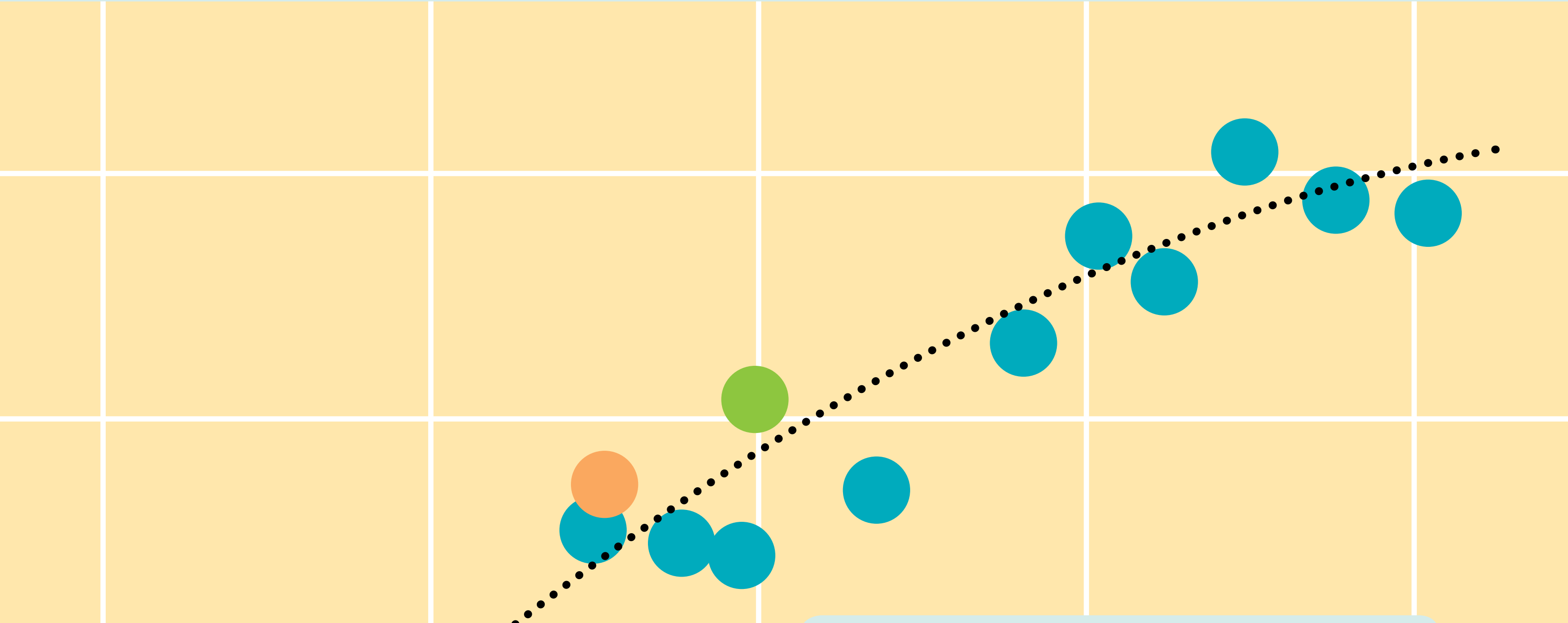
GREEN BOND PRICING IN THE PRIMARY MARKET:

October - December 2017

Q4 2017



Report highlights

- Includes USD15.1bn of green bonds issued in Q4 2017
- 14 out of 22 issuers are first time green bond issuers
- USD green bonds again have larger oversubscriptions and achieve larger spread tightening during book building than vanilla equivalents, EUR green bonds are similar to the market.
- 44% of green bonds are bought by green investors. Non-mandated investors continue to support the market.
- The greenium: new issue premiums are not a given for buyers of green bonds

Climate Bonds Initiative

IFC International Finance Corporation WORLD BANK GROUP

PAX Pax World Mutual Funds

obvion hypotheken

With support and funding from Pax World Mutual Funds and Obvion Hypotheken

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

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

Introduction

This is the fourth paper in our series examining the behaviour of green bonds in the primary markets and completes a full two years of data observation. This paper includes qualifying green bonds issued during the fourth quarter (Q4) of 2017 and employs similar metrics to those used in previous papers. Future papers on this topic will be semi-annual.

During Q4 2017, 105 green bonds were issued and their combined face value totals USD39.7bn[1]. This paper covers 23 labelled green bonds with a total face value of USD15.1bn (vs. USD15.4bn in our Q3 paper). The bonds are split 15 EUR and 8 USD. The breadth of available data remains poor, and the 23 bonds were chosen based on parameters designed to capture the most liquid portion of the market (see methodology discussion on page 13). Where possible we have drawn out trends encompassing observations made in prior papers.

Report Highlights

- **44% of green bonds were allocated to green investors**

  This is a small decline quarter on quarter (47% in Q3 2017), reinforcing support coming from all sources

  See more on page 5

- **USD green bonds are more oversubscribed than vanilla equivalents**

  This has been the case for the last three quarters. EUR green bonds tend to achieve similar book cover to vanilla equivalents

  See more on page 4

- **USD green bonds price tighter than IPT by more than vanilla equivalents.**

  This has held true for the last 3 quarters. EUR results are mixed.

  See more on page 3

- **Half of the green bonds in our sample of six exhibited greenium**

  The sample is limited to 6 of the 23 bonds covered in this paper due to a lack of comparable bonds. We have built yield curves for 42 bonds issued over the last 24 months. More do not exhibit a new issue premium than do.

  See more on page 6

- **More than half of EUR green bonds tightened by a larger percentage than corresponding index after 7 and 28 days**

  The numbers are lower than in prior quarters. Normally, EUR green bonds price the same or slightly better than vanilla equivalents and perform well in the immediate secondary market, with at least 70% beating indices and performing well against vanilla baskets. USD bonds continue to lag in the immediate secondary market.

  See more on pages 9

Market developments

In the conclusion of our last publication, we included some remarks about the lack of diversification in the green bond market, noting that most of the green corporate bond issuance had been in the utility, real estate, and financial sectors which would prohibit investors from constructing a balanced green bond portfolio. Further, we would like to see existing issuers consolidate their commitment to a sustainable future by returning to the bond market and building out green bond curves. This paper includes 23 green bonds from 22 issuers. 14 of those issuers brought green bonds to the market for the first time:

- German Landesbank LBBW
- Japanese bank Mizuho
- Japanese bank Sumitomo Mitsui
- Nordic / Baltic banking group Swedbank
- Italian Railway operator Ferrovie dello Sato
- German utility Innogy – first German corporate to issue a green bond
- Spanish energy firm Gas Natural Fenosa
- Danish power company Orsted
- Italian electricity and gas distributor Iren
- Deutsche Hypothekenbank issued its first green Pfandebrief
- China Nuclear
- American energy services company Avangrid
- Indian PowerFinance
- Indian Railways

We note that this does not bring any additional sector diversity, with these bonds all coming from utility, real estate, and financial corporate issuers. However, these issuers are sending positive signals to investors, and could become repeat visitors to the market. Among the green bonds meeting the criteria for inclusion in this paper, Berlin Hyp, Development Bank of Japan, IFC, Nederlandse Water (NEDWBK), Swedbank, Toyota, and Westpac have all issued green bonds before.

1. Order Books and Initial Price Thoughts (IPT): USD green bonds achieve larger oversubscription and price tighter than IPT by more than vanilla bonds

- **EUR:** Average oversubscription is 2.9x for green bonds, and 3x for vanilla bonds. Final pricing average -11bps than IPT, compared to market average of -13bps.
- **USD:** Average oversubscription is 2.7x for green bonds, and 2.2x for vanilla bonds. Final pricing average -13bps than IPT for both green and vanilla bonds.

Oversubscription and bonds pricing tighter than IPT are normal features of the bookbuilding process. We would not expect green bonds to behave any differently from vanilla counterparts in this regard, particularly given prevailing market conditions. However, there are some differences between USD and EUR denominated bonds which have held steady over the past three quarters. Q4 2017 is the third consecutive quarter that we have seen USD green bonds achieve average larger book cover than vanilla equivalents (baskets of non-green bonds – see page 13 for methodology notes), and the difference between IPT and final pricing has also, on average, been larger for USD green bonds.

