

GREEN BOND PRICING IN THE PRIMARY MARKET:

July - December 2018

H2
(Q3-Q4)
2018



Report highlights

- USD29bn of benchmark green bonds included
- 53% of green bonds sold to investors declaring themselves green
- EUR green bonds perform well in primary markets
- Two green bonds exhibited a greenium
- Spotlight on the Chinese green bond market
- Guest author: Jason Mortimer, Portfolio Manager at Nomura Asset Management

Climate Bonds INITIATIVE



Prepared jointly by the Climate Bonds Initiative
and the International Finance Corporation



With support and funding from Obvion Hypotheken

Additional funding was received by the Ministry of Finance of Japan and the
Government of the Kingdom of Denmark through the Ministry of Foreign Affairs

Introduction

This is the 7th paper in our series monitoring how green bonds perform in the primary markets and includes bonds issued in the second half of 2018 (H2 2018).

During this period, USD89bn of green bonds issued were in line with the Climate Bonds Taxonomy.¹ They were denominated in 23 different currencies.

This paper captures 33% of that volume, including USD21.5bn of EUR-denominated green bonds and USD7.5bn of USD green bonds (see methodology on page 24).

To make our observations meaningful, our methodology is designed to capture the most liquid portion of the market, and the size threshold is set at USD500m, i.e. benchmark-sized deals, and limited to EUR- and USD-denominated bonds.

Report highlights

- On average, EUR green bonds achieved larger oversubscription than vanilla equivalents. USD green bonds were, on average, slightly less oversubscribed. **See more on page 3**
- On average, EUR green bonds achieved slightly lower spread compression than vanilla equivalents. For USD bonds, the average spread compression was the same for green and vanilla bonds. **See more on page 3**
- 53% of green bonds were allocated to investors declaring themselves as green. **See more on page 6**
- Two green bonds priced with a greenium. The rest priced with either a traditional new issue premium, or on the curve. **See more on page 7**
- Immediate secondary market performance was mixed. After seven days more green bonds had tightened to a greater degree than equivalents. After 28 days, half of EUR green bonds and a third of USD bonds had tightened more than vanilla equivalents, but 67% of all bonds had tightened more than their indices. **See more on pages 12**
- China is the largest source of emerging market (EM) green bonds.² We spotlight the Chinese green bond market to highlight developments and opportunities for investors. **See more on pages 15**
- Guest author Jason Mortimer explores whether green bonds offer better risk-return characteristics, or exhibit downside risk protection, compared to vanilla equivalents in the secondary market. Could this justify the notion of a greenium? **See more on page 18**

1. Market developments

Uncertainties in Europe surrounding Brexit and the Italian Budget, and strong economic data in the US helped to push bond yields to multi-year highs towards the end of 2018. Such challenging market conditions affected vanilla and green bonds alike.

34 benchmark-sized bonds were eligible for inclusion in this research, a slight drop year-on-year from 38 green bonds over the same period in 2017.³

It was notably more difficult to find suitable vanilla bonds for comparison than it has been in prior periods, particularly for bonds issued in the fourth quarter (Q4). As a result, 13 out of 16 EUR and four out of six USD green bonds issued in Q4 are each matched with a single bond.

For several green bonds, we also needed to expand the time horizon, so for green bonds issued in Q4 we have used vanilla bonds issued in either Q3 or Q4. For example, INTNED 2030, issued in Q4, is matched with INTNED 2028 issued in Q3.

Matching bonds to only one comparable means that performance differences are more likely to be due to company specific risk. However, the point of the exercise is to highlight new bonds that investors could have otherwise bought at that time, so in this regard the comparisons are valid.

The 34 bonds included in this paper originate from 31 issuers, with ING, Asian Development Bank (ADB) and the World Bank (IBRD) issuing in both USD and EUR. These bonds included a sovereign, and were otherwise split over three categories: 11 SSA*, 11 Financial Corporates,

and 11 Non-Financial Corporates. 24 bonds are denominated in EUR, ten in USD.

18 bonds came from repeat issuers, some of which have demonstrated remarkable dedication to the green bond market. Among them, Crédit Agricole issued its 103rd green bond (the first to qualify for our pricing research), IBRD issued its 149th and 150th green bonds, EIB issued its 41st green bond (10th EUR), KfW brought number 17, and ADB came with its 11th and 12th. This has given us the opportunity to add some new angles to our yield curve analysis.

Most of the finance raised through development bank bonds is channelled into emerging markets (EM), which is where much of the low-carbon, climate-resilient infrastructure will be needed. The minimum size for inclusion in this paper (USD500m) may limit qualifying bonds from EM. We are encouraged to see three large EM bonds: Korea Hydro 2023 (South Korea), Chengdu Nuclear 2025 (China) and State Bank of India 2023 (India). The rest are from SSAs and developed markets (DM).

16 first time green bond issuers are covered in this paper. We are pleased to note that the largest category is non-financial corporates, where diversity of issuer types is notably poor. Most of the non-financial corporate paper is earmarked for renewable energy.

Sovereign EUR:

- Ireland 2031

SSA EUR:

- Eurofima 2024 – Low-carbon Transport: rail
- Cassa Depositi e Prestiti SpA 2024 – Water

- Société du Grand Paris 2028 – Low-carbon transport: rail. Société du Grand Paris is a newly set-up entity, investing EUR30bn in the expansion and enhancement of the Paris public transport system, and is planning a programme of repeat green bond issuance

Financial corporate EUR:

- Munchener Hyp 2023 (covered bond) – Low-carbon buildings

Financial corporate USD:

- Boston Properties 2028 – Low-carbon buildings

Non-financial corporate EUR:

- Terna 2023 – Renewable energy
- La Poste 2028 – Renewable energy, low-carbon buildings, and low-carbon transport
- ENBW 2033 – Renewable energy and low-carbon transport
- Royal Schiphol Group NV 2030 – Low-carbon buildings and low-carbon transport
- ALD SA 2022 – Low-carbon transport: electric vehicles
- ENBW 2033 – Renewable energy and low-carbon transport
- EDP Finance 2025 – Renewable energy

Non-financial corporate USD:

- Interstate Power and Light 2028 – Renewable energy
- Korea Hydro and Nuclear (EM) 2023 – Renewable energy, low-carbon buildings, and low-carbon transport
- Duke Energy 2028 – Renewable energy

*In previous publications, we have used a variety of terms to identify the Sovereign, Supranational and Agency asset class (SSA). These terms included quasi governments and quas. In this publication, and from now on, this asset class will be defined using the standard market term, SSA.

2. Spread compression and book size: EUR green bonds achieved larger average oversubscription but slightly lower spread compression than vanilla equivalents. USD green bonds were slightly less well subscribed than vanilla equivalents while spread compression was the same

▪ **EUR:** Oversubscription average is 2.6x for green bonds, and 2.1x for vanilla bonds. Spread compression, average -10bp for green bonds vs. -11bp for vanilla equivalents

▪ **USD:** Oversubscription average is 1.9x for green bonds, and 2.0x for vanilla bonds. Spread compression, average -11bp for green bonds and vanilla equivalents

Green bonds are oversubscribed, and experience price tightening during book building, like vanilla bonds. We compare green bonds to vanilla equivalents to see whether there are any notable differences in the magnitude of change.

Green bonds in our H2 sample were, on average, more oversubscribed than green equivalents issued in H1 2018 (2.3x H1 2018 vs. 2.6x H2), but vanilla bonds also attracted slightly larger order books in H2 (2x in H1 vs. 2.1x in H2).

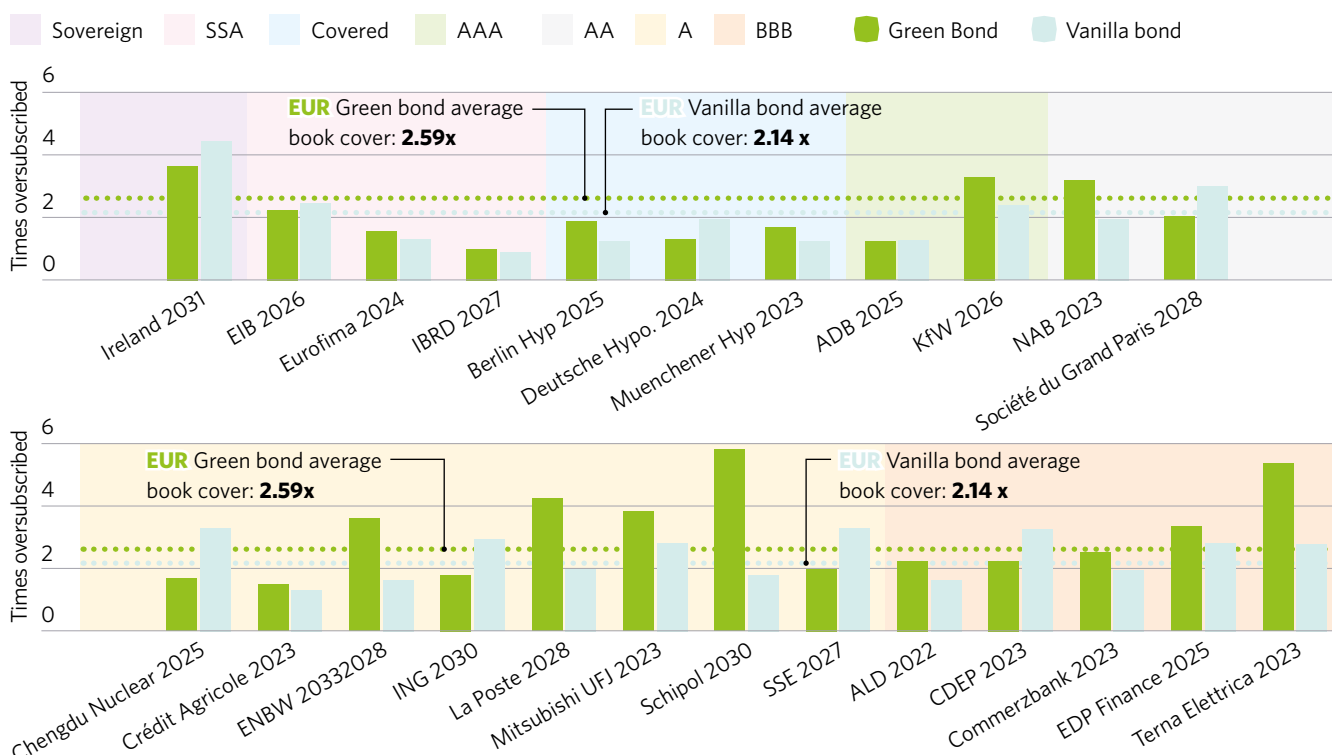
On an individual basis 15 out of 24 EUR green bonds attracted larger order books than vanilla equivalents. In terms of spread compression, 14 out of 24 EUR green bonds tightened by more than their vanilla equivalents, but the average green bond spread compression was slightly lower than the vanilla equivalent (-10bp against -11bp). One or two of the vanilla baskets achieved very high spread compression.

The EUR green bond with the most remarkable performance in the primary

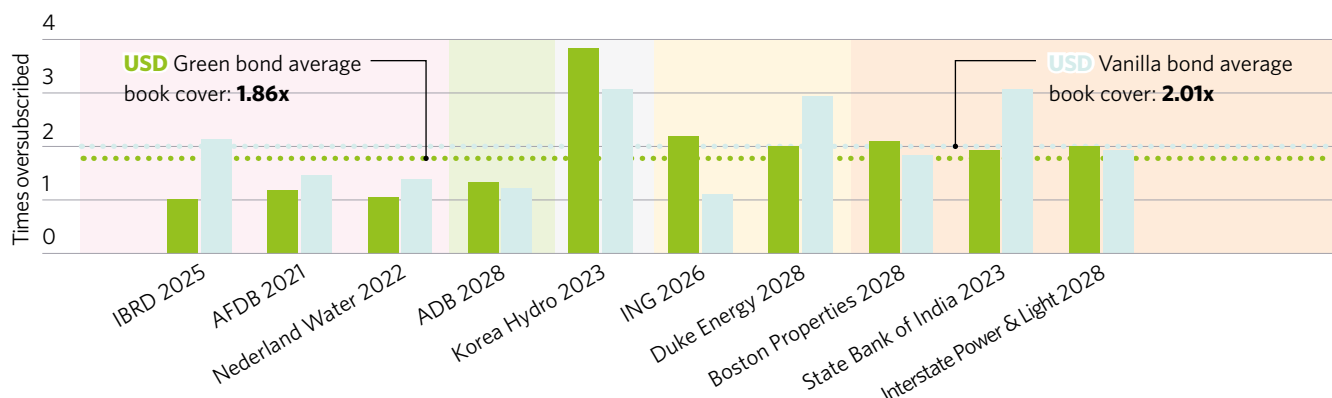
market was **Terna Elettrica 2023** which was the only deal of the day when it was launched in mid-July. The Italian grid company was able to increase the size of the offer from EUR500m to EUR750m with an order book that was 5.3 times covered and achieved 27.5bp of spread compression. This was also one of only two green bonds to exhibit a greenium in H2 2018 (page 7).

