HOW DOES THE USE OF PROCEEDS AFFECT THE GREEN BOND PREMIUM?

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Abstract:

Human-caused climate change has created a need for increasing financial flows to sustainable solutions. Green bonds are a novel asset type where the use of proceeds are earmarked for projects with environmental benefits. In this paper we examine whether the difference in yield between green bonds and conventional bonds, known as the green premium, varies depending on the type of project being funded. Using a matching method to match green bonds with equivalent synthetical conventional bonds we find evidence that there is a significant difference in the green premium depending on the use of proceeds after controlling for residual liquidity. We show that energy projects have the most negative green premium and that projects in transportation have a positive premium, i.e. are priced lower than a corresponding conventional bond. We argue that this highlights the need for a widely adopted taxonomy for green bonds to improve the transparency of the determinants of the green premium to issuers and investors alike.

Keywords:

Green Bonds, Green Premium, Green Projects, Matching Method, Sustainable Finance

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1. Introduction

Human-caused climate change is the main cause of the observed global warming in the last 150 years (Masson-Delmotte et al., 2018). As outlined in this landmark report by the Intergovernmental Panel on Climate Change (abbreviated IPCC), global warming of 1.5 degrees or more will have far reaching impacts on both natural and human systems. The IPCC recognize this, stating that "The lower the emissions in 2030, the lower the challenge in limiting global warming to 1.5°C after 2030 with no or limited overshoot" (ibid.). According to a report by the New Climate Economy (2015), the transition to low-carbon will require extra investments of around USD 270 billion annually until 2030. The European Investment Bank instead request a more aggressive level of additional investments of up to €380 billion a year (USD 427 billion at the time of writing) only in the EU (Kolev et al., 2012).

According to the IPCC, novel financial innovations will play an important part in the transition to a low-carbon infrastructure (Masson-Delmotte et al., 2018). One such innovation are green bonds, a type of bond whose proceeds are earmarked for projects with environmental benefits. Examples of projects eligible for investment include those in energy, transportation, water, buildings, land use and waste management. The first green bond was issued in 2007 by the European Investment Bank (European Commission, 2016). Since then, green bonds have become a mainstream vehicle for investment amongst many of the largest investors in both the private and the public sector. In 2018, over USD 183 billion were raised using labelled green bonds, taking the cumulative issuance up to USD 563 billion at the start of 2019 (SEB, 2019). Over the last five years, the annual issuance volume has grown by more than 37% per year (ibid.).

To date, no singular definition on green bonds exists. As such, multiple organizations have developed frameworks and criteria to be used in the classification of green bonds. The most prominent of these are the Climate Bonds Standard by the Climate Bonds Initiative (CBI) and Green Bond Principles (GBP) by the International Capital Market Association (IMCA).

The GBP are voluntary process guidelines on issuing green bonds and are published by ICMA (2018). The GBP was established by ICMA to promote integrity in the green bond market. These guidelines put pressure on transparency, disclosure and reporting and are commonly followed by green bond issuers (Lyubov, 2019). The Climate Bonds Standard by the CBI fully integrates the GBP and provide the requirements to be labeled as green by the CBI to consequently appear in their database (Climate Bonds Initiative, 2015). The labeling done by the CBI is commonly used by other institutions to define green bonds, among these the database Thomson Reuters Eikon (Refinitiv, personal communication, May 09, 2019).

As green bonds have become a more widely used mean of financing and investment, an increasing amount of discussion around the existence of a "green premium" has occurred, eg. (Karpf and Mandel, 2016), (Ehlers and Packer, 2017), (Zerbib, 2018) and (Flammer, 2018). A green premium occurs when a green bond is priced higher, i.e. has a lower yield, than an equivalent conventional bond. When the green premium is found to be for example -1.5 basis points (bps), this is equivalent to the yield of the green bond being 1.5 bps lower than it would be for a conventional bond. A lower yield is positive for the issuer of the green bond as it decreases the issuer's cost of debt.