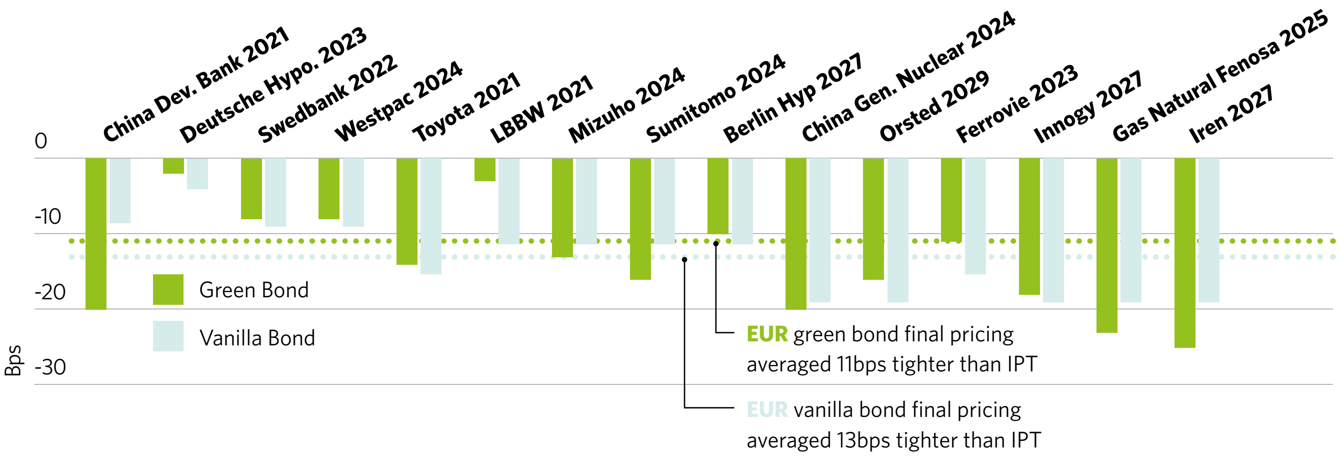
During Q4 2017, EUR green bonds achieved a book cover of 2.9x, almost meeting the 3.0x for vanilla equivalents. Both green and vanilla bonds achieved book cover of 2.7x during Q3, and green bonds achieved 2.3x compared to vanilla cover of 2.2x during Q2. Based on these data observations, the averages for vanilla and green bonds are +/- 0.1x, so no different. In terms of the differences between IPT and final price, the vanilla bonds (-13bps) tightened more aggressively than the green bonds (-11bps) in Q4 2017. In Q3, the green bonds (-11bps) beat vanilla equivalents (-9bps), but during Q2 the green bonds (-6.3bps) lagged the vanilla (-9.4bps).

German utility Innogy achieved the highest book cover among our green bond sample. Innogy's 10-year green debut was originally marketed as a EUR500mm deal. The bond was increased to EUR850mm after it attracted an orderbook of EUR4.2billion, which was 4.9 times the final deal size, and pricing settled at 18bp less than IPT. We note that this bond went on to tighten in the immediate secondary market (see page 8).

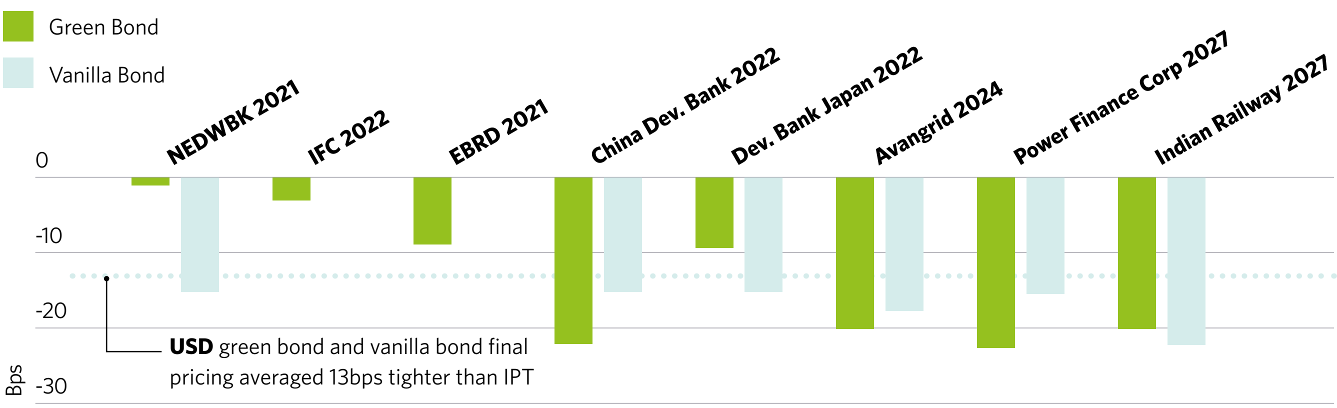
Demand for benchmark sized green bonds is clearly robust, particularly in the USD denominated space, where the market is relatively less developed than the EUR equivalent. We are unable to determine whether these advantages translate into a greenium, because of a lack of available yield curve data. (See page 6 for detailed discussion on greenium)

Methodology notes: We could not find book size data for Power Finance Corp 2027.

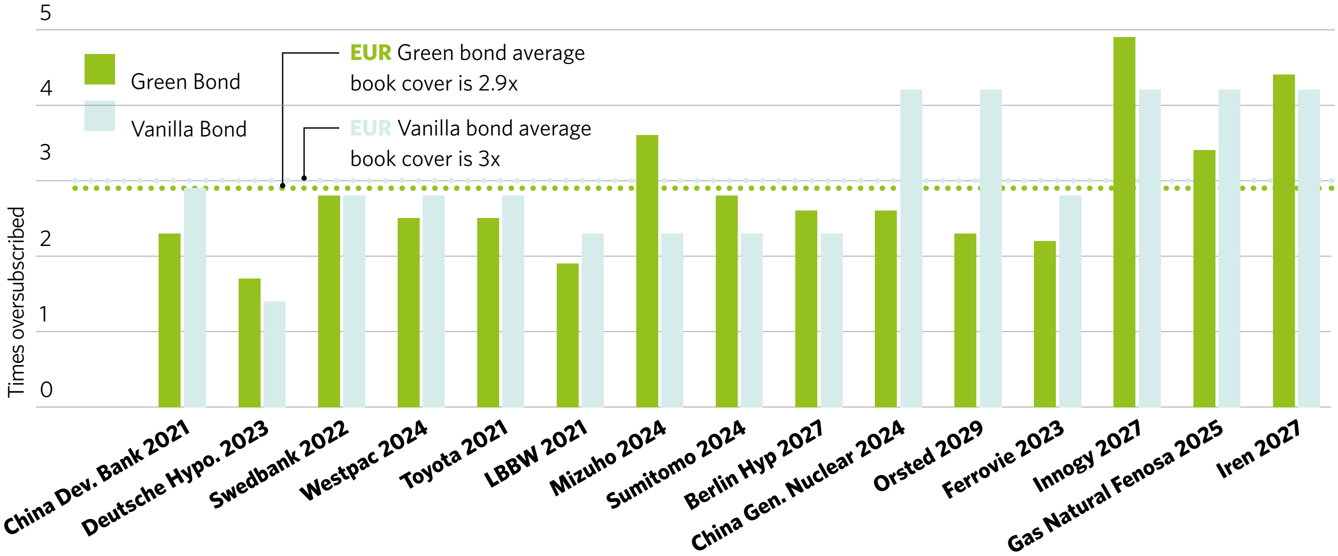
6 out of 15 EUR green bonds tightened more than their basket during the pricing process



