and find evidence of a negative premium of -2bps. Zerbib matches the green bonds with the two closest conventional bonds from the same issuer and with the same attributes. He identifies the green bond premium by creating synthetic conventional twin and running a panel regression with the difference in yield as the dependent variable, and the difference in liquidity as the independent variable. Hackenberg & Schiereck(2018) and Backelet et al.(2019) study samples of 63 and 89 using methods motivated by Zerbib. Hackenberg & Schiereck report a premium of -1bps in the overall sample, their results suggest that the premium is influenced by ESG and industry, while Backelet et al.(2019) report that overall, green bonds tends to trade at a higher premium than conventional bonds, but that isolated green bonds from institutions tends to trade with a negative premium, while green bonds from corporate issuers trade at a positive premium. Schmitt(2017) study a sample of 160 green bonds in the period from Jan 2015 to may 2017 and use 20 conventional bonds to create a synthetical conventional twin. To investigate the yield differential Schmitt calculates the term structure of interest rates and pricing the cash flows of the green bond with spot rates of comparable conventional bonds. Schmitt reports an overall premium of -3.2bps, with a negative premium prior to 2017 and turning positive in 2017. The findings are attributed to an excess demand that are met due to an increase in supply of green bonds through 2016.

3 Data collection

To investigate if there is a premium in green bonds we collect data from Eikon and received 3,952 active and expired green bonds from the CBI database. The CBI data include non-financial details such as detailed use of proceeds and if the green bond was externally reviewed. The bonds in the CBI database are filtered to include only bonds where at least 95% of the use of proceeds are financing or refinancing green and environmental projects. The bonds also have to be broadly aligned with the Climate Bonds Taxonomy, which means that bonds that fund projects like ”clean coal” are excluded (CBI, n.d.-b). We collect information on the outstanding population of labeled green bonds as of April 2019.

This study is taking a closer look at how the use of proceeds might affect the green bond premium, therefore, the information in the CBI database is crucial. After combining the information from both databases we are left with 899 green bonds with complete information from both Eikon and CBI.

To get a fair estimation of the green bond's synthetic conventional twin we use data on green and conventional bonds in the secondary market with clear restrictions. Our restrictions are motivated by Zerbib (2019) for picking both green and conventional bonds as they seem reasonable to get a good comparison. We exclude bonds that:

i. are not plain vanilla

ii. are not investment grade

iii. are not rated by at least one rating agency (S&P, Moody's or Fitch)

With the restrictions we are left with a sample of 394 green bonds and 60,000 conventional bonds. Since the yield is not necessary for the matching of the green and the conventional bonds, we run the matching function with only the necessary information.

i. ISIN

ii. Issuer

iii. Rating

iv. Seniority

v. Currency

vi. Coupon type

vii. Maturity

viii. Amount Issued

ix. Call type

After the matching we are left with 143 green bonds where each green bond have at least three conventional bonds complying with the matching criteria.

We collect the closing bid and ask yields from the period January 1, 2017 to April 12, 2019. Due to lack of price data, we were unable to use all the bonds, and end up with a sample of 117 green bonds. Figure 7 in appendix illustrates the sample representation compared to the investment graded green bonds and table 11 presents our total bond sample.

4 Methodology

4.1 Hypotheses

To answer the three objectives articulated in the introduction, we have defined three hypotheses; no green bond premium, the green bond premium does not differ among green bonds with different use of proceeds and the green bond premium remain constant over time.

Hypothesis 1: *No green bond premium.*

The motivation for the first hypothesis is to evaluate whether the green bond premium exist on a general basis. To test this hypothesis within our framework we compare the yield on the green bonds with their synthetic conventional twin.

Hypothesis 2: *The green bond premium does not differ among green bonds with different use of proceeds.*

This paper's main focus is on the use of proceeds. The motivation for the second hypothesis is therefore to investigate the premium over the use of proceeds categories and highlight any significant difference between the green bond premium for segmented samples separated by the categories. To test the second hypothesis, we will divide the green bonds into segments of their intended debt purposes (UoP) and compare the green bond premium.

Hypothesis 3: *The green bond premium remain constant over time.*

We have theorized that the previously observed green bond premium is due to an excess demand for green bonds. According to the efficient market hypothesis the same risk should give the same return (Fama, 1998), with this in mind, we believe that an increase in supply should price the green bond closer to the identical conventional twin. If there is no indication of an convergence in the yields there are probably other factors affecting the pricing of the green bonds. Fama & French (2007) argues that investors can develop a taste for assets from non-financial motives like only investing in stocks that are social and environmental responsible. They argue that this can change equilibrium prices, and we believe this could contribute to explain the green bond premium. To test this hypothesis, we will assess the green bond premium over the study's time period by regressing for the monthly green bond premium.

4.2 Matching method

In order to investigate the existence of the green bond premium, we match the yield of each green bond with a synthetic conventional bond with equivalent attributes (such as maturity) and within the restricted boundaries.

Attribute	**Restriction**
Coupon type	Equal
Seniority	Equal
Issuer	Equal
Currency	Equal
Amount issued	Within four times more or less
Maturity	Within two years more or less
Credit rating	Equal

The restricted boundaries limits the uncertainty linked to valuation based on the instruments structure, and make for better comparisons. We make sure that the coupon type of the conventional bonds are equal to the green bond; which we already have restricted to fixed coupon bonds. By limiting the bonds to the same issuer and same currency, we eliminate the exchange-rate risk and overall idiosyncratic risk that can be observed between different countries and companies. Restricting the credit rating and seniority reduces liquidity risk from the yield difference. Time to maturity for the conventional matched bonds converges between two year higher or lower than the green bond Restriction on the maturity down to the day, or even the week, would leave the sample close to empty, as few issuers issued green and conventional bonds at the same time. Maturity is an important attribute that should be matched upon if possible. To estimate the yields for the synthetic bonds ($y_{i,t}^{CB}$) and match the maturities between each green bond and their conventional bonds, we perform spline interpolation and extrapolation. Interpolation estimates an approximated value on a specific point in a data set between the other points in the set. Extrapolation estimates the value of points outside of the set (Dierckx, 1995).

In this case, we estimate the yield for the synthetic conventional bond by extrapolating, or interpolate, the value of the bonds yield at the time to maturity for each green bond based on the set of conventional bonds which fulfill the restriction criteria. The interpolation uses second degree polynomial spline interpolation to smooth the spline curve within the set of conventional yields. The extrapolation uses first degree polynomial spline, estimating the yield by a linear relationship between the sets' points.

The approximated point is adjusted by the all the points in the data set; shifting the synthetic yield towards a consistent range for that specific issuer's bonds. The synthetic bond is constructed out of at least three conventional bonds, with different maturities, per suited green bond. This provide us with a more certain extrapolated value because of the shift which is weighted by all of the conventional bonds. The limit of ± 2 years limits the inaccuracy of the approximation by catering the points in a narrow range. The extrapolated values will always suffer from uncertainty as we can never know fully the best represented yield for the synthetic bond. But, by at least including three bonds we can draw a pattern and make sure that the typical yield level of the issuer's bonds is accounted for. The twins that are created using this method are equal on every structural term, even maturities, and reduce most of

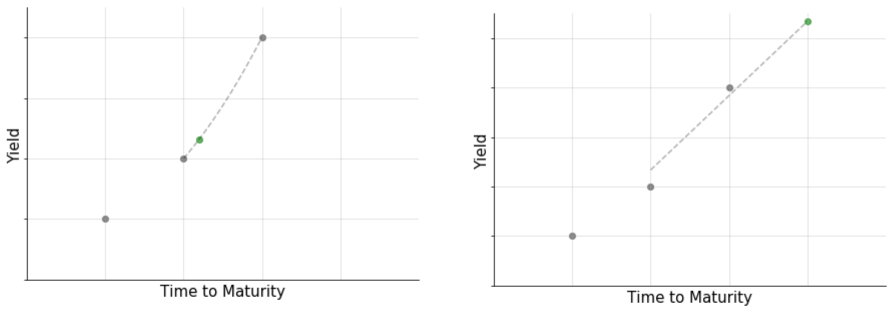


Figure 1: *The left graph illustrate second degree polynomial spline interpolation; structuring a yield point within the maturity range. The right graph illustrate first degree polynomial spline extrapolation; structuring a yield point outside of the maturity range. Green mark represent the estimated yield for the synthetic conventional bond, while grey mark are the matched sample's yield-maturity relation.*

the liquidity bias. Further, we will use the difference in yield ($\Delta y_{i,t}$) to investigate the green bond premium. $\Delta y_{i,t}$ is calculated as the difference in the green bond and the synthetic bond's yield, i.e.:

$$\Delta y_{i,t} = y_{i,t}^{GB} - y_{i,t}^{CB} \tag{1}$$

After the matching sequence we ended up with 117 twins of green and synthetic conventional bonds. The only factor which may interrupt the $\Delta y_{i,t}$ from being the actual green bond premium difference is the liquidity premium.