In USD, the story was slightly different. five out of ten USD green bonds attracted more interest than vanilla equivalents, but the average book cover for both green and vanilla bonds was smaller compared to H1, (e.g. green bonds 1.9 vs. 3.4x in H1; vanilla bonds 2x vs. 3x in H1). This suggests that

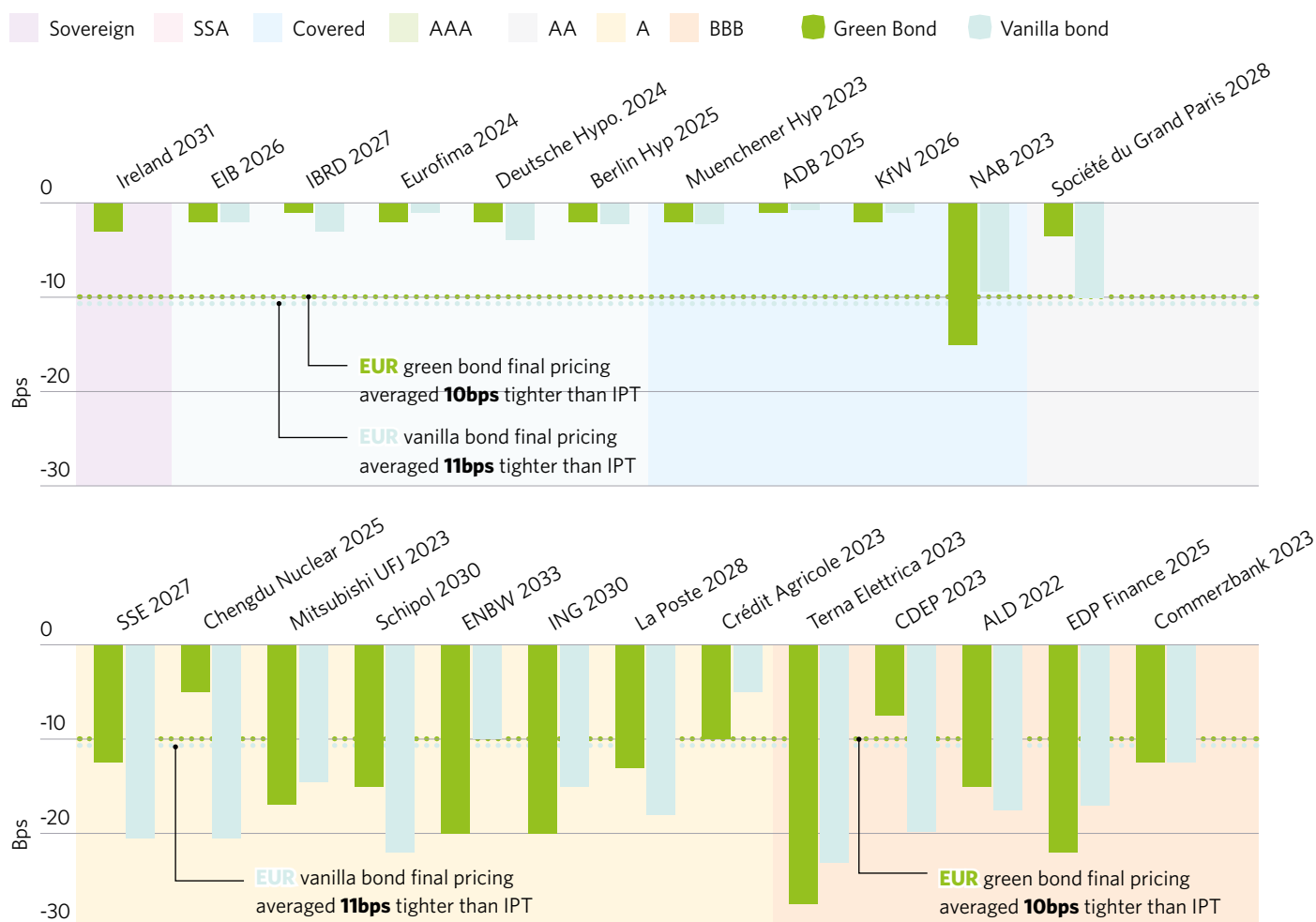
15 out of 24 EUR green bonds attracted higher book cover than vanilla equivalents



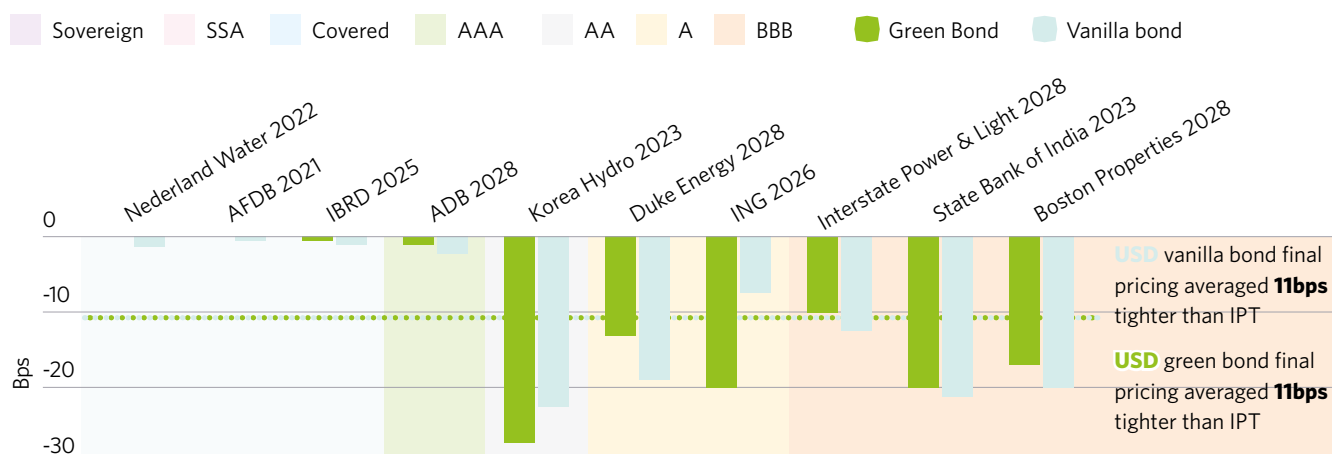
Five out of ten USD green bonds attracted higher book cover than vanilla equivalents



14 out of 24 EUR green bonds tightened by more than their basket during the pricing process



Two out of ten USD green bonds tightened by more than their basket during the pricing process



the appetite for all types of USD bonds was more muted towards the end of the year. In terms of spread compression, both green and vanilla bonds tightened by an average of 11bp but only two individual green bonds tightened more than their vanilla baskets.

When looking at primary markets, it is crucial to remember that timing influences the outcome of green bonds in the same way as for vanilla bonds. Nederland Water 2022, a USD bond issued in late November reached book cover of 1.06x and no spread compression. Two other USD bonds from the issuer attracted book cover of 1.5x and achieved spread tightening of 4bp and 1bp.⁴ Market circumstances in November 2018 were complicated by Brexit volatility and the AFDB 2021 USD 3-year green bond in the market on the same day.

Further, it was late in the year, and many investors tend to close their books ahead of the holiday season. Nevertheless, the book was oversubscribed and the deal went ahead with 35% participation from green investors.

Overall, we can say that appetite for EUR green bonds remained strong in H2 2018.

Historically, we have observed that USD green bonds tend to achieve larger book cover and greater spread compression than vanilla equivalents during the bookbuilding process.

We have seen that this was not the case in H2. Six of the ten USD bonds in our sample were matched with a single vanilla bond because there was a lack of suitable comparable bonds.

As we note in our introduction, while this may mean that performance differences are due to company specific risk, or exact timings of deals, the comparable bonds represent alternatives available to investors at that time.

Methodology notes: Baskets comprise bonds that most closely match the green bonds and are issued during the same quarter. The baskets in this publication include between one and six bonds. For methodology discussion see page 24, and summary statistics of the baskets are on pages 21-23.

A closer look at relative size of green and vanilla bonds

Does green bond size have pricing implications?

It is often assumed that green bonds receive good book cover compared to vanilla equivalents because green bonds tend to be smaller. We have included the sizes of green bonds along with the average sizes of those used for comparison in our summaries on pages 21-23.

In every case except one (Société du Grand Paris 2028), SSA green bonds are smaller than the non-green bonds with which we have compared them. In the case of USD-denominated bonds, the vanilla bonds are on average 4x the size, while for EUR-denominated bonds, the vanilla bonds average 4.8x the size.

One may expect this difference to manifest in relatively higher demand for SSA green bonds. Except it doesn't: only three out of ten SSA bonds received higher subscription interest than vanilla equivalents.

Yet it seems that the interest is 'stickier', at least in EUR. In five out of six cases (Société du Grand Paris 2028 being the exception), EUR SSA bonds all managed to tighten more than vanilla equivalents.

Meanwhile, none of the four USD SSA bonds tightened more than their vanilla equivalents suggesting the green label is less of a draw for USD investors.

Financial corporates and non-financial corporates were more mixed. Ten EUR green

bonds were smaller than their vanilla equivalents, while eight were larger than or equal to them. In USD, five out of six green bonds were larger than their vanilla equivalents. The magnitude of the difference was smaller for the non-SSA bonds. EUR-denominated vanilla bonds were, on average, 1.2x the size of the green bonds. USD-denominated vanilla bonds were on average 0.9x the size of the green bonds.

The magnitude of difference between non-SSA green and vanilla bonds does not appear sufficiently large to influence pricing or book size as there is no clear pattern, but we will explore this notion with a larger sample set in due course.

3. Green allocations: 53% of the amount raised by green bonds was allocated to investors declaring themselves as green

- 53% of the amount raised through green bonds in our sample was allocated to those labelling themselves as green or socially responsible investors
- All those who responded were DM or SSA issuers

Green bonds can attract a more diverse range of investors compared to vanilla bonds from the same issuer. This has ramifications, including giving the issuer more flexibility about the timing of taps and repeat issuance. Dedicated green bond funds provide a unique source of support to green bond issuers. However, we note that since none of the broad market indices actively exclude bonds based on them being green, as the market grows, forced participation among passive investors will become more pervasive. Therefore, non-dedicated investors will remain an important component of the green bond buying constituency. The inevitable growth in the choice of green bond ETFs will contribute to this.

We asked all the issuers in our H2 2018 sample to disclose what percentage of their

deals were allocated to green investors. 17 shared distribution statistics. All of them were either DM or SSA issuers. The overall figure (53%) represents a slight decline on the 55% recorded in our H1 publication, but nevertheless suggests material support from this segment of the market.

French vehicle leasing company ALD SA achieved the highest participation of green investors at 87%. The three bonds in our sample with the lowest share of green involvement - Boston Properties 2028 (23%), Duke Energy 2028 (33%) and Nederland Water 2022 (35%) - were all USD-denominated.

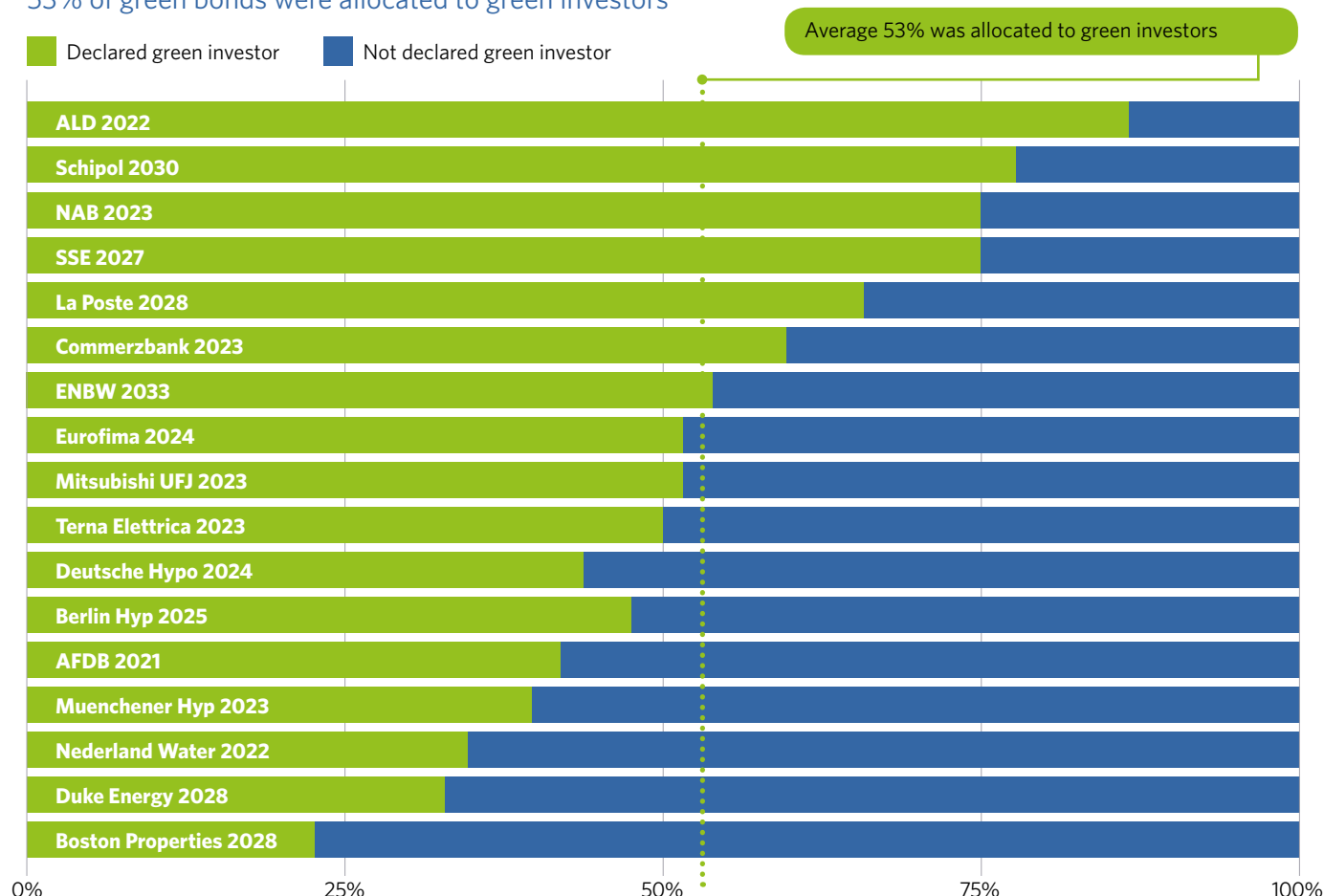
The average allocation to green investors by currency was 60% for EUR and 33% for USD. We expect the USD number to rise as more dedicated investors emerge. For now, we know that most dedicated green bond investors are based in Europe and it is good to see that these USD-denominated green bonds are attracting support from all areas of the market. Mainstream investors remain critical buyers of green bonds. We have been repeatedly told that all other things being equal, investors prefer to buy green bonds over vanilla alternatives.

Some issuers did not want to disclose the detail of their allocations but indicated that participation from green investors had been high:

- NTMA (Ireland 2031) said that green investors had been allocated more than half the total issued
- ADB (ADB 2025 USD and ADB 2028 EUR) told us that green allocations had been "significant"
- KfW (2026) wrote that "90 individual investors participated in the deal with an increasing number of them focusing on SRI criteria, amongst others: Achmea Investment Management, PGGM, Kempen Capital Management, Actiam, APG Asset Management and de Volksbank"

Methodology notes: Green investor participation is provided by issuers. There is no methodology for defining a 'green' investor, and we acknowledge that there may be differing interpretations. There is also no way to monitor how investors split their allocations of green bonds among their different portfolios.