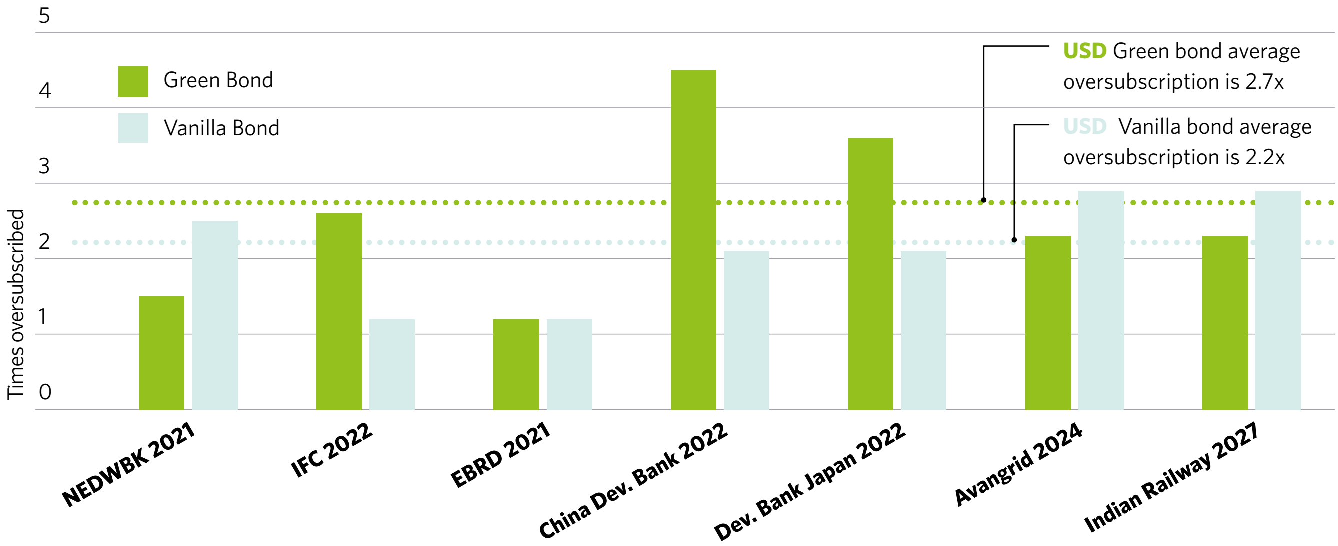
5 out of 8 USD green bonds tightened by more than their baskets during the pricing process



7 out of 15 EUR green bonds acheived the same as or larger oversubscription than vanilla equivalents



4 out of 7 USD green bonds acheived the same as or larger oversubscription than vanilla equivalents



2. Green allocation impact: 44% of the amount raised through green bonds was allocated to green investors

■ 44% of the amount raised through green bonds in our sample was allocated to those labelling themselves as socially responsible or green investors.

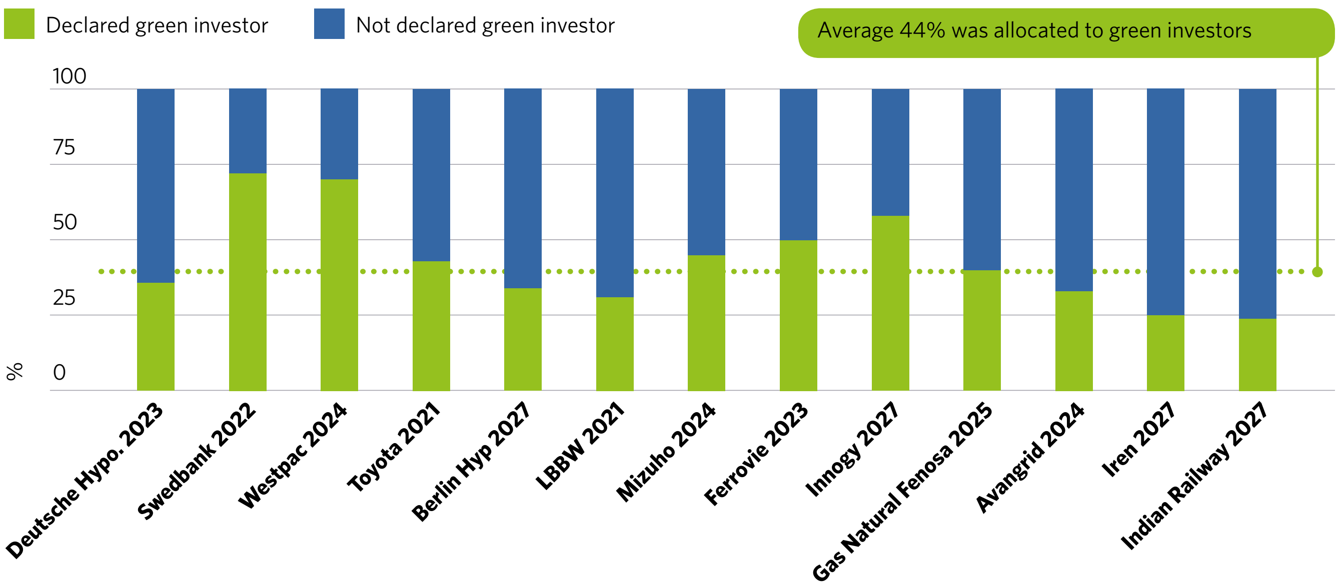
Green bonds can introduce issuers to a broader investor base than they would otherwise have access to, including those labelling themselves as green. Bookrunners suggest that this additional investor base can contribute to tighter pricing for green bonds. We approached all issuers in our Q4 sample and 13 of them replied and were willing to disclose the percentage of their deals allocated to green investors.

The responses ranged from 72% (Swedbank 2022) down to 24% (Indian Railway 2027), and the overall average was 44%. As Indian Railway was the only EM[2] issuer to respond to our request, we cannot draw any conclusions about this dimension. We have gathered this data for qualifying green bonds issued since April 2017, and summary results are tabulated below. We can see that the average allocation to green bond funds has declined slightly each quarter. This may be due to tightening credit spreads but we cannot say for sure. However, we can see that green bonds in our sample are oversubscribed and achieved price improvements during the pricing process. This means that the market continues to receive healthy support from all types of investor which is precisely what is required to absorb the necessary growth of the market.

Green bonds tend to be bought by investors falling into one of the following three categories: 1. Dedicated green bond funds, 2. No dedicated mandate, but deliberately active in green bonds, 3. Those for whom the green label is not relevant to investment decisions. The second category encompasses the investors who got the market going and have supported it to date. These investors buy bonds because they are green, and fit their credit preferences, but are not compelled to do so by policy guidelines

Methodology notes: Green investor information is provided by each issuer and taken at face value. There is no universal definition of a green investor. This data relies on self-disclosure from buyers who may have green allocations within a portfolio but may not only use the green allocation to buy the bond. Alternatively, buyers may claim to be using green allocations in the hope of receiving more bonds, and then park the bonds in non-green portfolios. We note that investors such as Amundi, AXA IM, Blackrock, Calvert, Mirova, Nikko AM, and PIMCO have dedicated green bond portfolios (category 1), while others such as AP4 actively buy green bonds to fulfil a pervasive ESG strategy (category 2).

44% of green bonds were allocated to green investors



Half of the green bonds in our sample over the last three quarters have been allocated to green investors

Observation period	% of green bonds allocated to green bond funds	Developed Markets	Emerging Markets	No. of bonds in sample
Q2 2017	54%	62%	25%	13
Q3 2017	47%	54%	33%	16
Q4 2017	44%	46%	24%	13
Averages	**48%**	**54%**	**27%**	

3. The Greenium: 3 out of 6 bonds exhibited a greenium

- 3 bonds priced inside their curves = greenium
- 3 bonds priced outside their curves = new issue premium

The new issue premium is extra yield that a buyer gets, and a seller pays, for a new bond, when compared 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 at a higher price and lower yield than 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, a greenium. Intuition suggests that a bond being green should not influence its price. 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 additional costs such as certification and third-party review. Market dynamics such as supply, uncertainty surrounding interest rates, and geopolitical issues can influence final pricing for vanilla and green bonds alike.