The existence of a premium is of interest to both issuers and investors. To investors, a green premium is negative as it would lower the yield of the investor's investment. On the other hand, a green premium is positive for the issuer as it lowers the cost of debt. A green premium on the secondary market could translate into a negative premium occurring on the primary market as well, as green bond yields on the secondary market can be interpreted as the yield at which investors will be willing to buy (Kapraun and Scheins, 2019). This is a line of thought that has been pursued by the CBI, who in their latest green bond pricing report show that the yield spreads of green bonds tend to tighten more than comparable conventional bonds once the bonds trade on the secondary market (Climate Bonds Initiative, 2018a). This may lead to the emergence of a consistent green premium on the primary market, which has been found in a recent study by Kapraun and Scheins (2019). Recognizing this phenomenon, this study will focus on the occurrence of a green premium on the secondary market.

The asset manager NN Investment Partners (2018) published a report in 2018 where they identify a yield difference stemming from the use of proceeds, i.e. which type of project the bond will finance. In their report they show that projects in renewable energy has the largest negative green premium, while projects that finance green buildings exhibit a discount compared to the issuer's conventional yield curve. Hence, their report shows that the type of project being financed may have a significant impact on the bond's yield.

However, the statistical methods employed are not clearly explained and the robustness of the results is not easily verifiable. While the report thus raises important questions there is also a need for further research into this area of the green premium.

The existence of a green premium that may vary based on the project being financed by the bond in question is of interest to both issuers and investors. Issuers aiming to finance projects with a larger negative premium may be more incentivized to issue a green bond and lower their cost of capital. On the other hand, investors may wish to focus their investments on bonds that are earmarked for certain types of green projects. This is a hypothesis that has not yet been studied in academic research. This paper will therefore focus on whether or not a green premium can be identified in the secondary market for green bonds, and whether this premium is affected by the project being financed. As such, the research question is:

Does the green premium vary depending on the type of project being financed by the green bond?

We use a model free matching method to compare the green bonds with an equivalent synthetic bond which allows us to isolate a potential green premium. Using a fixed effect panel regression, we find the green premium as the fixed effect in the regression of the yield differential on a liquidity proxy. To examine the effect of the use of proceeds, we then find the determinants of the green premium using a cross sectional regression.

In our sample of 166 green bonds issued between the 1st of January 2014 and the 31st of December 2018, we first identify the existence of an average green premium of -1.4 bps. Focusing on the determinants of the green premium and the use of proceeds in particular, we find that the use of proceeds has a significant effect on the green premium for one out of five included project types at a significance level of 0.05, and three out of five at a significance level of 0.1. Of the five project types, energy is found to have the largest effect on the green premium. While not all project types reach statistical significance, the majority of them are shown to have a negative green premium.

2. Literature Review

Multiple studies on green bonds and the green bond premium have been published in the last three years, including but not limited to those produced by Reboredo, Quintela, and Otero (2017), Tang and Zhang (2018), Flammer (2018), Gianfrate and Peri (2019), and Bachelet, Becchetti, and Manfredonia (2019). However, only a few have performed research regarding the components of the green premium. In a 2018 paper, Zerbib (2018) explores how different factors may affect the size of the green premium. Zerbib uses a matching method where he compares green bonds with close to identical synthetic conventional bonds. Studying a sample consisting of 110 bonds issued between July 2013 and December 2017 he finds a green premium of -2 bps. Zerbib shows that the occurrence and size of a green bond premium largely depends on the issuer's rating and issuer type but also explores how other factors including currencies, maturities and issue amounts may affects the green premium. However, Zerbib does not include the use of proceeds as an explanatory variable.

To the best of our knowledge, the only study examining the potential effect of green project types is a report from NN Investment Partners (2018). NN Investment Partners gather data for 133 green bonds ranging from December 2014 to November 2017. The report compares the green bonds' monthly average yield with the monthly average yield of equivalent conventional bonds. The conventional and green bonds are from the same issuer and with a similar seniority. Based on this, the yield differences for each project are identified. The project type alternative energy on average leads to the most negative yield difference of approximately -1.3 bps and transportation of around -1 bps. Green buildings are shown to have a slightly positive yield difference. The yield difference is presented as the yield of the green bond minus the conventional bonds' average yield. We investigate this further with more rigorous methods and find the project's effect on the green bond premium.

