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The bond market: Its relevance and functionality for the climate transition

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A growing number of financial market participants include climate change as a decisive factor in their asset management decisions. There are several explanations for this, from attempts to protect the portfolio against financial risks to trying to contribute to climate change mitigation.

The purpose of this report is to explain and highlight the importance and functionality of the bond market for investing that can have an impact on the climate transition. It presents ways for investors to use bond market mechanisms to include climate perspectives and to push the agenda in this area. It also suggests topics for further investigation in future research.

”A significant part of the financial market is focused on entities that are not traded on the stock exchange but rather in the fixed income market. This is also where a lot of climate impact possibilities are to be found.”

In 2019, the oil company Saudi Aramco launched one of the world's largest bond issues by offering USD 12 billion to the market. The bond sale gathered a record-breaking USD 100 billion in orders in what the Financial Times (2019a) referred to as a "Saudi bond bonanza," whilst it was also clear that the company aimed "to fund further gas and oil expansion" (Financial Times, 2019b). Later the same year, Saudi Aramco failed to convince the equity market to buy into what was supposed to be the world's largest initial public offering (IPO). The limited amount of stocks that was eventually placed on the market was consumed by local investors. The unsuccessful equity capital raising received widespread media attention while the bond issuance was barely covered outside the scope of sector-specific publications.[1] The bond market proved more than willing to finance a company with one of the world's largest climate burdens (Heede, 2019) while the equity market resisted.

In another capital market occurrence related to fossil fuels, in early 2020 the German industry group, Siemens, was strongly criticized by climate activists for its dealings with the Indian energy conglomerate, Adani, because of Adani´s controversial coal mining project at the Carmichael mine of the Galilee basin in north-eastern Australia. The mine was originally set to become the world's largest, with a total production capacity of several billion tonnes of coal over 60 years (Queensland, 2020). In February, BlackRock, the world's largest asset manager, criticized Siemens at its annual general meeting for its business relationship with Adani (Financial Times, 2020a). The international movement Extinction Rebellion called a demonstration outside the meeting about the same issue. While this was unfolding, Adani Power, the power generation arm of Adani Group, issued USD 1bn in 10-year bonds with a yield below 4 per cent. The bond issue was heavily oversubscribed, meaning that demand widely exceeded supply, with USD 5 billion in placed orders (Bloomberg, 2020a). The Carmichael mine is considered a support function of Adani Power.[2]

These are examples of how the bond market is often sidelined in comparison with the equity market with regard to questions related to climate change and sustainability. This could be seen as surprising given that the global bond market is twice the size of the equity market – the size of the global bond market is approximately USD 110–130 trillion, whereas the market capitalization of global stocks is around USD 75 trillion.[3]

A growing number of financial market participants include climate change as a decisive factor in their asset management decisions. For example, the investor initiative Climate Action 100+ has seen an annual increase in subscribing institutions of 65 per cent since its launch in 2016 (Climate Action 100+, 2020). There are several explanations for this, from attempts to protect the portfolio against financial risks to trying to contribute to climate change mitigation. In addition, the Paris Agreement (UNFCCC, 2015) stipulates that financial flows should support the two-degree goal while the Addis Ababa Action Agenda on Financing for Development states that sustainability should be integrated into trade and financial flows (United Nations, 2015). There are therefore good reasons to investigate the opportunities and possibilities that exist for investors in different asset classes to work towards these goals.

The purpose of this report is to explain and highlight the importance and functionality of the bond market for investing that can have an impact on climate change. It presents ways for investors to use bond market

1) For example, the Financial Times website, ft.com, published 161 articles with the search tags "Saudi Aramco" AND "IPO" but only seven with the search tags "Saudi Aramco" AND "bond issue" in 2019.

2) For a further analysis around the Carmichael case, see Anthropocene Fixed Income Institute (2020).

3) Bank of International Settlements (2020), World Federation of Exchanges; (2019) authors' own time-adjusted and market-weighted calculations applied to original figures.

mechanisms to include climate perspectives and to push the agenda in this area. It also suggests topics for further investigation in future research.

The bond market's relevance for financial mandates

A bond is an interest-bearing debt instrument or, in other words, a loan that needs to be repaid within a specified period. The issuer of the loan earns interest during its lifetime. Bonds can be issued by entities such as companies, government, inter- and sub-governmental organizations, municipalities, and mortgage loan institutes. Bonds are part of the so-called fixed income market, where other types of debt instruments and financial instruments are traded. The fact that the fixed income market solely trades instruments that offer a predefined return on the initial investment (such as a fixed interest rate) differentiates it from e.g. the equity market, where payments to investors are discretionary.

From an asset management perspective, a bond portfolio is traditionally seen as complementary to equities. A normal economic cycle comprises economic expansion, which leads to rising equity markets and rising interest rates; and economic contraction, which leads to falling equity markets and falling interest rates. In the expansion phase, bond portfolios are expected to show modest or even negative returns on capital, while in the economic contraction phase the value of bond portfolios increases as interest rates fall. The price of the bond moves in the opposite direction to the move in interest rates, which is illustrated in Figure 4. Equity markets fell sharply during the 2008 financial crisis, while bond yields also fell (and prices went up) increasing the value of bond portfolios.

It is also commonly assumed that economic contraction has a negative impact on illiquid risk instruments – equity markets fall alongside banks and mutual funds while bonds remain more liquid. For this reason, bond portfolios are seen as a "hedge" against equity market risk as well as a liquidity buffer. Note the distinction also within bond markets, where government bonds are more liquid and better hedges than corporate bonds.

From this perspective, fixed income portfolios are naturally seen as a more passive part of the investment portfolio. It is a buffer to the more concentrated equity risk that is supposed to drive portfolio returns. As a result, fixed income portfolios are often more conservative in terms of investment policies and which could also lead to a slower uptake of new developments, such as sustainability considerations.