53% of green bonds were allocated to green investors



4. Two bonds exhibited a greenium in H2, the rest priced on or outside their curves

▪ **EUR:** two bonds exhibited a greenium, three bonds priced on their curves, nine bonds exhibited new issue premia

▪ **USD:** two bonds priced on their curves, five bonds exhibited new issue premia

The new issue premium is the extra yield that a buyer gets, and a seller pays for a new bond in comparison to where seasoned bonds from the same issuer are trading in the secondary market.

A new issue premium is a standard feature of the bond market, and an issuer bears this cost to attract new investment.

Occasionally, a bond may be issued with a higher price and lower yield compared to existing debt, and the bond will sit inside its own yield curve. This is known as a new issue concession, or when present in green bonds, we have termed it a greenium.

Logically, there is no reason a bond being green would impact its price because green bonds rank pari passu (on equal footing) with bonds of the same rank and issuer. There is no credit enhancement to explain pricing differences, and issuers of green bonds incur albeit minimal costs such as certification and third-party review. Market dynamics such as supply, interest rate expectations, and geo-political issues can influence pricing for vanilla and green bond alike.

We were able to build yield curves for 21 out of 34 bonds in our sample. Nine of the bonds with yield curves had existing green bonds which have also been plotted. 14 of the H2 2018 green bonds priced with normal new issue premia. Five priced on their yield curves, and two exhibited a greenium: Terna Elettrica 2023 and EIB 2026, both EUR-denominated.

Methodology notes: We use yield on issue date, which reflects the price the green bond

offered on the pricing date. For comparable bonds, we use the yield-to-convention-mid.

For all bonds, we use modified duration to mid, and all the data is as of the pricing date of the green bond. The modified duration is the percentage price change of a security for a given change in yield. Modified duration increases with risk.

First, we plot seasoned vanilla bonds (blue dots) and fit a 2nd order polynomial yield curve. Next, we overlay any seasoned green bonds (orange), finally we add our subject bond (green). We include the yield curves of bonds in our sample with a minimum of four suitable comparable bonds.

Comparable bonds used for this exercise must fit the specification for green bond selection outlined on page 24, except that the use of proceeds is not limited. Bonds must share the same credit rating and payment rank as the green bond and have been issued after 01/01/2010.

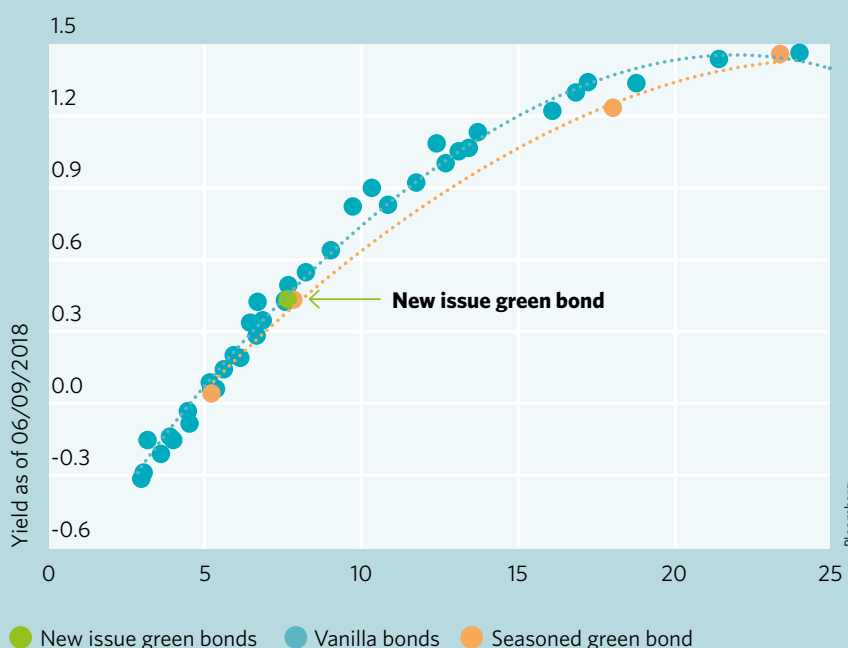
CASE STUDY: EIB 2026 EUR priced inside conventional curve, slightly outside green curve

EIB has an EUR green yield curve comprising four bonds.

The new green bond priced outside this curve, but inside the vanilla curve. This suggests that the green yield curve was used to price the green bond.

However, the fact that the green bond curve is inside the vanilla curve suggests that investors may attach value to the green label.

EIB 2026 EUR - greenium



CASE STUDY: ADB 2028 USD moved from being outside to being inside the curve within a month

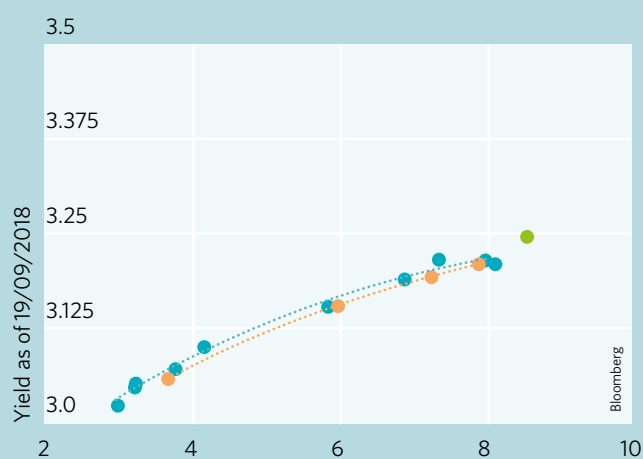
ADB is a prolific issuer of green bonds. As of 26/09/2018, it had a total of 12 outstanding, amounting to just under USD5bn.

Six of them are USD denominated, and total USD3.8bn. We have used four of the USD-denominated bonds to build a secondary market yield curve, which sits inside the vanilla curve.

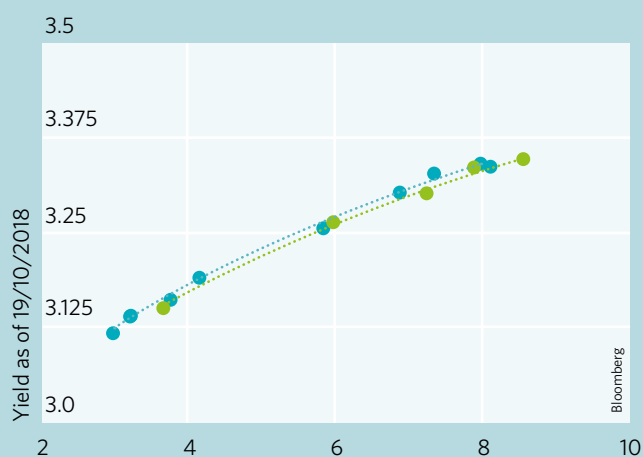
The new green bond issued on 19/09/2018 came with a traditional new issue premium to the conventional curve. Revisiting the data after a month on 19/10/2018, we observe that although both curves had widened, the new green bond had moved inside the conventional curve to sit on the green curve.

We note that among the bonds used in this exercise, the green bonds had an average size of USD0.6bn while the vanilla bonds had an average size of USD2.1bn.

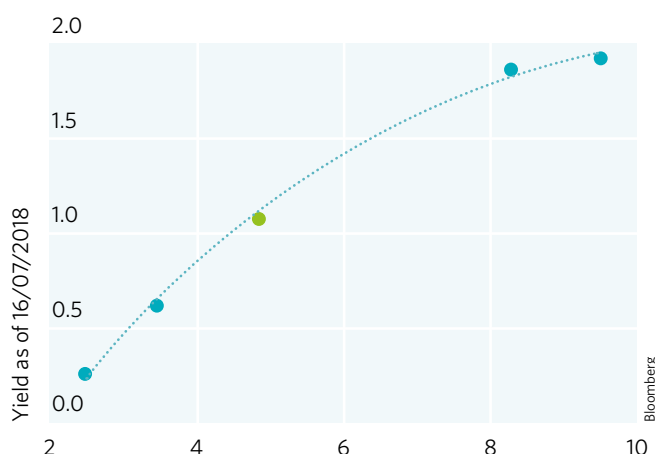
ADB 2028 USD - at issue: new issue premium



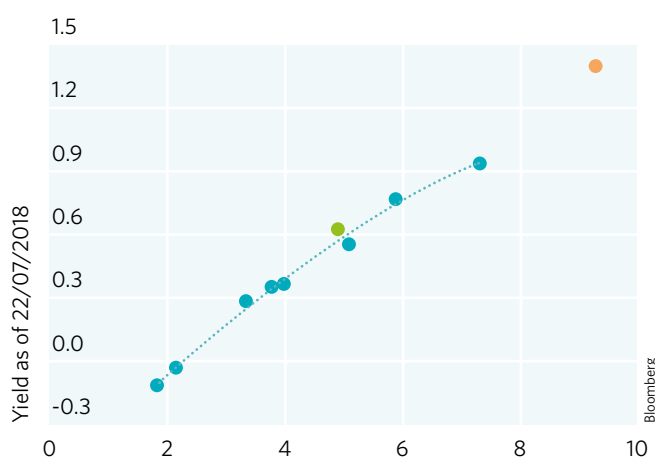
ADB 2028 USD - 1 month after issuance, inside the conventional curve.



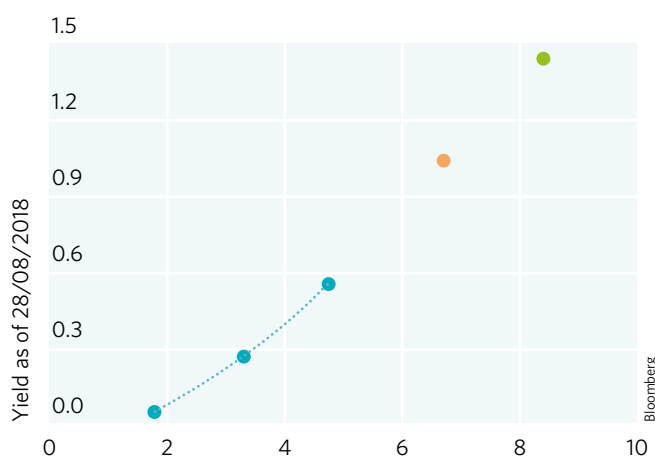
Terna Spa 2023 EUR - greenium



NAB 2028 EUR - new issue premium

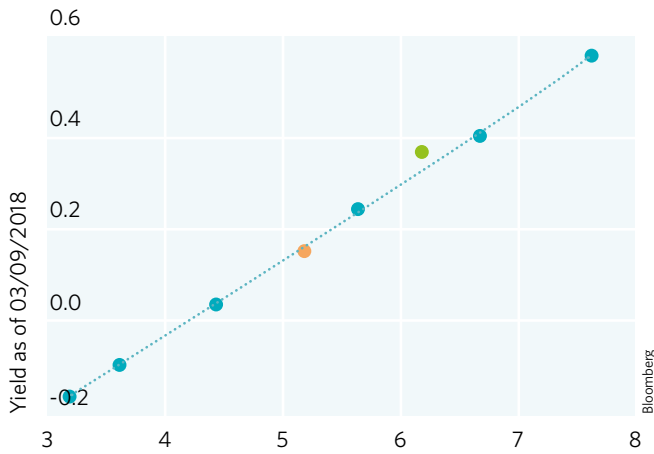


SSE Plc 2028 EUR - priced on the curve

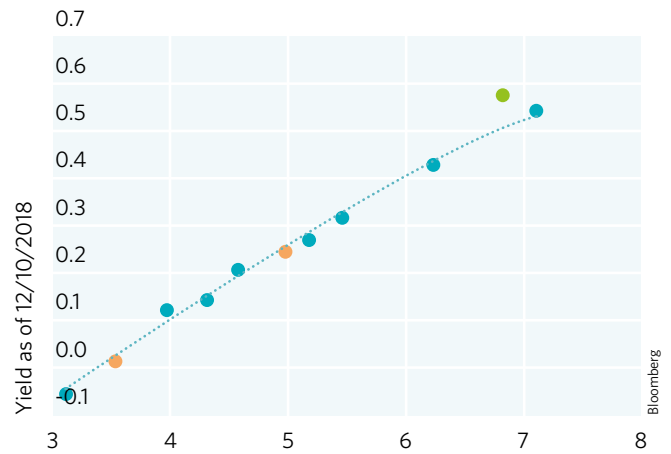


● New issue green bonds ● Vanilla bonds ● Seasoned green bond ● Non-green bond issued on the same day as the green bonds

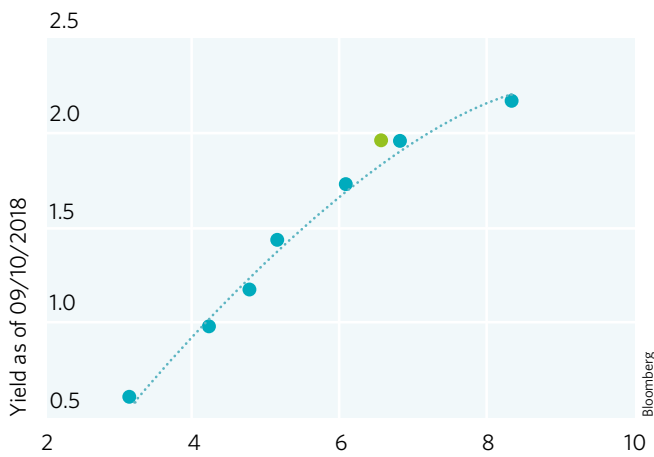
DHY (covered) 2024 EUR - new issue premium



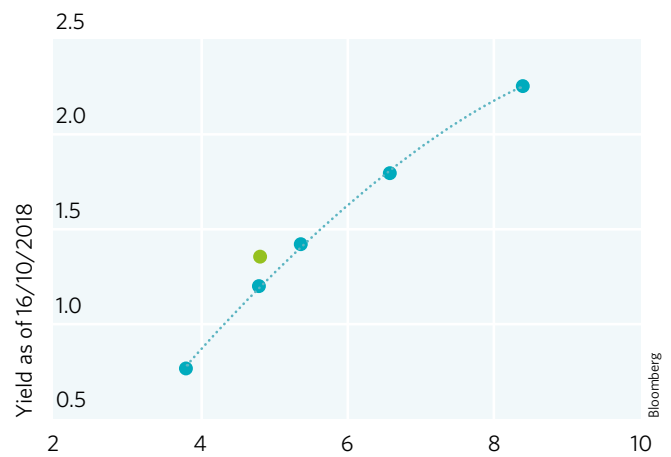
BHH (covered) 2025 EUR - new issue premium



