JÖNKÖPING UNIVERSITY
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Building a Green Living

Measuring the green bond premium on the Swedish real estate market

Master Thesis Project in Business Administration, Finance

Background: With the first green bond being issued in 2008 as a joint venture between World Bank Organization and the Swedish bank SEB the financial instrument has made an impact on the financial markets. With a high demand for sustainable investments in Sweden partly due to policies a premium for the green bonds is to be expected at least according to theory. The real estate market has adapted to the increased demand for green investments by moving more towards green bonds, and rightfully so as it is one of the largest polluters seen by sector. In result, it is also one of the largest issuers of bonds which creates an excellent opportunity to research the industry as there is plenty of data available.

Purpose: This report will examine the premium of green bonds in the Swedish real estate market. Furthermore, it will also examine the effects of Covid-19 and to what extent this pandemic had an impact on green bonds.

Method: The thesis examines the Option Adjusted Spread (OAS) of 166 bonds of 9 different companies from the start of 2016 to December 2020 within the Swedish real estate market. Control variables such as Company risk, Market risk and Macroeconomic variables were used in an OLS regression to estimate the premium. The effect of the Covid-19 pandemic was also examined.

Conclusion: After analyzing 53 green and 113 conventional bonds no significant results were found on how premium differs between green and conventional bonds. However more general findings were found that suggest bonds become more sought during the

Covid-19. It was further found that the green bond market is rapidly growing and may in a few years be in a better position to be examined.

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Acknowledgement

1. Introduction

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This section aims to introduce the topic of Socially Responsible Investments (SRI) and the green bond market. In addition, it also aims to highlight the problem as well as purpose and delimitations.

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1.1 Background

Over the last decades, sustainability and environment demand has grown. According to a survey done by Svensk Handel (2019) the interest in sustainability has increased heavily. In 2019, almost four out of five consumers stated that sustainability is important. This change in consumption behavior affects businesses, and almost all Swedish companies with 50 or more employees stated that they work with sustainability questions. This change is also visible in the financial market. Jansson el al. (2014) shows that Swedish pension beneficiaries tend to prefer pension funds that engage in sustainable investments.

This comes as a result to the increased worry over climate changes. United Nations (2019) announced global warming to be one of the major threats to the human race during the next century. According to the European Environment Agency (2019) between 1980 and 2019 the economic losses from disasters linked to extreme weathers and climate-related extremes amounted to 81% of all economical destruction caused by natural causes such as with melting polar ice, extreme weather events and the threat of increased sea levels. The total costs amounted to 11.1 billion per year, or almost 3% of the GDP of the countries being analyzed. This clearly demonstrates the risks of our overuse of our planet and the urgency of action.

The Paris Agreement was the starting point for many of the green products offered by the financial industry. The aim for The Paris Agreement is to limit global warming and is of great significance as it's one of the first and largest agreements written between multiple countries within this field. The agreement is signed by 196 countries and the aim is to make a united effort to reduce climate change. Part of this agreement involves Economics

disciplines and specifically for Finance there is a new direction called Sustainable Finance. (UFCCC, n.d)

European Unions, (n.d) definition of sustainable finance is investments that are aimed to support economic growth while considering the social and environmental effects. To counter the increased worry over the environment, the European union has set sustainable finance goals for both the long and short term and as a consequence of these the green offerings within finance have greatly increased. In order to reach the energy and climate targets for 2030 around 350 billion euros are required per year in green investment which is too big for the public sector to fund alone. The private sector is therefore a key player in reaching these goals and it can be done through re-orienting investments to fund more sustainable businesses, more long-term projects and lastly to also contribute to a circular economy which is resilient against environmental impact.

As a response to the increased demand for sustainability, the World Bank Organization issued the first green bond in 2008 together with SEB to satisfy the rising demand for sustainable investments. Green bonds make it possible for investors to invest their capital safely while also contributing to the improvements of the environment (SEB, n.d). Over the last decade green bonds have increased dramatically, and Sweden's green bond market has over this period grow to become one of the 10 largest issuers of green bonds by 2018 (Climate Bond Initiative, 2020a). However, the green bond market is still facing challenges going forward. As of 2019 the global green bond market is dwarfed by the conventional bond market. The green bond market represents between one to two percent of the traditional bond market (Deschryver and Mariz, 2020).

When an investor chooses to participate in Socially Responsible Investing (SRI), they tend to look at more factors than just the pure financial return. Fama and French (2007) demonstrated that when investors prioritize certain investments the market equilibrium shifts, and the traditional Capital Asset Pricing Model (CAPM) can no longer predict the returns of the given asset. They explained this phenomenon through that investors care about other things than just sheer performance of their investments. Investors may also look at what effects their investments may have further in the future and the effects it may bring. With green investments being a step in the right direction towards combating global warming as well as making the finance industry more sustainable. It is therefore vital to

examine if investors would pay a premium to hold green bonds. In addition to this, policy changes may also reshape the landscape for SRI.

Karpf and Mandel (2018) suggest that a tighter yield spread demonstrates that investors are willing to pay to hold more environmentally friendly bonds. If the spread of a green bond is tighter than that of conventional bonds investors are choosing to pay a premium to hold green bonds. Further, for the companies that issue bonds at a tighter yield spread will gain a lower capital cost which subsequently will increase the investment opportunities of the company.

Heinkel et al. (2001) found as green investors allocate more resources towards more environmentally friendly investments it therefore removes it for more polluting companies driving up their cost of capital. Therefore, the green bond premium reflects investors' demand for green investments. As the demand for green investments have increased, some fund companies have created funds that only invest in green assets. The increased capital allocated to green assets removes resources from more polluting companies further driving their capital costs up.

Turning to the real estate sector, it carries a large role in global pollution. Birol and Andersen (2019) state that in 2018 buildings and construction accounted for 39% of energy and process-related carbon dioxide emissions. Out of the 39%, the construction of buildings and infrastructure stood for 11% of the world's emission. Emissions have steadily increased from this sector over the last decade. Having a more environmentally friendly constructing process as well as producing more green buildings are therefore essential to reach the goals set by the Paris agreement. According to the climate bond initiative (2020b) The real estate issuers of green bond are a large part of issuers in Sweden and the financing of buildings amounts to 35% of the volumes of green bonds in 2020 and as such has been embracing the new financial instrument rather well. At the same time, it remains a fairly unexplored market in terms of research (Climate Bonds Initiative, 2020b).

Further, during the start of 2020 the world was getting increasingly worried of a new pandemic which was starting to spread in Wuhan, China. On the 22 of February the Italian government decided to implement a quarantine in areas which had been extra affected by

the Covid-19 virus (Nozawa & Qiu 2021). Goodell's (2020) study regarding financial markets and Covid-19 mentions that there have been many pandemics throughout the years (some being global while others are more concentrated to certain areas) and many of them have had a large impact on the financial markets as they cause economic losses. Epidemics are present in a certain area and with a comparatively lower death toll in comparison to pandemics which spreads throughout a wider area or on a global level with a higher death toll. One can expect losses to be 0.6% of global income or about 500 billion USD annually for future pandemics. During the years 2011 and 2018 the World Health Organization tracked 1483 epidemic events in 172 countries, which is an indication that they are far more present than one might expect. The real risk of a pandemic outbreak has been stressed about many prior to the Covid-19 outbreak, however very few companies and countries had adequate preparations to combat it. This is rather worrying as a pandemic may lead to bank runs and banks are inherently vulnerable to times of economic downturn. One should also keep in mind that in times of economic crisis governments tend to come with large bailout packages. During the financial crisis of 2008 the US had a bailout package of 750 billion USD while during Covid-19 the package was worth 2.2 trillion USD. The research regarding how epidemics and pandemics effect financial markets are still limited, but one can compare the events to natural disasters or terrorist attacks. Goodell (2020) also mentions that Covid-19 will likely have a major impact on companies' capital structure, and as a result of this some companies may choose to have less leverage.

Because of the high demand for green bonds and the limited supply there should in theory be a premium to owning them. There are a number of studies done exploring this hypothesis on a global scale, however, the results vary. Zerbib (2019), Nanayakkara and Colombage (2019) found a significant premium for green bonds. Preclaw and Bakshi (2015) Ehlers and Packer (2017) found a premium, but they explained it through the lower risk associated with the green bond, while Larcker & Watts, (2020) found no evidence that there would be a premium for green bonds. The results therefore vary, making it hard for companies and market participants to know what to expect from the decision to move their debt towards a greener alternative. Likewise, with new green bonds being a new financial tool, the impact of market uncertainty is still unexplored. The green market therefore needs to be further examined to clear up these issues. In addition to this it is

most motivated to examine how sustainable investments fair during economically challenging times such as the Covid-19 pandemic.

1.2 Problem

The green market boom has resulted in an acceleration of academic research as a consequence of the green market boom. However, the research is still in an early stage, as the analyzable data is still limited. Currently the predominant part of previous literature on green bond pricing is done on a global scale, examining large datasets (Nanayakkara and Colombage, 2019).

As the research up until now has been mainly done on the global market, we will look at one market to see how the premium is acting on a national level. The real estate market has adapted to this new financial tool in a greater proportion than other sectors and is therefore a good market at analyzing. In relation to this, Sweden has also adapted quickly to the green bond market and is one of the largest green bond markets in Europe (Climate Bond Initiative, 2020a).

The market uncertainty associated with the development of the Covid-19 pandemic saw a direct response in the financial market. It is therefore both interesting and relevant to measure the effects of market uncertainty for green bonds. Something which, due to the timing of this thesis, have not been explored to any great extent.

1.3 Purpose

The purpose of this thesis is to examine if there is a green premium on bonds issued by Swedish real estate companies. Our thesis will examine green and conventional bonds issued by Swedish real estate companies. While we will exclusively examine how green bonds are traded in the secondary markets, the pricing in the secondary market will have a correlation to how companies can price their future bonds in the primary market. When looking at the performance of financial instruments one usually turns to data in the secondary market. If a green bond is issued at a premium to conventional bonds this increases the incentives for companies to issue green bonds for lower cost capital. This subsequently provides more investment opportunities for the firm (Cavallo and Valenzeula, 2007). This will highlight the benefits that real estate companies can gain by

issuing green bonds. However, the main result will relate to how willing investors are to accept lower returns to hold green bonds.

1.4 Hypothesis

H:1 Investors pay an economic premium to own green bonds issued by Swedish real estate companies.

H:2 Covid-19 will have an impact on the premium.

1.5 Delimitations

This thesis will solely look at the performance of corporate bonds issued by Swedish real estate companies between the years 2016 and 2020. Moreover, the companies were required to have issued both conventional bonds as well as green bonds, both with fixed coupons. By choosing only companies that have issued both times of bonds we can account for the firm-risk in our model. The thesis will also only sample data from companies with public information, this means listed companies or companies which report their financial debt structure. Only senior unsecured bonds with fixed coupons will be part of the dataset.

2 Literature Review

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This section will examine what previous studies have found but will also look into what models and methods have been used to come to these results.

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2.1 Green bond market

Bonds are fixed-income securities which gives the issuer the possibility to borrow capital from the bondholder. The bondholder will as compensation receive a flow of cash in return. Corporate bonds have a higher risk associated with them as compared to their government counterparts. This risk means that investors require a higher yield in return. As a response to the increased demand for sustainability among consumers and investors, companies have started to issue green bonds. Green bonds give investors a place to invest

their money while at the same time contributing to projects which will benefit the environment (Karpf and Mandel, 2018).

The definition of a Green Bond according to the International Capital Markets Association (2018, p.3) is "any type of bond instrument where the proceeds will be exclusively applied to finance or refinance, in part or in full, new and/or existing eligible Green Projects." To be more specific the International Capital Markets Association (ICMA) also gives guidelines and examples of what these projects may be. The proceeds are permitted to be used for renewable energy, energy efficiency or pollution prevention and control. In addition to these there are also other criteria, namely if the company aims to manage land or natural resources in an environmentally sustainable way, aim to conserve land or aquatic based biodiversity, climate change or if it helps the company to adapt to climate change. Lastly the bond can also be issued as a green bond if it is" eco-efficient and/or circular economy adapted products, production technologies and processes; and green buildings which meet national or inter-nationally recognized standards or certifications." (International Capital Markets Association, 2018, p.4)

Although the Swedish economy is quite small in comparison to the major economies in Europe, it has been fast at embracing the new financial tool of green bonds according to Climate Bonds Initiative (2020a). With the demand for green alternative investments in Sweden, the number of issuances has gone up dramatically. However, as a consequence of the Covid-19 pandemic the amount issued has seen a decline according to Climate Bonds Initiative. A noticeable difference of the Swedish and the European market is the size of the green bond issuance. While ranking fourth in the monetary volume issued in Europe, they are first in number of deals in Europe. This means that the Swedish market is issuing smaller bonds and more frequent rather than fewer and bigger ones which we can see in the European market. This is due to the countries such as France and Germany issuing large sovereign green bonds. The average size of green bonds issued in Sweden is 103 million USD (Climate Bonds Initiative, 2020b). Further, besides being fourth in monetary volume issued in Europe, Sweden is also ranked fourth in the world in the number of issuers, hence, the number of companies and public sectors that have issued green bonds. With only the much the larger economies of USA, China and Japan being in front in number of issuers. Climate Bonds Initiative gives a clear picture that Swedish

companies have embraced the new financial instrument rather well. It also means that smaller issuers an advantage to gain the potential lowering of capital costs on their debt.