Green bonds

Green bonds have their own unique place in the bond markets. They were introduced at the initiative of Swedish investors in 2007 (World Bank, 2019). The market for green bonds grew exponentially in the second half of the past decade. The concept of a green bond involves the issuer (i.e. the borrower) committing to use the money raised to finance projects that have a positive impact on the environment. The market was expected to reach USD 1 billion by 2020 (Climate Bonds Initiative, 2019). This has contributed to far-reaching changes in the way the bond market perceives the debate on climate (see e.g. Maltais & Nyqvist, 2020) and to a new research field investigating how green investments should be

priced vis-à-vis traditional ones (see e.g. Zerbib, 2019 or Erlandsson, 2020a).

Green bonds so far only account for a small part of the total bond market: they were only 1 per cent of the total bond market in 2019 (SEB, 2020). Sweden is an exception as green bonds issued in SEK made up 19 per cent of the total market in 2019 (ibid.). Sweden has had an expansionary real estate financing market, and newly built properties are technically relatively easy to use as green assets for green bond issuance. Coupled with a strong investor interest in green finance, this has led to a large number of green bonds being issued. The Swedish government issued a green government bond in 2020.Other notable green government bond issuers include France, Germany, the Netherlands, Belgium, Ireland, and Poland (somewhat controversial).

While green bonds can be used to finance parts of the green transition, the Paris Agreement and the Addis Ababa Action Agenda stipulate that there is also a need for financial flows that are not explicitly targeted at green causes to be redirected in a more climate-friendly direction. So-called transition bonds are supposed to lead the way by moving capital flows to sectors with greenhouse gas (GHG) emissions that wish to work towards a greener economy. By December 2019, however, only three such bonds had been issued globally (BNP Paribas, 2019).

Examples of the bond market's importance for a greener economy

A fundamental difference between bonds and equities is the possibility for a shareholder, at least theoretically, to take direct control of a company. A shareholder that is dissatisfied with the activities of a company can elect a new board to move the company in the desired direction, and even present direct suggestions at the board meeting. It is also common for the shareholders of a listed company to have an ongoing dialogue with the board about sustainability, which can have an impact on leading the company in a more sustainable direction.

Bondholders do not have the same direct influence on a company; they have no voting power in board meetings and cannot participate in the election of board members.[4] However, there are some mechanisms unique to the bond market that can be used to have an impact on companies. The following section highlights how the bond market could be of relevance to investors' climate initiatives and why there might be good reasons for market participants, the climate movement, politicians and academic researchers to dig deeper into this subject.

Businesses with high levels of greenhouse gas emissions are more commonly financed by bonds than equities

The bond market has a large share of the total fixed income market, which also includes loans and other credit facilities. Hence, the bond market affects more or less all types of organizations with financial flows. By contrast, only those companies that have decided to be listed

4) A specific case arises if a company goes bankrupt, when bond holders can play an important role in the continued management of the company in the case of restructuring or liquidation. See for example Financial Times, 4 May 2020, Norwegian investors back debt-for-equity swap to unlock rescue. https://www.ft.com/content/ae1fc18f-f95b-4d6a-8036-8b9a98679d4d

on public equity markets (stock exchanges) are affected by traditional equity investors.

From a global perspective, there is clear evidence that GHG emissions-intense companies are more affected by financing from the bond market than from the equity market, simply because many such companies do not use the equity market for financing.

Figure 1 shows the historical distribution of GHG emissions of companies traded on stock exchanges compared with non-listed companies. We refer to this as the 25/25/25 principle. The 25 companies with the largest emissions are responsible for 25 per cent of total emissions, but only 25 per cent of these companies are listed on and thus subject to the influence of the equity market. All companies, however, are in one way or another influenced by the bond market. A company's various credit facilities, such as its revolving credits, and various internal interest rates are determined by the fixed income market's perception of the creditworthiness of the company or its guarantor.

In other words, one reason for highlighting the climate effect of bond portfolios is that the investor can apply significantly more sustainability influence than they can through the equity market.

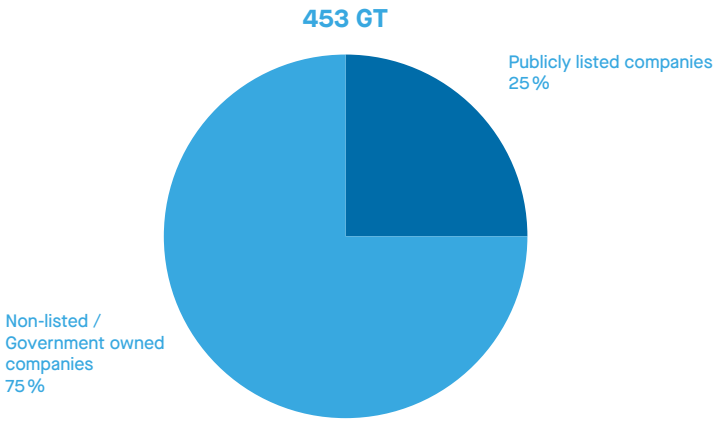

Figure 1: The 25/25/25/ principle Note: The 25 largest emitters of greenhouse gases were responsible for 25% of emissions in 1988–2015. Only 25% of these companies are listed. Emissions refer to Scope 1 and Scope 2.

Source: The Carbon Majors Database, CDP; Bloomberg.

The bond market can still be influential when it comes to listed companies. The large oil companies often hold a special place in investors' equity portfolios, given that they have historically offered relatively high and stable dividends.[5] Despite the fact that the oil price is volatile and the basic revenue model does not merit such a stable flow of dividends, these companies have been able to finance dividends through loans in the bond market. This became particularly obvious during the 2020 corona virus crisis when oil companies were able to finance continuing dividends through record issuance and borrowing from the bond market (Financial Times, 2020b).