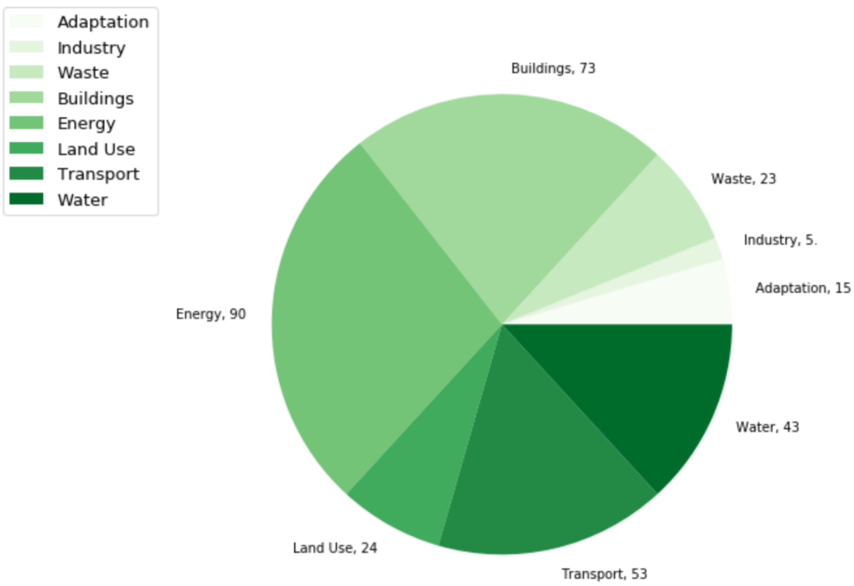


Figure 2: The distribution of the Use of Proceeds category on the 117 green bonds.

4.3 Liquidity proxy

One attribute which is not yet accounted for is the difference in liquidity. Amihud & Mendelson (1986) suggest that assets that are not frequently traded tend to have larger expected return. Their model predicts that the higher the bid-ask spread and the longer the holding period, the larger the expected return will be. If an investor wants to buy (or sell) an asset immediately, the quoted bid (or ask) includes a liquidity premium, which is the cost of illiquidity. Even though we have bonds from the same issuer with identical characteristics, the liquidity of the bond can differ and we have to take this into account with a liquidity proxy.

Though, a subjective concept, a proxy of the liquidity premium is possible to estimate through indirect measures that are based on bond characteristics and prices (Houweling, Mentink, & Vorst, 2005). We need to calculate the illiquidity in the bonds to be able to separate the difference in liquidity premium from the green bond premium. Therefore, we need to compute the liquidity difference and extract out the green bond premium from the $\Delta y_{i,t}$.
The method that we believe suits the best to estimate the liquidity premium in each bond is the bid-ask spread percentage at closing yield. Fong et al.(2017) did a performance test on empiric global data to find the most suited liquidity proxies. We are interested in their research's analysis of the daily market liquidity on global asset pricing. With a sample of 400 firms and varying liquidity methods, the research conclude that the daily version of Closing Percent Quoted Spread is the best daily percent-cost proxy when data is available.

$$ClosingPercentQuotedSpread = \frac{Ask_c - Bid_c}{(\frac{Ask_c+Bid_c}{2})} \tag{2}$$

The liquidity proxy is calculated based on the bid-ask yields on the bonds. In today's climate with negative interest rates as well as the fact that on the yield, the bid is higher than the ask. We use the absolute values to account for the "negative spread". Some bonds also had a positive bid and a negative ask, this result in extreme values with the formula and we removed the observations from those days.

The liquidity of the synthetic conventional bond is created based on the matched conventional bonds. Except from using more than two bonds, the bid-ask spread of the synthetic conventional bond is calculated similarly to Zerbib (2019) as the distance-weighted average of the conventional bonds where the distances are defined as:

$$\mathrm{d}_j = |GBmaturity - CB_j maturity|$$

The closing percent quoted spread of the synthetic conventional bond is calculated with a multiple points weighted average distance method performed as:

$$BA_{i,t}^{CB_{synthetic}} = \sum_{j=1}^{J} \frac{\frac{1}{d_j}}{\sum_{j=1}^{J} \frac{1}{d_j}} BA_{i,t}^{CB_j} \tag{3}$$

The independent variable in the fixed effect regression is the difference of the liquidity proxy from the green and the synthetic conventional bond, let:

$$\Delta L_{i,t} = \Delta BA_{i,t} = BA_{i,t}^{GB} - BA_{i,t}^{CB_{synthetic}} \tag{4}$$

The distribution of the difference of the liquidity proxy is shown in table 1. We can assume from the table that the bid ask spread is concentrated around the mean which is close to zero, making the sample evenly spread on the plus and minus side. The statistics hints of a fatter left tail, but a zero centered distribution of the proxy difference.

Table 1: Statistical distribution of the difference of the liquidity proxy. From the left: Minimum, first quartile, median, mean, third quartile, maximum and standard deviation.

	Min	1Q	Median	Mean	3Q	Max	Std.dev
ΔL_i	-0.5843	-0.0204	-0.0004	0.0056	0.0090	0.6458	0.1096

4.4 Model for yield difference identification

The model we use to identify the green bond premium is this fixed effect panel regression:

$$\Delta y_{i,t} = \beta_1 \Delta L_{i,t} + \epsilon_{i,t} \tag{5}$$

Regressing the $\Delta y_{i,t}$ on the liquidity proxy provide us with the explanatory effect that affect the $\Delta y_{i,t}$. The fixed effect model estimates the time-invariant individual intercept for each bond without imposing any variation from the other bonds. We performed a Durbin-Wu-Hausman test to take a stand on whether to use a fixed effect panel regression or a random effect panel regression. The test resulted in rejecting the null hypothesis, random effect model, on a 1% significance level. This set the assumption in the model for correlation between the within fixed effect estimation and the liquidity proxies. The residual, ϵ, captures the $\Delta y_{i,t}$ not explained by the difference in liquidity. The residual can be intersected as:

$$\epsilon_{i,t} = \alpha_i + u_{i,t} \tag{6}$$

The α is defined as the bond-specific green bond premium isolated from the model by estimating the fixed effect for each observation and grouping by bonds (i). To check for a significant result of a green bond premium different from zero, we perform a Wilcoxon signed-rank test. The test is used to compare the difference in two samples where the population cannot seem to be normally distributed. α is used as the defined difference between the two samples, green and conventional bonds. The test will assist in determining the statistically significance of α. We will apply this test for the whole sample to investigate the overall existence of the green bond premium. To evaluate the second hypothesis, we will also perform the test for the different use of proceed groups to determine if our results vary over the categories of the green bond samples. As the green bonds' purposes can be quite specific, we could not find equivalent underlying objectives from the synthetic bonds. This study will only investigate the proportion of the observed green bond premium from the chosen categories. We will be able to determine which category that bear the largest weight of the premium or if it is equally distributed among all categories. Aspects like quantity, total amount of issuance, average size of issuance, quantity growth are attributes we are able to isolate and verify besides the subject of the category.

Further, will we regress equation 5 and 6 on a monthly basis to investigate the movement of the green bond premium over the time period of the study. That is, limiting the time (t) to each month and collaborating each monthly green bond premium to form a line graph to represent the findings. We will also be able to limit the bonds (i) to capture the course of each use of proceeds specified bond, and sectors.

4.5 Determinants of the green bond premium

After we have found and identified a special green bond premium, we want to study if the premium is determined from different characteristics of the green bond. The characteristics uses Zerbib (2019) as guideline for the determinants. This study use time to maturity, the natural logarithm of issued amount, credit ratings, currency, sector and use of proceeds. The reference categories in this study is US dollar for the principal currencies and Governmental sector for the sectors. Since the use of proceeds can overlap, i.e. that several can be active at the same time, they will be treated as separate dummy variables without a reference category.

$$\begin{aligned}\alpha_i = \beta_0 + \beta_1 Maturity_i + \beta_2 ln(AmountedIssued)_i + \beta_3 Rating_i \\ + \sum_{j=2}^{N_{sector}} \beta D_{Sector_j,i} + \sum_{j=2}^{N_Currency} \beta D_{Currency_j,i} + \sum_{j=1}^{N_{UoP}} \beta D_{UoP_j,i}\end{aligned} \quad (7)$$

5 Results

5.1 Estimating the green bond premium

The first regression aims to estimate a statistically difference in yield unequal to zero by removing the difference in liquidity premium from the green bonds and their matched synthetic twin. The results of the Hausman test confirm that the fixed effect within estimator is the most appropriate model compared to the random effect model. After running a Breusch-Pagan test we rejected the null hypothesis that the variance of the $\Delta y_{i,t}$ level in the difference in bid-ask spread is homoskedastic. Hence, the test verify the existence of heteroskedasticity within the data. We also ran a Wooldridge test, which suggested autocorrelation. To counter these findings we implement Driscoll-Kraay robust estimator for heteroskedasticity and autocorrelation in panel data.