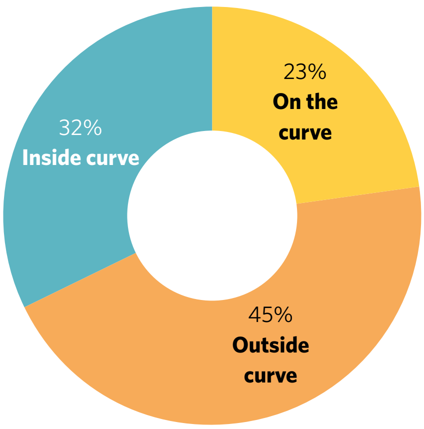
For this analysis, our sample includes just 6 out of the 23 green bonds covered in this paper. A lack of comparable bonds limits the sample size.

The results of this exercise are mixed, which is consistent with what we concluded in our earlier papers. Three bonds priced inside their curves, exhibiting a greenium, three outside. Throughout 2016 and 2017 we have built new issue curves for 42 green bonds. The highest number of bonds still deliver a traditional new issue premium (19 green bonds), but combining bonds priced inside the curve (13 green bonds), thus exhibiting a greenium, with those priced on the curve (10 green bonds), 55% of bonds did not exhibit a new issue premium. This split tells us that investors cannot automatically expect to receive a new issue premium. Because the group of bonds is small and mixed, we cannot make any further inferences about sector or currency.

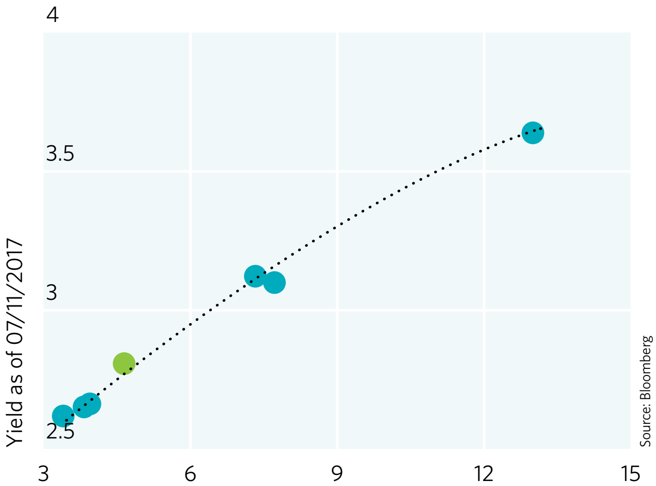
In our last paper, we touched on the topic of secondary market green curves, we cannot elaborate any further on this because none of the bonds in our Q4 sample have secondary market green curves yet.

Methodology notes: We use yield on issue date, which reflects the price the green bond offered on the issue date. For comparable bonds, we have used yield to convention mid. For all bonds, we have used modified duration to mid, and all data is as of the announcement 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 curve. Next, we overlay any seasoned green bonds (orange), finally, we add our subject bond (green). We have included bonds in our sample with a minimum of 4 comparable bonds. Comparable bonds used for this analysis must fit the specification for green bond selection described on page 13 except 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.

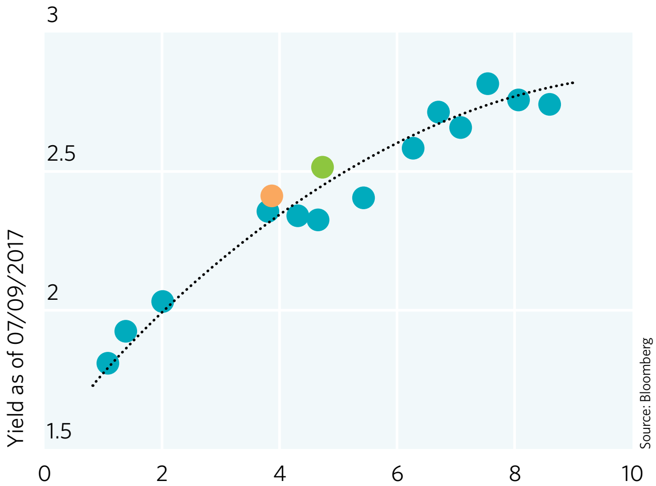
New issue premiums for green bonds in our sample, 2016 & 2017



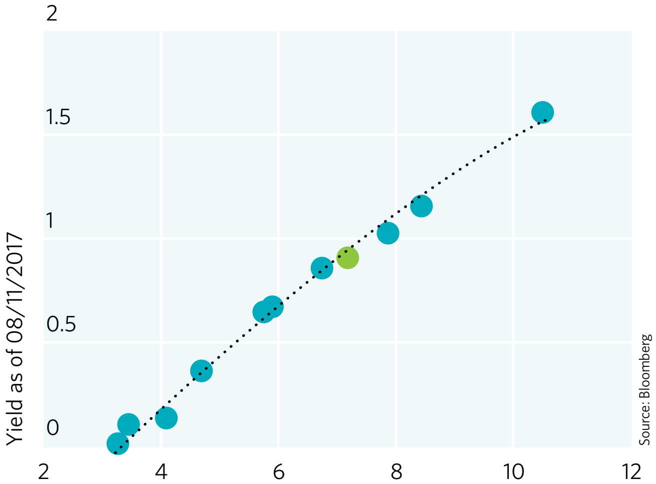
China Dev. Bank 2022 USD - exhibited new issue premium



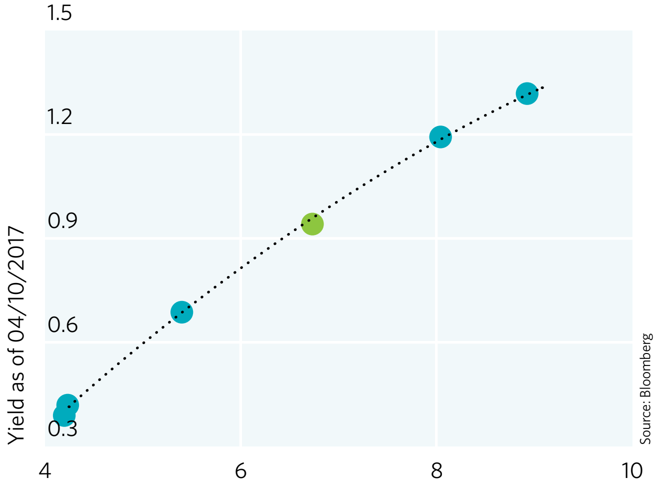
Dev. Bank of Japan 2022 USD - exhibited new issue premium



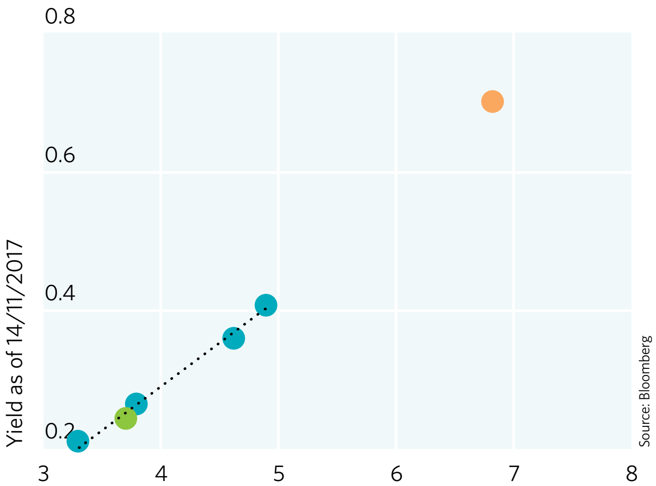
Gas Natural Fenosa 2025 EUR - exhibited slight greenium



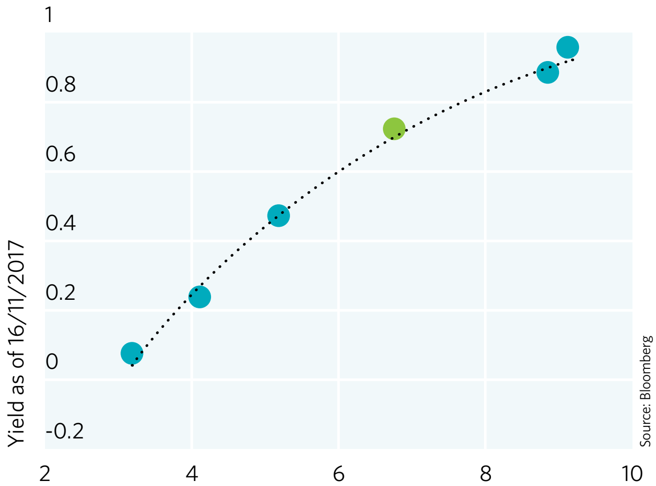
Sumitomo 2024 EUR - exhibited slight greenium



Toyota 2021 EUR - exhibited slight greenium



Westpac 2024 EUR - exhibited new issue premium



4. Performance against comparison basket: Green bond spreads tighten in the secondary market

- One third of green bonds in our sample had larger price improvements than vanilla equivalents after 7 and 28 days.