5) For example, BlackRock's iShares High-Dividend ETF on 3 April 2020 had a 33% exposure to sectors with high fossil fuel content (energy, utilities) and the single largest exposure was Exxon Mobil at 10.16%.

The primary market offers impact possibilities

"A majority of bond investments are made in the primary market. That is why investor demand for bonds has a direct impact on the capital cost for companies."

Bondholders are significantly more active than equity investors in what is referred to as the primary market for financing.[6] The primary market constitutes direct transactions between investors (those who offer loans) and companies/issuers (those who borrow money). If British Petroleum issues a bond, this is a primary market transaction; the company, together with several banks, goes out to investors and asks to borrow money at a specified rate or yield. If BP manages to get enough traction, the transaction will go through. Investors send money to BP (buy the bond) and BP commits to pay coupons and repay the loan at the time of the bond's expiration date (sells the bond). If not enough investors are willing to buy the bond at a certain interest rate, BP will need to increase the interest rate on offer (the yield) in order to gather more investor interest. The higher yield that BP offers is a direct cost to the company. Hence, divestments, meaning decreased demand for bonds, would have direct capital cost effects. Higher bond yields (lower prices) translate directly to lower earnings and worsened cash flows for a company, even though it seldom becomes as dramatic as during certain government crises.[7]

This can be compared to the secondary market where investors are matched to buyers and sellers without any effect on the financial flows of the issuing company. If an investor sells Exxon Mobil shares, this has no direct impact on the company's access to capital since there is another investor buying them. As long as investors' transactions do not affect the company financially, divestment is less meaningful as a direct impact methodology (Ansar et al., 2013). If it receives media attention, divestment can send an important signal to management and contribute to stigmatizing a company or sector, thereby having an indirect impact (Ayling and Gunningham, 2017; Bergman, 2018). As a purely financial mechanism, however, it is not particularly efficient. Research has shown that even though an announcement by investors of a decision to divest from fossil fuel sectors has put pressure on the stock market prices for fossil companies in several cases, the effect is only short term in nature (Dordi & Weber, 2019; Hansen & Pollin, 2018).

Credit spreads as an impact tool

One mechanism that is useful to understand is how bond market divestment can be used as a tool to drive climate issues by affecting the bond yield that an issuing company is facing. Investors could try to increase the yield by selling bond holdings, thereby increasing the cost-of-capital of the company, even potentially putting the company at risk of bankruptcy due to excessive borrowing costs. This section explains such a process.

The two most important components of the yield and the value of a bond is the risk-free interest rate and the credit spread. The risk-free rate is the return that can be obtained by not taking on risk in any given period. The credit spread is the difference between the price/interest rate of different bonds that have the same return on investment but different credit ratings. If a bond issued by Vodafone has an interest rate of 3 per cent and a (risk-free) government bond with the same expiry date has an interest rate of 2 per cent, then the credit spread is the difference between the two (3%–2% = 1%).[8]

6) In 2019, USD 228bn was issued in primary market equity transactions in the United States. The average daily turnover was USD 322bn, a primary/secondary quota of 0.7x. In corporate bonds, the corresponding numbers were USD 1,400bn in issued capital and an average daily turnover of USD 34bn, a primary quota of 41.2x. Source: SIFMA, 4 May 2020, https://www.sifma.org/resources/archive/research/statistics/.

7) This was at the core of the euro crisis. When the crisis hit its peak, Italian 10-year government bonds were quoted at 7%. If Italy had had to borrow at that yield for an extended period, the Italian government would have been insolvent. In extremis, this applies to all borrowers that need to extend their loans when they expire.

8) In bond portfolio management, credit spreads are expressed as basis points (bp); 1% corresponds to 100bp.

If the risk-free rate changes, then the price and interest rate of the Vodafone bond would follow by the same magnitude, so the credit spread would be unchanged. Should Vodafone struggle as a company, the bond would be valued lower relative to the government bond. The interest rate on the Vodafone bond would increase but the risk-free interest rate remains unchanged so in this case the credit spread would widen.[9]

The credit spread is, in somewhat simplified terms, the level of compensation for the risk that Vodafone might default on its bond, which is typically the same as filing for bankruptcy. There is thus a strong connection between the credit spread and the probability of bankruptcy. A higher probability means a higher credit spread and vice versa. This connection is of fundamental importance from a sustainability perspective. The credit spread can be used to assess the probability of bankruptcy that the market assigns to a company. In practice, we can hypothesize that fossil dependent companies have an elevated bankruptcy risk in the energy transition and compare this fundamental valuation to where the market is actually pricing that risk. Figure 2 shows a graphical presentation of the relationship between the credit spread and the probability of bankruptcy.

There is also a certain recursiveness in this relationship: a higher credit spread, all else being equal, means a higher probability of bankruptcy. Hence, if action is taken to push credit spreads upwards for companies believed to be unsustainable, for example as a result of their levels of CO2 intensity or their goals surrounding climate change in response to upcoming regulation, the probability of these companies going bankrupt increases. As is mentioned above, higher interest rates on a company's bonds translates into deteriorating cash flows through higher borrowing costs in the primary market or other loan facilities. Investors that wish to challenge fossil fuel-intense companies could therefore actively sell their bonds, thereby increasing the credit spread and driving the price down. This would have a fundamentally negative effect on the companies.

9) In practice, bond portfolios are often managed so that the interest rate and credit component are separate. An owner of a Vodafone bond tends to hedge the interest rate risk through interest rate swaps or government bond futures in order to maintain the credit spread.