Table 2 presents the results of the fixed effect regression from equation 5 with 28,482 daily closing time observations from the full sample spanning from January 2017 to April 2019. The coefficient for the difference in bid-ask spread proxy, $\Delta L_{i,t}$, is estimated to -0.1866 with a statistical significance on the 1% significance level. The coefficient describe a negative movement on the yield difference with 18.66 base points per percentile difference in the bid ask spread proxy. The negative sign is expected as less liquid financial objects experience less favorable bid/ask prices for investors at a transaction, which causes lower yields.

Table 2: *Fixed effect regression (5) between the* $\Delta y_{i,t}$ *and the difference in bid ask spread with Driscoll-Kraay robust estimator. Std. Errors reported in parentheses*

Dep. Variable	$\Delta y_{i,t}$
No. Obs	28482
Cov. Est.	Driscoll-Kraay
R-squared	0.0618
P-value (F-stat)	0.0000
$\Delta L_{i,t}$	-0.1866***
	(0.0116)

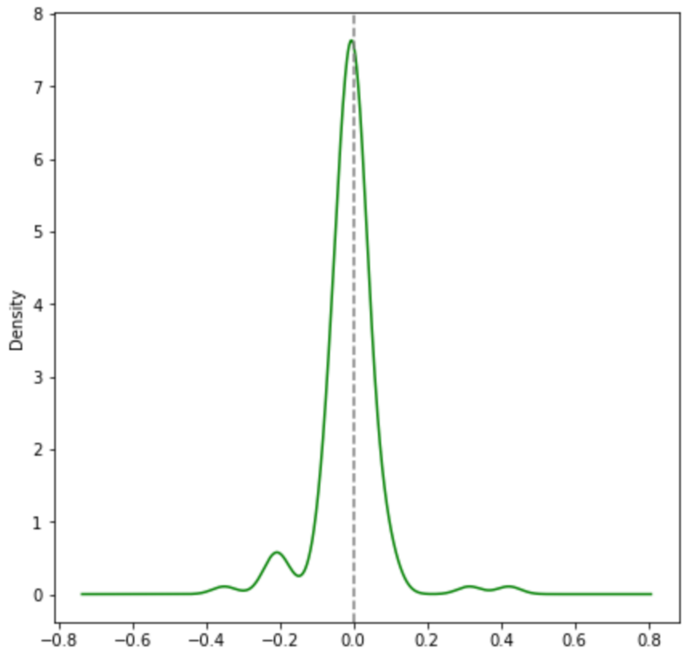
The first regression calculate the time-invariant individual estimated effect of each bond couple which we refer to as α_i, where i indicate the entity number of the 117 bond couples. Table 4 illustrate α_i's statistical distribution for the full sample and separated by the UoP categories. The full sample α_i has a mean at -0.0174 indicating a -1.7 bps yield difference on average between the green and conventional bond. The median indicate a green bond premium of -0.5 bps, illustrating that the majority of the α_i's have a negative sign and we can also argue by the quartiles (1Q: $-0.0408, 3Q : 0.0115$) that there might be a left-way skewness. The α_i from the UoP categories show various results. The Energy (mean: -0.0242) and Buildings (mean: -0.0118) category are the only α_is which imply a similar distribution as the full sample. The other categories have means of maximum 0.4 bps, which we consider as close to zero. There are some possible explanations for the difference in distribution; there might be too few green bonds in the other categories except for Transport (53) and Water (43) which can imply a lesser representation of the population within these categories, or these categories are issued by issuers that mostly have similar use of proceeds on their conventional bonds, making the green label insignificant. The fact that energy and buildings span over most sectors and industries make them more general in the market, with their sample size, also explains their similarity with the full sample. Transport and Land use have a more industry specific application which might suppress the importance of the green label.

Table 3: *The distribution statistics of the green bond premium estimator,* α

	Min	1Q	Median	Mean	3Q	Max	Std.dev
α_i	-0.3503	-0.0408	-0.0047	-0.0174	0.0115	0.4212	0.0678
$\alpha_i^{Adaptation}$	-0.2625	-0.0275	0.0075	0.0044	0.0399	0.3015	0.0989
$\alpha_i^{Buildings}$	-0.3555	-0.0354	-0.0021	-0.0118	0.0129	0.3150	0.0664
α_i^{Energy}	-0.3501	-0.0463	-0.0089	-0.0242	0.0094	0.4212	0.0730
$\alpha_i^{Industry}$	-0.0027	-0.0026	0.0002	0.0081	0.0160	0.4252	0.0227
$\alpha_i^{LandUse}$	-0.3655	-0.0308	0.0078	0.0040	0.0385	0.3165	0.0937
$\alpha_i^{Transport}$	-0.3493	-0.0318	0.0002	-0.0030	0.0235	0.3141	0.0733
α_i^{Waste}	-0.3582	-0.0301	-0.0021	0.0020	0.0376	0.0999	0.0722
α_i^{Water}	-0.3090	-0.0347	-0.0027	-0.0035	0.0191	0.4214	0.0621

We can see on Figure 3 that α_i's sample mean is skewed to the left and also that the sample has a fatter and more substantial left tail.

Figure 3: *Distribution of the estimated green bond premium in the full sample of 117 bonds*



To verify the statistically significance of the green bond premium within the different categories and the full sample, we perform a Wilcoxon signed-rank tests. We highlight the p-value from the tests in table 5, where the p-values express the statistical probability for the mean of the α_i to be different than zero. The full sample α_i is significantly different from zero on a 5% significance level with a mean on -1.74 base points. We present this as evidence for a negative premium fundamentally in the green bonds in the secondary market on an overall perspective. This is in alignment with most of the previous research on the topic. We can thus reject the first hypothesis of no green bond premium.

Table 5: *Wilcoxon signed-rank test results. P-values express the probability of wrongly reject the null hypothesis of* $\overline{\alpha_i} = 0$. *The third column represent the amount of bonds in each category described in the first column.*

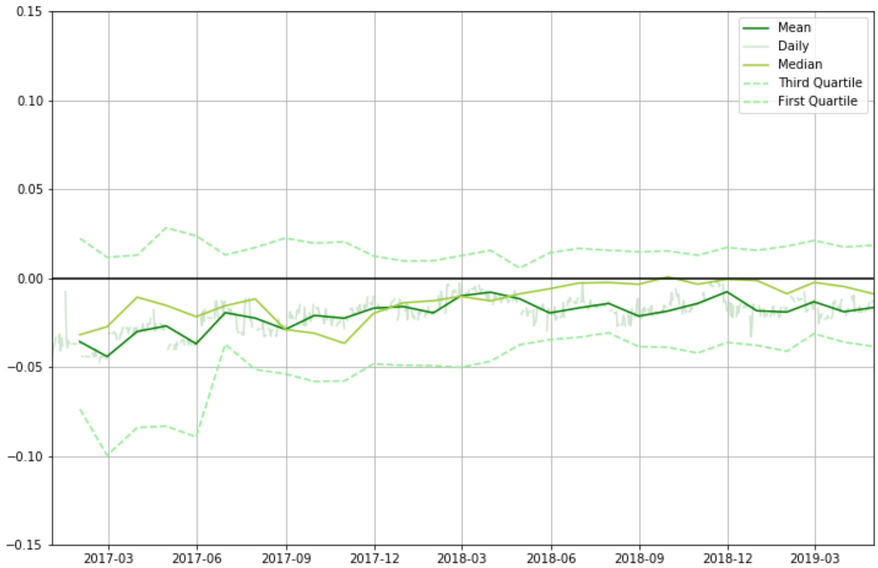
Description	p-value	No.bonds
Full sample	0.0131**	117
Adaption	0.6496	15
Buildings	0.0914*	73
Energy	0.0068***	90
Industry	0.5002	5
Land Use	0.3282	24
Transport	0.4629	53
Waste	0.2012	23
Water	0.7616	43
AAA	0.0627*	60
AA	0.6309	27
A	0.0176**	17
BBB	0.5067	13
CBI certified	0.5701	15