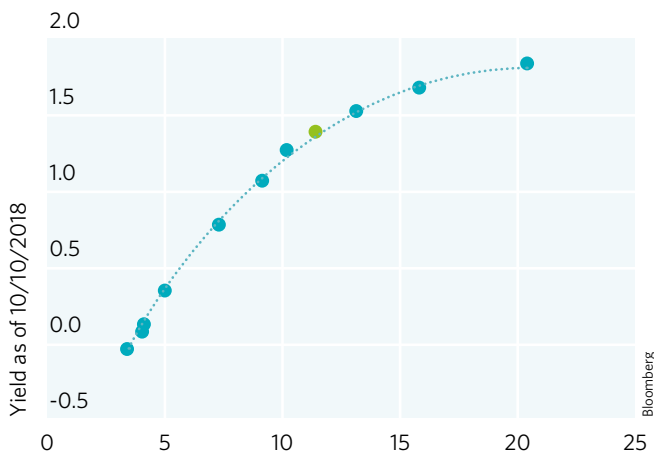
EDPPL 2025 EUR - new issue premium



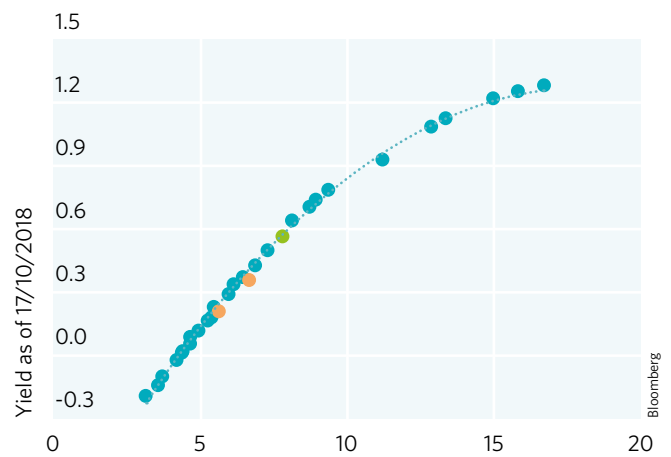
CMZB 2023 EUR - new issue premium



Irish 2031 EUR - on the curve

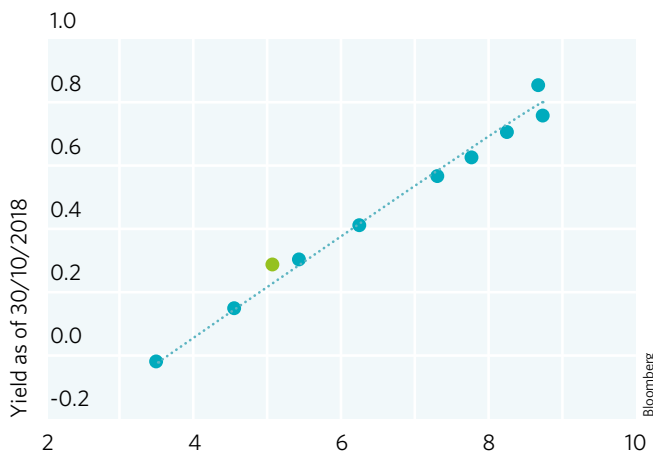


KFW 2026 EUR - on the curve

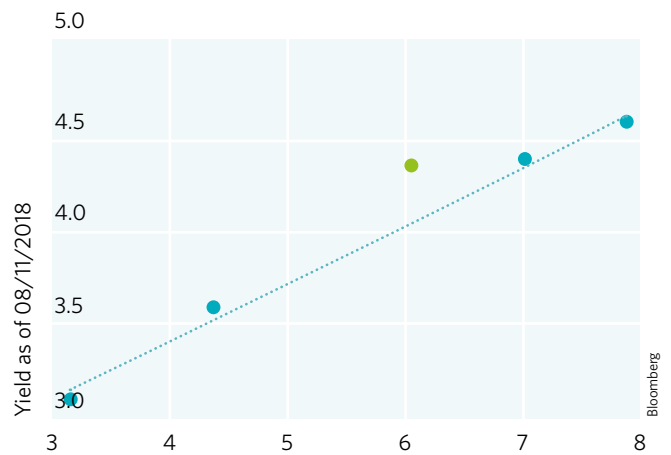


● New issue green bonds ● Vanilla bonds ● Seasoned green bond ● Non-green bond issued on the same day as the green bonds

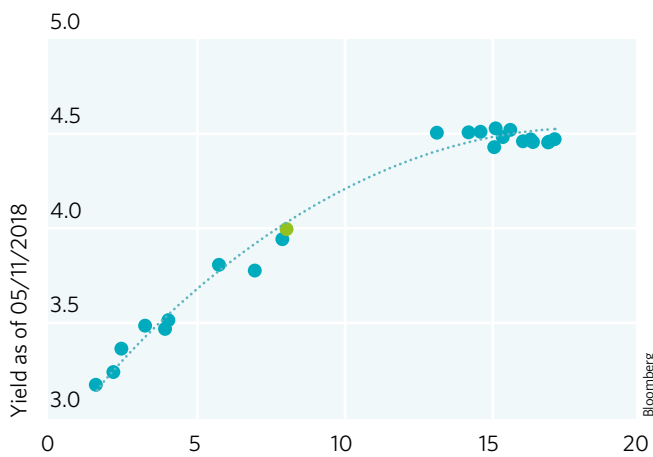
Munich Hyp. (covered) 2023 EUR
- new issue premium



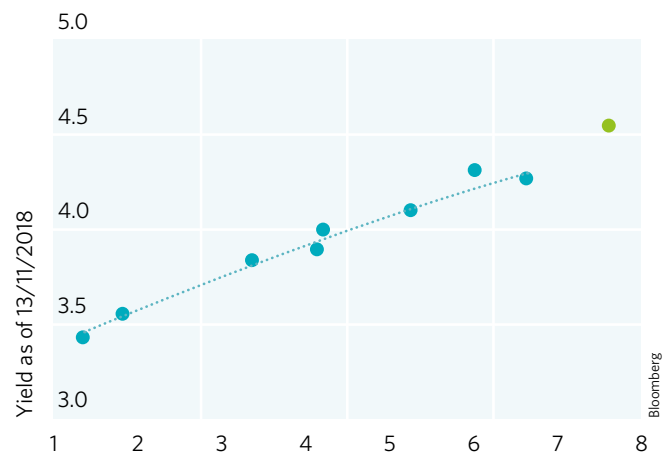
ING 2026 USD - new issue premium



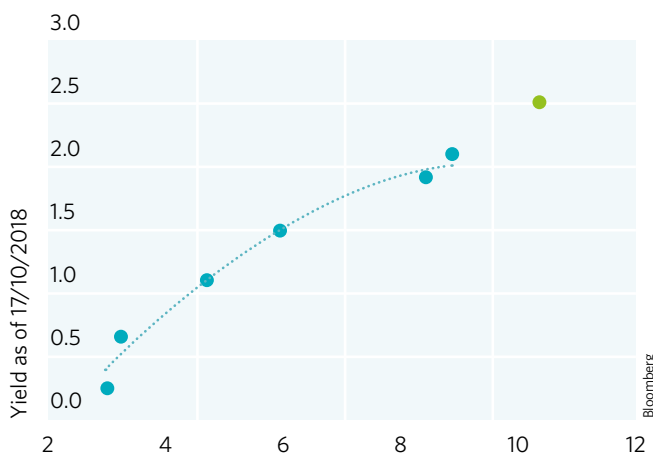
Duke Energy 2028 USD - on the curve



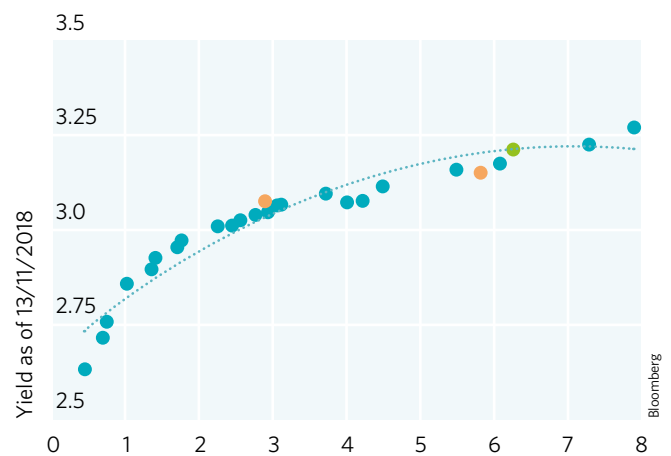
Boston Properties 2028 USD - new issue premium



ING 2030 EUR - new issue premium

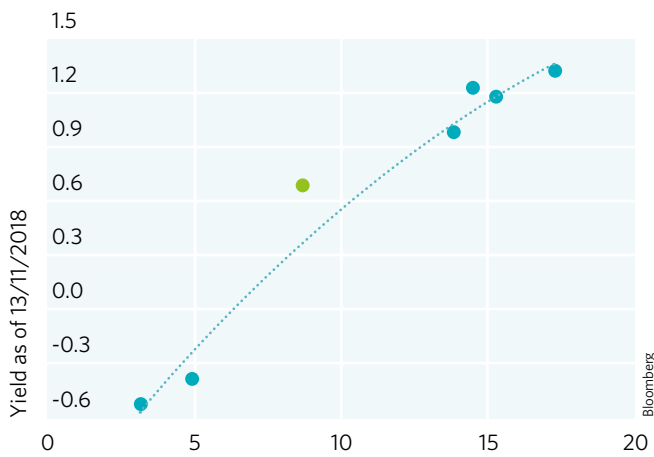


IBRD 2025 USD - on the curve

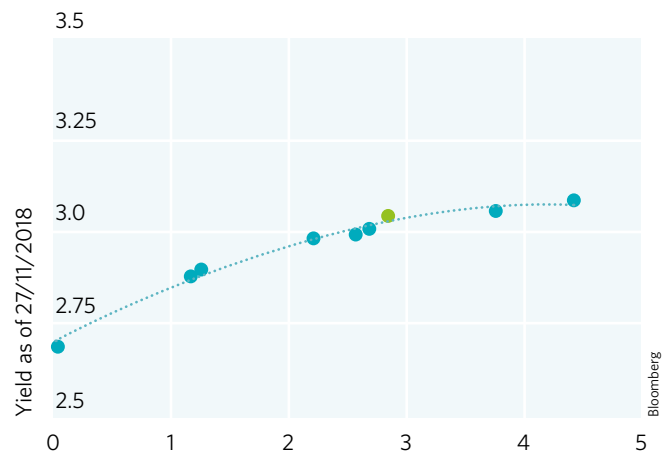


● New issue green bonds
 ● Vanilla bonds
 ● Seasoned green bond
 ● Non-green bond issued on the same day as the green bonds

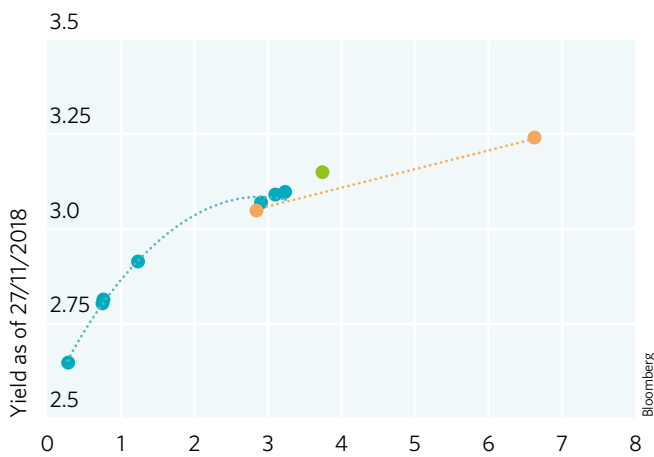
IBRD 2027 EUR - new issue premium



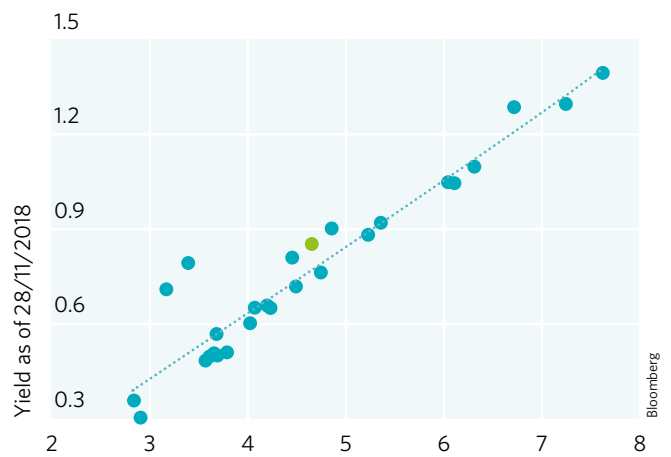
AFDB 2021 USD - new issue premium



NEDWBK 2022 USD - new issue premium



Crédit Agricole (senior pref.) 2023 EUR - new issue premium



● New issue green bonds
 ● Vanilla bonds
 ● Seasoned green bond
 ● Non-green bond issued on the same day as the green bonds

5. Performance in the immediate secondary market: Many green bonds deliver price improvements

▪ **7 days after pricing**, 56% of green bonds had tightened more than comparable bonds, 71% of green bonds had tightened more than their comparable index

▪ **28 days after pricing**, 44% of green bonds had tightened more than comparable bonds, 67% of green bonds had tightened more than their comparable index

We know that many bonds deliver price improvements in the immediate secondary market. Investors may be looking to get involved in or increase their position in a transaction where desired allocations were underfilled. If bonds are issued early in the month, this could be an opportunity for managers to add some off-benchmark performance before bonds enter indices at

month end. We look at how bond spreads change in the immediate secondary market. We do not go any further than one month since liquidity becomes patchy once bonds are added to indices.