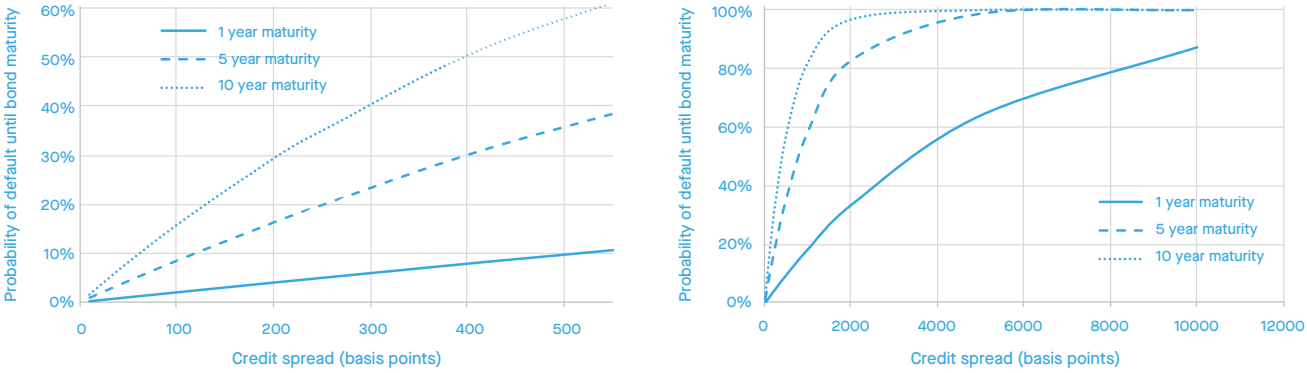

Figure 2. Credit spreads and the probability of bankruptcy. Graphs show the relationship between the credit spread and the cumulative probability that the underlying company will file for bankruptcy during the duration of the bond (the number of years to the expiry of the bond). For example, the graph to the left shows that a bond with a five-year maturity is traded with a credit spread of 100bps, indicating a probability of bankruptcy of 8.4% in the coming five years. If you believe that the probability of bankruptcy is higher you should "buy the credit spread" / "sell the bond" and vice versa.

Source: Bloomberg and the authors' calculations. Date of pricing: April 7, 2020. We have assumed a coupon of 1% and a remaining value of 40% in the bankruptcy.

Short selling and speculative attacks

A more extreme way of influencing credit spreads is through the practice of short selling. Selling short can be explained as the speculator offering to replace the payout from a bond with his or her own money. As an example, an investor could put on a short position on Exxon Mobil by informing the market that: "if you buy an Exxon Mobil bond in the market, you will receive a yield of 4 per cent, but we will offer a yield of 4.1 per cent for an identical cash flow and based on the same credit risk (Exxon Mobil)." When Exxon Mobil then wants to borrow money directly from the market (the primary market), the yield offered must be, all things being equal, higher than the yield offered by the short seller for the same amount of risk. In extremis, a short seller with an unlimited balance sheet or assets could make it impossible for Exxon Mobil to borrow money in the market by always making a higher bid in terms of yield.

Such extreme situations, "speculative attacks", are not very common, but still occur at a relevant frequency for bond investors to be aware of and potentially use. Theoretically, investors could, for example, use such attacks against coal mining companies that have a fundamentally questionable business model, and thereby increase the speed of liquidating these companies (Erlandsson, 2018).

Impact through interaction and clear expectations

"I used to think that if there was reincarnation, I wanted to come back as the president or the pope or as a .400 baseball hitter. But now I would like to come back as the bond market. You can intimidate everybody."

James Carville (1993), adviser to US President Bill Clinton

Another aspect of primary market transactions is that the company seeking to issue bonds needs to have a dialogue with and market themselves to investors to get the best possible terms for the bond issue. As a result, there is a close interaction between the company and its bondholders at events such as "roadshows". There are not as many investors per transaction in the bond market as there are in the equity market. This gives bond investors substantial opportunities to make an impact (see e.g. Global Capital, 2018).

Bond investors could also give better terms to sustainable companies if they believe that such sustainability will have a positive impact on the company's future earnings. This could be a reason for companies to listen to investors in the first place. There is limited research on the relationship between environmental, social and governance (ESG) issues and the pricing of bonds, but an overview of studies published in 2016 shows that ESG factors could be correlated with credit quality. The cost of capital increased by as much as 64 basis points and was on average 20 per cent higher for companies with worse environmental qualities than their similar competitors (Clubb et al., 2016). A Chief Financial Officer (CFO) with experience of her company borrowing money at a higher cost than more sustainable companies could therefore have an incentive to raise environmental questions if she believed that this might lead to reduced borrowing costs.

It might be thought that one basis point, or 0.01 per cent, does not matter very much, but it can. If company X borrows USD 500 million in the bond market with a 10-year expiry date, each 0.01% difference in the issued bond's coupon (at a discount rate on future cash flows

of 2.5%) makes a difference of USD 430,000 for the company. It is important to appreciate this in order to understand why many CFOs listen to investors – a few basis points of lower borrowing costs translate into sizeable incentives on the individual's level.

Passive investments: taking climate into account when using an index investing approach

To divest – meaning to sell the entire holding in a company or even an entire sector – as a result, for example, of climate concerns could only be done in the active part of an investor's portfolio. Many asset managers invest in passive products, however, meaning that they invest in the constituents of a certain index, which makes it impossible to sell at their own discretion. Index investing is a fast-growing part of the market (Fink & Novick, 2018).

Over time, credit ratings agencies have become increasingly interested in including sustainability risks in their credit ratings. The first credit derivative index to include ESG issues was launched in March 2020. Work is continuing to introduce indices with lower CO2 intensities. This development is still in its early stages and bond portfolios are still managed against indices that do not take sustainability into account.

Currently, many of the large investments in, for example, bonds issued by coal mining companies originate from passive managers who are following an index. The world's largest asset manager, BlackRock, has announced that it will exclude coal from its investments, but this only applies to the active book, which is a much smaller part of the total assets managed compared to their passive investments.[10]

With regard to passive investments, there are significant development opportunities when it comes to restructuring underlying passive indices to take climate change into account. There is also some evidence that doing this could achieve excess returns. Polbennikov et al. (2016) identified significant excess returns from allocating bond portfolios to "ESG leaders", that is, companies leading on ESG issues in their respective sectors. Figure 3 shows that S&P's CO2 efficient S&P 500 IG Bond Index,[11] which was constructed based on the ECOBAR model (Erlandsson, 2017), has had an annual excess return of 0.24 per cent compared to the "original" index.