Bond prices normally increase on the 'break' when they start trading in the secondary market. If bonds are issued early in the month this is an opportunity for managers to chalk up some off-benchmark performance, before bonds enter indices at month end.

57% of our Q4 green bonds sample by number had tightened 7 days post announcement date. After 28 days, 74% of our sample had tightened. Most of the vanilla baskets had tightened after 7 (95%) and 28 days (91%).

In terms of relative tightening, a third of green bonds in our sample had larger price improvements than vanilla equivalents after 7 and 28 days. Among the EUR bonds that tightened more than their baskets are two bonds from Chinese issuers: China Dev. Bank 2021, and China Gen. Nuclear 2024. Both offer investors exposure to green debt from an EM domicile. Westpac 2024 and Mizuho 2024 also tightened more than their baskets after both 7 and 28 days, along with Innogy 2027, which also had the largest book cover in our sample. Among the USD bonds, NEDWBK 2021 and Avangrid 2024 both tightened more than their respective baskets after 7 and 28 days.

Methodology Notes: 7 calendar days includes 5 data observations. 28 calendar days includes 20 data observations.

Our vanilla baskets include bonds that share, as closely as possible, the same characteristics as the green bonds in our sample in terms of currency, sector, credit rating, and maturity, and were issued during Q4 2017. The 7 and 28-day periods are not necessarily overlapping and are not necessarily the same for all bonds in the basket. These metrics are calculated for each bond in the basket and then averaged.

Baskets include bonds issued between 30th September and 31st December 2017 and that fit the parameters described on page 13, except that the use of proceeds is not stated as green. The resulting baskets are a proxy for how else the money could have been invested within the three-month observation period. The number of bonds in each basket ranges from one to 11 bonds. Summary statistics of the baskets are on pages 13 and 14. We understand that bonds behave differently according to when in the month they are issued and acknowledge that geopolitical events can influence bond prices. We have designed this proxy to circumvent the fact that green and vanilla bonds sharing similar characteristics are rarely issued on the same day.

EUR Green bonds - Spread changes compared with baskets of vanilla bonds

Bond	Spread change 1 week	Spread change 1 week, basket	Greater than basket	Spread change 1 month	Spread change 1 month, basket	Greater than basket
China Dev. Bank 2021	-5.28	-1.11	✓	-6.56	-5.23	✓
Deutsche Hypo. 2023	1.31	0.10	✗	-0.56	-0.69	✗
Swedbank 2022	-1.01	-2.70	✗	-3.18	-5.34	✗
Westpac 2024	-5.57	-2.70	✓	-7.72	-5.34	✓
Toyota 2021	1.16	-0.92	✗	-3.11	-3.73	✗
LBBW 2021	-3.69	-5.28	✗	-0.60	-6.97	✗
Mizuho 2024	-7.33	-5.28	✓	-8.53	-6.97	✓
Sumitomo 2024	-2.29	-5.28	✗	-4.34	-6.97	✗
Berlin Hyp 2027	-1.60	-5.28	✗	-5.78	-6.97	✗
China Gen. Nuclear 2024	-17.32	-4.73	✓	-18.96	-9.93	✓
Orsted 2029	0.29	-4.73	✗	-9.86	-9.93	✗
Ferrovie 2023	0.29	-0.92	✗	-0.15	-3.73	✗
Innogy 2027	-7.21	-4.73	✓	-19.08	-9.93	✓
Gas Natural Fenosa 2025	5.44	-4.73	✗	2.52	-9.93	✗
Iren 2027	4.32	-4.73	✗	-2.76	-9.93	✗

Source: Thomson Reuters

USD Green bonds - Spread changes compared with baskets of vanilla bonds

Bond	Spread change 1 week	Spread change 1 week, basket	Greater than basket	Spread change 1 month	Spread change 1 month, basket	Greater than basket
NEDWBK 2021	-22.60	-0.54	✓	-22.60	-0.76	✓
IFC 2022	n/a	-1.35		2.60	1.40	✗
EBRD 2021	1.80	-1.35	✗	1.80	1.40	✗
China Dev. Bank 2022	-0.86	-0.72	✓	-1.87	-1.10	✓
Dev. Bank of Japan 2022	-19.80	-0.72	✓	-6.20	-1.10	✓
Avangrid 2024	n/a	-3.38		0.51	-6.84	✗
Power Finance Corp 2027	4.02	-0.02	✗	4.08	-1.68	✗
Indian Railway 2027	0.01	-13.15	✗	0.27	-13.42	✗

Source: Thomson Reuters

5. Performance against indices: Just over half of green bonds outperform indices 28 days after announcement date

- 7 days after announcement 47% tightened more than corresponding index
- 28 days after announcement 52% tightened more than corresponding index

Comparing bonds to indices gives us an indication of how bonds have performed versus 'the market', or similar risk.

During Q4, 47% of green bonds in our sample had tightened by more than their corresponding index 7 days after announcement date, rising to 52% after 28 days.

Splitting this out by currency, more EUR bonds tightened by a greater percentage than their index, compared to the USD green bonds. After 7 days, 53% of EUR green bonds had tightened by more than their corresponding index versus 33% of USD green bonds. After 28 days, that number was 66% for EUR green bonds, and 25% for USD green bonds.

Below is a table summarising the results of this exercise over the past two years. So far, more EUR bonds have tightened by a larger percentage than their index compared to the USD denominated bonds on a consistent basis. We suspect this is because the USD green bond market is relatively smaller than in EUR, and there is less opportunity.

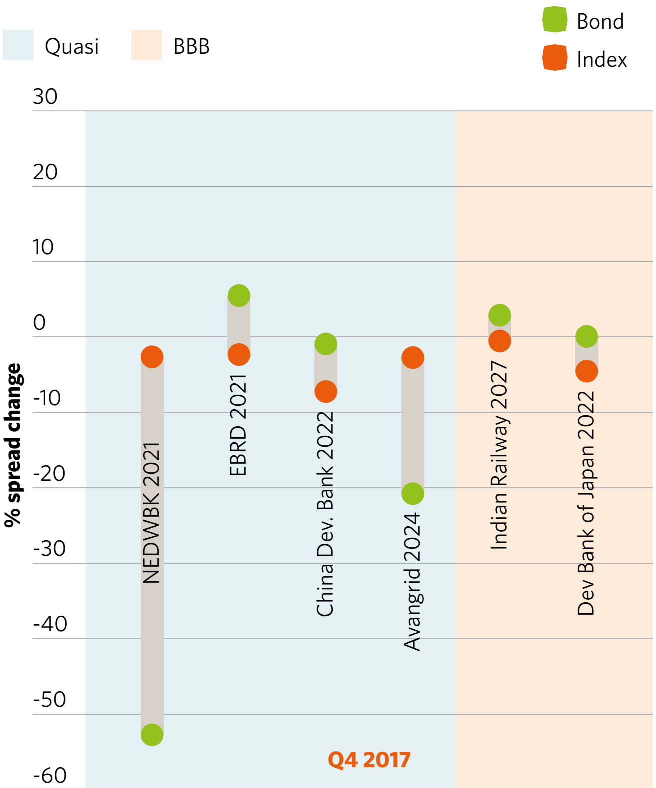
Methodology notes: To isolate the performance of a green bond we would need to compare it to an index from which green bonds were actively excluded. In the absence of such indices, we have used standard iBoxx indices[3]. The indices are partitioned by currency, asset class, tenor, and credit rating where possible, all of which can influence the performance of a bond. As a result, green bonds are compared to an index comprising bonds sharing similar characteristics. For example, EUR Mizuho 2024 is matched with the iBoxx EUR Corporates a 5-7 Index.