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

Further, we can observe significant p-values from the Energy and Buildings category on 1% and 10% significance level respectively. As we can see from table 4, The green bonds with the Energy category have the largest green bond premium and also the most significant p-value on the Wilcoxon signed-rank test. This could imply that the green bond earmarked for clean energy production and usage are higher valued in the secondary marked than the other UoP categories. The Buildings category also has a significant difference in yield, but lesser than the full sample. With a relatively large sample size we can assume that buildings are not as highly valued as the Energy earmark. As previously discussed, these two categories have the highest number of bonds, and are some of the most general use of proceeds applicable for most industries. This may provide higher valuation in alignment with the full sample. Water and Transport still have considerably large numbers of bonds, thus, we can not certainly write off the amount as reason for the highly insignificant result. Water and Transport have a mean of -0.30 and -0.35 basis points, which we consider indistinctly with zero. This serve as evidence that the secondary marked does not value these categories any different than the conventional bonds, while, the Energy and Buildings category does show a distinct difference in yield. Thus, we can reject the second hypothesis that the green bond premium does not differ among green bonds with different use of proceeds. When it comes to the rest of the UoP categories, we can not with certainty provide any discussion as they have too few number of bonds in the sample, but they also seems to follow the conclusion of Water and Transport.

From table 4 we added the p-values of the different ratings from AAA to BBB, and whether the bonds are CBI certified. Significant p-values can be observed on AAA and A, but not on AA and BBB. These results grant us with an obscure finding. Firstly, since credit ratings have a ordinal nature, the fact that AA has not a significant level on the Wilcoxon test, and 0.6309 in p-value, the results from the credit ratings of all the credit ratings are difficult to interpret and assume significantly relevant. There may be higher green bond premium between the A-rated bonds and lower, but the lack of observations for BBB-rated bonds might make the results insignificant. The 10 % significance level on the AAA rating is possibly coming from the high amount of observations making the AAA-rated bonds more frequent over the full sample, and thus being somewhat significantly different from zero which originate from the full sample's nature, i.e. a green bond premium on a general basis. Hence, we can not find evidence that credit rating affect the green bond premium. There were only CBI certification on 15 green bonds, resulting in a p-value of 0.5701. We could not provide evidence that CBI certification affect the green bond premium.

Figure 4: *The first regression with monthly rolling window estimating the mean green bond premium from 2017 to 2019. The darkest green line indicate the monthly mean level of* α_i. *The slightly lighter line coherently following the mean, is the monthly median. The cyan colored lines above and below the mean and median are the first and third quartile. The faded spiky line following the mean, is the daily observations.*



Previous studies (Hachenberg & Schiereck, 2018) have observed a higher green bond premium for corporate bonds in absolute term. We restricted the monthly rolling window regression to only corporate bonds. The results are illustrated in Figure 5. Comparing the two mean lines in Figure 5.1 and 5 we can verify that corporate bonds has a distinct higher green bond premium in accordance with previous research. We can also observe that the premium is closing in to zero within the corporate bonds in a lower rate than the full sample. More distinctly is the median line, which is clearly moving towards zero in a steady rate, indicating a shift towards zero in the long run. Again, the time span is too short to get a clear conclusion on the course of the premium. This provide indications, but not evidence, that the green bond premium is decreasing over time. It might happen on a general basis, but referring to corporate bonds or the bonds with use of proceeds directed towards energy (Figure 6) we can not foresee any evanesce of the green bond premium. It would be of interest for future research to investigate the green bond premium's continuity.

Figure 5: *The first regression with monthly rolling window estimating the mean green bond premium restricted to corporate bonds from 2017 to 2019. The darkest green line indicate the monthly mean level of* α_i*. The slightly lighter line coherently following the mean, is the monthly median. The cyan colored lines above and below the mean and median are the first and third quartile. The faded spiky line following the mean, is the daily observations.*

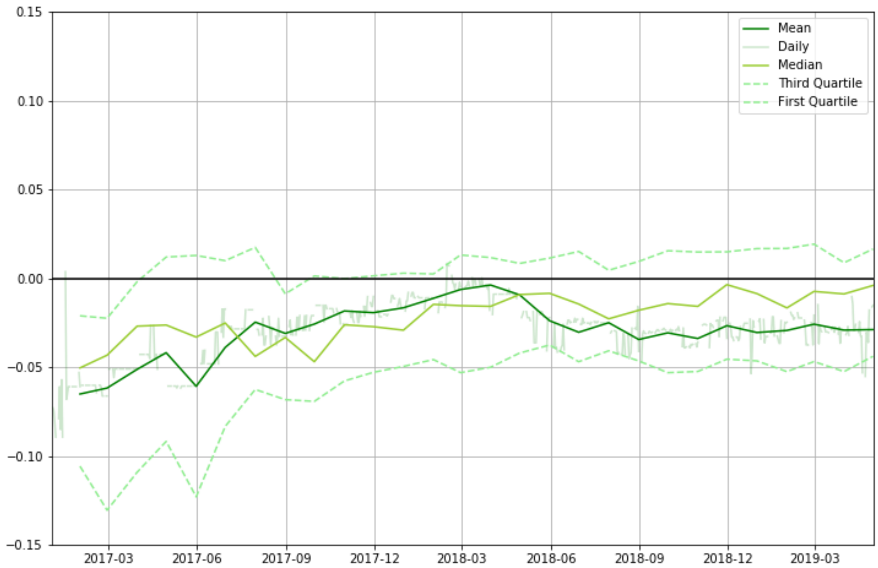
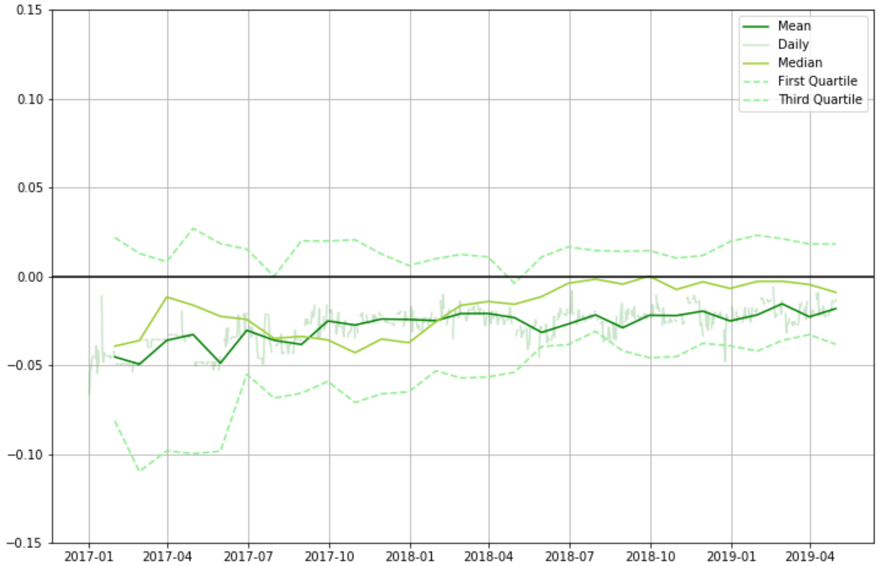


Figure 6: *The first regression with monthly rolling window estimating the mean green bond premium restricted to Energy earmarked bonds from 2017 to 2019. The darkest green line indicate the monthly mean level of α_i. The slightly lighter line coherently following the mean, is the monthly median. The cyan colored lines above and below the mean and median are the first and third quartile. The faded spiky line following the mean, is the daily observations.*



5.2 Determinants of the green bond premium

Table 6 shows the regression which is in line with equation 7. The purpose of this regression is to evaluate the fundamental attributes of the green bond's effect on the observed green bond premium. We use a standard OLS regression with the α_is as the endogenous variable. The standard errors are estimated with HC3 (Hayes & Cai, 2007), heteroskedasticity-consistent standard error estimator. We performed four variants of the regression. (a) regress only on the UoPs to observe their explanatory effect, individually and jointly, on the green bond premium. (b) contains: **time to maturity**, **the logarithmic value of amount issued**, **the ratings**; AAA (reference category), AA, A and BBB, **the sectors**; Financial, Real Estate, Technology, Utility and Government (reference category), **principal currencies**; Australian Dollar, Euro, Swedish Krona, US dollar (Reference category), **the Use of Proceeds**; Adaptation, Industry, Waste, Buildings, Energy, Land Use, Transport and

Water, and **CBI certification**. (c) is a direct transcript of Equation 7 and similar to (b) only difference is numeric ordinal credit rating instead of dummy variables. (d) is a regression on the credit ratings alone to observe their jointly explanatory effect on the green bond premium. The samples are restricted to only contain dummy variables that captures at least five observations. The motivation for the restriction is to ensure a better representation of the variables' population. This reduce the amount of bonds in the sample to 101 in regression (b), (c) and (d).