"Passive investments via standardized indices are common in the fixed income market. It is possible to reconstruct such indices."

10) BlackRock manages approximately USD 7 trillion, of which USD 1.8 trillion (25%) is actively managed. The decision was to divest from companies that obtained 25% or more of revenues from thermal coal, i.e. coal that is burned for heating or electricity production. This does not apply to: (i) passive investments (75%); (ii) conglomerates where more than 25% of revenue is related to other energy sources, electricity networks or other type of activities; or (iii) "coking coal". See e.g. Bloomberg (2020b) and BlackRock (2020).

11) For the complete methodology and information about the index, see: https://us.spindices.com/indices/fixed-income/sp-500-bond-investment-grade-carbon-efficient-index and the benchmark index: https://us.spindices.com/indices/fixed-income/sp-500-investment-grade-corporate-bond-index. Note that the CO2 efficient index reflects a rebalancing of the original index but contains exactly the same issuers.

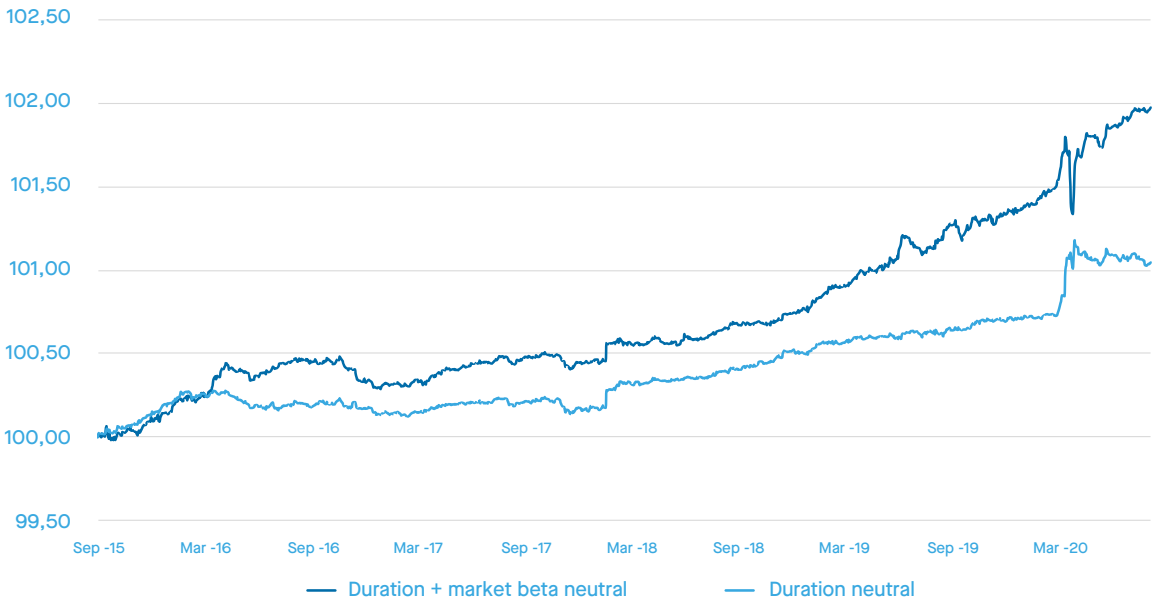

Figure 3. Excess return from the S&P 500 investment grade carbon-efficient index compared to the original index.

Source: S&P Dow Jones indices and the authors' calculations. The indices are adjusted to the same interest rate sensitivity/duration.

The downside risks and insurance possibilities of bonds

"The returns on bonds are characterized by small high-probability profits and large low-probability losses. "

An investor in a bond could lose 100 per cent of the capital invested but can never get back more than the nominal amount plus the coupons paid out during the life of the bond. For this reason, bond investors are more focused on downside risks, or risks that are associated with losses. When investing in equities, by contrast, the downside is also 100 per cent but the upside potential is unlimited.[12]

The bond market typically has significant tail risks, meaning risks that are unlikely to happen but when they do they lead to big losses. Many sustainability-related risks have such tail risk properties. It can be difficult to foresee that a dam will burst, for example, but if it does the consequences will be catastrophic. Corruption scandals and oil leakages are other examples of such risks.

Early-stage research[13]. on the subject suggests that tail risk insurance costs increase for CO2-intensive companies when public attention on climate issues is heightened (Ilhan et al., 2020). Generally speaking, research shows that options for protecting against tail and variance risks become more expensive when there is a high level of political uncertainty (Kelly et al., 2016).

CO2-intensive businesses have already experienced such effects in the bond market, as is illustrated in Figure 4. One of the most sizeable risks in the investment grade market in Europe in the 2010s was related to the repricing of bonds issued by Vattenfall. In early 2015,

12) For a longer discussion about the differences between bonds and equities when it comes to risk and return, see e.g. Erlandsson (2020b).

13) Research on the financial effects of CO2 intensity generally encounters significant problems when it comes to data. The limited data meant that early studies often relied solely on Scope 1 (direct emissions) and Scope 2 (indirect emissions) data on CO2 intensity. Over time, larger studies covering a broader spectrum of companies and issuers, and higher quality data, such as on Scope 3 emissions from the entire value chain, should be expected.

Vattenfall issued a EUR 1.5 billion hybrid bond[14] at an average yield of approximately 3 per cent. Shortly after the issuance, as was the case for other European utility companies, the market began to question the valuation put on the company's coal business. As the re-evaluation of coal intensified, the price of the newly issued bond fell by 25 per cent in one of the largest price drops of a newly issued investment grade bond in history. For an investor seeking to invest in bonds for protection, a price drop of 25 per cent is hard to accept, even though the price recovered over time. At the trough, the bonds were traded at a yield of 6 per cent. It is likely that the significantly higher capital costs implied by this had a substantial impact on the estimated costs of shutting down the coal business. Its lignite activities were put up for sale latter part of 2015.