Likewise, the real estate market has been fast adapting to this new financial tool. Stephan et al. (2021) also mentions that real estate, rental, and leasing issues 11.9% of all green bonds on a global scale, while their share of the conventional bonds is only 3%. Similarly, the construction sector has issued substantially higher amounts of green bonds as compared to their proportion of conventional bonds, with their green bond share being 3.4% of the existing market while their share of conventional bonds is only 0.2%. Constructing buildings with better insulation, more environmentally friendly materials or adding solar panels is an easy way to meet the requirements to issue a green bond and therefore to benefit from the new financial tool. The real estate market has therefore been able to adapt to investors' increased demand for green investments. Climate Bonds Initiative (2020b) finds that this is a phenomenon which is reflected in the Swedish market as well. Of the 15 first time green bond debt issuers in 2020, 12 were from the real estate sector.

By doing interviews with nine Swedish issuers of green bonds and nine Swedish investors Maltais and Nykvist (2020) tried to explain the rapid growth of the green bond market. They conducted 22 in-depth interviews between the fall 2017 and spring 2018 with actors from the Swedish bond market. Among the actors being interviewed were issuers from both public and the private sector, investors for private and public pension funds as well as investment funds and insurance companies. The study also interviewed representatives of two banks, both of which underwrites green bonds, one which underwrites bonds on the exchange and one which is focused on Swedish government bonds. Maltais and Nykvist (2020) highlight that green bonds offer a possibility to invest in an environmentally friendly project while not taking any other unwanted risks. They further found that while the investors responded that there was a difference in yields for a conventional bond and green bonds, they indicated that they would not accept any lower returns. Hence, the participants' statements were contradictory. The study also suggests that there are stronger incentives for green bond issuers rather than green bond investors.

Further, Maltais and Nykvist do not attribute Sweden's swift growth to the financial benefits that can be gained. Rather they point to reasons such as the increased non-

pecuniary benefits of making them look better in the eyes of customers, employees and investors.

2.2 Challenges to the green bond market

The bulk of earlier research on the green premium has been done global scale, examining large datasets but over a short period of time ranging from one to five years.

There have been several different explanations to why there is a difference in valuation between green bonds and conventional bonds. Deschryver and Mariz (2020) mentions issues such as the lack of standardization, greenwashing, more complex process as reasons why a green bond might become a less attractive investment. Barriers and uncertainties such as those make investors less likely to allocate resources towards green bonds, reducing the demand for the product. Maltais and Nykvist (2020) say that there is no lack of demand for green bonds, rather the challenges are the amount of potential green projects and asset available for the companies. The demand for green bonds is large, but according to Deschryver and Mariz (2020) firms only have a limited amount of renewable and energy efficient assets. This disparity between the demand of green investments and the supply available to the market makes it attractive for issuers to do what is known as greenwashing. An issuer that greenwashes signals their assets, product or service as green to gain the benefits but does not take any tangible action towards meeting their environmental obligations.

If there is a large mismatch of the demand and supply of a product then it should be lowered by the invisible hand. The reduced capital cost of issuing a green bond rather than a conventional one would give companies a huge incentive to issue more green bonds. However, as companies have limitations on their number of energy efficient and renewable assets it might not be a possibility (Deschryver and Mariz, 2020).

Franklin (2016) argues that the lack of standardization is problematic, although there have been plenty of improvements. This causes a lack of identifiable incentive for investors and makes it harder for them to detect if the issuer is greenwashing. The green bond market has further challenges ahead. The minimum liquidity problem creates a barrier for issuers as their bonds have to reach a certain size to be attractive to investors. Bond investors tend to prefer investments with 200 million USD in liquidity. This creates a

hurdle as not every company has enough green assets on their books to overcome the threshold. Further, for rating agencies such as Moody's, the bonds need to have a value of 250 million USD to be included in their index (Banga, 2018). Stephan et al. (2021) found that green bonds tend to be issued in slightly larger volumes compared to conventional bonds and in addition to these green bonds tend not to be rated as often as conventional bonds.

This barrier for green bonds was reflected in Kapraun and Schein's (2019) working paper. They studied both the primary and secondary green bond market. Their data set consisted of 21 872 conventional bonds and 2 099 green bonds of the green bonds 1 374 were corporate bonds, 317 were supranational[1] and 408 were government bonds. The data was downloaded from Bloomberg and Reuters. The data was then processed in a fixed effect model to arrive at the following conclusions. In the primary market they found that investors were only willing to accept the green premium in bonds that achieved a certain size. The study noted that the largest 30% of their sample were traded at a premium of 19 Basis Points[2] (bps) while the smallest 30% showcased a lower spread. Kapraun and Schein (2019) further suggest that this could be due to a larger green project indicating a larger environmental impact. Moreover, green bonds that showcased certification or were traded on a green exchange were traded at yields of around 22 bps lower than conventional bonds. However, green bonds that did not possess the necessary certification were penalized by investors and subsequently traded at a discount of around 12 bps.

Maltais and Nykvist (2020) found that the consensus among issuers was that the extra cost of issuing a green bond was not large enough to outweigh the gains in reduced capital cost. However, the study highlighted that the reduction cost of capital benefits still seems small and not enough to affect the company's overall investment decision. They found that the reason most companies issue green bonds was to get a larger investor base, cheaper cost of capital as well as meeting demand from investors. Maltais and Nykvist (2020) could also see that companies benefited more from the financial gains of offering green bonds than the investors, as they benefit from lower interest rates. Lastly, the study concludes that the green bond market in Sweden is driven by business incentive and not

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[1] A supranational organization is one that stretches over many nations. The European union is a good example of a supranational organization.
[2] Basis points are commonly used within the bond market to explain interest rate of the instrument. 100 basis points is equivalent to 1%.

based on financial incentives as these were seen as very minimal. Furthermore, there was a consensus of positive attitudes towards green bonds within the financial sector of Sweden could be observed as only one of the interviewees were negative towards the green bonds market and sustainability.

Further, Kapraun and Schein (2019) finds that on the secondary market they find that green bonds are less liquid than that of conventional bonds, suggesting that the demand is not as high as in the primary market. They suggest that corporate bonds are viewed as less credible and therefore traded at a lower spread. They further suggest that the reputation of the bond issuer as sustainable is a significant factor in the green-conventional yield differential.

2.3 The green bond premium

Zerbib (2019) used a method called *matching method* in his study. *Matching method* also referred to as a model free approach which aims to match a pair of bonds with the same characteristics except for the one which is of interest in the study. An example of this can be to look at two bonds with the same issuing amount, duration, and coupon rate, while leaving the bond label such as green bond or conventional bond to be the only differentiating factor. By then comparing this pair of nearly identical bonds one can fairly precisely examine the effects of the "greenness" and how that impacts the performance.

Zerbib (2019) used a matching method to analyses the difference in the yield spreads of green bonds and conventional bonds by matching a green bond with two conventional bonds with the same maturity date. One conventional bond was used for its duration while the other was used for its outstanding amount. By combining them a more precise match to the green bond can be made. The study included exclusively investment grade bonds. Investment grade bonds are bonds which are rated between AAA to BBB by the credit rating agencies such as Standard and Poor or Moodys. They are believed to have lower chances of default. (U.S. Security and Exchange Commission, n.d) Zerbibs' sample of bonds was gathered from Bloomberg and included 1065 bonds from different issuers. The data includes corporate, municipal, and financial bonds however they all have the same seniority, coupon and rating, the only parameter which is different for every bond is liquidity. These bonds were issued in several different currencies in many different nations across the world. They were issued in AUD, CAD, CHF USD and GBP among

others. Zerbib found a premium for green bonds explained through investors' preference for environmentally friendly investments and suggests that due to lower trade frequency of green bonds on secondary markets the bond yield might not accurately reflect the fair value of the bond. The downside to this model is that you end up comparing bonds from different companies which will give a misleading resolution as you do not take the company risk into account. The finding of a premium of 2 bps was calculated by running panel regression models. This is done by gathering the financial data as well as additional data of relevant independent variables, also known as financial and extra-financial independent variables.

Bachelet, et al. (2019) used an ordinary least square (OLS) model to examine 89 bond couples which had been composed through the *exact matching method* and examined the yield difference between green and conventional bonds. The data was gathered from Datastream and included daily observations between 1 January 2013 and 31 December 2017. Roughly 34% of the bonds in the data set were issued by institutions such as governments, municipalities and an additional 22% were bank issuers. Nationality wise the US represented 22% of the bonds in the sample, Germany 17%, Sweden 11% and Luxembourg 10%. In terms of currency USD was the most common with 44% of the bonds being issued in that currency followed by Euros with 23%. They used a matching method where they took into account maturity date, coupon rate and in which amount the bond was issued. They do not find exact matches for each bond but allow them to differ in predetermined intervals, for example "issue amount" was allowed to be up to four times smaller or larger and maturity was allowed a two-year lead or lag and so forth. They found a small premium of 3.2 bps for green bonds.

According to Stephan et al. (2021) the conventional green bond does indeed trade with a premium. They looked at 1928 green and 184,757 non-green bonds from various international issuers across many different sectors between the years 2007 and 2019. The findings do confirm a green premium of about 15-20 bps in comparison to a traditional corporate bond. The study uses various methods to come to these conclusions. However, Stephan et al. uses two different kinds of matching methods, one called coarsened exact matching and another one called propensity score matching. A regression was performed to measure the spread difference and the study shows that these green bonds are mostly used to fund projects within clean transport, renewable energy, and energy efficiency.

The study also found that the real estate sector, insurance, and construction are the sectors which issue most of the green bonds. Also, according to Stephan et al., Swedish issuers are overrepresented in the green bond market.

Larcker and Watts (2020) found a zero premium on green bonds compared to conventional bonds while looking at United States municipal bonds. Their sample consisted of 640 matched pair of green and conventional bonds. To find their sample the implemented the exact matching method, in addition they also used a t-test as well as a Wilcoxon test. In their model they used bonds which were issued on the same day with the same rating and maturity, furthermore they were also issued by the same municipality. To find an explanation for their findings further tests were made to see if issue amount, supply and liquidity could explain their results, but none of these were found to have an important role explaining the lack of premium. They found that investors are not willing to sacrifice returns and thus a green premium does not exist. In addition to this they also found that green bonds are on average 10% more expensive to issue. The average issue size in their study was 5.36 million dollar which is rather small when compared to corporate bonds which are often issued in hundreds of million or even billion. If green bonds are more costly yet do not come with a premium, why would companies and municipalities issue them? The explanation given by the study is because it helps the issuer to attract a broader array of investors.

Further Larcker and Watts (2020) examine how the issuer-related variables affect the spread through introducing placebo bonds to a fixed-effect model. They used the same sample as in their earlier model, but instead employed a fixed-effect model. These placebo bonds are non-green securities. They find that the spread is close to identical between the placebo bonds and the green bonds. They relate this to that larger issuer outperform smaller ones suggesting that if you take in to account the issuer-related variables, the spread shrinks substantially.

One should however keep in mind that the data used in Larcker and Watts (2020) study was based on US municipal bonds which are rather different from Swedish real estate bonds issued by both listed and private companies. Furthermore, the municipal bonds may also be considered to be a safer option compared to corporate bonds hence their

premiums and risk are valuated differently. In addition to this it's important to note that their results were contradicting may of the other previous findings made by others.

Ehlers and Packer (2017)[3] researched the credit spread of green bonds and conventional bonds over the period of 2014 to 2017. They looked at bonds at a global level, with some of the countries being the US, Germany and France. They found a mean difference of 18 bps of spread in their research. However, only 5 of the 21 bonds they examined reflected the yield discount associated with issuing a green bond. They also looked at conventional bonds and green bonds within the same company. Furthermore, they also limited their data to only include fixed rate bonds. By doing so they can remove factors which may vary from firm to firm such as credit rating and the rate. By collecting data of both green bond and conventional within the same company they could also see that the spread between the companies was very inconsistent, this means that not all companies may be able to benefit from the yield discount when issuing green bond. One thing to note on the secondary market for bonds is that investors may not hold them to maturity and therefore may also be interested in metrics other than yield. Volatility is therefore a measurement which is often used to evaluate investments. They further showcased that investors were reluctant to accept lower yields without gaining a lower risk in the form of lower volatility as compensation. Hence, they explained the premium paid by investors through the lower risk. If issuers can gain the benefit of low cost of capital, they will issue more green bonds to the market.

The conventional way to measure the price of a bond is to use the Yield To Maturity (YTM) measurement where one discounts the present value of the bond with respect to future payments (coupons) and the given rate. *Option-adjusted spread* (OAS) also aims to measure the price of a given bond, however, it goes about it differently than YTM. OAS can be described as the spread between the current rate and the given spot rate for an issuer. The method works by breaking up the cash flow and discounting them with the correct discount factor for the given cash flow period. In other words, the OAS measures the interest rate of the bond compared to the rate of a risk-free bond. This would be perceived to be a more complicated way to go about determining the price of a bond and is indeed, however it also brings one key advantage. With OAS one can compare bonds

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[3] Ehler and Packer (2017) is a published in BIS Quarterly, but have 179 citations on Google Scholar and is therefore seen as a credible source.

from different issuers with different maturity dates and different cash flow structures. In addition to this one can also include bonds with callable options in them as their unknown YTM is counted for in OAS, thus enabling one to include more bonds in their data set (Cavallo and Valenzeula, 2010).