Literature regarding the effect of the green label on the cost of debt is of interest since the underlying components, such as project type, could have different impacts on the issuer's cost of debt. In a 2019 paper, Gianfrate and Peri (2019) claim to have conducted the first study on this topic. Gianfrate and Peri study 121 European green bonds issued between 2013 and 2017 using a propensity score matching, different to the matching method used in this paper. Their findings show that issuers of green bonds on average paid a lower interest of 18 bps to green bond investors in comparison to what was paid to investors of conventional bonds. According to Gianfrate and Peri, the issuance of a green bond is beneficial even when the costs associated with the issuance of a green bond is taken into account. Gianfrate and Peri claim that green bonds are beneficial not only to the issuing firm, but also to society. This is confirmed by Flammer (2018) and points to the environmental benefits of the green projects. Flammer studies the potential of green bonds by empirically examining all the corporate

green bonds issued by public and private companies worldwide since the beginning of 2013 to the end of 2017. Flammer argues that "green bonds have real impact, and hence are not merely a tool of greenwashing" (p.6) by showing that issuers of green bonds enjoy decreases in CO_2 emissions when undertaking green projects, as well as higher environmental performance and an increase in the filing of green patents. Moreover, in addition to the benefits found by Gianfrate and Peri (2019) Flammer's study shows that the announcement of a green bond issuance causes a positive response on the stock market, an increase in the issuing company's long-term value and a higher return on assets (Flammer, 2018).

Researchers do not unanimously agree on an overall negative green premium as found by Zerbib (2018), Gianfrate and Peri (2019) and Bachelet, Becchetti, and Manfredonia (2019). For example, Tang and Zhang (2018) do not find a significant green bond premium using a within-firm and between-firm comparison of 41 companies with data from 2007 to 2017 in 28 countries. Tang and Zhang therefore argue that "positive stock returns around green bond announcements are not driven by the lower cost of debt"(p.1). Thus, it is not clear if a green premium exists. Analogies to the effect of Corporate Social Responsibility (CSR) can however be made, as many researchers today agree on a positive effect of CSR (von Arx and Ziegler, 2008), (El Ghoul et al., 2010). Among these effects is a lower cost of debt (Albuquerque, Koskinen and Zhang, 2018). Nonetheless, the green premium for different project types might vary even if the overall green premium is found to be nonexistent.

3. Method

3.1. Methodology

3.1.1. Methodology overview

The major objective of this study is to investigate whether there are any differences in the green premium depending on the underlying type of green project being funded. To do this, we employ a similar matching method to the one used by Zerbib (2018). We first find whether a green premium exists for the entire dataset, as well as its magnitude. Secondly, we group the green bonds based on the different types of projects being funded. Lastly, using a cross-sectional regression we find the effect of the project type on the green premium. The starting point for our data collection is every green bond issued in the period between the 1st of January 2014 and the 30th of December 2018. We choose this period to limit the disparity between the maturity in the matched pairs.

3.1.2. Measuring the green premium

We define the green premium as the bond yield spread between conventional and green bonds less effects that may stem from other sources than the green nature of the bond, with liquidity effects being the main residual that may affect the yield differential. We use a matching method to minimize uncertainty and maximize accuracy. By using this model-free approach we are able to, in theory, eliminate effects caused by variables other than the green premium and the liquidity. Another option would be to use a regression method. However, this would require that we include all variables that have significant explanatory power with respect to the bond yield spread. Covering all explaining factors is extensive, difficult and comes with the risk of model misspecification.