Table 6: *OLS regression on α_i with HC3 robust standard errors. The reference categories in (c) are Government and US dollars. (b) additionally has AAA as reference category as the ratings are dummy variables in this regression. Standard errors in parenthesis*

	(a)	(b)	(c)	(d)
Dep. Variable	α_i	α_i	α_i	α_i
Std. errors	HC3	HC3	HC3	HC3
β_0	-0.0033	0.0190	0.0088	-0.0224**
	(0.0161)	(0.0279)	(0.0278)	(0.0107)
Time to maturity		0.0022	0.0025	
		(0.0043)	(0.0044)	
Log_AmountIssued		-0.0157	-0.0148	
		(0.0157)	(0.0160)	
Rating			-0.0008	
			(0.0040)	
AA		0.0303*		0.0269**
		(0.0182)		(0.0132)
A		-0.0280		-0.0243
		(0.0232)		(0.0236)
BBB		-0.0092		0.0076
		(0.0309)		(0.0253)
Financial Sector		-0.0291	-0.0204	
		(0.0258)	(0.0265)	
Real Estate Sector		-0.0107	-0.0164	

		(0.0504)	(0.0539)	
Australian Dollar		-0.0326	-0.0185	
		(0.0351)	(0.0345)	
Euro		-0.0054	-0.0033	
		(0.0207)	(0.0187)	
Swedish Krona		-0.0272	-0.0332	
		(0.0332)	(0.0336)	
Adaptation	-0.0275	-0.0493	-0.0463	
	(0.0380)	(0.0310)	(0.0316)	
Industry	0.1120			
	(0.1044)			
Waste	0.0150	0.0441	0.0476	
	(0.0358)	(0.0370)	(0.0383)	
Buildings	0.0062	-0.0116	-0.0051	
	(0.0146)	(0.0188)	(0.0203)	
Energy	-0.0323**	-0.0495***	-0.0485**	
	(0.0149)	(0.0189)	(0.0193)	
Land Use	0.0260	0.0067	0.0062	
	(0.0257)	(0.0225)	(0.0229)	
Transport	-0.0136	-0.0016	0.0055	
	(0.0299)	(0.0263)	(0.0281)	
Water	0.0210	0.0000	-0.0018	
	(0.0251)	(0.0252)	(0.0266)	
CBI certified	0.0149	0.0349	0.0327	
	(0.0177)	(0.0270)	(0.0284)	
F statistic	1.036	1.118	1.158	2.626*
P-value(F-test)	(0.334)	(0.350)	(0.318)	(0.0547)
R-squared	0.10	0.19	0.14	0.05
No. observations	117	101	101	101

*p < 0.1; **p < 0.05; ***P < 0.01 //

From (b) and (c) it can be observed that neither time to maturity, amount issued, CBI certification, nor currency have significant coefficients. Therefore, based on the findings, we choose to neglect the significance of these fundamental attributes of the bonds. In (c) we find that rating is close to zero in ordinal value and in (d) has the same conflicting pattern as we observed in table 5, where A (-0.0243) show a different sign than AA and BBB (0.0269 and 0.0076). This is not the progressive pattern we would expect when we consider credit rating to be a consecutive default proxy. Also, AA rating is the only credit rating with positive sign (taking the constant into account) and significant coefficient. We cannot derive to any significant effect on credit rating based on our findings.

The sectors all have negative signs on their coefficients which signify that green bonds in both financial and real estate sector have larger green bond premium in absolute term. This finding is consistent with Zerbib (2019), Hachenberg Schiereck (2018). Hackenberg Schiereck (2018) argue that the difference in government and financial sector are that ”government-related issuers actively promoting growth of the green bond market and may fear that tight pricing of green bonds compared to non-green bonds might hurt market growth”. This also go along with the findings in Figure 5 where we found higher green bond premium in corporate issuer types compared to governmental.

The currency with the highest negative green bond premium is the Australian dollar with coefficient of -0.0351 and -0.0185, (b) and (c) respectively; followed by Swedish krona with -0.0272 and -0.0332; Then Euro and lastly US dollars scoring positive values when we take the constant into account. Additionally, we find no significant values in the the two regressions, (b) and (c), can not derive any statistically significant effect on the green bond premium. In the use of proceeds variables we find consistent result with previous tables and graphs. The Energy category score highest and show a negative premium of ca. 4 bps in every regression. This undoubtedly suggest that bonds earmarked for green energy consumption and production have a higher green bond premium in absolute terms. In (b) and (c) we surprisingly find that the Buildings category has a insignificant, and equal to zero, coefficient and does not further support any of the findings above regarding Buildings. Not that surprising, we find no significant values on the other UoP categories, if any, they apply positively to the premium. (a) have a R-squared of 10% and does not have jointly significance on the premium according to the F-statistics.

5.3 Robustness check

Our first concern is the quality of the liquidity proxy. To make sure it capture several ranges of volatility in the bonds we calculate, similarly to Zerbib, the distance-weighted average of 10, 20 and 30-day annualized volatility. The difference in volatility are used as an additional independent variable in the fixed effect panel regression. The results in table 7 are similar to those of Zerbib (2019) and shows no signs of the difference in volatility explaining the yield differential, indicating that the green bond premium should differ from a risk premium.

Table 7: *Results of the first step panel regression with the difference in 10, 20 and 30-day volatility as an independent control variable:* $\Delta y_{i,t} = \alpha_i + \Delta L_{i,t} + \Delta\sigma_{i,t} + \epsilon_{i,t}$ *with Driscoll-Kraay robust standard errors in parenthesis.*

Dep. Variable	Δy	Δy	Δy
Cov. Est.	Driscoll-Kraay	Driscoll-Kraay	Driscoll-Kraay
Δ L	-0.1862***	-0.1864***	-0.1865***
	(0.0115)	(0.0116)	(0.0116)
$\Delta\sigma_{10-day}$	-0.0875		
	(0.1039)		
$\Delta\sigma_{20-day}$		0.0015	
		(0.1014)	
$\Delta\sigma_{30-day}$			0.0523
			(0.0865)

*p < 0.1; **p < 0.05; ***P < 0.01

We consider the Energy category to be substantially large related to the sample, with 90 out of 117 bonds. We know that the UoP overlap, and that Energy occur in many of the other UoP categories. Table 8 show how many of the other categories that overlap with Energy.

Table 8: *Amount of Energy marked Use of Proceeds overlapped with the other UoP categories in the full sample of 117 green bonds*

Buildings:	$50/73$
Adaptation:	$12/15$
Land Use:	$23/25$
Industry:	$2/5$
Transport:	$44/53$
Waste:	$21/23$
Water:	$31/43$

We have found evidence that energy labeled green bonds trade with a lower yield than other matched bonds. To exclude the effect of the Energy category, we do a test where we remove all non-energy labeled green bonds, and take Energy out of the equation. Our motivation for this test is to check if Energy disturb any of the other categories or fundamental attributes of the green bond and whether any other variable has a significant effect within the Energy label. The regression is in similar fashion to the test done for the determinants of the green bond premium, in line with equation 7. The results can be found in table 9 below. The regressions are continually labeled as (e), (f) and (g).The first regression, (e), regress the Energy labeled green bond premium on the UoP categories. (f) and (g) are similar to equation 7 only differing in that (f) has ordinal values, and (g) has dummy variables, for the rating.