In H2 2018, 60% of green bonds in our sample demonstrated spread tightening a week after pricing, softening to 40% after a month. In isolation, this doesn't tell us much and that's why we compare green bonds to two alternatives. Firstly, we compare green bonds to baskets of vanilla bonds issued in the same 3-month window (see methodology notes). Secondly, we compare green bonds to matched indices, to determine how they performed against 'the market' or similar risk.

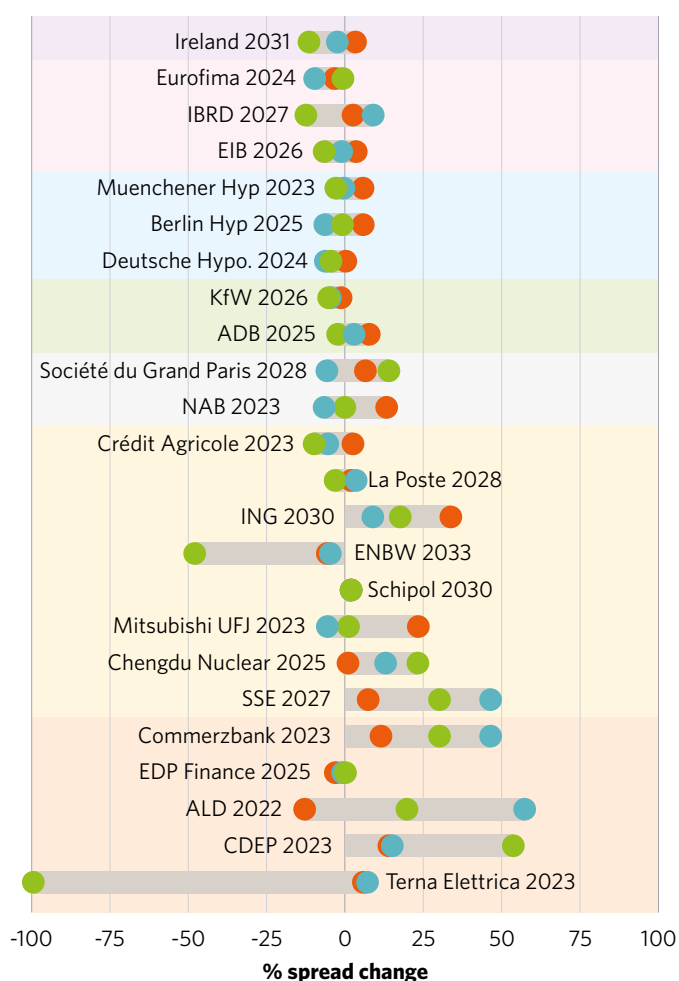
After seven days, 56% of green bonds tightened more than their baskets and

71% more than their matched indices. 13 out of 24 EUR bonds and six out of ten USD bonds tightened more than their matched baskets, and 16 out of 24 EUR and eight out of ten USD bonds tightened more than their indices.

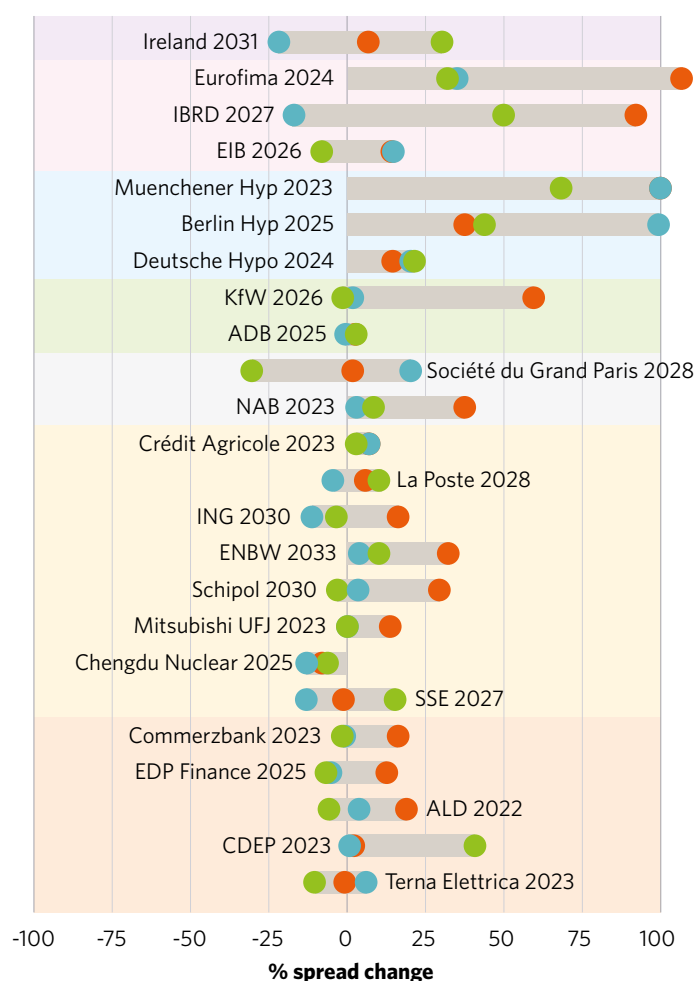
After 28 days, less than half of the green bonds had tightened more than their baskets (44%), but 67% had tightened more than their matched indices. 12 out of 24 EUR bonds and three out of ten USD bonds tightened more than their baskets, while 17 out of 24 EUR and six out of ten USD bonds tightened by more than the matched indices.

EUR green bonds do appear to perform well in the secondary market, with at least half achieving better spread compression compared to alternatives.

EUR 7 day H2 2018



EUR 28 day H2 2018



USD green bonds on average, tend to tighten by a lesser magnitude than alternatives, in particular the matched baskets.

This is consistent with observations in past research papers in this series. Secondary market performance in EUR could be a manifestation of unmet primary demand, and we note that, for now, there are fewer dedicated green bond investors in the US.

Methodology notes:

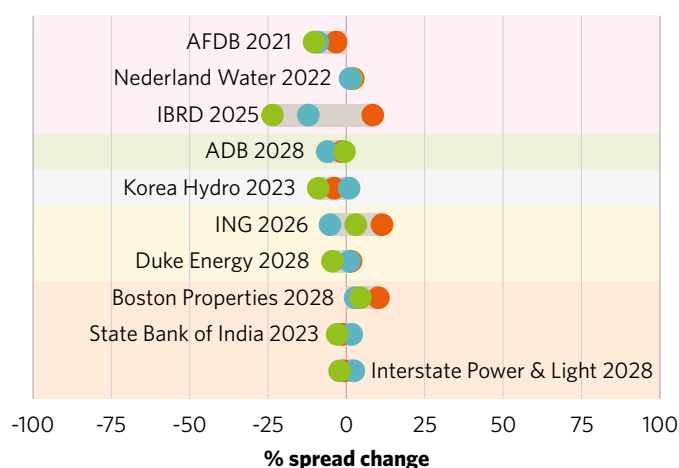
1. Comparable baskets. Each bond is matched with a basket of comparable bonds issued in

the same quarter (except where noted), fitting the parameters described on page 24. The number of bonds in each basket ranges from one to six. Summary statistics of the baskets are on pages 21-23. Bonds can behave differently according to which part of a month they are issued in. Geopolitical events can influence bond prices. We use baskets because green and vanilla bonds sharing the same or similar characteristics are rarely issued on the same day, and the baskets are a proxy for other investment opportunities in the same quarter or period.

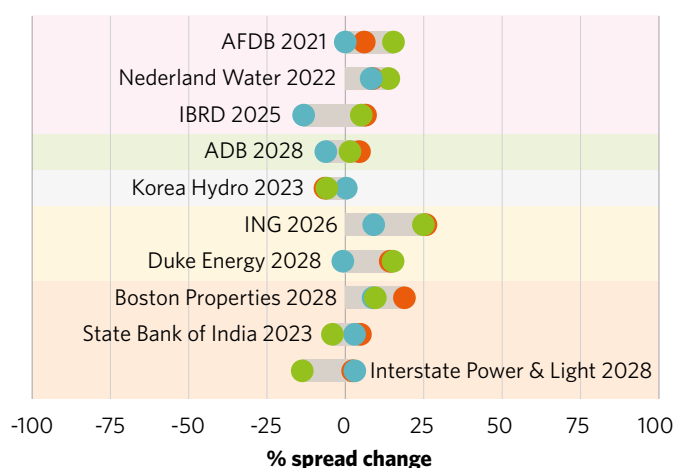
2. Indices. We compare each bond to a standard iBoxx index.⁵ The indices are granulated by currency, asset class, tenor, and credit rating all of which can influence the pricing of a bond. As a result, each green bond is compared to an index composed of seasoned bonds sharing similar characteristics. For example, Muenchener Hyp 2023 EUR is matched with the iBoxx EUR Covered 3-5-year index.

Seven calendar days include five data observations, 28 calendar days include 20 data observations.

USD 7 day H2 2018



USD 28 day H2 2018



Sovereign SSA Covered AAA AA A BBB Bond Index Basket

6. What the Treasurers say

Beyond pricing, issuing green bonds can bring many benefits to issuers. We repeatedly hear remarks from Treasurers describing their increased investor base, stronger internal engagement on

sustainability, and the positive perception of the organisation among external stakeholders. Much of this perception appears to be based on the increased transparency and monitoring that green

bond conventions demand. We invited green bond issuers from H2 2018 to share some remarks on their experience, some of which are printed below.

SSE Plc

1.375% 04/09/2027 EUR650m, priced 28/08/2018

Head of group funding, George Duncan: *"Following on from an inaugural green bond in August 2017, SSE plc successfully issued a second €650m 1.375% nine-year green bond in August 2018. Green investors from a wide range of countries showed significant interest in the bond. The issuance affirms SSE plc as the largest issuer of green bonds from the UK corporate sector and the only UK corporate to offer up multiple benchmark-sized tranches in the Euro market."*

Asian Development Bank

0.35% 16/07/2025 EUR600m, priced 04/07/2018

Mr. Pierre Van Peteghem, Treasurer, ADB: *"We are very pleased to accommodate the strong demand for our green bonds from euro investors with last night's offering, which allowed us to both tighten price guidance while increasing the issue size for our first Euro-denominated benchmark green bond."*

Kreditanstalt fuer Wiederaufbau

0.5% 28/09/2026 EUR1bn, priced 17/10/2018

Petra Wehlert (Head of Capital Markets) comments: *"Unbroken demand for the KfW Green Bond - the order book was three times the new issue size. A sustainable investment approach increasingly gains importance for investors, we witness this development with every single new green bond."*

Duke Energy Carolinas LLC

3.95% 15/11/2028 USD650m, priced 05/11/2018

Steve Young, Executive Vice President and Chief Financial Officer, Duke Energy: *"Today marks a milestone for our company and demonstrates our continued commitment to generating cleaner energy for our customers and communities. We are proud to provide this option for investors to advance our goal of reducing carbon emissions by 40 percent by 2030."*

Crédit Agricole SA

0.75% 05/12/2023 EUR1bn, priced 28/11/2018

Philippe Brassac, Chief Executive Officer of Crédit Agricole S.A.: *"The economy and finance can and should become powerful allies in order to achieve the objective of carbon neutrality by 2050 as set out in France's Climate Plan. This green bond issuance will enable us to forge ahead with our commitments. The size, nature and granularity of the bond is likely to make it a benchmark operation in the banking landscape."*

Ireland

1.35% 18/03/2031 EUR3.0bn, priced 10/10/2018

Frank O'Connor, the NTMA's director of funding and debt management: *"Today demonstrates our commitment to finding attractive new ways to meet the State's funding requirement by diversifying our issuance and accessing a new base of investors to lend to Ireland. Sovereign Green Bonds are an innovative form of finance and it makes sense for Ireland to be at the forefront of developments in this space."*

Royal Schipol Group NV

1.5% 05/11/2030, EUR500m, priced 22/10/2018

Tom Gerritsen, Manager, Corporate Finance, Royal Schipol Group: *"We are proud to be the first European airport, and the second airport in the world, that has entered into the green bond market. We are proud that the investor landscape has complimented and supported us in our mission to be the most sustainable airport in the world. Our inaugural green bond was very well received by the market with a final oversubscription of circa 6.0 times, allowing us to price the bond within our curve and therefore with a 2-3 basis point new issuance premium."*

Berlin Hyp AG

0.625% 22/10/2025 EUR500m, priced 12/10/2018

Bodo Winkler, Treasury and Investor Relations: *"With our third green covered bond (Green Pfandbrief) which was our sixth green bond in total, we were able to underpin our position as the most frequent European bank issuer of green bonds. As with all our green bonds its proceeds are used to finance/refinance loans for green energy-efficient commercial buildings in Europe. The exciting thing about this bond was that it attracted the most international order book of any of our Pfandbriefe that we issued during our 150 years corporate history. 58 per cent of the bond went to non-domestic investors."*

Deutsche Hypothekenbank AG (Pfandbriefe)

0.25% 10/12/2024 EUR500m, priced 03/09/2018

Sabine Barthauer, Member of the Board of Managing Directors of Deutsche Hypo: *"Again, we are very pleased with the high demand for our Green Pfandbrief. We see today's success as a clear display of trust from "green" investors, especially since many of these investors have invested in our Green Pfandbriefe for the second time. In addition, the new asset class has established itself in the market."*

7. Spotlight: The green bond market in China

In our last pricing publication we included a spotlight on EM green bonds.⁶ We noted that China is the largest EM issuer in the green bond market.

Between January 2016 and 2018, Chinese entities issued USD76bn of green bonds, aligned to the Climate Bonds Taxonomy.^{7,8} This represents 18% of all green bonds issued during that period (chart 1).⁹

Of this USD76bn, USD56bn equivalent was issued in Chinese Renminbi (CNY) (chart 2). We do not include CNY denominated bonds in our pricing work for two reasons:

1. Many investors are restricted on CNY (policy guidelines exclude from investible opportunity set);
2. Pricing transparency, particularly with regards to bookbuilding, is currently too limited to enable credible comparison.

This said, China has the world's third largest onshore bond market, and given the relative size of the green bond market we believe it is worth exploring. We examine some of the features and highlight the opportunities for Western Investors to gain exposure to this rapidly growing investment space.

China's domestic bond market

The International Monetary Fund (IMF) decided to include CNY in the Special Drawing Rights (SDR) basket as of October 2016.¹⁰ This has increased the likelihood of future foreign participation in the Chinese onshore bond market.