3.1.3. The matching method

The matching method enables us to compare green bonds with conventional bonds without having to consider differences in issuer, currencies, ratings, seniority, collateral, coupon type and other affecting factors. We can thus isolate any yield differential as being attributable only to the green label and a difference in liquidity. This is done by comparing a green bond with an identical conventional bond. However, such pairs rarely, if ever, exist. We therefore create an identical synthetic conventional bond consisting of two conventional bonds, both similar to the green bond. The theoretical result is that the only difference that may affect the yield spread between the synthetic conventional bond, consisting of two bonds, and the green bond is the liquidity differential and the green nature of the bond. While the green premium could vary over time as a result of a changing market risk premium, Zerbib (2018) concludes that this is

not the case by finding that the time effect of the green premium is not explained by market risk after comparing the green bonds' fixed effects with the daily return of three market indices. A similar methodology to the one used in this paper has successfully been applied in related areas of research such as ethical funds by Mallin, Saadouni and Briston (1995) and Kreander et al. (2005).

3.2. Data

3.2.1. Data retrieval

We gather all data using Thomson Reuters Eikon, which label green bonds as those in line with the CBI's Climate Bonds Standards (Refinitiv, personal communication, May 09, 2019). We first collect all 1150 bonds that have been labeled as green in Eikon in the period between the 1st of January 2014 and the 30th of December 2018. This dataset consists of a range of different bonds and is not limited to a specific type. For example, it includes municipal, corporate and supranational bonds of different ratings, currencies, maturities, coupon types and seniorities.

3.2.2. Matching requirements

For each green bond in this dataset we must find two conventional bonds with which to build the synthetic conventional bond. The two bonds should be as close to a perfect match to the green bond as possible. Some characteristics have to be identical, including the issuer, rating, currency, seniority, collateral and coupon type. Other aspects have to be similar but not identical, including the maturity, issue date and issue amount. When finding appropriate matches we prevent the maturities from deviating too much from each other by limiting the conventional bonds' maturities to be within two years of the corresponding green bond's maturity. In the same sense, we constrict the issue dates of the conventional bonds to be no further than six years before or after the issue date of the green bond. Lastly, we select only those conventional bonds that have an issue amount that is either larger than a quarter of the green bond's or lower than four times the issue amount of the green bond. We consider the issue amount and issue date as they affect the bond's liquidity, as shown by Bao et al. (2011) and Houweling, Mentink and Vorst (2005), which in turn is known to affect the yield of the bond (de Jong and Driessen, 2012), (Favero et al., 2009). Similarly, the differences in maturity must be limited based on the fact that they affect the yield of the bonds (Lenz, 2010). The yields of the pairs used to create the synthetical bond must not be significantly influenced by characteristics that differ from the green bond's, such as maturity and liquidity. We set these restrictions to further isolate the green nature of the bond and to better control for liquidity.

3.2.3. Matching

For each green bond, we find all conventional bonds that fulfill the requirements presented in the previous paragraph. If for any green bond there does not exist two conventional bonds that meet the requirements the bond is deleted from the dataset. This generates a list of 2386 bonds which make up the pool from which we construct the synthetic conventional bond. Each green bond is matched with the two closest matching conventional bonds based on issue date, issue amount and maturity. The conventional bonds are chosen so that one has a maturity above the green bond's and one below it, enabling us to use interpolation to find the yield of the synthetic bond. We are left with 166 triplets, i.e. 498 individual bonds. For each individual bond, we gather data on the closing ask yield and bid yield for each date ranging from the issue date, at earliest the 1st of January 2014, to the 31st of December 2018.

3.2.4. Project type

We find the green project type for each of the 166 green bonds (see appendix table A1). 69 of the green bonds' proceeds are dedicated to projects in energy, 56 to buildings, 20 to transportation, six to water, three to land use, one to waste management and eleven cannot be identified.[1] This information cannot be retrieved from any one database. According to the Green Bond Principles, all green bonds are required to "make, and keep, readily available up to date information on the use of proceeds to be renewed annually until full allocation, and on a timely basis in case of material developments." (IMCA, 2018, p. 4). Thus, the green bond issuers normally present what type of projects the proceeds have been funding in annual reports. However, there is no standardized means of reporting the use of proceeds for green bonds. We select a specific project type for a green bond if we can retrieve a report belonging to the exact green bond of interest, that is published no longer than two years ago and states that a particular project type has been funded by more than 60 % of the used proceeds.