	(e)	(f)	(g)
Dep. Variable	α_i^{Energy}	α_i^{Energy}	α_i^{Energy}
Std. errors	HC3	HC3	HC3
β_i	-0.0390***	-0.0282	-0.0170

	(0.0136)	(0.0243)	(0.0208)
Time to maturity		-0.0026	-0.0033
		(0.0047)	(0.0047)
Log_AmountIssued		-0.0102	-0.0108
		(0.0169)	(0.0165)
Rating		0.0024	
		(0.0069)	
AA-nest			0.0684
			(0.0459)
A-nest			0.0048
			(0.0383)
BBB-nest			-0.0007
			(0.0605)
Financial Sector		-0.0124	-0.0280
		(0.0333)	(0.0376)
Real Estate Sector		0.0000	0.0000
		(0.0000)	(0.0000)
Australian Dollar		-0.0124	-0.0309
		(0.0374)	(0.0371)
Euro		-0.0123	-0.0171
		(0.0209)	(0.0232)
Swedish Krona		-0.0345	-0.0209
		(0.0391)	(0.0404)
EnergyBuildings	0.0224	0.0237	0.0105
	(0.0191)	(0.0258)	(0.0216)
EnergyAdaptation	-0.0363	-0.0408	-0.0354
	(0.0458)	(0.0478)	(0.0456)
EnergyLanduse	0.0296	0.0291	0.0258
	(0.0320)	(0.0328)	(0.0306)
EnergyIndustry	0.1199	0.0969	0.0771
	(0.1091)	(0.1119)	(0.1004)
EnergyTransport	-0.0223	-0.0237	-0.0262
	(0.0456)	(0.0478)	(0.0440)

EnergyWaste	0.0104	0.0127	0.0011
	(0.0390)	(0.0444)	(0.0443)
EnergyWater	0.0235	0.0177	0.0191
	(0.0361)	(0.0376)	(0.0373)
F statistic	1.2098	0.6007	0.7212
P-value(F-test)	(0.307)	(0.856)	(0.747)
R-squared	0.11	0.13	0.19
No. observations	90	90	90

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

The variables in regression (f) and (g) does not change considerably when comparing with (b) and (c) in table 6. We do not acquire any essential substance with those regressions, but they do tell us that the energy marked green bond premium has similar characteristic as the whole sample. Further, if we take a look at (e), we can observe that none of the UoP categories have significant coefficients. Also, we notice that the coefficient are close to similar for regression (a) and (e) for the UoP categories. Thus, signifying that the energy mark was implied in the other categories as it overlapped a large piece of the sample. This robustness check did not affect the conclusion on the UoP categories. Energy is still the only significant UoP, referring to our findings.

6 Conclusion

The literature aimed at this field has so far produced mixed findings regarding the green bond premium. The sample of 117 green bonds covering the period from January 2017 to April 2019 were tested for the presence of a green bond premium. By using similar methodological approach as Zerbib (2019) it was possible to obtain significant results consistent with previous studies and contribute to the field with our findings. We first provide evidence of a negative green bond premium for the whole sample period. Second, for green bonds that have a Energy label on the use of proceeds, we evidence that it has a significant differentiating effect on the premium. If this is also present in the primary market, issuers might benefit from lower cost of debt by issuing energy labeled green bond than they would by issuing green bonds for other purposes. Further, our findings give indications of a premium that decreases over time, but to determine if the premium is temporary due to excess demand, more research is necessary as the market segment matures.

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7 Appendix

Figure 7: *Sample representativeness of our sample of 117 green bonds compared to the 406 investment graded bonds from Eikon that was also in the CBI database. Top left table illustrate the distribution of currencies in the database and the sample, distributed by Euro, USD, SEK, AUD and a nested category; other. Top right illustrate the distribution of credit rating in the database and the sample, distributed by AAA, AA, A, and BBB; nested for plus and minus grades. The bottom left is the distribution by issuer types from Agency, Corporate, Government, Non-US Munis and Other government. Bottom right is the distribution by the sectors; Financial, Governmental, Real estate, Utility, Technology, Service, and Basic material.*

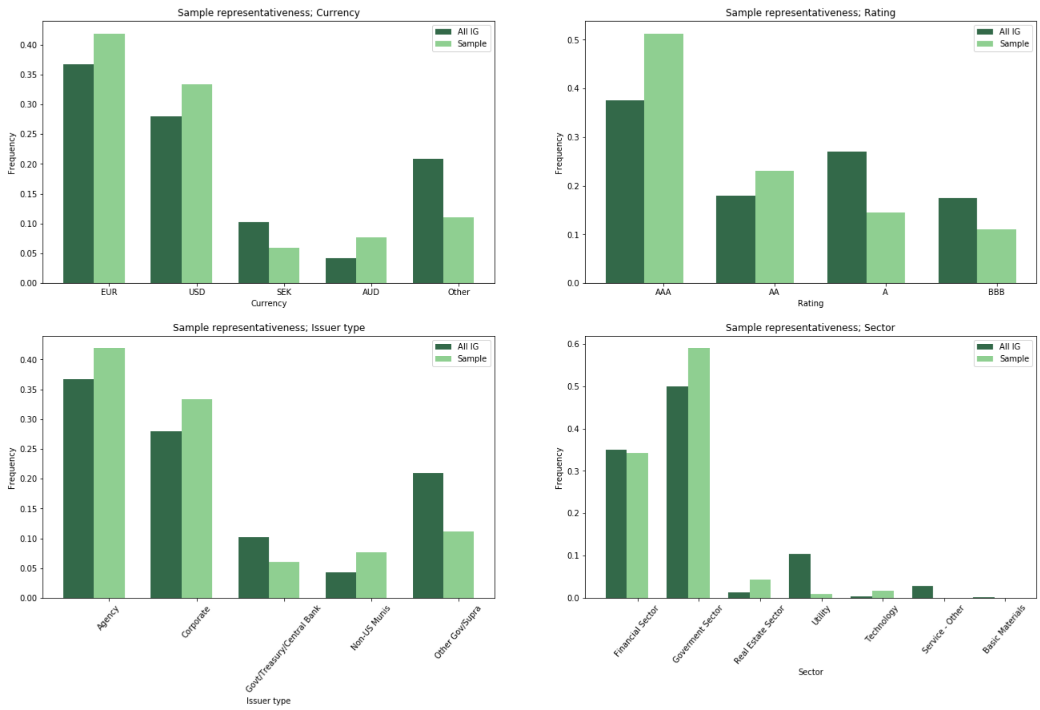

Figure 8: *Results of the Breusch-Pagan test for heteroskedasticity. The test result is to reject the null hypothesis that the variance within the regression is constant. The test is performed in Stata.*

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of y

         chi2(1)      =   3602.40
         Prob > chi2  =    0.0000
```

.

Figure 9: *Results of the Durbin-Wu-Hausman test comparing the fixed effect model to the random effect model. The test result is to reject the null hypothesis that random effect model is the better fit. The test is performed in Stata.*

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
x	-.1639732	-.1643797	.0004066	.0001617

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

             chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                     =        6.32
           Prob>chi2 =      0.0119
```

.

Figure 10: *Result of the Wooldridge test for autocorrelation. The test result is to reject the null hypothesis that there is no first order autocorrelation in the panel data.*