"Insurance contracts on bonds (CDS) could also be relevant from a sustainability perspective."

Example: The bond market pricing in coal-related risks

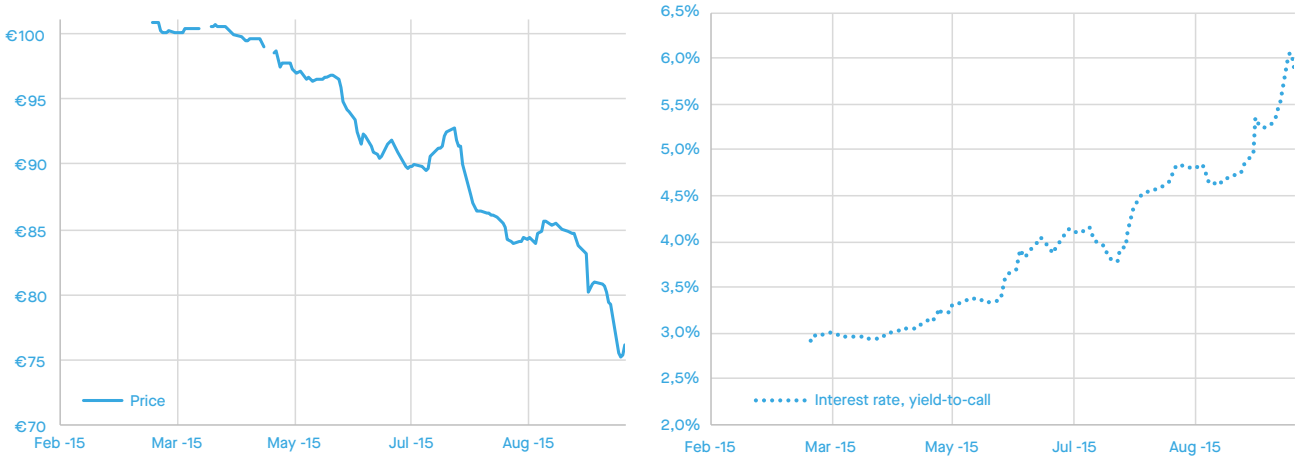

Figure 4. Vattenfall 3% Perp, call 2027, hybrid bond in €. Bond price after issuance in February 2015 (left) and yield/implicit capital cost (right). The initial price was €100 for a capital cost of 3%. The price fell to around €75 in September, translating into an implied capital cost of 6%.

Source: Bloomberg and authors' calculations.

The asymmetry inherent in bonds, with their large downside risks, translates into a need to find insurance solutions. In the same way as private individuals buy insurance for low-probability events, such as the risk of the house burning down, there is also an active market for bond insurance. Credit Default Swaps (CDS) are one way for investors to insure bond portfolios against downside risks. There is, however, no requirement for the underlying asset to be owned by the insurer. Hence, investors can buy insurance protection in the CDS market for issuers that are believed to be at high risk without owning the actual bonds.

What implications does the CDS market have for sustainability? First and foremost, this gives investors an opportunity to speculate on certain companies that do not have climate-related risks priced into their bond valuations. Exxon Mobil, for example, currently has very low risk priced into its credit spread. Buying CDS protection in Exxon Mobil is therefore a direct way of speculating that higher climate-related risks will be priced into the company's bonds over time.[15]

14) A hybrid bond is a bond that can be converted to equity capital if the company's financial condition deteriorates. This buffer property involves higher risk than a regular bond and a wider credit spread. Bonds that take on equity-like risks are referred to as subordinated capital and are most commonly used by banks, financial issuers and power companies.

15) The share price of Exxon Mobil fell by 33.4 % in the first four months of 2020. The five-year CDS spread increased from 0.35% to 0.74%.

Such speculation can have an impact on the bond price and the capital costs of Exxon Mobil.[16] The market's pricing of CDS, or the CDS spread, is an important input factor when new bonds are issued and priced, and also affects the pricing of different types of credit facilities (see e.g. Ivanov et al., 2014). A bank quoting a yield for a credit facility for a company, so-called revolving credit,[17] will price in how expensive it will be for them to hedge against the company's risk, which will be done in the CDS market if possible. As a result, the interest rate that the company receives on its credit facility will be directly linked to the CDS spread. During the COVID-19 pandemic, many companies have used their revolving credit facilities as a first port of call to obtain liquidity (Financial Times, 2020c).

Bond curves and the time perspective on climate risk

Bond issuers face important decisions when borrowing money – and so do investors when trying to evaluate the risk profile of an individual bond. One of the most important risk factors is the time to maturity.[18] When BP borrows USD 1 billion by issuing a bond with a time to maturity of 30 years, this has a significant impact on financing risks for a long time to come.

At the same time, investors need to carefully analyse very different climate risks if they are lending on/investing in a bond that is to be repaid in 30 years as opposed to 2 years. This creates opportunities for investors to initiate so-called curve positions on bonds. An equity investor simply chooses whether to invest in the BP stock or not. As a bondholder, there is a decision to be made on making an investment over different time horizons.

It could be that the market believes the risk premium for BP should be 0.3 per cent annually over the risk-free rate for a three-year horizon, but maybe 0.5 per cent annually on a 30-year horizon. In this case the curve is said to be 0.5% – 0.3% = 0.2%. The investor then needs to judge whether the curve is "correct". If the investor believes the curve is too flat, there is the possibility of building a position to profit from a steeper curve; or, in other words, to prepare for a scenario in which the market starts to assess the long-term risk as higher relative to the short-term risk. For a demonstration of common credit curve trade techniques see, for example, Rennison et al. (2008).