Nanyakkara and Colombage (2018) used a fixed and random-effect hybrid model to examine 82 green bonds and 43 conventional bonds on the global market between the years 2016 and 2017 and found a spread differential of 63 bps. However, within the local currency the spread tightens to a premium of 51 bps. This suggests that there is a high demand for the green bonds to the point where investors choose to even lose some of their return because of it. Further, their study also found that green bonds indicate a wider investor base. They also identify the reputation of the issuing firm as a major determinant for the conventional spread. Suggesting that the firm has to maintain their goodwill to gain the benefit from the green bonds, making it important to keep the "integrity" of their "green credentials" This study used option adjusted spread to measure the differences between green and conventional bonds. Through adding variables such as the US treasury, Gross Domestic Product (GDP) growth rate, Consumer Price Index (CPI) and firm-specific effects into a fixed-effect model they measured the effect the label of green bonds have on their option adjusted spread.

Preclaw and Bakshi (2015)[4] the company paper "The Cost of Being Green" investigates if there is a premium associated with being green. Their sample consisted of corporate and municipal bonds to name a few and were gathered from all over the world. Europe accounted for 43% of the sample, North America 23%, Asia 4% and Supranational accounted for 30%. They used the OAS method and implemented an OLS regression and controlled for variables such as currency, when the issuance was held and a dummy variable to measure the effect of the green bond label. They found a smaller but still significant premium at approximately 17 bps.

Fatica et al. (2021) used an OLS model to examine 637 green bonds yield at issuance to determine if there exists a premium. They further divided their sample into three different sets of groups, green bonds of financial institutions, non-financial firms and

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[4] Preclaw and Bakshi (2015) is publish in Barclay Research, but is referenced in many peer-reviewed papers, and is therefore scene as a credible source.

supranational. They control variables such as callable, puttable and use of proceeds among others. Besides these variables they also controlled firm-specific characteristics through introducing an issuer fixed effect. As they do not use either the matching method or OAS to control for maturity, they added a variable to account for the bonds' different maturities and ratings. Their results showed that green bonds issued by non-financial firms and supranational institution had a premium of 22 bps and 80 bps, respectively. However, their results also found that green bonds issued by financial institutions stick out due to not having a green bond premium. This is surprising as they are the most frequent issuers of green bonds. They suggest that the lack of a premium among financial institutions is explained by the distance from the green project to the green bond. Making it hard for investors to see the environmental utility of the bond. Another finding from their study shows that repeated issuers gain an increased premium. Suggesting that as issuers gain a better reputation, they get increased benefits from green bonds.

Table 1. Summary of previous green bond premium literature

	Zerbib (2019)	Stephan et al. (2021)	Bachelet, et al., (2019)	Nanyakkara and Colombage (2018)
Scope	Global	Global	US + Europe	Global
Green sample	1065	1928	89	82
Method	Matching method and panel regression	Several	Matching method and OLS regression	OAS and Hybrid-model
Premium	-2 bps	-15 to -20 bps	- 3.2 bps	- 63 bps
	Ehler and packer (2017)	Preclaw and Bakshi (2015)	Fatica et al. (2020)	Larcker and Watts (2020)
Scope	US + Euro	Global	Global	US
Green sample	21	Not disclosed	637	640
Method	Comparison	OAS + OLS regression	Comparison + OLS regression	Matching method + Paired t-test and Wilcoxon
Premium	- 18 bps	-17 bps	-22 to -80	Close to 0

2.4 Covid-19 effect on the green market

During the start of 2020 the world was getting worried over the new pandemic Covid-19. On the 22 of February the Italian government decided to implement a quarantine on some areas which had been seriously affected by the Covid-19 virus (Nozawa & Qiu 2021). These announcements of uncertainty saw a direct response from the financial market in Sweden, which saw the OMXIPI[5] take a downturn. However, by the end of the 2020, the stock market had fully recovered from the initial downturn, even though Covid-19 was still very much in affect (Nasdaq, n.d).

Naeem et al. (2021) studied the effectiveness of the market pre- Covid-19 and during. Their sample consists of three green bond indexes and three conventional bond indexes

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[5] OMXPI index contains all companies listed on Nasdaq Stockholm.

in a period between November 3, 2014, and September 3, 2020. They find that both the conventional bond market and the green bond market were greatly affected by the pandemic.

Naeem et al. (2021) further suggest that the green bond market is in fact less vulnerable to market sentiment when the market is in a turmoil such as the one that occurred during Covid-19. They attribute this to the type of investors which engage in the green bond market. Investors who are more driven by non-financial motives such as helping the environment through their investments. These investors view green bonds as less risky and as such tend to employ a more long-term strategy.

Yi et al. (2021) investigated the impact of Covid-19 on the green bond market in China. China has issued 170 billion USD of green bonds between 2016 to 2019 thus making it the second largest green bond market in the world. A large fraction of these funds has been allocated to projects concerning pollution control and protecting the environment. The study looked at how average abnormal return and cumulative abnormal returns of green bonds were affected by the pandemic. To research this a method called event study method was used as the aim to find what impact a certain event had on the green bonds market. The authors chose January 23, 2020, as the event day as this was the day the Chinese city of Wuhan was locked down due to the spread of Covid-19. Further the study also uses a model to estimate the changes in average abnormal return and cumulative abnormal return, the data for this was gather from the database, The Wind and bonds between August 27, 2019 and June 1, 2020 were part of the data set. The model contained variables such as debt-paying ability, information asymmetry and ratio of intangible assets to total assets, ratio of net operating cashflow to interest-bearing liabilities. The study found that Covid-19 had a big impact on the green bond market. This was believed to be due to the lack of demand for energy in general as industries came to a halt and people were spending most of their days in quarantine. Many of the bonds analyzed by Yi et al. (2021) were issued by companies in the renewable energy sectors. As the green energy has no price advantage against "regular" energy investors of these bonds were willing to sell them for a great discount to get the off their books. Furthermore, many big infrastructure projects and production industries were closed for a period of time. Since many of these are to some extent funded by green bonds investors were hesitant towards

holding these assets as their future cash flow would be affected by the sudden stop in production or construction.

The financial market has clearly been affected by the implications of the Covid-19 pandemic and the market uncertainty which has followed it. It is therefore impossible to get a picture of the current green bond market and the potential premium without taking it into account.

3   Methodology and method

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This section will describe the method chosen to answer the research questions. It will also present what advantages and drawbacks the chosen method may have.

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3.1 Research methodology

To test our hypothesis, we approach the problem through a deductive way. This is done by basing the approach on already established research. In this thesis this was done through analyzing previous peer-reviewed studies that have tackled similar hypothesis, however on other markets. Due to the recency of green bond market, we also use working papers as publications have not gone through the process of becoming an article. As our geographical limitations of only looking at Swedish real estate bonds have not, to our knowledge, been researched, some efforts were made to translate variables to make it relevant for our study. With the thesis implementing a new geographical area as well as explore the relatively unknown Covid-19 pandemics impact on the green bond spread we also implement a explorative method (Bryman and Bell, 2011).

In accordance with previous literature, we proceeded through employing a quantitative approach through analyzing a number of bonds. Through our quantitative approach the thesis is able to examine the hypothesis using existing data on the spread of green bonds and conventional bonds. Our quantitative data is gathered by using Thomson Reuters eikon database to find relevant bond information and is therefore second-degree data. By introducing these measures to gain a credible model and data base we employ a positivistic approach. As we use objective movements, that are measurable and comparable we employ a positivistic approach (Bryman and Bell, 2011).

Hence our thesis uses a deductive and explorative way of analyzing quantitative data using a positivistic approach.

3.2 Model

While choosing the sampling method to determine our dependent variable the two predominant methods were the Matching Method as used by Zerbib (2019) and the OAS method which was implemented by Preclaw and Bakshi (2015) and Nanayakkara and Colombage (2018). To account for the issuer-related variables explained by Larcker and Watts (2020), where companies issuing green bonds have in general a lower cost of capital than that off companies that only issue conventional bonds. We choose to only sample companies that issued both green and conventional bonds. Through only choosing companies that have issued both, we mitigate potential bias that this would cause. However, this decision reduces the potential sample but it is necessary as there would otherwise be a bias and thus lead to an incorrect assumption. Further, the matching method is highly dependent on how the bonds are sampled. As one needs to match variables such as maturity, firm-specific and security exactly right as they will affect the spread of the bond. Due to our already limited potential sample, matching maturity and firm-specific effect would not have been possible to take into account in a non-bias way without heavily reducing our sample size. The OAS on the other hand allows us to take this into account and is a widely used as a measurement for comparing bond spreads. We therefore employ OAS to compare the conventional spreads of green bonds and conventional bonds with different maturities and cash flows as Preclaw and Bakshi (2015), Nanayakkara and Colombage (2018) and Cavallo and Valenzeula (2007).

While choosing a model to analyze the spread of green and conventional bonds the previous literature offers wide range of approaches. However, due to the choice of implementing an OAS the possible models narrow down. Further, in line with the findings of Larcker and Watts (2019), our model needs to take issuer-specific variable into account to give a reliable result. As a fixed-effect estimator does not offer us the possibility to examine that in a reliable way, we move towards a OLS regression with fixed-effect as used by Bachelet et al. (2019) and Fatica et al. (2020). Further, the variables controlled in Fatica et al.'s (2020) model such as puttable, callable and maturity is already implemented through the choice of OAS. Instead, our model will implement a range of

different variables which can affect the spread of our sample bonds, as used by Nanayakkara and Colombage (2019) and Cavallo and Valenzeula (2007). The model will therefore be a combination of Nanayakkara and Colombage (2019) and Fatica et al. (2020).

To control for the Covid-19 pandemic period we develop another variable. It will be introduced as a dummy variable where it is equal to 1 for the period between the 22 February 2020 until the end of 2020 and 0 for the pre-Covid-19 period, the motivation of the date will follow. To measure the green bond premium, we employ a dummy variable for green bonds and conventional bonds, where a green bond is denominated as 1 and conventional bonds as 0. By employing an OLS on our sampled OAS we can determine how dependent the green label of a bond will affect the OAS.

$$OAS_{i,t} = \alpha + \beta_1 GREEN_i + \beta_2 MR_{i,t} + \beta_3 TR_{i,t} + \beta_4 MC_{i,t} + F_i + Co_i + Cu_i + \varepsilon_{i,t} \quad (1)$$

The $OAS_{i,t}$ refers to OAS of the bond i at the time t. $\beta_1 GREEN_i$ is the dummy variable for green and conventional bonds. $\beta_3 TR_{i,t}$ is the Swedish 10-year treasury rate. $\beta_2 MR_{i,t}$ is the time market risk for bond i at time t. $\beta_4 MC_{i,t}$ are the macroeconomic variables GDP growth and monthly CPI. F_i is the fixed-effect of firm-specific risk. $\varepsilon_{i,t}$ is the error term. Cu_i is the dummy variable for the currency the bond has been issued in Co_i is a dummy variable where 1 is for the time 22 February 2020, to 31 December 2020 and 0 is between the period 1 Januari 2016 to 21 February 2020. Further, in the model, we cluster the standard errors of firm specific effects to account for autocorrelation and heteroskedasticity. Stata was used to calculate our OLS regression.

While the effect of Covid-19 on the premium has not been researched in any greater extent it is evident that the effect is relevant to the findings of our thesis. As the Covid-19 pandemic has been affecting the financial market. We therefore introduce a revised model to measure the effect. Our model will look similar to the one we measure the period for between January 2016 to December 2020, but instead we split the time period. We create to separate OLS models, one for the period of pre-Covid-19 (2016 until 22 February 2020) and one for the period during Covid-19 (22 February 2020 until the end of 2020). Further, as we are measuring the two different periods that is controlled with the variable Covid in previous model, we remove that variable.

$$OAS_{i,t} = \alpha + \beta_1 Green_i + \beta_2 MR_{i,t} + \beta_3 TR_{i,t} + \beta_4 MC_{i,t} + F_i + Cu_i + \varepsilon_{i,t} \qquad (2)$$

3.3 Data

To gather our data, the thesis sampled the 50 largest participants in the Swedish real estate market according to Fastighetsvärlden (fastighetsvarlden.se, 2020). We used the database Thomson Reuters Eikon to find the data. Out of our sample of 50 real estate companies, 23 companies were removed from the sample due to no public information. Further, another 7 companies were removed as they did not hold any green bonds. Finally, 9 companies were removed for either holding only green bonds or only holding floating bonds. (see appendix 3.)

Further, the choice to only include bonds with fixed coupons was chosen as this will make the yield calculations simpler as mentioned by Larcker and Watts (2020). This a reason that is not specified in other studies but it is evident that the other studies have the same approach if you analyze their samples. Further, by only analyzing senior unsecured bonds we could guarantee the risk, within the issuer were at the same level.