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,       97) =     16.204
           Prob > F =      0.0001
```

Figure 11: *The distribution of the green bond premium separated for the different credit ratings. Listing left to right: Full sample, AAA, AA+, AA, AA-, A+, A, A-, BBB+, BBB, BBB-. The dashed vertical line indicates premium value zero.*

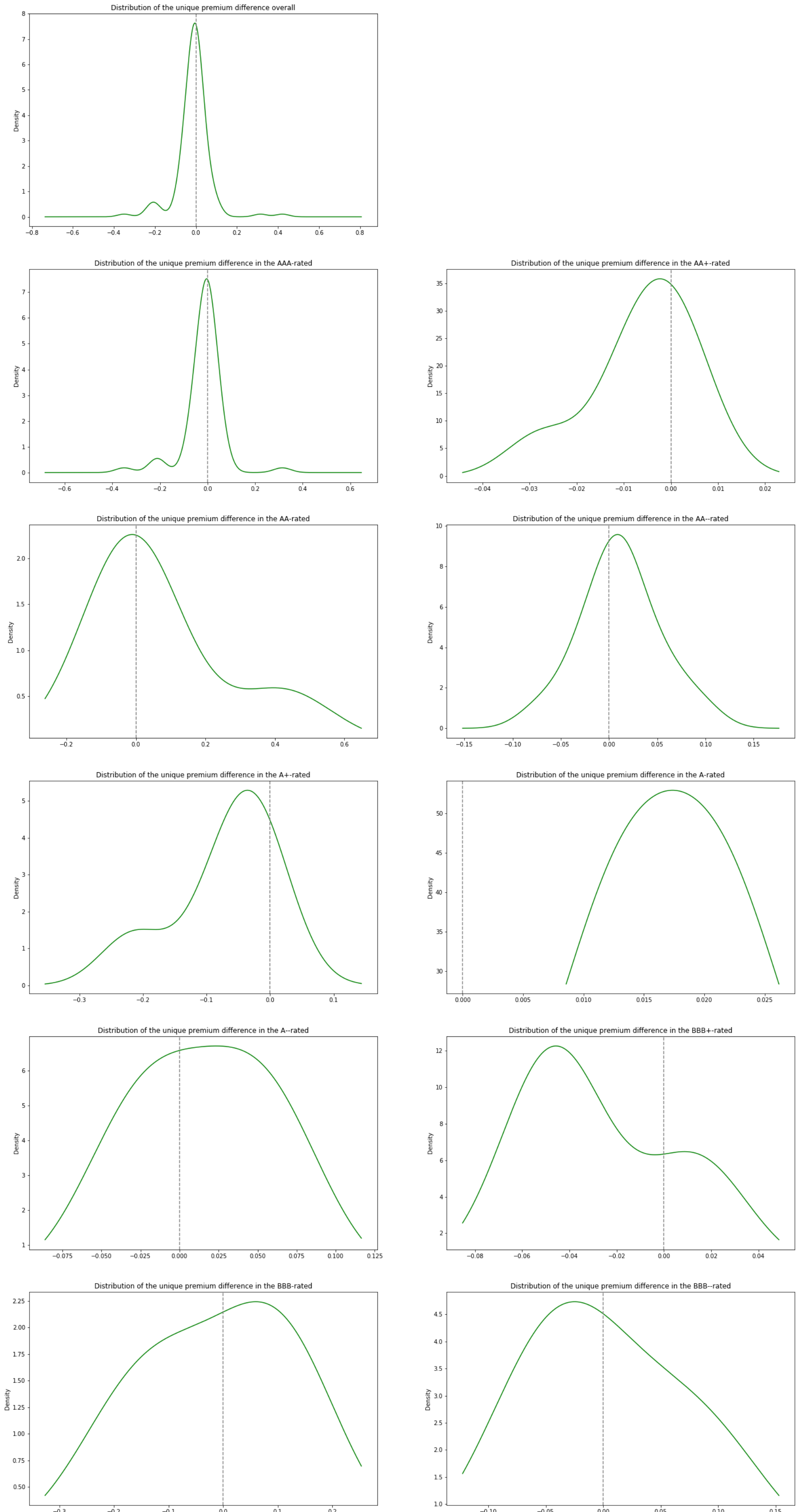

Figure 12: *The distribution of the green bond premium separated for the different Use of Proceeds categories. Listing left to right: Full sample, Energy, Buildings, Adaptation, Industry, Waste, Land Use, Transport, Water. The dashed vertical line indicates premium value zero.*

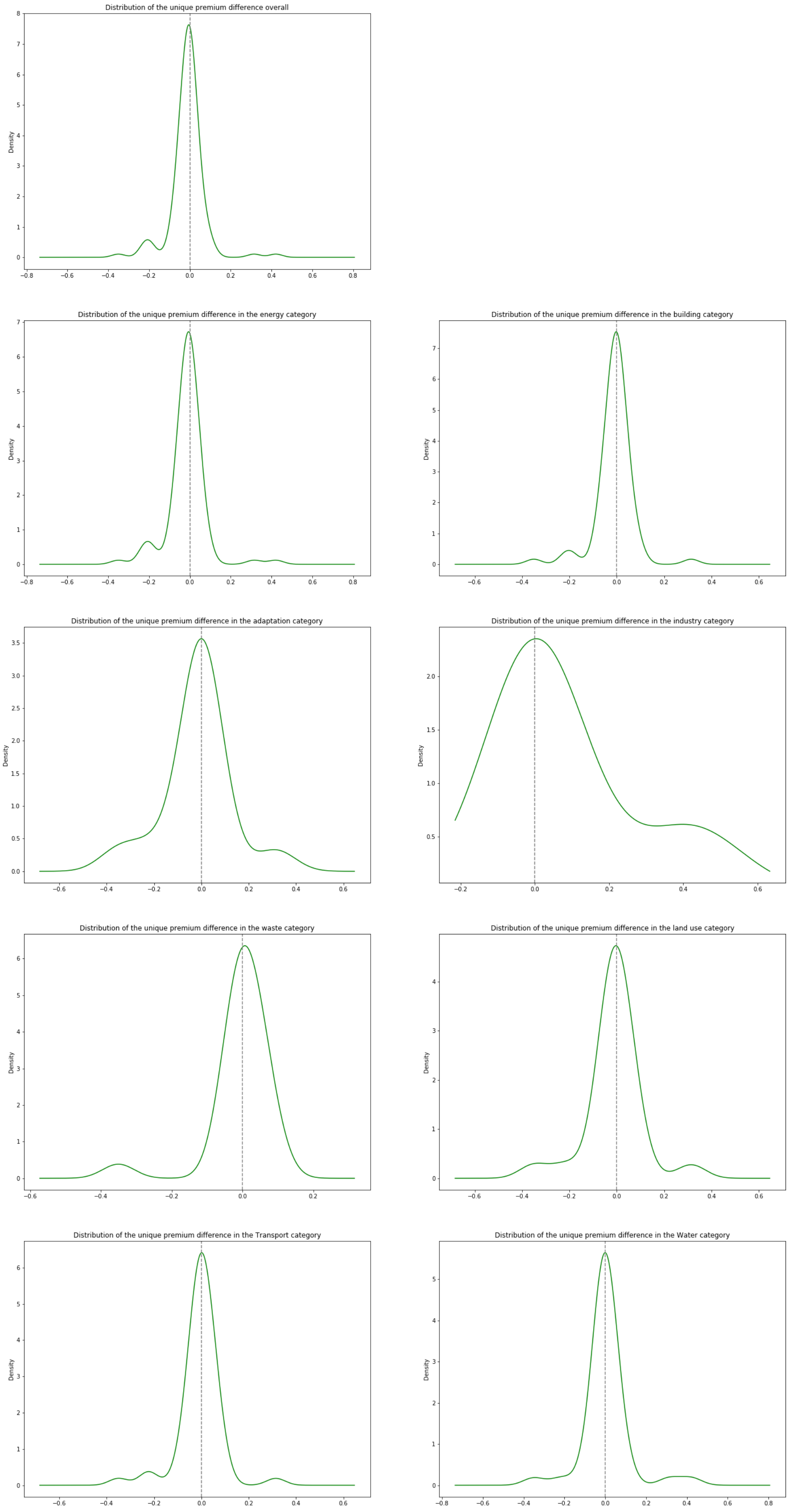

Table 10: *Numeric ordinal conversion of the credit ratings illustrated by increasing the numeric sequence systematically by credit risk sequence. The credit rating span from AAA to BBB-.*

Rating	Ordinal measure
AAA	0
AA+	1
AA	2
AA-	3
A+	4
A	5
A-	6
BBB+	7
BBB	8
BBB-	9

Table 11: *The full green bond sample. Listed 117 green bonds with ISIN-code, coupon size, Issue date, maturity date, principal currency and the issued amount.*

	ISIN	Coupon	Issue Date	Maturity	Currency	Amount Issued
1	XS0490347415	7.5	2010-03-05	2020-03-05	MXN	1870000000
2	LU0953782009	1.375	2013-07-18	2019-11-15	EUR	3000000000
3	FR0011637586	2.25	2013-11-27	2021-04-27	EUR	1400000000
4	CH0233004172	1.625	2014-02-04	2025-02-04	CHF	350000000
5	XS1051861851	2.25	2014-04-08	2020-03-07	GBP	1800000000
6	XS1057055060	2.5	2014-04-24	2022-10-24	EUR	750000000
7	XS1083955911	0.625	2014-07-03	2019-07-03	EUR	500000000
8	XS1087815483	0.375	2014-07-22	2019-07-22	EUR	1500000000
9	XS1111084718	1.375	2014-09-17	2024-09-17	EUR	1000000000
10	XS1107718279	1.25	2014-09-10	2026-11-13	EUR	1800000000
11	US65562QAW50	2.25	2014-09-30	2021-09-30	USD	500000000
12	US298785GQ39	2.5	2014-10-15	2024-10-15	USD	1000000000
13	AU3CB0226090	4	2014-12-16	2021-12-16	AUD	300000000
14	US45905URL07	2.125	2015-03-03	2025-03-03	USD	600000000
15	US045167CY77	2.125	2015-03-19	2025-03-19	USD	500000000
16	XS1209864229	2.75	2015-04-01	2020-04-01	USD	500000000
17	AU000KFWHAC9	2.4	2015-04-02	2020-07-02	AUD	1000000000

18	XS1218319702	1	2015-04-15	2025-03-14	EUR	500000000
19	DE000BHY0GP5	0.125	2015-05-05	2022-05-05	EUR	500000000
20	AU3CB0230100	3.25	2015-06-03	2020-06-03	AUD	600000000
21	XS1244060486	0.75	2015-06-09	2020-06-09	EUR	500000000
22	US25389JAL08	3.95	2015-06-23	2022-07-01	USD	500000000
23	XS1253847815	1.455	2015-06-30	2021-06-30	SEK	1050000000
24	XS1268337844	1.625	2015-07-30	2020-06-05	GBP	1000000000
25	XS1280834992	0.5	2015-08-27	2023-11-15	EUR	1900000000
26	XS1311459694	0.125	2015-10-27	2020-10-27	EUR	1500000000
27	DE000NWB0AC0	0.875	2015-11-10	2025-11-10	EUR	500000000
28	US500769GU24	1.875	2015-11-18	2020-11-30	USD	1000000000
29	XS1324217733	0.75	2015-11-24	2020-11-24	EUR	500000000
30	XS1324923520	0.75	2015-11-25	2020-11-25	EUR	500000000
31	NO0010752702	2.35	2015-12-04	2024-09-04	NOK	1500000000
32	FR0013067170	1.125	2015-12-14	2022-12-14	EUR	300000000
33	XS1346202184	0.625	2016-01-20	2021-01-20	SEK	1000000000
34	CA68323ADL58	1.95	2016-01-29	2023-01-27	CAD	1550000000
35	US302154BZ10	2.125	2016-02-11	2021-02-11	USD	400000000
36	US037833BU32	2.85	2016-02-23	2023-02-23	USD	1500000000
37	USY3815NAV39	2.875	2016-03-16	2021-03-16	USD	500000000
38	US50046PAU93	1.5	2016-03-22	2019-04-23	USD	600000000
39	FR0013170834	1.875	2016-05-20	2026-05-20	EUR	500000000
40	XS1414146669	0.05	2016-05-20	2024-05-30	EUR	1000000000
41	XS1422841202	0.625	2016-05-31	2022-05-31	EUR	500000000
42	AU3CB0237683	3.1	2016-06-03	2021-06-03	AUD	500000000
43	XS1433082861	0.885	2016-06-15	2022-06-15	SEK	1000000000
44	XS1436518606	1.048	2016-06-23	2021-06-23	SEK	1000000000
45	US29874QCW24	0.875	2016-07-20	2019-07-22	USD	650000000
46	US045167DR18	1.75	2016-08-16	2026-08-14	USD	500000000
47	US606822AH76	2.527	2016-09-13	2023-09-13	USD	500000000
48	US29878TCU60	1.125	2016-09-16	2021-09-16	CAD	500000000