[1] We use similar but fewer project types than those presented in the Green Bond Principles and Climate Bond Initiative to gain larger subsamples (IMCA, 2018), (Climate Bonds Initiative, 2018b). The project type category energy includes projects that make use of renewable energy by production, transmission as well as energy efficiency such as energy storage, smart grids, and energy efficient products. The project type buildings includes projects with green buildings that meet the industry's green standards. Transportation includes low-emission vehicles and green transportation infrastructure as well as public transportation. The water category includes sustainable water and wastewater management projects, such as sustainable infrastructure for clean water, wastewater, and different forms of flooding mitigation. The land use category includes sustainable agriculture, animal farms, and biological protection and preservation. Lastly, waste management includes projects that are eco-efficient, make use of a circular economy, have eco-labels, and use resource-efficient distribution and packaging.

3.2.5. Limiting rating categories

The data of the ratings retrieved from Thomson Reuters Eikon cannot be processed in its initial state. The ratings are inconsistent as all issuers have not been rated by the same credit rating agency and thus have been given differently titled credit rating tiers. Furthermore, our sample of 166 triplets is relatively small compared to the number of different rating categories present in the sample. We use Standard & Poor's rating tiers as the standard and convert all alternative ratings to their Standard & Poor's equivalent. We limit the number of available ratings to four, including AAA, AA, A, BBB and include the category not rated for bonds that do not have a credit rating. We round off the ratings by removing all plus and minus signs, i.e. AA+ becomes AA. All short-term ratings are converted into the closest equivalent long-term rating. When required the ratings are rounded down.

3.3. Data processing

3.3.1. Finding the yield difference

We use the ask yield to find the yield difference. If on any date we cannot find the ask yield for any of the bonds in each matched triplet, the day's data for the triplet is removed from our dataset. To remove the maturity bias stemming from the conventional and green bonds' slightly different maturities we linearly interpolate the yields of the two conventional bonds that make up the synthetic bond's yield at the green bond's maturity date. Graphically, this can be understood as the maturity being on the x-axis while the ask yield is on the y-axis. On each date, each of the two conventional bonds create a point in the chart based on their maturity and yield, $(Maturity_{CB1}, Yield_{CB1})$ and $(Maturity_{CB2}, Yield_{CB2})$. Between these points, a line can be drawn. The yield of the synthetic bond is found on this line at the abscissa of the green bond maturity. We use the following mathematical formula to find the ask yield for each green bond's corresponding synthetical bond at each specific date where data is available. CB1 denotes the first conventional bond, CB2 the second conventional bond, GB the green bond and CBs the synthetic conventional bond:

$$Yield_{CBs} = Yield_{CB1} + (Maturity_{GB} - Maturity_{CB1}) * \frac{(Yield_{CB2} - Yield_{CB1})}{Maturity_{CB2} - Maturity_{CB1}} \quad (1)$$

Through interpolation, the maturity of the synthetic bond is now identical to the green bond's maturity. The only characteristics that are not identical, but now very similar, are the issue amount and issue date. We are now able to find the difference in yield between each green bond and the corresponding synthetic conventional bond for each date that has sufficient data. We denote both of the bonds in the pair, synthetic and green, as *i* while we let *t* represent the specific day and use the following equation to find the yield difference:

$$\Delta \widetilde{Yield}_{i,t} = Yield_{i,t}^{GB} - \widetilde{Yield}_{i,t}^{CBs} \quad (2)$$

3.3.2. Finding the difference in liquidity

The yield difference as defined in equation (2) is not the green premium, due to residual liquidity effects. To find the green premium, we thus control for a difference in liquidity between the green and synthetic conventional bond. So far, we have limited the liquidity effect by selecting matches that had an issue amount and issue date close to that of the green bond. However, one bond could still have been more frequently traded than the other which would affect its yield. We create a variable, $\Delta Liquidity_{i,t}$, which captures the difference in liquidity between the synthetic conventional bond and the green bond:

$$\Delta Liquidity_{i,t} = Liquidity_{i,t}^{GB} - Liquidity_{i,t}^{CBs} \quad (3)$$