16) There is an arbitrage argument regarding the CDS spread and the bond spread, see e.g. Bai & Colin-Dufresne (2018).

17) A revolving credit facility is a binding contract on behalf of a bank or bank syndicate to lend money to a company directly. This can be compared to a personal overdraft. In the early days of the COVID-19 pandemic, many companies maxed out their credit facilities to access liquidity..

18) Other parameters include currency, subordination and coupon (floating or fixed).

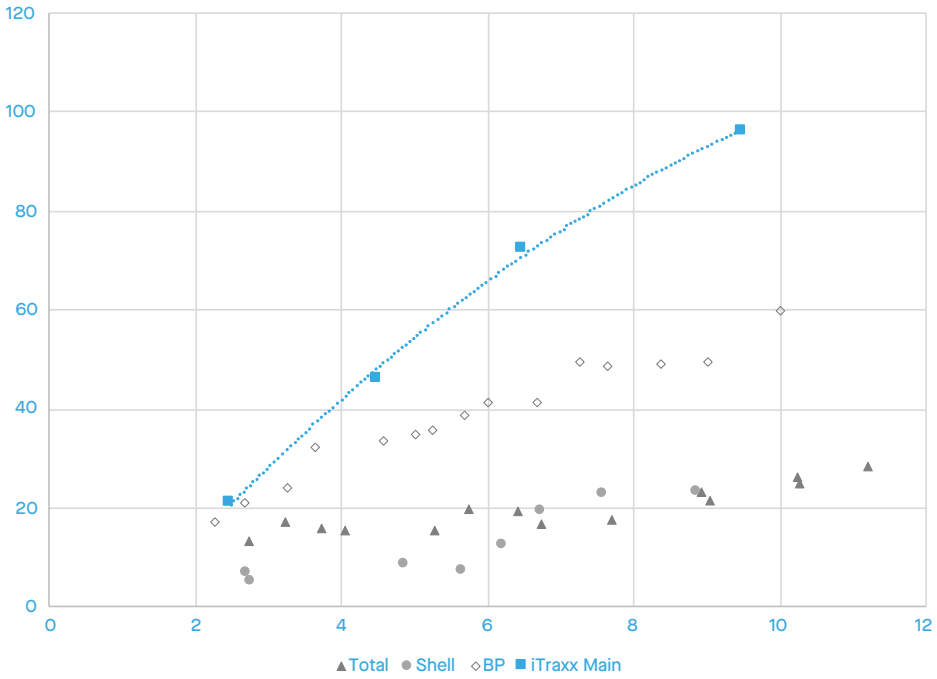

Figure 5. Bond curve credit spreads for three oil company issuers and a broad credit index. iTraxx Main, 2091H1.

Source: Bloomberg.

All this could have significant implications for how the markets prices climate risks. Big oil companies' bond curves appear to discount very low long-term risks in their business models. The bond curves are quite flat from 3 year maturities and further out. BP will likely still be around in three years, regardless of whether the company makes structural changes on renewable energy. The long-term risks, however, are substantial if there is no effort to transition into renewables. In today's market, however, as is illustrated in figure 5, many fossil-intense companies have flat price curves, indicating high short-term risks relative to long-term risks. Hence, the market seems to believe that there are bigger risks for BP in the short run relative to the long term. This inference is even more clear for Total and Royal Dutch Shell who have flatter long term curves.

For investors, the shape of the curve can send an important message to companies. An investor may be looking to provide capital to BP under the condition that the proceeds will be used to transition the business model from fossils to renewables. The company might accept this in spirit, but through the traditional bond market the lender will have little legal recourse over the company to actually fulfil such a transition commitment. However, by only agreeing to lend shorter term, e.g. over three years, the investor achieves a form of control. If BP does not comply, the investor simply will not renew the loan. Thus, the willingness to finance over the longer or shorter term plays an important role in incentivizing companies to actually execute on commitments.

Central banks and their impact on the bond market

Central banks have become an increasingly dominant player in the bond markets. Despite their dominance, however, they have taken few initiatives in relation to sustainability. The world's central banks currently hold bond portfolios of approximately USD 10,000 billion for the management of foreign exchange reserves alone.[19] Central banks are also big players in the government bond markets. For example, they own 20 per cent of Australian government debt (IMF, 2020; Australian Office of Financial Management, 2020),[20] and are thereby financing the world's largest exporter of coal and the world's third-largest exporter of fossil fuels (Australia Institute, 2019). The Swedish Riksbank has begun to analyse its bond holdings from a climate perspective , and the European Central Bank is starting to look at climate risks in its bond portfolio. November 2019, the Riksbank decided to sell its bonds in the Canadian province of Alberta and the Australian states of Queensland and Western Australia because of their large climate footprint (Sveriges Riksbank, 2019; Environmental Finance, 2020). It should be noted that the government bond market is a source of financing for global public fossil subsidies, which were estimated to be USD 5.2 billion or 6.5 per cent % of global GDP in 2017 (Coady et al., 2019).

Additional central bank resources of approximately USD 11.5 billion (Papadopoullos, 2020) are in the non-conventional portfolios linked to quantitative easing (QE). It is here that "green QE" is being discussed. Green QE would occur when a central bank conducts a bond purchasing programme that prioritizes a larger share of green bonds over regular purchases. (For more on the effects of QE on corporate bonds, see Todorov, 2020, among others.) Such a policy would primarily affect the proportion allocated to corporate bonds, which have historically been a small part of QE programmes.[21] The QE programmes launched in response to the COVID-19 pandemic are explicitly tilted towards corporate bonds, which will increase the importance of these programs in the future.