49	US62630CAH43	1.375	2016-10-04	2021-09-21	USD	500000000
50	XS1500337644	0.125	2016-10-05	2021-10-05	EUR	500000000
51	XS1502438820	0.125	2016-10-11	2021-10-11	EUR	500000000
52	US50048MCD02	1.375	2016-10-26	2020-10-26	USD	500000000
53	XS1505655537	2	2016-10-19	2021-10-19	USD	500000000
54	US45905UZT41	1.75	2016-11-22	2021-11-22	USD	500000000
55	DE000NWB0AD8	0.375	2016-11-17	2026-11-17	EUR	500000000
56	US500769HD99	2	2016-11-30	2021-11-30	USD	1500000000
57	XS1527753187	0.5	2016-12-01	2022-06-01	EUR	500000000

58	XS1536786939	0.5	2016-12-20	2021-12-20	EUR	750000000
59	XS1550149204	1	2017-01-16	2024-09-16	EUR	1250000000
60	XS1551293019	0.5	2017-01-19	2022-07-19	SEK	3000000000
61	XS1567475303	0.3	2017-02-17	2022-02-17	EUR	500000000
62	XS1575474371	0.35	2017-03-07	2022-09-07	EUR	500000000
63	AU3CB0243657	3.25	2017-03-31	2022-03-31	AUD	450000000
64	US45905UG408	2	2017-04-12	2022-04-12	USD	300000000
65	XS1612940558	0.25	2017-05-16	2025-06-30	EUR	2000000000
66	XS1618289802	1.875	2017-05-23	2021-06-01	USD	500000000
67	DE000BHY0GH2	0.125	2017-06-14	2023-10-23	EUR	500000000
68	XS1618178567	6	2017-05-24	2021-02-24	INR	5000000000
69	US30216BGU08	1.625	2017-06-01	2020-06-01	USD	500000000
70	XS1627778316	0.625	2017-06-14	2023-06-14	SEK	1200000000
71	US037833CX61	3	2017-06-20	2027-06-20	USD	1000000000
72	XS1636000561	0.875	2017-06-27	2022-06-27	EUR	500000000
73	ES0200002022	0.8	2017-07-05	2023-07-05	EUR	600000000
74	XS1640493372	0.3	2017-06-30	2022-06-30	EUR	500000000
75	US045167EC30	2.375	2017-08-10	2027-08-10	USD	500000000
76	FR0013281755	1.5	2017-09-13	2027-09-13	EUR	600000000
77	US89114QBT40	1.85	2017-09-12	2020-09-11	USD	1000000000
78	US29874QDG64	1.875	2017-10-05	2021-07-15	USD	500000000
79	US500769HP20	2	2017-10-05	2022-09-29	USD	1000000000
80	US45950VLH77	2	2017-10-24	2022-10-24	USD	1000000000
81	XS1655322953	6.2	2017-08-07	2021-08-07	INR	3200000000
82	XS1711933033	0.25	2017-11-07	2022-11-07	EUR	500000000
83	US63983TBK07	2.125	2017-11-15	2021-11-15	USD	500000000
84	CH0387879049	0.5	2017-11-29	2031-11-28	CHF	200000000
85	XS1711173218	0.375	2017-11-16	2021-11-16	EUR	1000000000
86	DE000DHY4887	0.125	2017-11-23	2023-11-23	EUR	500000000
87	XS1720639779	0	2017-11-21	2021-07-21	EUR	600000000
88	DE000LB1M214	0.2	2017-12-13	2021-12-13	EUR	750000000
89	AU3CB0249787	2.7	2018-01-12	2023-01-12	AUD	750000000
90	XS1760129608	0.5	2018-01-30	2025-01-30	EUR	1000000000
91	XS1766612672	1.125	2018-02-07	2026-08-07	EUR	1000000000
92	XS1697651468	2.5	2017-10-18	2022-10-18	USD	1000000000
93	XS1684812255	1.625	2017-09-27	2021-09-27	USD	150000000
94	XS1684811794	1.375	2017-09-26	2019-09-26	USD	200000000
95	XS1796211933	1.95	2018-03-22	2020-03-22	HKD	100000000
96	US63254ABA51	3.625	2018-06-20	2023-06-20	USD	750000000
97	XS1839888754	0.625	2018-06-19	2025-06-19	EUR	1500000000

98	US015271AM12	4	2018-06-21	2024-01-15	USD	650000000
99	XS1848875172	0.375	2018-07-03	2023-07-03	EUR	500000000
100	DE000LB1P9C8	0.125	2018-06-27	2023-06-27	EUR	500000000
101	XS1814390099	2.25	2018-04-30	2020-04-30	HKD	100000000
102	XS1872032369	0.625	2018-08-30	2023-08-30	EUR	750000000
103	AU3CB0256162	2.7	2018-09-05	2023-09-05	AUD	450000000
104	DE000DHY4994	0.25	2018-09-10	2024-12-10	EUR	500000000
105	IT0005346579	2.125	2018-09-27	2023-09-27	EUR	500000000
106	XS1856795510	4.5	2018-09-28	2023-09-28	USD	650000000
107	US045167EJ82	3.125	2018-09-26	2028-09-26	USD	750000000
108	US45905UX338	2.92	2018-10-03	2020-10-01	USD	200000000
109	XS1893621026	1.875	2018-10-12	2025-10-13	EUR	600000000
110	XS1897258098	0.625	2018-10-23	2023-06-01	SEK	3000000000
111	DE000BHY0GC3	0.625	2018-10-22	2025-10-22	EUR	500000000
112	DE000MHB21J0	0.25	2018-11-08	2023-12-13	EUR	500000000
113	AU3SG0001878	3	2018-11-15	2028-11-15	AUD	1800000000
114	HK0000375300	2.84	2017-11-17	2027-11-17	HKD	600000000
115	AU3CB0258739	2.9	2018-11-26	2025-11-26	AUD	500000000
116	US00828EDF34	3	2018-12-06	2021-12-06	USD	500000000
117	XS1917719319	3.125	2018-12-05	2022-12-05	USD	500000000