3.4 Dependent variables

Due to green bonds being fairly new, the available OAS data before 2016 was severely limited. We therefore used data from 2016 until December of 2020. This gave us a final sample of 166 bonds from nine companies. Out of our sample, 53 were green bonds and 113 bonds were conventional bonds. The total number of observations amounted to 91,917 were 24,193 were daily observations from green bonds and 67,724 daily observations from conventional bonds.

3.5 Independent variables

To investigate additional relationships the decision was also made to find data for control variables. These variables were chosen based on the regression model in Nanayakkara

and Colombage (2019) and Cavallo and Valenzeula (2007)[6] where they used the following variables, Market Risk through Cboe volatility index, US 10-year treasury rate, Consumer price index and Gross national product. These variables were relevant for their studies that investigated the global bond performance. However, for our thesis which examines only the Swedish market, the decision was made to convert these to the equivalent for the Swedish market.

The Cboe volatility index is constructed using the rolling 30-day standard deviation of a wide range of S&P 500 index options to measure their volatility. In this report we construct our own equivalent using the Swedish market by adapting a 30-day rolling standard deviation of OMXPI (Nasdaq).

Cavallo and Valenzeula (2007) and Nanyakkara and Colombage (2019) used the US 10-year treasury rate to control the global effects on conventional spreads. To capture the conventional spread effect of the Swedish market we instead translate the US treasury rate to the Swedish equivalent to get a more accurate effect (Riksbanken, n.d).

To remove macroeconomic variables, we control GDP growth and the CPI for the Swedish market. Both variables have been gathered through Refinitive Eikon.

As green bonds are guaranteed by the firm that issued them, their valuation and security is therefore linked to the security of that firm. Due to this, it becomes impossible to measure the valuation of different bonds between companies. The firm-specific risk is controlled through a fixed-effect dummy variable. By controlling this variable, our intentions are to give a nuanced and fairer way of examining the premium of green bonds.

During 2020, the world was affected by the Covid-19 pandemic, which had a large impact on the financial market. To account for this, we introduced another dummy variable, over the period affected by Covid-19. Where 1 indicated that the period is affected by Covid-19. Nozawa & Qiu (2021) used 23 of February as a measuring point while analyzing the spread of US corporate bonds. This set back in the market was a response to the increased unease in the market from Italy taking more extraordinary measures to counter the spread of Covid-19. Sweden had a stock market downturn which started on the 22 of February

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[6] The 2007 version of Cavallo and Valenzeula is a working-paper, however some information that are relevant to this thesis are removed from the 2010 article.

(Nasdaq). We therefore implemented our dummy variable from 22 of February 2020 until the end of December 2020.

Table 2 shows the summary of the data used for our OLS regression. The mean value of the bonds included in our model was 77.7 bps with a min valuation of -71.6 bps and a max valuation of 343 bps.

Table 2.

Variable	Mean	Standard Deviation	Min	Max	Obs.
OAS	77.70085	46.78842	-71.58	343.04	N = 91,917
Treasury rate	0.206786	0.3352941	-0.514	0.986	N = 1,163
GDP Growth	-0.04327275	3.361135	-8.2	4	N = 18
CPI	1.297251	0.7347107	-0.4	2.3	N = 52
Market Risk	15.04082	12.89131	2.400637	91.17877	N = 1,163

Table 2. *display the summary of statistics used for our OLS model.*

3.6 Sample companies

Our sampled nine companies are all major real estate companies there are some major differences within them. The most obvious being the ownership structure, 3 of them being fully owned by the Swedish government (Jernhusen, Specialfastigheter, Akademiska Hus), while an additional 3 being partly or fully owned by the various AP funds (Rikshem, Willhem, Vasakronan) which manage the national pensions in Sweden, the last three (Kungsleden, Castellum, Atrium Ljungberg) are listed on the Swedish Stock Exchange.

Table 3.

Company	Non-green	Percent, Non-Green	Green	Percent, Green	Total	percent, Total
Akademiska hus	33	29%	2	4%	35	21%
Atrium Ljungberg	2	2%	5	9%	7	4%
Castellum	15	13%	1	2%	16	10%
Jernhusen	2	2%	6	11%	8	5%
Kungsleden	1	1%	4	8%	5	3%
Rikshem	9	8%	3	6%	12	7%
Specialfastigheter	23	20%	2	4%	25	15%
Willhem	11	10%	2	4%	13	8%
Vasakronan	17	15%	28	53%	45	27%
Total	113	68%	53	68%	166	100%

Table 3. *The sampled real estate companies and their share of green bonds to our sample.*

By looking at the figure presented above one can clearly see that the companies are in very different stages when it comes to adopting the financial instrument of green bonds. For example, Specialfastigheter, Castellum and Akademiska hus are the largest to issue regular bonds, while Vasakronan, Jernhusen and Atrium Ljungberg are the most frequent issuers of green bonds in our sample. Further one can also observe that Castellum accounts for a rather small part of the green bonds in the data set at 2% while accounting for 13% of the conventional bonds. In contrast to this Vasakronan accounts for 27% of the green bonds while only making up 15% of the conventional bonds. Vasakronan who stands for 27% of the number of issued is Sweden's largest corporate issuer of green bonds. (Climate Bonds Initiative, 2020b). In between the two one finds Rikshem who has a rather even distribution between green and conventional bonds, where they make up 6% of the green bonds and 8% of the conventional bonds. However, as we do not account for floating green bonds these numbers might differ from reality. However, We do not measure floating bonds in this thesis, and therefore some companies may have different amounts of issued green and non-green bonds than what is displayed here

Jernhusen is a real estate company which focuses on managing train stations, depots and cargo terminals within Sweden. The company is fully owned by the government and aims to improve public transportation by developing urban areas near stations as well as

improving city districts. Today Jernhusen has a portfolio of 152 properties with a market value of 17.9 billion SEK and employs around 200 people. The company was founded in 2000 when they joined with Statens Järnvägar and in 2001 they acquired real estate for 6 billion SEK. Today the company has their head office in Stockholm. During the coming years Jernhusen plans a big expansion and is focusing more on development rather than just managing the properties. (Jernhusen, n.d)

Kungsleden is a publicly traded company with its head office in Stockholm and about 90% of their properties can be found in the three largest cities in Sweden, namely Stockholm, Gothenburg and Malmö. Kungsleden focuses on commercial real estate and was founded in the early 1990. In 1999 they got listed on the Swedish stock exchange and today they employ about 140 people. They build, develop and manage properties with a long-time horizon and aim to have most of their properties in their chosen cities which they hope will develop well during the coming years. Their portfolio is currently worth over 35 billion SEK and the aim is to have steady growth each year. (Kungsleden, n.d)

Castellum is a publicly traded company which owns 642 properties throughout Sweden, Copenhagen, and Helsinki. This adds up to about 4.2 million square meters of space and is divided between office spaces and properties for logistics. Castellum builds, renovates, and manages various types of properties. Their main aim is to increase the cash flows of their portfolio. Castellum employs around 400 individuals and have their head office in Stockholm. (Castellum, n.d)

Specialfastigheter is a government owned real estate company which specializes in owning, building and managing buildings with specific security needs such as courthouses, police properties and correction centers etc. Specialfastigheter owns about 1.1 million square meters of real estate with a value of 29 billion SEK, these properties are scattered over approximately 60 municipalities all the way from Ystad in the south to Kiruna in the north. The company employs about 170 people and has their head office split between Linköping and Stockholm. They also have additional offices in Gothenburg, Lund and Örebro to name a few, in addition they have maintenance offices in a few more locations. (Specialfastigheter, n.d)

Rikshem is one of Sweden's largest privately-owned real estate companies, the main owners are Fjärde AP-fonden and AMF Pensionsförsäkringar. They manage 29000

apartments and have a portfolio worth 52 billion SEK. They own various types of properties from rental apartments, schools and nursing homes to name a few. The company was founded in 2010 when Vasakronan decided to sell most of their residential properties and was then fairly concentrated in Uppsala. From then the company has made a rather large expansion and today they employ about 270 individuals over Sweden, however most of them being at their head office in Stockholm. (Rikshem, n.d)

Wilhelm is a real estate company founded in 2011 and have their head office in Gothenburg. They are owned by Första AP-fonden and both develop and manage properties in 13 different cities in Sweden. Their vision is to be present in the growing cities and aim to provide simple living for their tenants. Today Willhem owns 26500 apartments and have around 1 850 00 square meters of rental space. Nearly all of it (92%) of this being residential areas and has a market value of about 46 billion SEK. Wilhelm has 280 employees which are divided into three main groups namely East region, South region and the West region. (Wilhelm, n.d)

Akademiska hus focuses on developing, renovating and managing properties for educational purposes. Their focus is on universities and colleges and they own properties throughout Sweden. The company is fully owned by the Swedish government and has a market share of 60%. The company has properties for about 100 billion SEK and have an additional 14 billion SEK of coming projects. They have 51 education centers spread in 29 different cities from the far north all the way to south of Sweden. (Akademisksa hus, n.d)

Atrium Ljungberg is one of the largest listed real estate companies on the Swedish stock exchange. It was founded in 1946 and they focus on properties in Stockholm, Gothenburg, Malmö and Uppsala. Atrium Ljungberg has 1.1 million square meters of real estate which has a market value of 48 billion SEK. The company has three main business areas, property development, property management and renovating existing buildings, most of them for commercial tenants. They employ around 330 people and have their head office in Stockholm. (Atrium Ljungberg, n.d)

Vasakronan is Sweden's largest real estate company and is owned by Första, Andra, Tredje and Fjärde AP-fonden. They have 170 properties which equates to about 2.3 million square meters. The market value of their properties is around 165 billion SEK.

Vasakronan focuses on developing and managing commercial properties and most of their space is used for offices and retail. Their head office is located in Stockholm. (Vasakronan, n.d)

3.7 Evaluation of methodology

The data was collected from Thomson Reuters and was downloaded as separate excel sheets, furthermore parts of our data was also presented in different units of time. For example, inflation was presented for every month of the year, GDP was presented for every quarter while the spread of the bond was updated on a daily basis.

Bryman and Bell (2019) mention that the sample size should not be the main focus. One should instead focus on the error which might arise due to different sample sizes. As a consequence, when the size of the sample grows the sampling error is reduced. This might be a shortcoming of our method as only bonds from nine companies were used, however the number of observations was substantial enough to be comparable to some of the earlier research. Further, most of the previous research done studies the US or globally, not the Nordic or Swedish market. This may lead to skewed perceptions as certain phenomena only occur in certain markets. The data found in foreign markets and the conclusions made with that data may not hold true for the Swedish market and may therefore be misleading.

Even though the aim was to look at the largest companies the sample came to be smaller than expected after applying the chosen screening criteria. The sample in this report was not as broad and representative as initially planned for as only nine very large companies were part of the sample. Hence, one should be cautious of assuming that the results hold true for the entire sector. However, the number of daily observations is still in line with some of the earlier studies, on the global market and does not include other sectors which might miss lead the results as indicated in Fatica et al. (2020). However, with this in mind, our study will give a better outlook for Swedish real estate companies than previous studies.

4 Results

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This section will present the results from our models.

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The main results of our model are presented in table 4 and the regression is based on eq (1). Neither the normal OLS regression nor our model which includes a firm-specific fixed-effect does not give us a significant result.

Table 4.

Variables	OLS regression	OLS with fixed effects
Green Bonds	10.10828 (9.772997)	-5.019254 (6.044755)
Market Risk	0.7181998*** (0.1894837)	0.7067147*** (0.1911392)
Treasure Rate	27.75311*** (5.333748)	30.49182*** (6.345352)
Consumer Price Index	-10.6972*** (2.919914)	-13.5373*** (2.427226)
GDP Growth	-3.262859*** (1.1894837)	-3.062508** (6.044755)
Covid-19	-20.45778*** (2.395827)	-24.51497*** (1.718575)
R-Squared	0.2295	0.4931

Table 4. *The statistics results for a normal regression model and our OLS regression. The stars, ***, ** and * indicate statistical significance at 1%,2% and 10% respectively. We Clustered standard errors at firm level.*

The relationship between the spread and the treasury rate and market risk had a positive effect on the OAS at 1% significance level. The market risk affects the spread at 0.7 bps. and the treasury rate affects the spread at 30.5 bps. The CPI, and Covid-19 affects the OAS negatively at a 5% significance level. The CPI affects the spread at -13.4 bps and

the GDP G at -3.1 bps. Covid-19 affects the spread with 20.5 bps. Our R-squared value is 0.49 and shows that our model can explain for 0.4931% of the spread.

To test if there is correlation between our green bond variable and other variables which could affect our significance, we use two different models. As our green bond variable is of nominal character, we use the independent-samples T-test. The independent-samples T-test is the most powerful tool for comparing to independent variables according to Derrick et al. (2017). Further, a Pearson chi-test is used to measure the nominal values we have with our dummy variables for currency, firm and Covid-19 (McHugh, 2013).

Table 5.