Historically, foreign participation in the Chinese onshore bond market has been limited. Although the total foreign holdings had reached about CNY1.69tn for onshore bonds on the China Interbank Bond Market (CIBM) as of end-September 2018, foreign participation was only 2% of the CNY80tn bond market (2017: 1.25%).¹¹ By comparison, other markets have far larger participation such as Russia at 13%, France at 64%, and UK at 41%.¹²

However, Chinese regulations are being adapted to open the market to foreign participation. There are three ways for them to access the domestic market:

1. People's Bank of China (PBoC) **Qualified Foreign Institutional Investor (QFII)** and **Renminbi Qualified Foreign Institutional Investor (RQFII)** schemes permit eligible overseas investors to enter the domestic capital market for securities investments up to certain approved quotas.
2. **Direct access via the China Interbank Bond Market (CIBM)** was introduced in 2012. Investors must register with the PBoC and identify a qualified onshore agent bank through which to invest.
3. **Bond Connect**, launched in 2017, is the most convenient investment conduit, as it removes some investment hurdles. Through Bond Connect, foreign investors can access the Chinese onshore market without a local presence. The Bond Connect scheme had attracted 522 registered investors by end-October 2018.¹³

Most international investors participating in the onshore market opt for Chinese Government Bonds or Policy Bank Bonds.¹⁴ In April 2018, China's central bank governor Yi Gang announced plans to further open the financial sector.

Notwithstanding improved accessibility, Western investors still have several other barriers to contend with, including the opacity of the market. **Foreign investors tend to prefer government or policy bank bonds** owing to the relative transparency of credit information, and familiarity with the names.

Information on corporate bond issuers

can be sparse. AAA rated corporate bonds accounted for over 60% of total issuance in Q2 2018, according to Moody's.¹⁵ In the past, there's been heavy reliance on implicit government support, but the government is signalling that it will not always step in to prevent defaults.

Large Chinese bond investors have dedicated in-house research teams to evaluate creditworthiness, but smaller firms must rely on local agencies or their own more limited resources.

The unreliable nature of the local rating agencies was highlighted by the suspension of one of the Chinese top-three for a conflict of interest controversy.¹⁶

The door is slowly opening to foreign rating agencies. As of January 2019, S&P Global Ratings has been allowed to conduct credit rating business in mainland China.¹⁷

However, this could present some challenges. S&P (and Fitch Ratings and Moody's, if given access) are likely to apply different assessment metrics from local firms, and companies may be less inclined to seek their services as a result. Western credit evaluation methods are beneficial to foreign investors who will be familiar with them, but this approach could alienate the local investor base.

Defaults are on the rise amid the economic slowdown in China.¹⁸ Defaults have only been permitted in China since 2014, thus the track record is limited, and there are still fewer defaults compared to developed markets.

As we have recently observed, the Chinese government is reducing direct support for state-owned enterprises (SOEs) that are not strategically important and that operate in competitive sectors.¹⁹

Chart 1. 18% of green bonds issued 2016-2018 are from Chinese entities

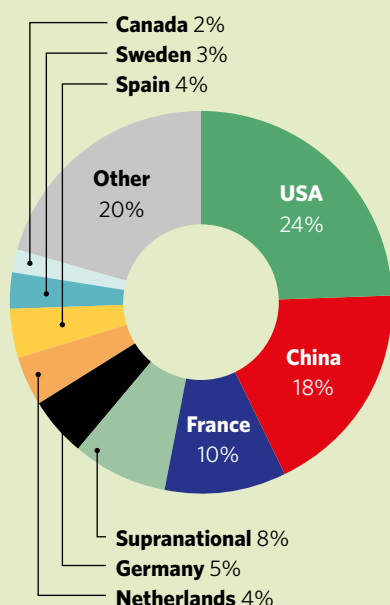
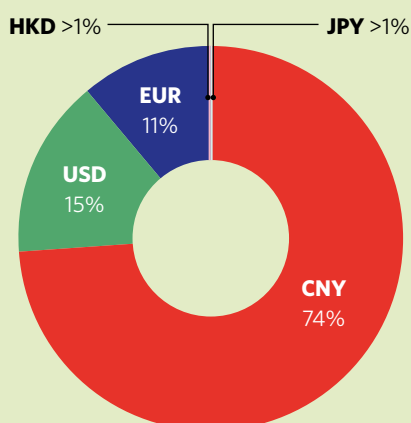


Chart 2. 74% of bonds from Chinese entities 2016-2018 are denominated in CNY



Beyond credit risk, foreign investors are also aware of poor liquidity (mostly buy-and-hold) in the corporate bond market, and uncertainty about whether the legal system would protect them in the event of default. **Funding and hedging can present challenges in CNY**, particularly for those investors, which do not have an onshore presence. Other concerns include lack of clarity on tax, and the settlement risk with China's depository agency in the absence of western style Delivery vs Payment settlement (DVP).²⁰

We do, however, expect that demand for all kinds of Chinese paper will increase. In March 2018 Barclays said it would phase Chinese bonds into its Global Bond Aggregate Index starting in April 2019.²¹ Based on January 2018 data, 386 eligible Chinese bonds – which equate to a quarter of the onshore market – would account for 5.49% of the USD53.7tn index. Index inclusion makes a tremendous difference to how bonds trade due to the forced participation of passive investors.

In addition to the international part of the demand curve, **we must consider local participation, which is also atypical**. The majority of purchasing power is concentrated within the top 5 banks: Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), Bank of China (BOC), Agricultural Bank of China (ABC), and Bank of Communications (BOCOM) which together buy 75-80% of the issues in the primary market. Most bonds are short-term by Western standards (usually 3 years), and many investors are buy-and-hold, which limits the liquidity.

The supply side is highly regulated. Prior to issuing a bond, an organisation must first seek approval from the appropriate regulator. Corporates, banks, and SOE each have their own regulator, and the regulator decides how much can be raised through a bond.

Most bonds go out with very wide initial price guidance, usually around 40-60 bps. Indications of interest are gathered via a Dutch auction. Chinese government bonds are not the most liquid instruments in the local market, so most new issues are benchmarked against China Development Bank bonds (which constitute 10% of the local market, or over USD1.1tn) and with up to 80% of demand coming from top 5 players, the pricing can be largely influenced by their risk appetite for the name. The big banks pay a funding cost of around 2.5% at the time of publication,

which allows quite a large margin to put in orders for new issues.

While this analysis is not specific to the green bond market, it is applicable to the supply and demand dynamics of green bonds and defines the extent and way foreign investors can participate.

China's green bond market

Green bonds offer certain incentives and therefore there is an advantage to preferencing them:²²

- **PBoC now accepts green bonds and green loans as collateral** for its Medium-Term Lending Facility (MLF). The MLF offers three-month loans to commercial lenders with the aim of also guiding credit to underserved sectors.
- **PBoC has included consideration of green credit** in its Macro Prudential Assessment (MPA), a scoring system that assesses banks' capital levels and monitors risks. The more green assets a bank holds, the higher score it can receive in the MPA. Green credit currently accounts for about 9% of total outstanding loans for the PBoC.

With the market scale achieved in China, green bond indices were established to track the performance of China's onshore green bonds and compare returns and volatility with other investments. For example, the ChinaBond China Climate-Aligned Bond Index which is displayed on Luxembourg Green Exchange provides international investors access to China's onshore green bonds and climate aligned bonds. In December 2018, FTSE Russell became the first global institution to launch a China focused green bond index that benchmarks securities whose proceeds are specifically used to finance climate or environmental projects in mainland China.

At present, the *Fullgoal Green Pure Bond Fund* is the only dedicated green bond mandate denominated in CNY that we are aware of.

The *Green Cornerstone Fund* is a partnership between IFC and Amundi with USD2bn of capital to invest in focus EM countries including China. The fund is designed to encourage more local EM financial institutions to issue green bonds by acting as a buyer. IFC and Amundi also collaborate with local financial institutions to strengthen their capacity to issue green bonds through training and sharing international best practises.

In addition to these two examples, we understand that many other funds choose green bonds where possible.

With a more sophisticated investor base, increasing emphasis on issues, and the expanding role of passive investments through indices, Chinese green issuers can access their perfect customer in the West.

Offshore issuance provides an alternative

to investors who want to get exposure to Chinese green bonds without having to navigate the onshore market. Between January 2016 and December 2018, 12 EUR denominated, and 23 USD green bonds were issued by Chinese issuers.

From those 35 green bonds, 11 benchmark-sized bonds have qualified for inclusion in our pricing analysis (see page 17). Seven of the bonds are from financial institutions, and the rest from companies in consumer cyclical (LTC GB 2021), energy (3 Gorges 2024) and utilities (CGNPC International 2024 and 2025). We note that the tenors of these particular EUR and USD bonds tend to be longer than those in the onshore market, with the 5-year tenor being the mode. Data pertaining to allocations is very scarce, and in fact we have only able to source green investor participation data for one out of 11 bonds.

Green bonds issued through the Bond Connect Scheme are emerging.

In December 2017, Agricultural Development Bank of China (ADBC) and Export-Import Bank of China became the first issuers of green bonds under the Bond Connect Scheme. Their CNY-denominated green bonds issued on CIBM received strong interest from foreign investors, with 4.75 and 3.46 times oversubscription respectively.^{23,24}

There has been an impressive push for environmental policies and the financing thereof, but China still has a great deal left to contribute to the green revolution.

Further information on the shape, size, and particulars of the Chinese green bond market can be found in the CBI publication China Green Bond Market 2018 <https://www.climatebonds.net/resources/reports/china-green-bond-market-2018>

Contributing analyst: Anastasiya Ostrovnaya

Sources:

1. IFLT: PRIMER: The Hong Kong-China Bond Connect, 27Jul2017
2. Moody's: Renminbi Bonds Monitor (Quarterly issue, latest used for this publication was published in June 2018)
3. FT, Reuters and Bloomberg regularly publish updates on China

Table 1. China Offshore issuance – 11 benchmark sized bonds have qualified for inclusion in our pricing analysis

Country of Risk	Name	Coupon	Maturity	Pricing Date	Tenor	Currency	Size USD bn	Size Local bn	Book cover	IPT	% sold to green investors	Spread Compression	Bench Type	Primary Spread	Sector	Composite Rating
China	LTC GB Ltd	2.75	26/05/2021	19/05/2016	5	USD	0.4	0.4	6.0	170	-	30.0	UST	140.0	Consumer, Cyclical	NR
China	Bank of China Ltd/Luxembourg	1.875	12/07/2019	7/4/16	3	USD	0.5	0.5	2.4	145	-	20.0	UST	125.0	Financial	A
China	Bank of China Ltd/Luxembourg	0.75	12/07/2021	05/07/2016	5	EUR	0.6	0.5	2.6	120	-	25.0	Swaps	95.0	Financial	A
China	Bank of China Ltd/London	1.875	09/11/2019	03/11/2016	3	USD	0.5	0.5	-	115	-	20.0	UST	95.0	Financial	NR
China	Three Gorges Finance II Cayman Islands Ltd	1.3	21/06/2024	14/06/2017	7	EUR	0.7	0.7	3.1	110	-	17.0	Swaps	93.0	Energy	A+
China	Industrial & Commercial Bank of China Ltd/Lux	2.875	12/10/2022	28/09/2017	5	USD	0.4	0.4	1.5	120	43%	21.0	UST	99	Financial	NR
China	China Development Bank	0.375	16/11/2021	09/11/2017	4	EUR	1.2	1.0	2.3	63	-	20.0	swaps	43.0	Financial	NR
China	China Development Bank	2.75	16/11/2022	09/11/2017	5	USD	0.5	0.5	4.5	100	-	22.0	UST	78.0	Financial	NR
China	CGNPC International Ltd	1.625	12/11/24	04/12/2017	7	EUR	0.6	0.5	2.6	140	-	20.0	Swaps	120.0	Utilities	A-
China	Beijing Capital Polaris Investment Co Ltd	4.25	26/03/2021	19/03/2018	3	USD	0.5	0.5	-	210	-	22.5	UST	187.5	Financial	BBB-
China	CGNPC International Ltd	2	9/11/25	9/4/18	7	EUR	0.6	0.5	1.7	155	-	5.0	Swaps	150.0	Utilities	A-

Source: Thomson Reuters

8. Guest author Jason Mortimer, a portfolio manager at Nomura Asset Management, examines whether secondary market performance of green bonds could justify a greenium



Green bonds can be an effective market approach to financing climate solutions for investors with sustainable investment

mandates. But the question of greenium is a significant hurdle for conventional investors to buy these bonds, as they will have to justify any reduction in spread compensation from a risk and return perspective, consistent with their own fiduciary duty. If, however a “green factor” exists for green bonds that sustainably delivers superior risk adjusted returns or exhibits downside risk protection, qualities that investors can assign value to, then a greenium may be explainable from a fundamental market pricing perspective. To test this hypothesis, we analysed the secondary market performance of green bonds versus vanilla equivalents to isolate the green label and test for a positive relationship with secondary market performance.

Green vs Non-Green: Index Level Performance

Firstly, we compared the performance of green bonds versus vanilla equivalents at the bond index level by comparing the relative total return of the Bloomberg Barclays MSCI Global Green Bond versus the Bloomberg Barclays Global Aggregate Bond (USD hedged), and the Bloomberg Barclays MSCI Euro Green Bond versus the Bloomberg Barclays Euro Aggregate Bond Index, from October 2015 to March 2019. Over this period, both the Global Aggregate Green Bond and European Green Bond indices outperformed their non-green counterparts by 201 and 292 bp respectively, with a consistent pattern of outperformance starting around July 2016 through the end of the survey (chart 1). Although the index characteristics of each pair were generally comparable, the underlying issuers and other non-green factors such as duration varied greatly between indices and over time, making a true comparison difficult.