7 calendar days includes 5 data observations. 28 calendar days includes 20 data observations.

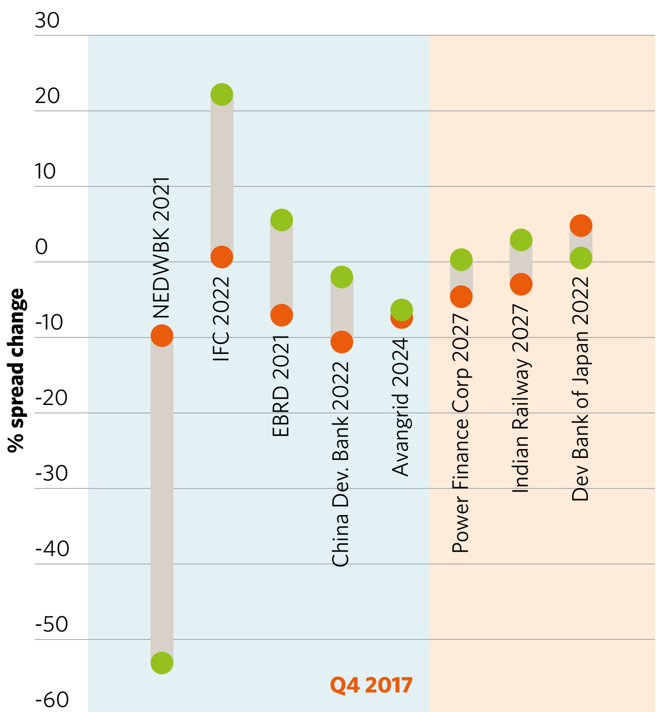
Percentage of bonds tightening by a greater percentage than their corresponding index after 7 and 28 days

	2016 & Q1 2017		Q2 2017		Q3 2017		Q4 2017	
	7 days	28 days	7 days	28 days	7 days	28 days	7 days	28 days
EUR	**79%**	**76%**	**85%**	**75%**	**100%**	**91%**	**53%**	**66%**
USD	**59%**	**65%**	**50%**	**33%**	**43%**	**43%**	**33%**	**25%**

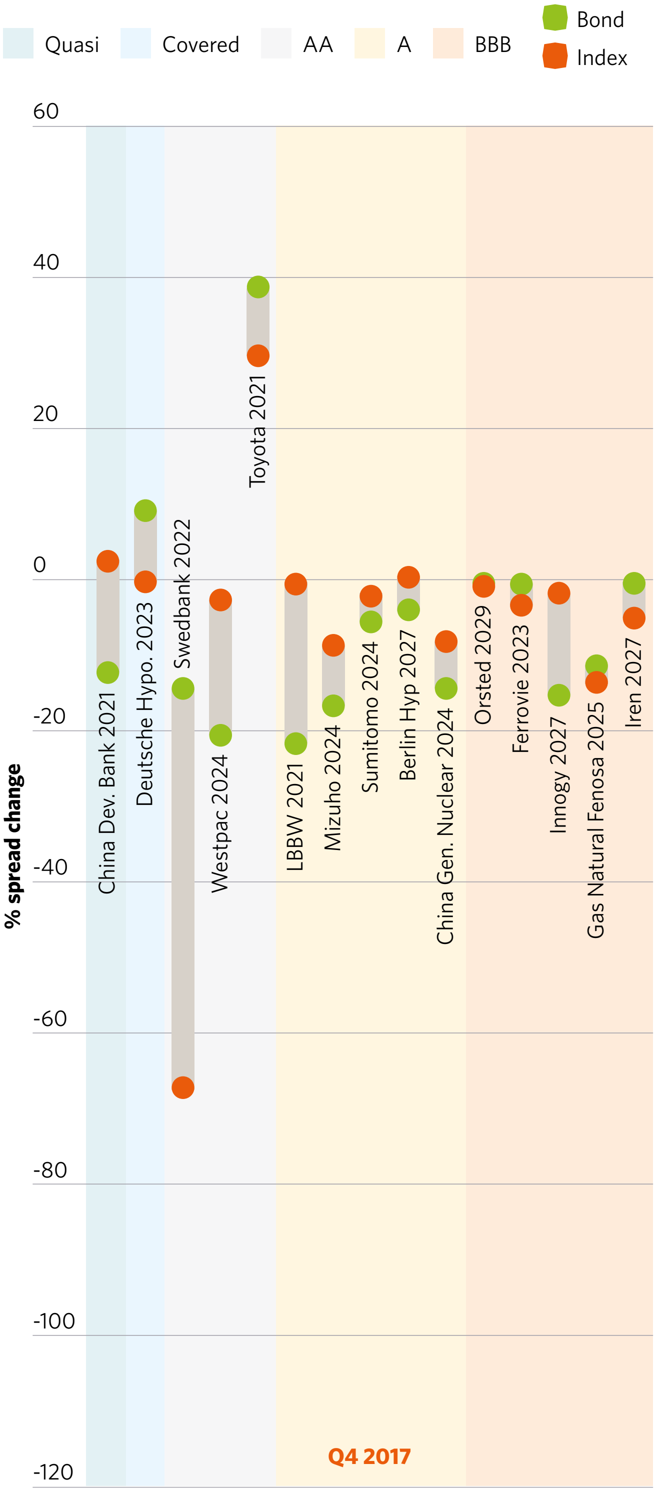
USD 7 days: 2 out of 6 green bonds tightened by more than their corresponding index



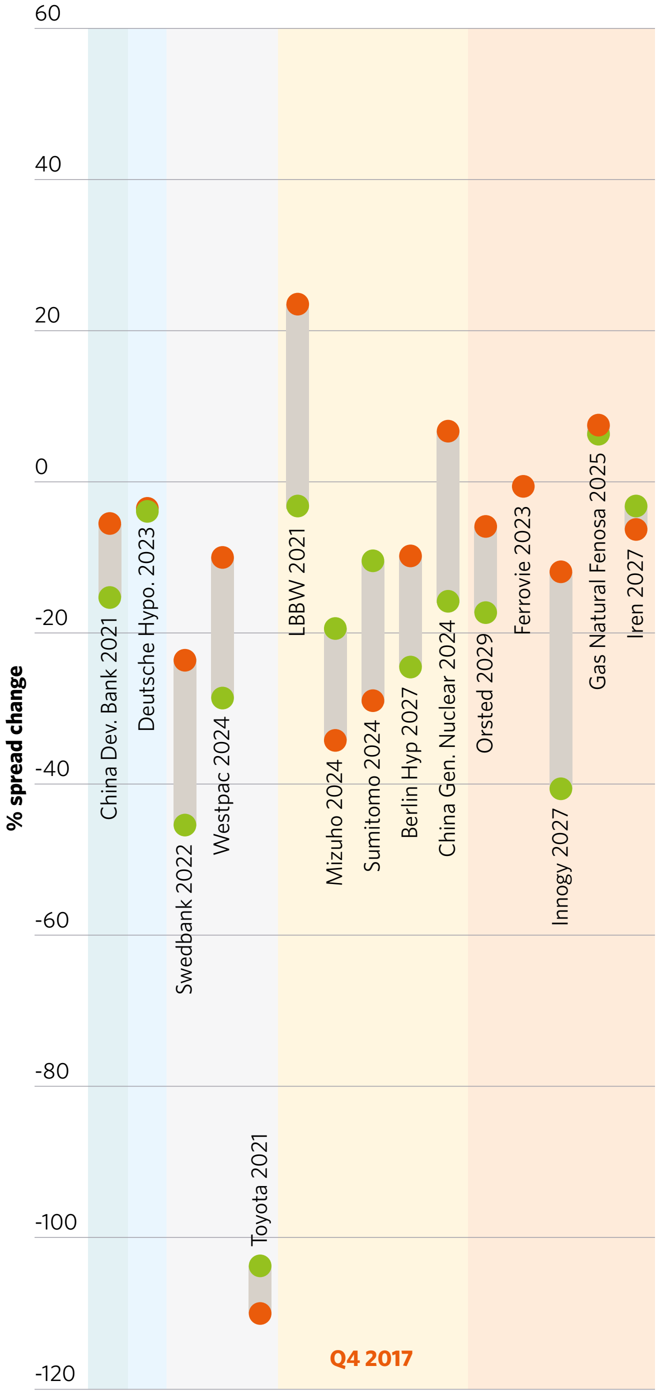
USD 28 days: 2 out of 8 green bonds tightened by more than their corresponding indices