Test	Variable	In relation to variable	Confidence level	Relationship
Independent-samples T-test	OAS	Bond	99%	Not correlated
Independent-samples T-test	CPI	Bond	99%	Not correlated
Independent-samples T-test	GDP - Growth	Bond	99%	Not correlated
Independent-samples T-test	Market Risk	Bond	99%	Not correlated
Independent-samples T-test	Treasury Rate	Bond	99%	Not correlated
Pearson chi-test	Covid-19	Bond	99%	Not correlated
Pearson chi-test	Currency	Bond	99%	Not correlated
Pearson chi-test	Company	Bond	99%	Not correlated

As seen from table 5 the green bond variable does not correlate with any of the other variables used in our model at a 99% confidence level.

The revisited model's results, examining the difference between the green bond premium, are displayed in table 6.

Table 6.

Variables	Pre-Covid 19	During Covid-19
Green Bond	-5.054992 (6.04819)	-2.886369 (6.702247)
Market Risk	- 0.321363*** (0.0870677)	0.8381845*** (0.17450548)
Treasury Rate	6.369726* (3.302808)	-40.35663*** (5.060157)
Consumer Price Index	-9.567226** (3.220213)	-15.38487* (6.714798)
GDP Growth	6.711702*** (1.347512)	-4.652405*** (1.023949)
R-Squared	0.4784	0.5190

Table 6. *The statistics results for our OLS regression. The stars, ***, ** and * indicate statistical significance at 1%,2% and 10% respectively. We Clustered standard errors at firm level.*

The results of our revised equation do unfortunately not find a significant result for the green bond variable. However, the market risk goes from effecting the spread negatively to effecting it positively at 1% significance. While the Treasure rate and the GDP growth goes in the opposite direction at 1% significance.

Lastly, to get better insight in to the effect of Covid-19 on the green bond market we also examined the four quarters of 2020.

Table 7.

Variables	2020 Q1	2020 Q2	2020 Q3	2020 Q4
Green bond	4.158259 (9.634734)	13.64925 (9.516513)	-6.495391 (8.737482)	-16.68164 (6.957325)
Market Risk	1.262368*** (0.2943695)	0.3056531* (0.1630938)	1.621011*** (0.3021899)	0.0211872 (0.525762)
Treasury Rate	-40.66242*** (6.519027)	31.61311* (11.00699)	54.78917*** (11.71823)	-11.95738** 3.815096
Consumer Price Index	44.31956*** (8.710964)	-24.11486** (8.131006)	3.890658 2.21113	-24.4253*** (4.995375)
R-Squared	0.5923	0.7052	0.4644	0.4343

Table 7. *displays the change of eq(2) during Q1-4 in 2020. The stars, ***, ** and * indicate statistical significance at 1%,2% and 10% respectively. We Clustered standard errors at firm level.*

The green bond variable for our four quarters affected by Covid-19 does not produce a significant result. During the four quarters affected by Covid-19 the CPI and Treasury rate move substantially in its effect on the spread. CPI moved from having a large negative impact on the price in quarter one at 1% significance to having a large positive in quarter 2 and 4 of 2020 at 5% significance and 1% significance respectively. The Treasury rate affects the price positive during quarter 1 at 1% significance and quarter 4 at 5% significance. It changed to affecting the price negative in quarter two and three at 10% significance and 1% significance respectively. Noticeable from this calculation is that quarter one only includes date after February the 21. Further, due split of quarters, the GDP growth, which is reported per quarter is omitted.

5 Analysis

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This section will analyze and compare the results with previous findings.

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The data had a large differential in the valuation of bonds ranging from -71.6 and 343. This might be due to times of uncertainty due to covid-19 where investors are unsure in how to evaluate the bond as well as a result of the spread of sample companies. Specially since the instrument is rather new and it makes it somewhat uncertain how it will react to different scenarios such as terrorist attacks, natural disasters or with pandemics such as Covid-19.

The results were found to not be significant and as such the hypothesis H:1 is rejected. The H:2 hypothesis was also rejected as the results found could not in a significant way prove that the premium of bonds changed during the Covid-19 pandemic. It was however observed that they were more desirable during the pandemic, but no evidence was found if the premium differ between green and conventional bonds.

The relationship between the spread and the treasury rate and market risk had a positive effect on the OAS at 1% significance level. The market risk affects the spread at 0.7 bps. and the treasury rate affects the spread at 30.5 bps. The CPI, GDP growth and Covid-19 affects the OAS negatively at a 5% significance level. The CPI affects the spread at -13.5 bps and the GDP G at -3.1 bps. It is, however, important to note that for both the GDP growth and CPI the number of observations decreases. Our R-squared value is 0.49 and shows that our model can explain for 49% of the spread. However, the interest of this study is to examine the difference in spread between green bonds and conventional bonds and not to explain the entire movement of bonds and is as such not of great importance for our study. Further, the Covid-19 period has a substantially sized negative impact on the coefficient of the OAS. While the thesis cannot declare the change in premium during the Covid-19 period we see some interesting movements in the bond market during the Covid-19 period. The effect of GDP growth, market risk and treasury rate on the spread is reversed.

The result of our main model does not get a significant result and might be a consequence of a couple of reasons. It could be that our data sample is inadequate or that there is no green bond premium. As seen in table 7, none of the variable in the study have a correlation with our green bond variable. Hence, we can conclude that the result is not a result of correlation.

Tabel 8. Summary of previous green bond premium literature

	Zerbib (2019)	Stephan et al. (2021)	Bachelet, et al., (2019)	Nanyakkara and Colombage (2018)
Scope	Global	Global	US + Europe	Global
Green sample	1065	1928	89	82
	Ehler and packer (2017)	Preclaw and Bakshi (2015)	Fatica et al. (2020)	Larcker and Watts (2020)
Scope	US + Euro	Global	Global	US
Green sample	21	Not disclosed	637	640

Unsurprisingly, our sample is smaller than a lot of previous research done on the global market. As can be seen in the table both Zerbib (2019) and Stephan et al. (2021) examined over 1000 bonds, Fatica et al (2020) and Larcker and Watts (2020) sampled above 600. This thesis examines 52 green bonds which is closer to that of Bachelet at al. (2019) who examined 89 and Nanyakkara and Colombage (2018) who examined 82. However, Bachelet at al. used the matching method and Nanyakkara and Colombage used a smaller sample could be a possible cause to the result.

Our thesis analyzes the Swedish market rather than the entire the global market, or large economies such as the United States or Europe, which many of the previous studies do. As such, there should be clear differences in our findings and that of previous studies unless the Swedish market acts exactly as that of other markets. The difference between our results and previous is therefore becomes challenging to compare as different models, samples and variables will affect the result. Further, Fatica et al. (2020) suggests that financial institution's do not produce a premium, which could affect and reduce the premium in studies which includes them. Our study exclusively looks at bonds issued by actors in the real estate market and should therefore, if the Swedish real estate market worked the same as the global examined by Fatica et al's (2020), have a quite substantial green bond premium.

While the previously mentioned studies use different methods to reach their result, we see that majority suggest that there is an existing difference in the valuation of green and conventional bonds.

Maltais and Nykvist (2020) is, to our knowledge, the only ones that have researched the Swedish market. They say that investors insist on refusing to accept lower yields to invest in green bonds. The participants in their study further claim that there is a 4-bps difference between green and conventional bonds in the market. It is further important to note that Maltais and Nykvist study is not a quantitative research, nor was the aim of the study to try to see the green bond premium on the Swedish market. They do a qualitative study of interviewing market actors within the green bond market in the benefits of green bonds, whether financial or non-financial. This question of what the market actors believe the green bond premium is displayed as a smaller point and not necessary and indication for what the green bond premium actually is.

The control variables used in the model is gathered from Colombage and Nanyakkara (2019) and give results which are in the scope of existing literature. Our model uses the standard deviation of OMXPI, while Colombage and Nanyakkara (2019) uses standard deviation of the returns of their market index. However, the two different variables used in our thesis and Colombage and Nanyakkara's (2019) study used to measure market risk have a similar influence on the spread. However, unlike what is suggested by Colombage and Nanyakkara (2019) when measuring the effect of market risk, treasury rate and GDP on the OAS during the time of Covid-19 they affect it in the opposite direction. The GDP and the treasury rate go from having a positive relation to having a negative one and the market risk goes from having a negative to a positive one.

Yi et al. (2021) found that the Chinese green bond market did get effected by the Covid-19 pandemic. Their explanation for this was that many of the bonds in their sample were within the green energy sector and as demand for renewable energy fell investors sold the bonds in fear of it hurting future cash flows. While they showcase a decrease in the valuation of green bonds our results suggest that the Swedish market real estate bond market as a whole gets an increase in valuation.

6 Discussion

This section will discuss and elaborate on what implications the findings have and to some extent how they come to be.

In our research we see a clear divide in firms' approach towards green bonds. While some companies have been slow to embrace the new financial tool of green bonds, other companies such as Fabege have moved all their outstanding bond debt to the financial instrument. Out of the companies that had data available to be analyzed more than two-thirds had green bonds. Although the Swedish market introduces smaller sized green bonds than demonstrated in the global market, it was evidently clear while choosing our sample that it is still larger actors that take part in the green bond market. There are still some barriers preventing companies from adapting to this instrument. Some of the challenges that might prevent companies to implement green bonds is the lack of standardization and the fact that green bonds are more costly to issues and companies may not have the ability to cover these costs as mentioned by Deschryver and Mariz, (2020). This issue may be solved by creating standardized criteria for green bonds as well as developing a way to credit rate them. A more standardized criteria could bring down the costs through simplifying the process of retaining a valid green criterion. Further, through standardizing the process one can push down the size requirement to enable more companies will be able to participate in the market. As the green bond market matures a more standardized criteria would further help investors ensure that their capital is being used in the intentions that is expected.

Another issue with the high supply of green bonds in Sweden as compared to its European counterparts would be the quality of the green bonds. With only a certain number of green assets on the books, Swedish companies could be cutting corners rather than producing more green assets. If companies were to cut corners and label financial products green for the sake of increasing their popularity the action would be classified as greenwashing. With both a higher supply green bonds available as well as the possibility of a higher likelihood of greenwashing one could argue that the preference for green bonds issued in Sweden should be lower than that of other parts. As our sample group contains some of

the largest real estate owners in Sweden, where the reputation and reliability are high. Hence, we cannot draw any conclusion over how the Swedish green bond market is acting towards the possibility of greenwashing. Further, the real estate market offers an easy way of enforcing the environmentally friendliness of a building, hence investors have a clear insight to the usage of their green capital. Likewise, the likelihood of greenwashing in different markets is not something that to our knowledge have been well documented, which makes it hard to assume that it would be a concern for investors into the market.

All thought the Swedish green bond real estate market is fairly large the size of the market is still too small to receive a significant result. As we do not get a significant result on our main regression, we cannot conclude whether there exists a premium on green bonds issued by Swedish real estate firms. The potential financial benefits available for a real estate firm is therefore not measurable as of now. One reason that our results did not become significant could be that our data sample was not large enough. The Swedish bond market has had a rapid growth over the last 10 years and is ranked fourth in both number of issuers in the world and first in number of deals in Europe. However, although the real estate bond market is one of the predominant markets it might not yet be large enough to be examined. While there is a large size of green bonds issued in the market, a large part of those were either in companies that only issues floating bonds, or whom did only have green bonds. With the boundaries set in this thesis to ensure that the result is correct, the sample size might have decreased too much. However, with the green markets rapid growth this proposition might be revisited in the future with greater success.

Although our sample is relatively small, we still have a mix of repeatable issuers and one-time issuers. Due to only exploring one small national market, our study does not give a good answer if this reason is behind the premium showcased. At the same time, we can see a clear correlation with more government-controlled companies and the trait of being a repeatable issuer. This could very well affect an attempt to measure this and is therefore not something we believed we could correctly identify. However, it is nonetheless an important issue that arises for issuers, and something that should be explored upon.

Maltais and Nykvist (2020) says that the Swedish investors taking part in their study are not willing to accept lower yields for holding green assets. This suggest that they do not disclose the lower returns which we showcase with our result. This could be because they

do not know of the extent of premiums due to the spread of results on the premium. However, it could also be linked to a conflict of interest. As the investors want to present the best result to their investors it would be counterproductive to admit that they are accepting lower yields to hold green assets. Which is a reason that Maltais and Nykvist also mentions in their study. It could therefore be the case that the financial market is promoting their green product as an equally profitable asset as their conventional counterpart. If that is the case, then it would suggest that apart of the premium is fabricated through financial institutions misinforming the public about the opportunity costs of holding green assets.

Further, Maltais and Nykvist, suggested that the decisive appeal of issuing green bond does not arise from the reduction of capital cost, but rather from the non-financial gains. If there is a premium than it should make green bonds an attractive financial tool to lower the capital cost of real estate firms in Sweden. Considering the reduction of cost of capital showcased from our results and the non-financial benefits associated with green bonds, it has a very preferable position as compared to traditional debt instrument. Therefore, it would be highly likely that it continues to grow in popularity. As more companies realize the potential gain of the financial instrument the disparity of the supply and demand in the market should disappear. However, such a conclusion cannot be drawn.