Green vs vanilla equivalents: sector, currency, liquidity-matched baskets performance

Next, we compared the total return performance of matched baskets of green and vanilla bonds in the same industry sector to isolate the green label as a driver of return by controlling for idiosyncratic factors. We created baskets of all the Euro-denominated green labelled and vanilla non-hybrid fixed-rate benchmark-sized bonds issued between April 2016 and September 2017 by European-domiciled, investment grade-rated,

Chart 1: Index Performance: Global Green vs Vanilla Aggregate Bond (Total Return)

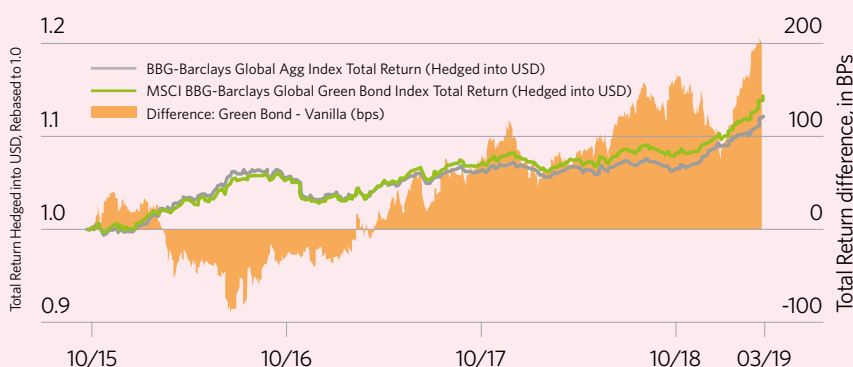
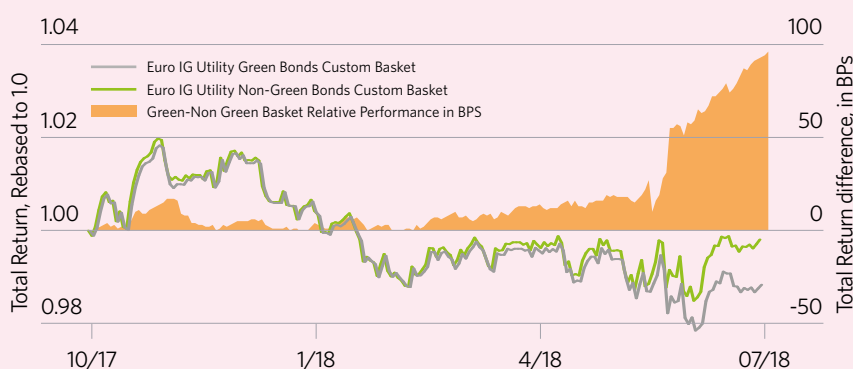


Chart 2: Basket Performance: Euro IG Utility Green vs Vanilla New Issue Baskets (Total Return)



power utility companies. The average duration, credit-rating, and spread levels of the baskets to start were similar. Liquidity was considered equivalent, because all bonds in the sample were issued in the same period, and the average notional of the green bond basket at EUR675m was larger than the EUR560m average notional of the vanilla equivalent basket. Because the underlying country composition of issuers in the baskets necessarily differed, we made two versions of the vanilla bond basket to account for country risk: one with as-issued country weights, and another with country weights equalized to that of the green bond basket.

The green bond basket outperformed the vanilla baskets (as-issued and equalized country weight versions) by 90bp and 48bp of total return respectively between October 1, 2017 and July 11, 2018. In particular, the green bond outperformance was most evident around May 2018, coinciding with a period of general market volatility following elections in Italy (chart 2)

Additionally, we tested if the green performance effect extended beyond the individual labelled green bonds to all the issuer's new bonds. For this we classified corporates as green bond issuers if they had at least one green bond outstanding between April 2016 and September 2017, and if not, non-green bond issuers. We then

constructed matched baskets of all new issue bonds as before. The green bond issuers basket outperformed the non-green bond issuer basket by 42bp using as-issued country weights and 49bp with equalised country weights, again mainly during the May 2018 period of market volatility.

Performance analysis of green vs non-green: Same issuers bonds in market stress conditions

Lastly, we analysed the relative spread performance of green versus vanilla bonds at the issuer level to control for non-green idiosyncratic factors. To do so, we calculated the individual performance of each green and vanilla bond relative to the fair value for that issuer's liquid curve, using the May 2018 Italian election volatility as a natural experiment to “shock” the Euro corporate credit curve across issuers.

Method of analysis

We selected 14 European investment-grade banks and utility companies with liquid fixed-rate non-hybrid credit curves and at least one liquid green bond (minimum size EUR500m, average size EUR750m). We calculated fair value yield curves for each issuer as a regression analysis. We

calculated each bond's difference from the fair value curve in basis points on May 16, 2018 (two weeks before the market selloff peaked or "T-2w"), and again on the shocked curve as of June 20, 2018 (three weeks after the market sell-off peaked or "T+3w"). We defined performance as the net change in a bond's spread to fair value in basis points residual from T-2w to T+3w (chart 3).

For example, the Intesa Sanpaolo 2022 (ISPIM 0.875% 6/2022) green bond was 0.4bp wide (cheap) to the fair value curve at T-2w and 4.8bp tight (rich) to the curve on T+3w, implying 5.2bp of net tightening (richening). As the sum of all the bond fair value residuals sums to zero, this method ensured internal consistency and comparability across issuers (chart 4).

Analysis results and discussion

Green bonds on average outperformed vanilla bonds on the same issuer curve by an average of 1.5 bp between T-2W to T+3W. Average outperformance of utility green bonds (2.7bps) was greater than bank green bonds (0.8bps). Distribution of green bond relative returns at the issuer level was asymmetrically skewed to outperformance. That is green bonds either performed the same as vanilla, or outperformed by a large margin (table 1).

A significant factor explaining the degree of green bond outperformance for any particular issuer in the sample was whether the issuer was an Italian company. Enel SpA (an integrated energy utility) and Intesa SanPaolo SpA (a bank) on average experienced the largest green vs. vanilla relative performance with 8.3bp and 5.2bp respectively. In other words, the green bond outperformance effect - or downside risk resiliency - was largest for the issuers most exposed to the underlying driver of the sell-off, Italian sovereign risk.

Conclusions: Greenium justifiable as "Insurance Premium"?

These data support a view that green bonds can consistently deliver superior risk adjusted outperformance with qualities of downside risk protection, and that this may be attributable to the "green factor" once idiosyncratic variables are controlled for. This green factor extended to all the issuer's newly issued bonds, possibly implying that an issuer's commitment to green bond issuance can itself be an indicator of superior sustainability and/or strategic governance. If true we postulate that the market may eventually come to justify some degree of greenium as a fundamental quality factor, like an "insurance premium" with intrinsic value, thereby supporting sustainable growth of the green bond market.

Chart 3: EUR Agg Corporate OAS (LHS) and Italy 5y CDS (RHS) Units: BPs

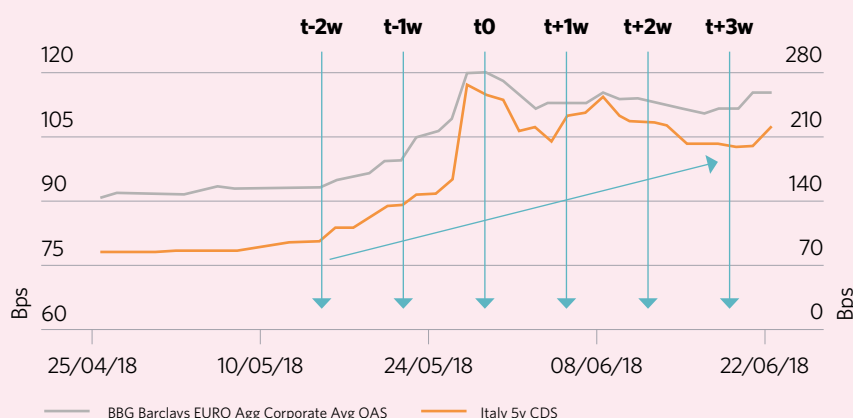


Chart 4: ISPIM - Intesa Sanpaolo SpA Bank (Italy)

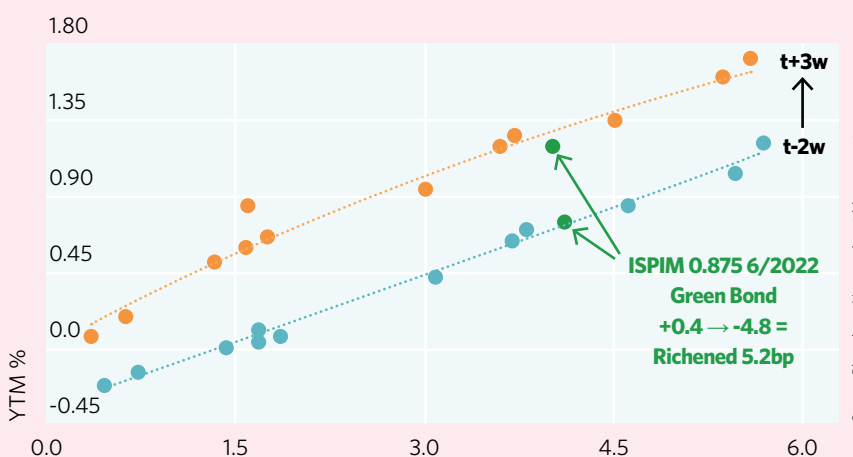


Table 1: Average Green Bond Performance

Name	Ticker	Country	Sector	Average Green Bond Performance, in BP (T-2w => T+3w)
Enel	ENELIM	Italy	Utility	-8.3
Intesa Sanpaolo	ISPIM	Italy	Bank	-5.2
EDF	EDF	France	Utility	-4.0
SocGen	SOCGEN	France	Bank	-1.3
Tennet	TENN	Netherlands	Utility	-1.3
BBVA	BBVASM	Spain	Bank	-0.9
Engie	ENGIFP	France	Utility	-0.5
Berlin Hypo	BHH	Germany	Bank	-0.4
ABN Amro	ABNANV	NE	Bank	-0.3
NRW Bank	NRWBK	Germany	Bank	-0.2
ING	INTNED	Netherlands	Bank	0.3
Iberdrola	IBESM	Spain	Utility	0.5
KfW	KFW	Germany	Bank	0.5
BNP	BNP	France	Bank	0.6

9. Conclusion

During H2 2018, USD89bn of green bonds were issued. Almost USD29bn of those bonds were suitable for inclusion in our pricing analysis. This is consistent with our previous pricing publications which have typically captured around 30% of the labelled green bond market.

Three quarters of the bonds included (USD21.5bn) were EUR denominated. The USD labelled green bond market is dominated by Fannie Mae and municipalities, which tend to be smaller domestically targeted issues, and therefore fewer USD bonds are eligible for inclusion in this publication.

In the prevailing challenging market conditions, many green bonds achieved higher oversubscription and higher spread compression compared to vanilla equivalents, particularly in EUR.

We have seen that, where yield curves are available, this does not necessarily translate into a greenium, with most of the bonds having a normal new issue premium.

Green bonds appear to perform well in the immediate secondary market, particularly the

EUR-denominated. We have introduced the idea of a relationship between size and demand for green bonds in the primary market, and we will review this more thoroughly in due course. For now, the data tells us that, by and large, investors want to be involved in green deals.

On average, 53% of green bonds are allocated to investors declaring themselves as green or socially responsible, which as we have noted in prior publications, suggests that support for the green bond market is coming from all sources.

Our pricing research concentrates on USD and EUR denominated green bonds, with vanilla structures, and greater than USD500m in size. We captured 63 such bonds in 2018. Larger, benchmark-sized, green bonds are eligible for inclusion in the broad market indices and are exposed to the widest possible base of mainstream investors.

Encouragingly, Blackrock launched the iShares Global Green Bond ETF (BGRN) in November 2018, which tracks the Bloomberg Barclays MSCI Global Green Bond Select. In December, UniCredit launched the UC MSCI European Green Bond ETF. We expect

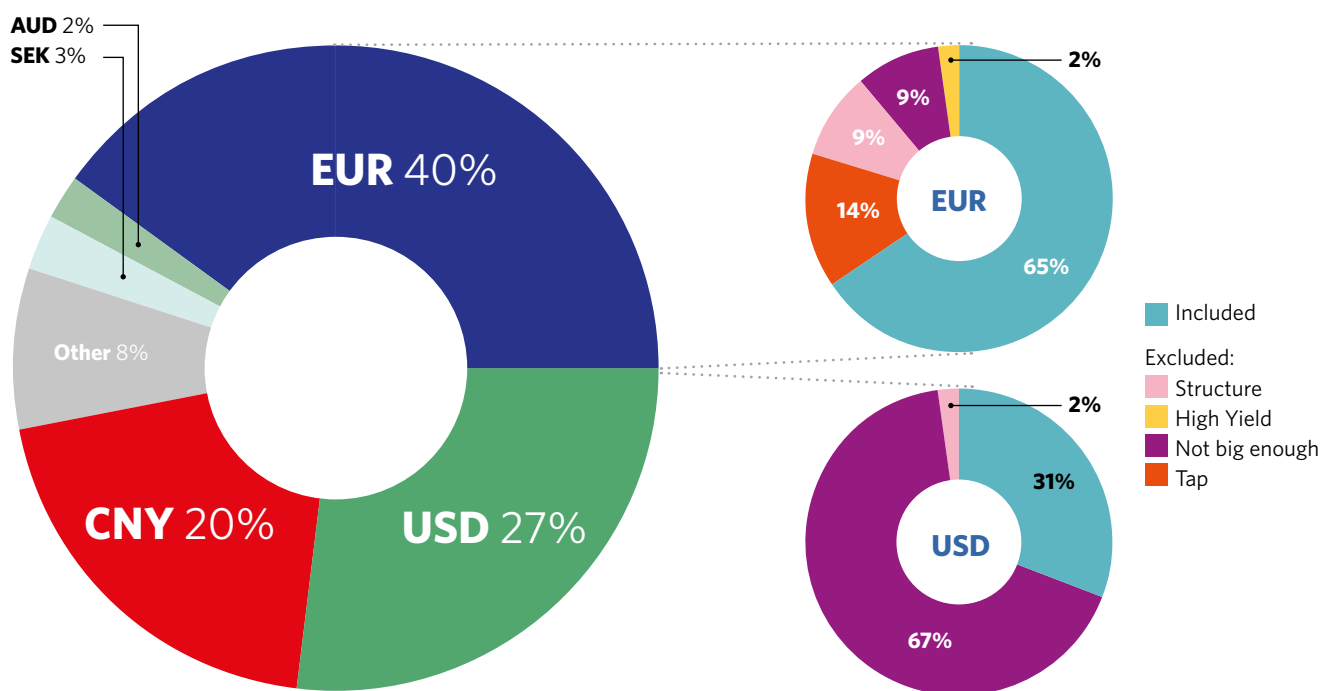
that an increase in the number of available ETFs will give additional value to the green bond label, which will be used to determine inclusion eligibility.