EUR 7 days: 8 out of 15 bonds tightened by more than their corresponding index



EUR 28 days: 10 out of 15 bonds tightened by more than their corresponding index



6. Treasurers see manifold benefits from issuing green bonds

The distribution of green bonds can often result in a more varied investor base because of demand from green bond funds and responsible investors. As we have noted, the green bond market is supported by all types of investors. A diverse investor base may help to stabilise debt in times of volatility.

Investors may interpret green bonds as a signal of intent that an organisation is preparing to face future challenges associated with climate change. Green bonds give organisations an opportunity to reinforce their commitment to societal responsibility which can impact both internal and external stakeholders. Treasurers are consistently happy with how green bonds place, and below of some of the remarks we have gathered pertaining to bonds included in this publication.

Orsted A/S
1.5% 26/11/2029 EUR750m, announced 16/11/2017

Signe Nygaard Marcher Senior Funding Analyst Treasury & Funding Orsted: *"When we decided to go to the market with a new issue, we had no doubt that we would issue a green bond. The investments we make in Ørsted reflects our company vision of a world that runs entirely on green energy, and it is therefore only natural to fund these investments with green bonds. With an oversubscribed orderbook, we can say that our first green bonds were very well received by the market."*

Indian Railway Finance Corporation (IRFC)
3.835% 13/12/2027 USD500m, announced 29/11/2017

Mr. S. K. Pattanayak, Managing Director, IRFC said: *"IRFC is delighted to launch its first green bond on the London Stock Exchange today. Our debut green bond is a significant milestone for IRFC, supporting the company's ambitious infrastructure green projects, which includes procurement of rolling stocks electrifying rail tracks across India. Not only was the bond three times oversubscribed but today we have also achieved our aim, through London, to increase our investor base across EMEA."*[4]

Gas Natural Fenosa Finance BV
0.875% 15/05/2025 EUR800m, announced 08/11/2017

Press release: *The funds received in this operation [....] will serve to optimise the company's financial structure, increase the capital market weight, diversify the investor base with a focus on sustainability, lengthen the average debt lifetime and improve the maturities profile. All this will enable the company's already ample liquidity to be increased.*[5]

European Bank for Reconstruction and Development (EBRD)
1.875% 15/07/2021, USD500m, announced 28/09/2017

Isabelle Laurent, EBRD Director, Deputy Treasurer, Head of Funding: *"EBRD's green bond issuance garnered broad support from the green investment community, allowing EBRD to achieve both competitive pricing and a wider investment reach."*

Iren Spa
1.5% 24/10/2027 EUR500m, announced 17/10/2017

Massimiliano Bianco, Chief Executive Officer, Iren Spa: *"The success of IREN's first green bond is a strong signal that the markets recognise the group's sound sustainable profile in financial, environmental and social terms. Being always faithful to our "green" spirit, constantly including the ESG criteria in our strategies, has been a fundamental element of balanced growth to the benefit all stakeholders. This strategy has been boosted further by the green bond, which confirms the company's focus on the growing number of investors who put particular importance on non-financial elements in their long-term investment choices."*

Avangrid Inc.
3.15% 01/12/2024 USD650m, announced 16/11/2017

Patricia C. Cosgel Vice President Investor and Shareholder Relations, Avangrid: *"We announced a $500 million transaction with initial price talk at treasuries + 115 basis points. Strong interest in the transaction, bolstered by the interest of green investors that comprised 1/5th of the order book and 1/3rd of the allocations, allowed us to upsize the transaction to $600 million and price at treasuries + 95 basis points. We were very pleased with the outcome."*

China Development Bank
2.75% 16/11/2022 USD500m, and 0.375% 16/11/2021 EUR1.0bn, announced 07/11/2017

Flora Li Deputy Director, Foreign Debt Division, Treasury & Financial Markets China Development Bank: *"The bonds represent China's first-ever quasi-sovereign international green bonds. The USD tranche was priced at T+78bps with a coupon rate of 2.750%, and the EUR tranche was priced at MS+43bps with a coupon rate of 0.375%, both inside CDB's secondary curves. Both tranches attracted strong interest from international investors, especially within the green and SSA investor space."*[6]

Conclusion

Qualifying bonds amounting to USD15.1bn were included in our analysis of the green bond market in Q4 2017. 14 of the 22 issuers are new entrants to the green bond market, bringing diversity to the pool of available bonds. However, all bonds come from the "usual sectors": quasi sovereigns, and in the corporate space, financial, real estate, and utility companies. Sector diversification remains elusive.

At issue, we note that USD green bonds appear to perform better than vanilla equivalents in terms of attracting participants and tightening spreads during the pricing process. This has remained true for the past three quarters, perhaps because the USD green bond market is relatively smaller than in EUR, and there is less opportunity.

On average, order books for EUR green bonds are similar to vanilla equivalents, while spread tightening during the pricing process shows mixed results over the last three quarters. In Q4, EUR green bonds lagged vanilla equivalents but in other quarters, green bond spreads have, on average, narrowed more. Overall, we are pleased to see that green bonds behave no differently from other categories of bonds, in that order books are oversubscribed, and spreads tighten during the pricing process.

We note that both EUR and USD green bonds tend to be smaller than their vanilla cohort, except for those in the Utility sector (see Summary Statistics tables on pages 13 and 14). In our next publication we will examine whether relative deal size could have any effect on primary pricing metrics.

44% of the green bonds in our sample were allocated to green investors. Comparing this to the data that we have gathered over the prior two quarters, we observe a slight decline, but view this as positive given that green bonds must, and evidently do, appeal to as broad an investor base as possible.

Performance of green bonds in the secondary market appears to have softened when compared to baskets of vanilla bonds, and corresponding indices. However, more than 50% of EUR green bonds in our sample tightened more than their matched indices after both 7 and 28 days.