If this occurs, the companies will no longer be able to benefit from the broader investment base and cheaper cost of capital that green bonds currently enable. This might happen in the futures as there are only so many projects or assets a certain company can convert or fund with green bonds. In addition to this the investors should also be given more bonds to select from in the future thus making the profitability of the investment more important as the "lack of other alternatives" will not be a sufficient reason for investors.

On the other hand, if the market finds a balance in the future, it would remove the financial incentives for companies to issue green bonds, which in return would reduce the supply of green investments. Unless companies decide that the non-financial benefits are attractive enough that companies were to issue green bonds at a discount, which according to some studies are not unlikely.

As Maltais and Nykvist (2020) mentioned, many institutions and rating agencies tend to value green bonds higher than a similar conventional bond, even though it at times should

be valued equally or even lower than its conventional counterpart. In addition to this EU and the Paris Agreement has further emphasized Sustainable Finance. With rating agencies and governments prizing the new instrument it has seen a very rapid growth, one might even argue that it has seen an unsustainable growth. One should also consider if this growth and demand will be sustained in the long term when regulations might look different and governments change focus. In the shorter run one should be careful that the instrument is not experiencing a bubble. Since policies and organizations have been redirecting funds to these instruments to the extent that one has to pay a premium to own them one should consider if this is a sustainable way to invest money and further is this is a sustainable way to fund green projects. While the environment is an urgent challenge, the demand, pushed through not only consumer demand but also through political and dubious financial institutions the short-side effect might cause problems.

Yi et al. (2021) found that the green bond market did indeed get effected by the Covid-19 pandemic. Their explanation for this was that many of the bonds in their sample were within the green energy sector and as demand for renewable energy fell investors sold the bonds in fear of it hurting future cash flows. We find evidence of an increased demand for bonds in general during the Covid-19 pandemic. The explanation might be in the sample of bonds. Real estate is often seen a safe investment and bond usually have predictable as flows which is often sought after in tough times. As many stores were closed or struggled to make ends meet many investors feared that the real estate companies would be left with many empty properties or with tenants defaulting on their payments and thus the profitability of the company would be hurt as they lose revenue. However, this may not hold true for all real estate companies as many of them are government owned or the state is the tenant. Many of these lease deals are signed for many years ahead and since the tenant is the Swedish government default on monthly payments is rather unlikely. Two of these companies from our sample are Jernhusen or Specialfastigheter. These companies hold real estate which would be hard to just shut down from one day to another, hence the government would be paying the rent even in a stressed economic climate. Specialfastigheter who owns prisons should in theory not be affected greatly as their properties are essential for society to function normally. Thus, our sample of large real estate companies with secure tenants may be a reason why we see an increase in bond demand during the Covid-19 pandemic. As investors moved their

capital from more risky investment to once considered to be more secure the bonds in the sample of this thesis experienced increased demand.

On the other hand, Naeem et al. (2021) argues that many investors who chose to invest in green bond have other motives than pure financial gain and thus tend to go for a long-term strategy. They also see that they tend to value green bonds to be a less risky asset. This would be very true for the real estate market as it's a long-term industry which rather time consuming. An investor would not expect a real estate project to be completed during a one-to-two-year period. Hence many who chose to purchase green real estate bonds may not chose to sell of their bonds when the markets fell as they have other incentives than pure financial gain or that they intend to hold them for a long time as thus as sudden fall for a short period of time is not seen as un issue as it is expected to recover over the longer investment time horizon.

As mentioned earlier by Goodell 2020 epidemics are far more common than one might believe, and many counties and companies were not adequately prepared to combat these circumstances. As a result of this once can expect companies to have more cash reserves and are also better prepared for unlikely events such as natural disasters or pandemics. Most importantly however many companies will likely reexamine their capital structure and thus the bond market may look different in the future as companies chose to go for more or less leveraging or finance their operations in a different way.

From our results one could also see that previous to Covid-19 the bonds were priced higher which would indicate that the yield is lower but as markets turned south and became uncertain the prices of the bonds fell. This is expected as during uncertain times the risk of default increases and there for the bond holders require additional compensation for the increased default risk. One can also see that when the treasury rate has a negative correlation to on the bond price before Covid-19, while during Covid-19 it has a positive correlation. The reason for this is that as markets become more volatile investors seek safe investments than equity. As many bonds have a fixed coupon they tend to have a more predictable cash flow compared to equity which can decide when and if a dividend will take place. The most likely threat to bonds during tough economic conditions is default, while equity may face several different challenges. Hence investors tend to choose bonds when markets turn south.

7 Conclusion

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This section aims to summarize the key findings.

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The thesis aimed to answer if investors pay a premium to own green real estate bonds. It also aims to see if Covid-19 had an effect on the green bond market. Through looking at bonds issued by the same company the company credit risk variable was eliminated. The thesis analyzed the OAS for 53 green bonds and 113 conventional bonds by employing a OLS regression. While analyzing our sample we saw a clear divide between how Swedish real estate companies are adapting to the green bond market. The majority of companies that had available data held green bonds. We find that the Swedish real estate market has not reached a size where it is analyzable yet. However, the green bond market in Sweden is growing rapidly. We saw that the market has grown significantly during the last ten years, however it is still more prominent in certain industries and sectors. While the results to measure the difference in premium between green and conventional bonds was not significant the regressions gave other more general indications. We find evidence that during the uncertainty of Covid-19 had a positive effect on our sampled companies, increasing the price of the bonds by 20.5 bps. This indicates that bonds do indeed become more sought after in worse times.

8 Future research

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This section will present what additional research could be of interest to conduct in regard to the findings and sample of this thesis.

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While reading previous studies within the field many curious areas of green bonds were stumbled upon. This thesis only looks at the difference in performance of green bonds in the Swedish real estate sector as this sector is one of the largest issuers of bonds. It would however be very interesting to see if similar results can be found in other industries. One could also investigate if similar phenomena can be seen in companies of other sizes. This was somewhat limited since this thesis only included the 50 largest real estate companies. Another interesting topic to research would be the effect of size and liquidity and how this may be different for certain industries and company sizes. This sort of information would be of great interest for both companies who wish to issue bonds and for investors and institutions who wish to include them in their portfolios.

As the Swedish market starts using green bonds more, and the analyzable data grows our study could be further improved upon through seeing what amount of the green bond premium is attributed to issuers being repeated issuers. It would be further interesting to see how companies can affect their cost of capital through improving their reputation as environmentally friendly. While this study focused on Sweden and as such only features a small data set it would be curious to see if similar results appear in larger dataset collected from larger markets or regions. If such results can be found a more reliable conclusion can be made.

However, in the green bond research area there is still different methods used to examine the premium and not a main path to choose. It would be interesting to examine how the different methods such as matching method and OAS compares to each other. By analyzing the same market with both the OAS model and the matching model this could be achieved and make it possible to measure how the different methods results may vary.

Another interesting distinction of the evolving research literature available on green bonds is avoiding floating green bonds. This results in the exclusion a large part of analyzable data. There are peer-review papers on the valuation of floating conventional bonds. However, it has not, to our knowledge, been applied to green bonds. This leaves a large missing hole of research in the valuation of green bonds.

Since the introduction of green bonds in 2008, there has not been any major economical contractions. As a consequence, to this the analyzable data for the effect premium on green bonds in an uncertain market is unexplored. While our thesis did not provide

evidence of significant changes during the time when Covid-19 was present it would be of great interest to see if this phenomenon can be seen worldwide. It would be further interesting to explore the effects on investors preference for green investments during times of uncertainty.

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Appendices

Appendix **1.**

The green bonds used in this thesis.

Description	Maturity Date	Issued Amount	Coupon	Currency	Issue Date	Rank (Seniority)
RIKINR / RIKIN 1.250 22-Feb-2022 MTN	22-feb-2022	150 000 000	Fixed Coupon	Swedish Krona	22-nov-2016	Senior Unsecured
RIKINR / RIKIN 1.160 19-Oct-2022 MTN	19-okt-2022	450 000 000	Fixed Coupon	Swedish Krona	19-okt-2017	Senior Unsecured
RIKINR / RIKIN 0.828 03-Feb-2025 MTN	03-feb-2025	900 000 000	Fixed Coupon	Swedish Krona	03-feb-2020	Senior Unsecured
VASKNV / VASKN 0.445 30-Aug-2021 MTN	30-aug-2021	700 000 000	Fixed Coupon	Swedish Krona	30-aug-2018	Senior Unsecured
VASKNV / VASKN 0.942 18-Oct-2021 MTN	18-okt-2021	470 000 000	Fixed Coupon	Swedish Krona	18-okt-2016	Senior Unsecured
VASKNV / VASKN 0.775 24-Feb-2022 MTN	24-feb-2022	100 000 000	Fixed Coupon	Swedish Krona	24-jan-2019	Senior Unsecured
VASKNV / VASKN 1.083 24-May-2022 MTN	24-maj-2022	830 000 000	Fixed Coupon	Swedish Krona	24-maj-2017	Senior Unsecured
VASKNV / VASKN 0.930 01-Aug-2022 MTN	01-aug-2022	500 000 000	Fixed Coupon	Swedish Krona	01-feb-2019	Senior Unsecured
VASKNV / VASKN 0.785 14-Sep-2022 MTN	14-sep-2022	200 000 000	Fixed Coupon	Swedish Krona	14-sep-2018	Senior Unsecured
VASKNV / VASKN 1.235 25-Jan-2023 MTN	25-jan-2023	200 000 000	Fixed Coupon	Swedish Krona	25-jan-2018	Senior Unsecured
VASKNV / VASKN 1.205 24-Apr-2023 MTN	24-apr-2023	1 250 000 000	Fixed Coupon	Swedish Krona	24-okt-2017	Senior Unsecured
VASKNV / VASKN 0.465 21-Aug-2023 MTN	21-aug-2023	300 000 000	Fixed Coupon	Swedish Krona	21-aug-2020	Senior Unsecured
VASKNV / VASKN 1.060 04-Sep-2023 MTN	04-sep-2023	750 000 000	Fixed Coupon	Swedish Krona	04-sep-2018	Senior Unsecured
VASKNV / VASKN 1.265 20-Dec-2023 MTN	20-dec-2023	1 000 000 000	Fixed Coupon	Swedish Krona	20-apr-2018	Senior Unsecured
VASKNV / VASKN 1.320 24-May-2024 MTN	24-maj-2024	500 000 000	Fixed Coupon	Swedish Krona	25-feb-2019	Senior Unsecured
VASKNV / VASKN 0.914 28-Jan-2025 MTN	28-jan-2025	500 000 000	Fixed Coupon	Swedish Krona	28-jan-2020	Senior Unsecured
VASKNV / VASKN 1.165 04-Jun-2025 MTN	04-jun-2025	450 000 000	Fixed Coupon	Swedish Krona	04-jun-2020	Senior Unsecured
VASKNV / VASKN 2.168 16-Jun-2025	16-jun-2025	198 444 879	Fixed Coupon	Norwegian Krone	14-feb-2020	Senior Unsecured
VASKNV / VASKN 0.640 02-Sep-2025 MTN	02-sep-2025	1 550 000 000	Fixed Coupon	Swedish Krona	02-sep-2019	Senior Unsecured

Description	Maturity Date	Issued Amount	Coupon	Currency	Issue Date	Rank (Seniority)
VASKNV / VASKN 1.369 05-Mar-2029 MTN	05-mar-2029	644 454 221	Fixed Coupon	Euro	05-mar-2019	Senior Unsecured
VASKNV / VASKN 2.980 09-Jul-2029 MTN	09-jul-2029	624 000 000	Fixed Coupon	U.S. Dollar	09-jul-2019	Senior Unsecured
VASKNV / VASKN 2.679 26-Nov-2029 MTN	26-nov-2029	832 000 000	Fixed Coupon	U.S. Dollar	25-nov-2019	Senior Unsecured
VASKNV / VASKN 2.960 16-May-2030	16-maj-2030	99 222 440	Fixed Coupon	Norwegian Krone	16-maj-2019	Senior Unsecured
VASKNV / VASKN 3.270 16-May-2030 MTN	16-maj-2030	148 833 659	Fixed Coupon	Norwegian Krone	16-maj-2018	Senior Unsecured
VASKNV / VASKN 2.777 12-Apr-2039 MTN	12-apr-2039	200 000 000	Fixed Coupon	Swedish Krona	12-apr-2019	Senior Unsecured
VASKNV / VASKN 1.655 05-Sep-2039 MTN	05-sep-2039	100 000 000	Fixed Coupon	Swedish Krona	05-sep-2019	Senior Unsecured
VASKNV / VASKN 2.162 04-May-2040 MTN	04-maj-2040	200 000 000	Fixed Coupon	Swedish Krona	04-maj-2020	Senior Unsecured
VASKNV / VASKN 2.400 20-Jun-2044 MTN	20-jun-2044	283 000 000	Fixed Coupon	Swedish Krona	20-jun-2019	Senior Unsecured
CASTX 1.932 04-Oct-2021 FRN MTN	04-okt-21	650 000 000	Floating Coupon	Swedish Krona	04-okt-16	Senior Unsecured
VERGE 0.625 28-Nov-2022 MTN	28-nov-22	500 000 000	Fixed Coupon	Swedish Krona	28-nov-17	Senior Unsecured
VERGE 1.125 28-Nov-2024 MTN	28-nov-24	750 000 000	Fixed Coupon	Swedish Krona	28-nov-17	Senior Unsecured
JENEN 0.598 04-Feb-2022 MTN	04-feb-2022	150 000 000	Fixed Coupon	Swedish Krona	04-feb-2019	Senior Unsecured
JENEN 0.250 18-Oct-2022 MTN	18-okt-2022	150 000 000	Fixed Coupon	Swedish Krona	18-okt-2019	Senior Unsecured
JENEN 0.975 17-Apr-2023 MTN	17-apr-2023	1 000 000 000	Fixed Coupon	Swedish Krona	17-apr-2018	Senior Unsecured
JENEN 0.938 18-Apr-2024 MTN	18-apr-2024	750 000 000	Fixed Coupon	Swedish Krona	18-apr-2019	Senior Unsecured
JENEN 1.368 23-Apr-2025 MTN	23-apr-2025	500 000 000	Fixed Coupon	Swedish Krona	23-apr-2020	Senior Unsecured
JENEN 0.440 23-Sep-2025 MTN	23-sep-2025	550 000 000	Fixed Coupon	Swedish Krona	23-sep-2020	Senior Unsecured
ATRLJ 0.750 06-Sep-2021 MTN	06-sep-2021	300 000 000	Fixed Coupon	Swedish Krona	06-sep-2018	Senior Unsecured
ATRLJ 1.619 21-Mar-2022 MTN	21-mar-2022	200 000 000	Fixed Coupon	Swedish Krona	21-mar-2017	Senior Unsecured
ATRLJ 1.668 21-Aug-2024 MTN	21-aug-2024	500 000 000	Fixed Coupon	Swedish Krona	21-maj-2019	Senior Unsecured
ATRLJ 1.122 01-Apr-2025 MTN	01-apr-2025	500 000 000	Fixed Coupon	Swedish Krona	01-okt-2020	Senior Unsecured