The opportunities available to green bond investors in EM are currently limited. Investors with the mandate to explore Chinese green bonds could support a large number of green projects in a growing and diverse market. The Chinese bond market is gradually opening to foreign participation, with several platforms available to access the market. The inclusion of western style evaluations from the likes of S&P could also introduce a greater degree of transparency.

The results of our analysis pertain to a limited number of green bonds, chosen according to the parameters outlined on page 24.

While the market has grown rapidly over the past few years, since 2016, there have only been 180 green bonds that meet our criteria. We will continue to monitor how green bonds price in the primary and immediate secondary market, our next publication will focus on qualifying green bonds issued in H1 2019.

USD89bn of labelled green bonds issued in H2 2018



EUR summary statistics of bonds used for comparison

Bonds sharing similar characteristics to green bonds in our sample

Q3 - Green bonds priced between July 01 and September 30 2018	Number of bonds	Average Coupon (par weighted)	Maturity	Deal Size EURbn
Chengdu Nuclear 2% 11/09/2025	1	2%	7	0.5
SSE Plc. 1.375% 04/09/2027	1	1.38%	9	0.65
A Utilities 7-12 Years	2	1.63%	9.5	0.75
Terna Elettrica SpA 1% 23/07/2023	1	1%	5	0.75
BBB Utilities 5-8 Years	3	1.16%	6	0.6
National Australia Bank 0.625% 08/30/2023	1	0.625%	5	0.75
AA Banks 5 Years	5	0.58%	7	0.8
Deutsche Hypothekenbank 0.25% 10/12/2024	1	0.25%	6.25	0.5
AAA Consumer Finance, Covered Bonds 4-5 Years	3	0.26%	4.7	0.6
Asian Development Bank 0.35% 16/07/2025	1	0.35%	7	0.6
European Investment Bank 0.375% 05/05/2026	1	0.375%	8	0.5
AAA Development Banks 5-7 Years	4	0.15%	5.5	2.9
Cassa Depositi e Prestiti 2.125% 27/09/2023	1	2.125%		0.5
BBB Country of Risk: Italy	3			0.66
Q4 - Green bonds priced between October 01 and December 31 2018				
Mitsubishi UFJ 0.98% 27/09/2023	1	1	5	0.5
A Diversified Banks 3-5 Years (only includes MIZUHO 1.02% 10/11/2023)	1	1	5	0.5
ALD SA 1.125% 10/11/2022	1	1	4	0.5
BBB Consumer Cyclical 3-5 Years (only includes VW 1.375% 10/16/2023)	1	1	5	0.85
EDP Finance BV 1.875% 10/13/2025	1	1	7	0.6
BBB Utilities 12 Years (only includes VIEFP 1.94% 01/07/2030)	1	1	12	0.75
Ireland Government Bond 1.35% 18/03/2031	1	1	13	3
BBB Eurozone Sovereign (only includes BTPS 2.3% 10/15/2021)	1	1	3	3.5
Société du Grand Paris 1.125% 10/22/2028	1	1	10	1.75
AA Agencies 10 Years (only includes KHFC 0.75% 10/30/2023)	1	1	5	0.5
Berlin Hyp AG 0.625% 22/10/2025	1	1	7	0.5
Muenchener Hypothekenbank Eg 0.25% 12/13/2023	1	1	5	0.5
AAA Covered Bonds 5-7 Years	6	6	6.8	0.73
Commerzbank AG 1.25% 10/23/2023	1	1	5	0.5
BBB Senior Non-Pref. Banks 3-5 Years	2	2	4	0.75
Kreditanstalt fuer Wiederaufbau 0.5% 09/28/2026	1	1	8	1
AAA Dev. Banks 5 Years (only includes KfW 0.125% 11/07/2023)	1	1	5	5

Q4 - Green bonds priced between July 01 and September 30 2018. Cont.	Number of bonds	Average Coupon (par weighted)	Maturity	Deal Size EURbn
Royal Schiphol Group NV 1.5% 11/05/2030	1	1.5%	12	0.5
A Industrial 12 Years (only includes APRR 1.5% 01/25/2030)	1	1.5%	12	0.5
EnBW International Finance BV 1.875% 31/10/2033	1	1.9%	15	0.5
A Utilities 15 Years (only includes ESBIRE 2.125% 11/05/2033)	1	2.125%	15	0.5
ING Groep NV 2.5% 15/11/2030	1	2.5%	12	1.5
A Banks 12 Years (only includes INTNED 2.0% 09/20/2028 issued Q3)	1	2%	10	1.5
IBRD 0.625% 11/22/2027	1	0.625%	9	0.6
AAA Dev. Banks 10 years (only includes KfW 0.75% 06/28/2028 issued Q3)	1	0.75%	10	5
La Poste SA 1.45% 11/30/2028	1	1.45%	10	0.5
BBB Industrials 10 Years (only includes DPWGR 1.625% 12/05/2028)	1	1.625%	10	0.75
Crédit Agricole SA/London 0.75% 05/12/2023	1	0.75%	5	1
A Senior Pref. Diversified Banks 5 Years (only includes RBIIV 1% 12/04/2024)	1	1%	5	0.5
Eurofima 0.25% 02/09/2024	1	0.25%	6	0.5
AA Supranational 6 Years (only includes EFSF 0.2% 01/17/2024)	1	0.2%	6	4

USD summary statistics of bonds used for comparison

Bonds sharing similar characteristics to green bonds in our sample

Q3 - Green bonds priced between July 01 and September 30 2018	Number of bonds	Average Coupon (par weighted)	Maturity	Deal Size EURbn
Korea Hydro & Nuclear Power 3.75% 25/07/2018	1	3.75%	5	0.60
A Utilities 5 Years EM country of risk	2	3.88%	5	0.55
State Bank of India 4.5% 28/09/2023	1	4.5%	5	0.65
BBB Banks 5 Years (No EM and / or state owned available for comparison)	2	4.2%	5	0.63
Interstate Power & Light 4.1% 26/09/2028	1	4.1%	10	0.50
BBB Utilities 10-11 Years	2	4.6%	10.5	0.90
Asian Development Bank 3.125% 26/09/2028	1	3.125%	10	0.75
AAA Supranational 10 Years (only includes IADB 3.125% 2028)	1	3.125%	10	2.80
Q4 - Green bonds priced between October 01 and December 31 2018				
Duke Energy Carolinas LLC 3.95% 15/11/2028	1	3.95%	10	0.65
A Utilities 10 Years (Used 2 bonds issued in Q3 because nothing suitable available in Q4)	2	3.7%	10	0.53
ING GROEP NV 4.625% 06/01/2026	1	4.625%	8	1.25
A Banks 5-7 Years (Includes only USB 3.95% 11/17/2025)	1	3.95%	7	0.75
Int. Bank for Reconstruction & Development 3.125% 20/11/2025	1	3.125%	7	0.6
Supranationals 3-5 Years (Includes only EIB 3.125% 12/14/2023)	1	3.125%	5	3
Boston Properties LP 4.5% 01/12/2028	1	4.5%	10	1
BBB Real Estate 5-7 Years (includes only VER 4.625% 11/01/2025)	1	4.63%	7	0.55
Nederlandse Waterschapsbank 3.125% 05/12/2022	1	3.125%	4	0.5
Development Banks 3-5 Years (includes only RENTEN 3.125% 11/14/2023)	1	3.125%	5	1.25
African Development Bank 3% 06/12/2021	1	3%	3	0.6
Development Banks 3 Years	2	3.1%	3	3.5

Notes

- <https://climatebonds.net/standard/taxonomy>
- CBI adheres to the MSCI market definitions <https://www.msci.com/market-classification>
- This accounts for an increase in the minimum size for inclusion from USD300m to USD500m in January 2018. Our H2 2017 papers included 41 bonds, 3 of which were <USD500m.
- NEDWBK 2.375% 24/03/2026 issued Q1 2016 & NEDWBK 2.125% 15/11/2021 issued Q4 2017
- <https://ihsmarkit.com/products/iboxx.html>
- https://www.climatebonds.net/files/reports/cbi_pricing_h1_2018_OI1.pdf
- Excludes Hong Kong issuers. MSCI classifies Hong Kong as a developed market.
- Excludes Chinese green bonds which comply with the PBoC or NDRC green bond catalogues, but do not comply with the Climate Bonds Taxonomy. The top reasons for exclusion are the financing of so called "clean coal" and other energy efficiency improvements to fossil fuel power technologies and the financing of working capital (up to 50% allowed under the Chinese green bond catalogues).
- CBI data

- <https://www.imf.org/en/News/Articles/2016/09/29/AM16-NA093016IMF-Adds-Chinese-Renminbi-to-Special-Drawing-Rights-Basket>
- Source: Standard Chartered. And while I do not have most recent data for most countries, there are some figures from 2012. According to a paper published by the Worldbank, in 2012 foreign participation in domestic government securities were: Brazil 12%, Czech Republic 12%, Hungary 42%, Indonesia 30%, Malaysia 27%, Mexico 29%, Peru 58%, Turkey 17%, South Africa 29%.
- https://www.hkex.com.hk/-/media/HKEX-Market/News/Research-Reports/HKEx-Research-Papers/2018/CCEO_GreenBonds_201812_e.pdf?la=en
- China Policy Banks are: China Development Bank, Agricultural Development Bank of China, and The Export-Import Bank of China
- Moodys: Renminbi bond monitor June 2018.
- <https://uk.reuters.com/article/us-china-bonds-ratings/in-rare-move-china-punishes-ratings-agency-dagong-over-violations-idUKBNIL20K7>

- <https://www.scmp.com/business/banking-finance/article/2183971/sp-global-get-nod-enter-chinas-bond-rating-market>
- <https://www.bloomberg.com/news/articles/2018-07-02/china-heads-for-record-defaults-and-downgrades-tip-further-pain>
- FT: Chinese regional investment arm in landmark bond default, 14th of August 2018
- Delivery vs Payment. In China currently the buyer has to pay the money to their seller first before they are assured of the security transfer into their account
- The Bloomberg Barclays Global Aggregate Bond Index is a flagship measure of global investment grade debt from twenty-four local currency markets. This multi-currency benchmark includes treasury, government-related, corporate and securitized fixed-rate bonds from both developed and emerging markets issuers. Source: Bloomberg
- https://www.climatebonds.net/files/reports/cbi-policyroundup_q1-q2-2018-03c.pdf
- <https://www.chinabond.com.cn/cb/cn/xwgg/cjxw/cjyw/gnxw/20180629/149580855.shtml>
- <http://sh.people.com.cn/n2/2017/1227/c375898-31080464.html>

9. Methodology

This paper includes labelled green bonds issued during H2 2018. We have included all labelled green bonds meeting the following specifications:

- Announcement date between 01/07/2018 and 31/12/2018
- Currency: USD or EUR
- Size >= USD500m
- Investment grade rated
- Minimum term to maturity of three years at issue
- Consistent with Climate Bonds Taxonomy

Amortising, perpetual, floating-rate and other non-vanilla structures are excluded.

We have designed these parameters to capture the most liquid portion of the market, while not limiting diversity. Paucity of data remains a challenge. All historical data is based on asset swap spreads for EUR denominated bonds. For USD bonds, spreads are against a US treasury curve. All historical data is taken from Refinitiv EIKON.

Comparable baskets:

Comparable baskets include bonds issued in the same quarter as the green bond. Comparable bonds must fit the parameters described above except that the use of proceeds is not green. The resulting baskets are a proxy for how the money could have been invested within a three-month period. The number of bonds in each basket ranges from one to six bonds. We acknowledge that bonds behave differently according to which part of the month they are issued in, and that geopolitical events can influence bond prices from one day to the next. We have designed this proxy to circumvent the fact that green and vanilla bonds sharing similar characteristics are rarely issued on the same day.

Relative sizes of green and vanilla bonds used in yield curve construction

	Currency	Average size non-green bonds	Average of other green bonds	Green bond issued H12018
Terna Elettrica 2023	EUR	1.0		0.75
EDP Finance 2025	EUR	0.7		0.6
Commerzbank 2023	EUR	0.6		0.5
SSE 2027	EUR	0.6	0.6	0.65
Ireland 2031	EUR	7.4		3
ING 2030	EUR	1.3		1.5
Crédit Agricole 2023	EUR	1.0		1
NAB 2023	EUR	0.9	0.5	0.75
KfW 2026	EUR	4.0	1.5	1
Deutsche Hypo. 2024	EUR	0.6	0.5	0.5
Berlin Hyp 2025	EUR	0.6	0.5	0.5
Muenchener Hyp 2023	EUR	0.8		0.5
EIB 2026	EUR	3.4	1.6	0.5
IBRD 2027	EUR	1.2		0.6
Boston Properties 2028	USD	0.8		1
Duke Energy 2028	USD	0.5		0.65
ING 2026	USD	1.4		1.25
ADB 2028	USD	2.1	0.6	0.75
IBRD 2025	USD	3.0	0.6	0.6
Nederland Water 2022	USD	1.3	0.9	0.5
AFDB 2021	USD	1.5		0.5

Climate Bonds Initiative © May 2019

www.climatebonds.net

This report was prepared jointly by the Climate Bonds Initiative and the International Finance Corporation. Support and funding was provided by Obvion Hypotheken. Additional funding was received from the Ministry of Finance of Japan and the Government of the Kingdom of Denmark through the Ministry of Foreign Affairs.

Lead Author: Caroline Harrison
Co-Author: Monica Filkova, CFA
Design: Godfrey Design

Suggested citation: Green Bond Pricing in the Primary Market July-December 2018, Harrison, C.

If you would like to discuss this paper in more detail please contact:
caroline@climatebonds.net

Disclaimer: The information contained in this communication does not constitute investment advice in any form and the Climate Bonds Initiative is not an investment adviser. Any reference to a financial organisation or investment product is for information purposes only. Links to external websites are for information purposes only. The Climate Bonds Initiative accepts no responsibility for content on external websites.

The Climate Bonds Initiative is not endorsing, recommending or advising on the merits or otherwise of any investment or investment product and no information within this communication should be taken as such, nor should any information in this communication be relied upon in making any investment decision.

A decision to invest in anything is solely yours. The Climate Bonds Initiative accepts no liability of any kind, for any investment an individual or organisation makes, nor for any investment made by third parties on behalf of an individual or organisation, based in whole or in part on any information contained within this, or any other Climate Bonds Initiative public communication.