Central banks sometimes play an important role as managers of national funds, the Norwegian Oil Fund or the Monetary Authority of Singapore (MAS) being typical examples. Should the Norwegian Oil Fund, which has over USD 1 billion in assets under management, decide not to invest in certain bonds, this would have an impact on the bond market. Decisions by large institutions not to invest in certain bonds mean a permanent shift in demand for this type of capital. Once again, this translates into issuers being forced to offer higher coupon rates on their bonds, meaning increased capital costs, in order to replace the large institutional investors.

In this context, the role of central banks as financial regulators should also be noted.[22] This is outlined briefly in Box 1. Sometimes relatively technical regulations can have an impact on bond valuations and the capital costs of climate-related economic activities. Capital weights are being used as policy instruments in other contexts and this can be controversial. For example, capital weights for holdings in government bonds are often set at zero today, indicating zero risk of investing in these bonds. This means that the central bank or the regulator takes on the risk valuation element that would otherwise be handled by the

19) The foreign exchange reserve is a portfolio of foreign bonds that is kept to maintain the ability to process international payments in the case of disturbances in the supply of foreign currencies. For example, the Swedish Riksbank holds US government bonds that can be sold to obtain US dollars should Swedish companies be unable to obtain US dollars for themselves.

20) The authors make the assumption that at least 50% of the official figure for central bank holdings of AUD bonds is in government bonds.

21) For example, the ECB has implemented a quantitative easing programme of €2.1 trillion, of which €195 billion, <10%, has been invested in corporate bonds (ECB, 2020). The COVID-19 pandemic could affect these numbers significantly over time. The federal reserve had not bought corporate bonds before the current crisis.

22) In Sweden there is a difference between interest rate policy, which is set by Riksbanken, and financial regulation, which is undertaken by Finansinspektionen.

market (BIS, 2017). The discussion about so-called green risk weights is ongoing, not least within the Swedish Riksbank (Breman, 2020) but also at the international level – often in the shape of increased risk weights for fossil fuel risks (Financial Times, 2020d; Philipponnat, 2020).

Increased focus on the bond market and its link to the climate change mitigation

This report shows that there are obvious links to the climate and that there is considerable potential for investors to use their bond mandates to contribute positively to climate change-related investments. Academic researchers, market participants, the environmental movement, politicians and others who study sustainable finance or have an agenda for sustainable investing should put more emphasis on this aspect of the capital market.

The report also identifies questions that require further investigation, not least through academic research.

- We know something from previous research about how shareholders conduct so-called shareholder engagement (e.g. Sjöström, 2008; 2020): but to what extent are bond investors using their impact possibilities through roadshows and other interactions with the companies they are considering financing or refinancing? What do these processes look like? What are the potential obstacles to climate issues receiving greater attention? To what extent is there cooperation with colleagues in equity markets on discussions of climate impact investing? How is the climate question valued financially by investors?
- How does the climate question – or sustainability more generally – affect the pricing of bonds? There is nascent academic research on the subject (see e.g. Zerbib, 2019; Hachenberg & Schiereck, 2018) but more research is required.
- To use short selling, that is to use speculative positions to profit from falling prices, is often considered controversial. At the same time, however, it is useful to investigate, empirically or theoretically, whether it is more efficient to make green investments in a Swedish real estate company or to sell certain fossil-intense companies short, and to undertake other comparisons of this kind.
- How do central banks see their role with regard to climate change, as investors and regulators respectively? What effects would central banks have on the fossil fuel sector's capital costs if they redirected their holdings to less CO2-intense alternatives?
- Regarding the development of passive indices within the fixed income asset class: how could broad flexible indices with less climate impact be constructed? In addition, can cheap investment products be designed based on these indices?

- The “term structure of interest rates” has received widespread attention in financial research (see e.g. Cox, Ingersoll and Ross, 1985; or Merton, 1974). How can the research on the time aspect of climate scenarios be integrated into the shape of bond curves?
- What does the price relationship between the supply of and demand for capital look like in the bond market? In other words, what effect would the decision to exclude certain bonds have on interest rates and the capital costs of the borrower? In this context, it should be possible to devise central bank models related to how bond purchases drive down interest rates costs, thereby stimulating the economy. This would be a constructive way of starting to measure the climate effect of investment decisions on bond portfolios.
- How important is the bond market as a source of financing that allows listed fossil fuel-intensive companies to ensure stable dividend flows?

The role of the regulator: How risk weights work

A bank has equity capital of USD 100. The bank regulator[23] decides that the risk weight for lending to companies should be 25%. This means that for every dollar that the bank lends, it needs to set aside 25 cents as a buffer should the loan not be repaid. As a consequence, the bank could lend $100/25% = $400. The risk weight simply determines the maximum amount that the bank can use for its lending activities.

If the bank regulator increases the risk weight for “non-green” loans to 30%, then the bank can lend $100/30 %=$333 to non-green projects. If the regulator decreases the risk weight for “green” loans to 20%, then the bank can lend $100/20 %=$500 to green projects.

Assuming that the bank has a required rate of return from shareholders of 10%, meaning an annual dividend of $10, the bank would need to have a margin on its lending activities of $400 * x = $10 ↔ $10/$400 = 2.5 % in the base case scenario with neutral risk weights. In other words, if the bank pays 2% interest to its savings clients, it would need to lend money at an interest rate of 4.5% to achieve the shareholders’ required rate of return.

If the bank regulator requires the use of “non-green” risk weights, then the bank would need a margin of $10/$333 = 3 % for such lending, with a total interest rate of 2 %+3 %=5 %. For green financing, the required margin is only $10/$500 = 2 %, with total interest on the green loans of 4%. This means that a marginal shift of risk weights can shift the relative lending and capital cost of brown and green lending quite substantially. In this case, the green borrower gets a 1 per cent cheaper loan and a lower cost of capital compared to the non-green borrower.

23) Bank regulation is often part of a central bank’s mandate. In Sweden it is Finansinspektionen, not the Riksbank, that is responsible for the regulatory oversight of banks and for setting risk weights.

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