Description	Maturity Date	Issued Amount	Coupon	Currency	Issue Date	Rank (Seniority)
FORSAW / FORSA 1.490 16-Jan-2024 MTN	16-jan-24	200 000 000	Fixed Coupon	Swedish Krona	16-jan-19	Senior Unsecured
KLED 2.375 21-Mar-2022 MTN	21-mar-22	1 250 000 000	Fixed Coupon	Swedish Krona	21-mar-18	Senior Unsecured
KLED 1.510 06-Dec-2024 MTN	06-dec-24	200 000 000	Fixed Coupon	Swedish Krona	06-dec-19	Senior Unsecured
KLED 1.748 23-Jan-2026 MTN	23-jan-26	300 000 000	Fixed Coupon	Swedish Krona	23-jan-20	Senior Unsecured
KLED 1.593 25-Sep-2026 MTN	25-sep-26	550 000 000	Fixed Coupon	Swedish Krona	25-sep-20	Senior Unsecured
AKDHU 0.272 20-Jun-2024 MTN	20-jun-2024	1 000 000 000	Fixed Coupon	Swedish Krona	20-jun-2019	Senior Unsecured
AKDHU 0.448 07-Oct-2027 MTN	07-okt-2027	1 500 000 000	Fixed Coupon	Swedish Krona	07-okt-2020	Senior Unsecured
VASKNV / VASKN 2.030 02-Apr-2026 MTN	02-apr-2026	1 350 000 000	Fixed Coupon	Swedish Krona	02-apr-2020	Senior Unsecured
VASKNV / VASKN 1.190 22-Jan-2027 MTN	22-jan-2027	250 000 000	Fixed Coupon	Swedish Krona	22-jan-2020	Senior Unsecured
VASKNV / VASKN 3.010 31-Jan-2028 MTN	31-jan-2028	396 889 758	Fixed Coupon	Norwegian Krone	31-jan-2018	Senior Unsecured
ATRLJ 2.390 23-Nov-2027 MTN	23-nov-2027	793 779 516	Fixed Coupon	Norwegian Krone	23-nov-2020	Senior Unsecured
FORSAW / FORSA 1.103 03-Sep-2023 MTN	03-sep-23	500 000 000	Fixed Coupon	Swedish Krona	03-sep-18	Senior Unsecured

Appendix 2

The non-green bonds used in this thesis.

Description	Maturity Date	Issued Amount	Coupon Class	Currency	Issue Date	Rank (Seniority)
RIKINR / RIKIN 0.716 12-Jan-2022 MTN	12-jan-2022	376 000 000	Fixed Coupon	Swedish Krona	12-jul-2018	Senior Unsecured
RIKINR / RIKIN 0.538 27-May-2022	27-maj-2022	250 000 000	Fixed Coupon	Swedish Krona	27-maj-2019	Senior Unsecured
RIKINR / RIKIN 2.600 13-Mar-2024	13-mar-2024	396 889 758	Fixed Coupon	Norwegian Krone	13-mar-2017	Senior Unsecured
RIKINR / RIKIN 1.250 28-Jun-2024 '24 MTN	28-jun-2024	3 039 878 400	Fixed Coupon	Euro	28-jun-2017	Senior Unsecured
RIKINR / RIKIN 0.480 18-Mar-2025 MTN	18-mar-2025	500 000 000	Fixed Coupon	Swedish Krona	18-jan-2021	Senior Unsecured
RIKINR / RIKIN 3.040 01-Mar-2027	01-mar-2027	496 112 198	Fixed Coupon	Norwegian Krone	01-mar-2017	Senior Unsecured
RIKINR / RIKIN 3.078 31-Jan-2028	31-jan-2028	496 112 198	Fixed Coupon	Norwegian Krone	31-jan-2018	Senior Unsecured
RIKINR / RIKIN 3.480 07-Dec-2028 MTN	07-dec-2028	496 112 198	Fixed Coupon	Norwegian Krone	07-dec-2018	Senior Unsecured
RIKINR / RIKIN 2.970 12-Mar-2029 MTN	12-mar-2029	198 444 879	Fixed Coupon	Norwegian Krone	12-mar-2019	Senior Unsecured
VASKNV / VASKN 4.135 15-Nov-2021 MTN	15-nov-2021	200 000 000	Fixed Coupon	Swedish Krona	15-nov-2011	Senior Unsecured
VASKNV / VASKN 1.008 15-Dec-2021 MTN	15-dec-2021	515 000 000	Fixed Coupon	Swedish Krona	29-aug-2016	Senior Unsecured
VASKNV / VASKN 1.460 12-Mar-2022 MTN	12-mar-2022	100 000 000	Fixed Coupon	Swedish Krona	12-mar-2015	Senior Unsecured
VASKNV / VASKN 1.144 29-Aug-2022 MTN	29-aug-2022	200 000 000	Fixed Coupon	Swedish Krona	29-aug-2017	Senior Unsecured
VASKNV / VASKN 2.533 09-May-2023 MTN	09-maj-2023	396 889 758	Fixed Coupon	Norwegian Krone	09-maj-2016	Senior Unsecured
VASKNV / VASKN 2.500 18-Jan-2024 MTN	18-jan-2024	446 500 978	Fixed Coupon	Norwegian Krone	18-jan-2017	Senior Unsecured
VASKNV / VASKN 2.525 06-Oct-2026 MTN	06-okt-2026	198 444 879	Fixed Coupon	Norwegian Krone	06-okt-2016	Senior Unsecured
VASKNV / VASKN 2.900 30-Nov-2026 MTN	30-nov-2026	496 112 198	Fixed Coupon	Norwegian Krone	30-nov-2016	Senior Unsecured
VASKNV / VASKN 1.210 28-Jan-2027 MTN	28-jan-2027	151 993 920	Fixed Coupon	Euro	28-jan-2019	Senior Unsecured
VASKNV / VASKN 2.950 18-May-2027 MTN	18-maj-2027	496 112 198	Fixed Coupon	Norwegian Krone	18-maj-2017	Senior Unsecured
VASKNV / VASKN 3.020 07-Feb-2029	07-feb-2029	198 444 879	Fixed Coupon	Norwegian Krone	07-feb-2019	Senior Unsecured
VASKNV / VASKN 1.415 15-Mar-2029 MTN	15-mar-2029	50 664 640	Fixed Coupon	Euro	07-feb-2019	Senior Unsecured

Description	Maturity Date	Issued Amount	Coupon Class	Currency	Issue Date	Rank (Seniority)
VASKNV / VASKN 3.490 16-May-2033 MTN	16-maj-2033	1 488 336 593	Fixed Coupon	Norwegian Krone	16-maj-2018	Senior Unsecured
VASKNV / VASKN 3.460 06-Sep-2033	06-sep-2033	992 224 395	Fixed Coupon	Norwegian Krone	06-sep-2018	Senior Unsecured
VASKNV / VASKN 3.560 07-Nov-2033 MTN	07-nov-2033	218 289 367	Fixed Coupon	Norwegian Krone	07-nov-2018	Senior Unsecured
VASKNV / VASKN 2.277 11-Mar-2039 MTN	11-mar-2039	405 317 120	Fixed Coupon	Euro	11-mar-2019	Senior Unsecured
VASKNV / VASKN 2.533 28-Jan-2044 MTN	28-jan-2044	101 329 280	Fixed Coupon	Euro	28-jan-2019	Senior Unsecured
AKDHU 1.870 14-Jun-2021 MTN	14-jun-2021	602 230 751	Fixed Coupon	Hong Kong Dollar	30-jun-2016	Senior Unsecured
AKDHU 0.390 06-Sep-2021 MTN	06-sep-2021	1 000 000 000	Fixed Coupon	Swedish Krona	06-sep-2016	Senior Unsecured
AKDHU 1.740 24-Oct-2021 MTN	24-okt-2021	603 302 336	Fixed Coupon	Hong Kong Dollar	24-okt-2016	Senior Unsecured
AKDHU 2.220 15-Nov-2021 MTN	15-nov-2021	202 529 559	Fixed Coupon	Hong Kong Dollar	23-nov-2016	Senior Unsecured
AKDHU 0.190 13-Mar-2023 MTN	13-mar-2023	500 000 000	Fixed Coupon	Swedish Krona	13-mar-2020	Senior Unsecured
AKDHU 0.500 11-Apr-2023 MTN	11-apr-2023	600 000 000	Fixed Coupon	Swedish Krona	08-apr-2020	Senior Unsecured
AKDHU 0.450 12-Jun-2023 MTN	12-jun-2023	2 000 000 000	Fixed Coupon	Swedish Krona	12-jun-2020	Senior Unsecured
AKDHU 1.063 04-Jul-2024 MTN	04-jul-2024	200 000 000	Fixed Coupon	Swedish Krona	04-jul-2017	Senior Unsecured
AKDHU 0.165 02-Oct-2024 MTN	02-okt-2024	1 000 000 000	Fixed Coupon	Swedish Krona	02-okt-2019	Senior Unsecured
AKDHU 0.790 03-Dec-2024 MTN	03-dec-2024	200 000 000	Fixed Coupon	Swedish Krona	09-apr-2020	Senior Unsecured
AKDHU 0.250 17-Nov-2025 MTN	17-nov-2025	2 317 290 553	Fixed Coupon	Swiss Franc	17-nov-2015	Senior Unsecured
AKDHU 1.650 26-Jan-2026 MTN	26-jan-2026	500 000 000	Fixed Coupon	Swedish Krona	26-jan-2015	Senior Unsecured
AKDHU 3.440 17-Mar-2026 MTN	17-mar-2026	385 931 520	Fixed Coupon	Australian Dollar	17-mar-2016	Senior Unsecured
AKDHU 4.700 11-May-2026 MTN	11-maj-2026	150 000 000	Fixed Coupon	Swedish Krona	11-maj-2011	Senior Unsecured
AKDHU 2.080 02-Feb-2029 MTN	02-feb-2029	250 000 000	Fixed Coupon	Swedish Krona	02-feb-2017	Senior Unsecured
AKDHU 0.300 08-Oct-2029 MTN	08-okt-2029	2 317 290 553	Fixed Coupon	Swiss Franc	08-sep-2017	Senior Unsecured
AKDHU 2.450 10-Feb-2031 MTN	10-feb-2031	200 000 000	Fixed Coupon	Swedish Krona	10-feb-2016	Senior Unsecured
AKDHU 4.350 27-Jun-2036 MTN	27-jun-2036	325 000 000	Fixed Coupon	Swedish Krona	27-jun-2011	Senior Unsecured
AKDHU 3.375 24-Apr-2037 MTN	24-apr-2037	500 000 000	Fixed Coupon	Swedish Krona	24-apr-2012	Senior Unsecured