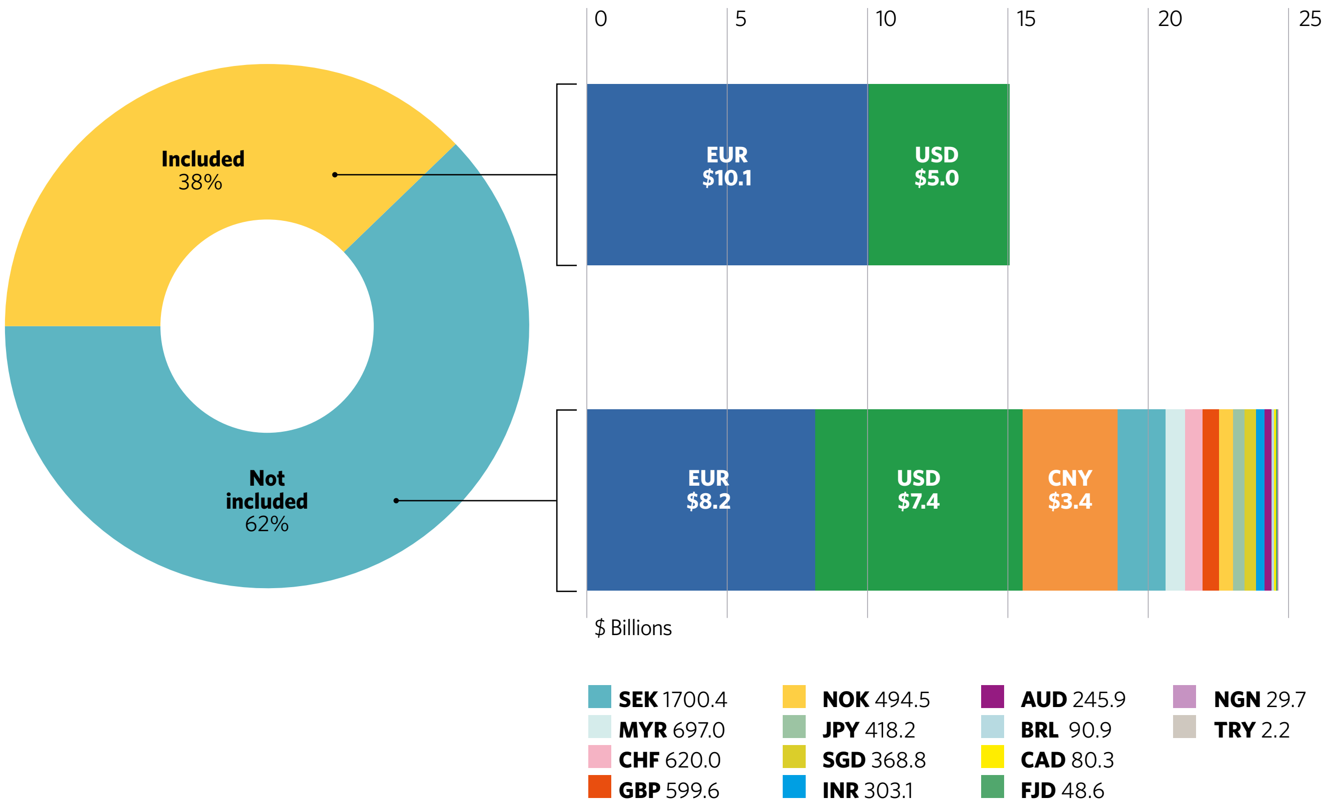
Issuers of green bonds have given us more positive feedback on their experiences of visiting the green bond market. The tone is extremely positive, with tighter pricing, reinforced commitment to sustainability, and engagement with stakeholders, being cited as benefits.

Over the past two years, we have witnessed downward pressure on yields. Against this backdrop it has been difficult to differentiate between asset types and determine to what degree a bond's performance is due to it being green or otherwise.

As economic measures begin to improve, and central banks start to unwind their quantitative easing strategies, we expect that there will be a repricing of risk which will extend to all asset classes. At this point, investor preferences may become more starkly observable, with potential for green bonds to bifurcate from vanilla counterparts.

Thus far, we have seen that green bonds offer benefits to both issuers and investors. Data remains limited, and we will continue to monitor the market. Future publications on green bond pricing will be produced semi-annually.

Our methodology captures USD39.7bn of green bonds issued in Q4.



Methodology: This paper includes labelled green bonds issued during Q4 2017, with the exception of EBRD 2021, announced 28/09/2017. We have included all labelled green bonds meeting the following specifications:

- Announcement date between 30/09/2017 and 31/12/2017
- Denominated either EUR or USD
- Size >= USD300m
- Investment grade rated
- Minimum term to maturity of three years at issue
- Consistent with the Climate Bonds Taxonomy
- Amortising, perpetual, 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 denominated bonds, spreads are against a US Treasury benchmark. All historical spread data is sourced from Thomson Reuters EIKON.

Comparable Baskets: Baskets for comparison include bonds meeting the above criteria with a use of proceeds which is not stated as green. To be included, bonds must have adequate data available. Baskets are equally weighted, and are organised according to:

- Currency
- Bloomberg Industry Classification Scheme Level 1
- Bloomberg Composite Rating
- Where possible, we have added a maturity dimension

Composition of sample

EUR	Quasi	Covered	AA	A	BBB
1 to 3	1		2	1	
3 to 5		1	1	3	
5 to 7				1	1
7 to 10					3
10+					1

USD	Quasi	A	BBB
1 to 3	5		
3 to 5			
5 to 7			
7 to 10			1
10+			2

EUR Summary Statistics of bonds used for comparison

Bonds issued in Q4 2017 sharing similar characteristics to green bonds in our sample

	Number of bonds	Average Coupon (par weighted)	Maturity	Deal Size EURbn
Toyota Motor Credit Corp 0% 21/07/2021	1	0%	4	0.6
Ferrovie dello Stato Italiane SpA 0.875% 07/12/2023	1	0.875%	6	0.6
Consumer Discretionary 6-10 years	4	0.87%	8	0.775
Landesbank Baden-Wuerttemberg 0.2% 13/12/2021	1	0.2%	4	0.75
Mizuho Financial Group Inc. 0.956% 16/10/2024	1	0.956%	7	0.5
Sumitomo Mitsui Financial Group Inc. 0.934% 11/10/2024	1	0.934%	7	0.5
Berlin Hyp AG 1.125% 25/10/2027	1	1.125%	10	0.5
A Financial Corporates 6-11 Years	3	1.25%	9	0.8
China Development Bank 0.375% 16/11/2021	1	0.375%	4	1.0
Development Banks 5-7 Years	4	0.243%	6	1.3
Swedbank AB 0.25% 07/11/2022	1	0.25%	5	0.5
Westpac Banking Corp 0.625% 22/11/2024	1	0.625%	7	0.5
AA Financial Corporates 10 Years	2	1%	10	1.1
Innogy Finance BV 1.25% 19/10/2027	1	1.25%	10	0.85
Gas Natural Fenosa Finance BV 0.875% 15/05/2025	1	0.875%	8	0.8
Orsted A/S 1.5% 26/11/2029	1	1.5%	12	0.75
Iren SpA 1.5% 24/10/2027	1	1.5%	10	0.5
BBB Utilities 10 Years	3	1.4375%	11	0.48
Deutsche Hypothekenbank AG 0.125% 23/11/2023	1	0.125%	6	0.5
Covered Bonds 6-10 Years	2	0.4%	8	1.0

USD Summary Statistics of bonds used for comparison

Bonds issued in Q4 2017 sharing similar characteristics to green bonds in our sample

	Number of bonds	Average Coupon (par weighted)	Maturity	Deal Size USDbn
Nedelandese Waterschapsbank NV 2.125% 15/11/2021	1	2.125%	4	0.5
China Development Bank 2.75% 16/11/2022	1	2.75%	5	0.5
Development Bank of Japan	1	2.50%	5	1.0
AA-A Development Banks 5 Years	3	2.65%	5	1.01
International Fiance Corp 2% 24/10/2022	1	2.000%	5	1.0
European Bank for Reconstruction & Development 1.875% 15/07/2021	1	1.875%	3.5	0.5
Supranationals 5 years*	1	2.125	5	2.0
* Includes one bond: AFDB 2.125% 2022				
Avangrid Inc. 3.15% 01/12/2024	1	3.15%	7	0.6
BBB Utilities 5-11 Years	11	3.04%	8	0.61
Power Finance Corp Ltd 3.75% 06/12/2027	1	3.370%	10	0.4
BBB Commercial Finance 6-10 Years	4	3.32%	8.75	0.54
Indian Railway Finance Corp Ltd. 3.835% 13/12/2027	1	3.835%	10	1.0
BBB Industrials 4-11 Years	7	3.098%	8	0.5

Notes
1. Climate Bonds Initiative - labelled green bond database
2. https://www.msci.com/market-classification
3. Loans and ABS bonds are excluded from this research
4. https://www.lseg.com/resources/media-centre/press-releases/london-stock-exchange-welcomes-indian-railway-finance-corporation%E2%80%99s-irfc-first-green-bond
5.http://www.prensa.gasnaturalfenosa.com/en/issue-green-bonds
6.https://www.climatebonds.net/files/files/China%20Development%20Bank's%20Debut%20Interntional%20Green%20Bond_Press%20Release%20FV.pdf

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This report was prepared jointly by the Climate Bonds Initiative and the International Finance Corporation. Support and funding was provided by Pax World Mutual Funds and 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.

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