Description	Maturity Date	Issued Amount	Coupon Class	Currency	Issue Date	Rank (Seniority)
AKDHU 2.410 04-Sep-2037 MTN	04-sep-2037	320 000 000	Fixed Coupon	Swedish Krona	04-sep-2017	Senior Unsecured
AKDHU 2.310 15-Dec-2037 MTN	15-dec-2037	250 000 000	Fixed Coupon	Swedish Krona	15-dec-2017	Senior Unsecured
AKDHU 2.240 01-Oct-2038 MTN	01-okt-2038	200 000 000	Fixed Coupon	Swedish Krona	01-okt-2018	Senior Unsecured
AKDHU 2.297 23-Oct-2038 MTN	23-okt-2038	100 000 000	Fixed Coupon	Swedish Krona	23-okt-2018	Senior Unsecured
AKDHU 2.185 21-Nov-2038 MTN	21-nov-2038	100 000 000	Fixed Coupon	Swedish Krona	21-nov-2018	Senior Unsecured
AKDHU 2.305 16-May-2040 MTN	16-maj-2040	406 000 000	Fixed Coupon	Swedish Krona	16-maj-2018	Senior Unsecured
AKDHU 3.750 15-Oct-2041 MTN	15-okt-2041	1 000 000 000	Fixed Coupon	Swedish Krona	30-aug-2011	Senior Unsecured
AKDHU 2.950 17-Sep-2042 MTN	17-sep-2042	200 000 000	Fixed Coupon	Swedish Krona	17-sep-2012	Senior Unsecured
AKDHU 2.950 17-Sep-2042 MTN	17-sep-2042	130 000 000	Fixed Coupon	Swedish Krona	13-dec-2012	Senior Unsecured
AKDHU 0.650 08-Feb-2044 MTN	08-feb-2044	926 916 221	Fixed Coupon	Swiss Franc	08-feb-2018	Senior Unsecured
AKDHU 1.766 29-Nov-2046 MTN	29-nov-2046	202 658 560	Fixed Coupon	Euro	29-nov-2018	Senior Unsecured
AKDHU 2.670 10-Oct-2047 MTN	10-okt-2047	100 000 000	Fixed Coupon	Swedish Krona	12-okt-2017	Senior Unsecured
AKDHU 2.600 28-Oct-2047 MTN	28-okt-2047	240 000 000	Fixed Coupon	Swedish Krona	27-okt-2017	Senior Unsecured
AKDHU 2.600 20-Nov-2047 MTN	20-nov-2047	165 000 000	Fixed Coupon	Swedish Krona	20-nov-2017	Senior Unsecured
CASTX 0.810 09-Jul-2021 MTN	09-jul-2021	700 000 000	Fixed Coupon	Swedish Krona	09-jul-2018	Senior Unsecured
CASTX 0.850 06-Sep-2021 MTN	06-sep-2021	300 000 000	Fixed Coupon	Swedish Krona	06-sep-2018	Senior Unsecured
CASTX 2.125 18-Jan-2022 MTN	18-jan-2022	600 000 000	Fixed Coupon	Swedish Krona	18-nov-2016	Senior Unsecured
CASTX 2.150 01-Sep-2022 MTN	01-sep-2022	550 000 000	Fixed Coupon	Swedish Krona	01-mar-2017	Senior Unsecured
CASTX 1.110 03-Oct-2022 MTN	03-okt-2022	400 000 000	Fixed Coupon	Swedish Krona	18-aug-2020	Senior Unsecured
CASTX 1.650 17-May-2023 MTN	17-maj-2023	750 000 000	Fixed Coupon	Swedish Krona	17-maj-2018	Senior Unsecured
CASTX 2.125 20-Nov-2023 '23 MTN	20-nov-2023	5 066 464 000	Fixed Coupon	Euro	20-nov-2018	Senior Unsecured
CASTX 1.365 09-Sep-2024 MTN	09-sep-2024	600 000 000	Fixed Coupon	Swedish Krona	09-sep-2020	Senior Unsecured
CASTX 2.290 20-Sep-2024 MTN	20-sep-2024	300 000 000	Fixed Coupon	Swedish Krona	20-sep-2017	Senior Unsecured
CASTX 1.203 21-Feb-2025 MTN	21-feb-2025	400 000 000	Fixed Coupon	Swedish Krona	21-feb-2020	Senior Unsecured

Description	Maturity Date	Issued Amount	Coupon Class	Currency	Issue Date	Rank (Seniority)
CASTX 1.805 19-Aug-2025 MTN	19-aug-2025	200 000 000	Fixed Coupon	Swedish Krona	19-aug-2020	Senior Unsecured
CASTX 1.545 27-Nov-2025 MTN	27-nov-2025	700 000 000	Fixed Coupon	Swedish Krona	27-nov-2019	Senior Unsecured
CASTX 0.750 04-Sep-2026 '26 MTN	04-sep-2026	4 053 171 200	Fixed Coupon	Euro	04-sep-2019	Senior Unsecured
CASTX 4.220 15-May-2029 MTN	15-maj-2029	843 390 736	Fixed Coupon	Norwegian Krone	15-maj-2019	Senior Unsecured
CASTX 2.840 05-Jun-2029 MTN	05-jun-2029	100 000 000	Fixed Coupon	Swedish Krona	05-jun-2019	Senior Unsecured
JENEN 1.150 17-Mar-2022 MTN	17-mar-2022	600 000 000	Fixed Coupon	Swedish Krona	17-mar-2017	Senior Unsecured
JENEN 1.027 29-Sep-2022 MTN	29-sep-2022	100 000 000	Fixed Coupon	Swedish Krona	29-sep-2017	Senior Unsecured
ATRLJ 3.225 26-Feb-2024	26-feb-2024	496 112 198	Fixed Coupon	Norwegian Krone	26-feb-2019	Senior Unsecured
ATRLJ 3.845 06-Nov-2028 MTN	06-nov-2028	496 112 198	Fixed Coupon	Norwegian Krone	06-nov-2018	Senior Unsecured
FORSAW / FORSA 0.930 01-Nov-2021 MTN	01-nov-2021	250 000 000	Fixed Coupon	Swedish Krona	01-nov-2016	Senior Unsecured
FORSAW / FORSA 0.690 11-Jan-2022 MTN	11-jan-2022	850 000 000	Fixed Coupon	Swedish Krona	11-jul-2018	Senior Unsecured
FORSAW / FORSA 1.428 08-Dec-2022 MTN	08-dec-2022	100 000 000	Fixed Coupon	Swedish Krona	08-dec-2016	Senior Unsecured
FORSAW / FORSA 0.836 16-Dec-2022 MTN	16-dec-2022	300 000 000	Fixed Coupon	Swedish Krona	16-jun-2020	Senior Unsecured
FORSAW / FORSA 0.575 14-Feb-2023 MTN	14-feb-2023	300 000 000	Fixed Coupon	Swedish Krona	14-feb-2020	Senior Unsecured
FORSAW / FORSA 0.340 03-Mar-2023 MTN	03-mar-2023	400 000 000	Fixed Coupon	Swedish Krona	03-nov-2020	Senior Unsecured
FORSAW / FORSA 0.979 22-Feb-2025 MTN	22-feb-2025	950 000 000	Fixed Coupon	Swedish Krona	22-jan-2020	Senior Unsecured
FORSAW / FORSA 2.870 13-Sep-2027 MTN	13-sep-2027	992 224 395	Fixed Coupon	Norwegian Krone	13-sep-2017	Senior Unsecured
FORSAW / FORSA 2.860 06-Dec-2027	06-dec-2027	744 168 297	Fixed Coupon	Norwegian Krone	06-dec-2017	Senior Unsecured
FORSAW / FORSA 2.350 20-Mar-2031 MTN	20-mar-2031	380 000 000	Fixed Coupon	Swedish Krona	20-mar-2019	Senior Unsecured
FORSAW / FORSA 1.824 18-Oct-2038 MTN	18-okt-2038	200 000 000	Fixed Coupon	Swedish Krona	18-okt-2019	Senior Unsecured
VERGE 0.605 06-Jul-2021 MTN	06-jul-2021	500 000 000	Fixed Coupon	Swedish Krona	06-jul-2016	Senior Unsecured
VERGE 3.750 28-Oct-2021 MTN	28-okt-2021	200 000 000	Fixed Coupon	Swedish Krona	28-okt-2011	Senior Unsecured
VERGE 0.580 30-May-2022 MTN	30-maj-2022	500 000 000	Fixed Coupon	Swedish Krona	30-maj-2017	Senior Unsecured
VERGE 0.710 29-Aug-2022 MTN	29-aug-2022	350 000 000	Fixed Coupon	Swedish Krona	29-aug-2017	Senior Unsecured

Description	Maturity Date	Issued Amount	Coupon Class	Currency	Issue Date	Rank (Seniority)
VERGE 0.935 21-Sep-2022 MTN	21-sep-2022	500 000 000	Fixed Coupon	Swedish Krona	04-maj-2015	Senior Unsecured
VERGE 0.380 15-Sep-2023 MTN	15-sep-2023	500 000 000	Fixed Coupon	Swedish Krona	15-jun-2020	Senior Unsecured
VERGE 0.575 02-Apr-2024 MTN	02-apr-2024	500 000 000	Fixed Coupon	Swedish Krona	02-apr-2019	Senior Unsecured
VERGE 3.370 25-Jun-2024 MTN	25-jun-2024	130 000 000	Fixed Coupon	Swedish Krona	25-jun-2012	Senior Unsecured
VERGE 0.270 04-Jul-2024 MTN	04-jul-2024	500 000 000	Fixed Coupon	Swedish Krona	04-jul-2019	Senior Unsecured
VERGE 0.310 24-Jul-2024 MTN	24-jul-2024	500 000 000	Fixed Coupon	Swedish Krona	24-maj-2019	Senior Unsecured
VERGE 4.560 09-Oct-2024 MTN	09-okt-2024	100 000 000	Fixed Coupon	Swedish Krona	09-okt-2009	Senior Unsecured
VERGE 1.850 08-Jan-2025 MTN	08-jan-2025	200 000 000	Fixed Coupon	Swedish Krona	19-nov-2014	Senior Unsecured
VERGE 0.175 12-May-2025 MTN	12-maj-2025	700 000 000	Fixed Coupon	Swedish Krona	29-aug-2019	Senior Unsecured
VERGE 1.240 25-Aug-2025 MTN	25-aug-2025	300 000 000	Fixed Coupon	Swedish Krona	25-aug-2016	Senior Unsecured
VERGE 1.300 09-Sep-2026 MTN	09-sep-2026	175 000 000	Fixed Coupon	Swedish Krona	09-sep-2016	Senior Unsecured
VERGE 2.150 30-Oct-2026 MTN	30-okt-2026	200 000 000	Fixed Coupon	Swedish Krona	30-okt-2014	Senior Unsecured
VERGE 1.000 02-Jul-2030 MTN	02-jul-2030	200 000 000	Fixed Coupon	Swedish Krona	08-maj-2020	Senior Unsecured
VERGE 1.215 14-May-2035 MTN	14-maj-2035	300 000 000	Fixed Coupon	Swedish Krona	14-maj-2020	Senior Unsecured
VERGE 2.205 11-Oct-2038 MTN	11-okt-2038	300 000 000	Fixed Coupon	Swedish Krona	11-okt-2018	Senior Unsecured
VERGE 1.120 19-Feb-2044 MTN	19-feb-2044	200 000 000	Fixed Coupon	Swedish Krona	19-feb-2020	Senior Unsecured
VERGE 1.180 02-Dec-2044 MTN	02-dec-2044	200 000 000	Fixed Coupon	Swedish Krona	02-dec-2019	Senior Unsecured
VERGE 2.375 25-Jun-2048 MTN	25-jun-2048	250 000 000	Fixed Coupon	Swedish Krona	25-jun-2018	Senior Unsecured
VERGE 1.280 20-Sep-2049 MTN	20-sep-2049	200 000 000	Fixed Coupon	Swedish Krona	20-sep-2019	Senior Unsecured
KLED 2.060 11-Oct-2021 MTN	11-okt-21	350 000 000	Fixed Coupon	Swedish Krona	11-okt-17	Senior Unsecured

Appendix 3

The 50 largest real estate companies in Sweden.

Companies	Availability for OAS
Vasakronan	Y
Akademiska hus	Y
Castellum	Y
Balder	Released to shortly ago
AMF Fastigheter	No information available
Fabege	Only floating
Svenska bostäder	No information available
SBB Norden	Only floating
Skandia fastigheter	Only floating
Stockholmshem	Only floating
Wallenstam	Only non-green
Rikshem	Y
Hufvudstaden	Only non-green
Klövern	Released to shortly ago
Folksam Fastigheter	No information available
Atrium Ljungberg	Y
Willhem	y
Familjebostäder	No information available
Heimstaden	Released to shortly ago
Posseidon	No information available
MKB	No information available
Kungsleden	Y
Wihlborgs	Only green
AFA Fastigheter	No information available
Hemsö	No information available
Locum	No information available
Alecta	No information available
Hembla	Only non-green
Humlegården	Only green
Bostadsbolaget	No information available
Stena fastigheter	No information available
SEB trygg Liv	No information available
Fortifikationsverket	No information available
specialfastigheter	Y
Öbo	No information available
fastpartner	Only floating
Akelius	Only non-green
Familjebostäder Gbg	No information available
Stångåstaden	No information available

Uppsalahem	Only non-green
Lundbergs	Only non-green
Sisab	No information available
Diös	No information available
Platzer	Only non-green
Olov Lindgren	No information available
Nyfosa	Only floating
Jernhusen	Y
Victoria Park	No information available
SKB	Only floating