To measure this liquidity, we define a liquidity proxy for each bond. The proxy is defined as the bond's daily closing bid-ask spread. This gives us equation (4). To measure liquidity in this manner is a common practice used by for example Schultz (1998), Chakravarty and Sarkar (1999), Collin-Dufresne, Martin, and Goldstein (2000) and Beber et al. (2009). The method has also been thoroughly analyzed by Fong et al. (2017) who draw the conclusion that the bid-ask spread (BAS) is the best low-frequency, i.e. daily, liquidity proxy.

$$\Delta BAS_{i,t} = BAS_{i,t}^{GB} - BAS_{i,t}^{CBs} \quad (4)$$

To retrieve the corresponding bid-ask spread for the synthetic conventional bond from the two underlying bonds, we weigh the individual ask-spreads differently based on the distance between the green bond's maturity and the respective conventional bond's maturity. The closer the maturity of the conventional bond is to that of the green bond, the higher the weighting of that conventional bond should be in the construction of the synthetic bond's bid-ask spread. We do this because bonds with different maturities may have different trading volumes. Consequently, we let d_1 and d_2 be the distance from each conventional bond's maturity to that of the green bond's maturity:

$$d_1 = |Maturity_{GB} - Maturity_{CB1}| \quad (5)$$

$$d_2 = |Maturity_{GB} - Maturity_{CB2}| \quad (6)$$

The synthetic bond's bid-ask spread is constructed by using the following distance-weighted average formula:

$$BAS_{i,t}^{CBs} = \frac{d_2}{d_1 + d_2} BAS_{i,t}^{CB1} + \frac{d_1}{d_1 + d_2} BAS_{i,t}^{CB2} \quad (7)$$

We now have data for the pair's bid-ask spread. We use equation (4) to find $\Delta BAS_{i,t}$ for our sample. Descriptive statistics for the bid-ask spread is shown in appendix table A2.

We observe that the sample mean of the liquidity proxy is close to zero with a relatively low standard deviation which means that the discrepancy in liquidity between the bonds are low. This implies that our previous matching restriction of issue date and issue amount have successfully controlled for much of the variation in liquidity.

The difference in liquidity is the explanatory variable in the fixed-effect regression of $\Delta\widetilde{Yield}_{i,t}$ on $\beta\Delta Liquidity_{i,t}$ as outlined in equation (8) below. This lets us define the green bond premium gp_i as the unobserved effect in the regression, hereafter referred to as regression (A), where $\varepsilon_{i,t}$ denotes the error term:

$$\Delta\widetilde{Yield}_{i,t} = gp_i + \beta\Delta Liquidity_{i,t} + \varepsilon_{i,t} \quad (8)$$

3.4. Statistical method

3.4.1. Finding the green premium – Regression (A)

To estimate the most appropriate model specification we first perform an F-test to investigate whether a pooled OLS, random effects or fixed effects regression is the most suitable. The null hypothesis of the F-test is that the fixed effects in regression (A), gp_i, are zero, i.e. equal across all bonds. Upon performing the test, we reject the null hypothesis with high statistical significance, as shown in table 1.

Table 1. Results from Tests Performed on Regression (A). This table shows tests performed on regression (A), $\Delta\widetilde{Yield}_{i,t} = gp_i + \beta\Delta Liquidity_{i,t} + \varepsilon_{i,t}$, their statistics, p-values, and implications.

Testing for	Test	Statistic	P-Value	Conclusion
Individual Effect	F Test	1130.58	0.0000	Individual Effect
Autocorrelation	Wooldridge	19.676	0.0000	Autocorrelation
Random or Fixed effect	Hausman	3.95 (df=1)	0.0468	Fixed Effect
Heteroscedasticity	Mod. Wald Test	1.1e+09	0.0000	Heteroscedasticity
Model misspecification	Ramsey Reset Test	3.83	0.0519	No misspecification

Thus, the test displays that our dataset shows evidence of panel-wise effect, meaning the fixed effects are non-zero. Hence, a pooled OLS is not appropriate given our data. It may however be the case that the fixed effects are non-zero but that they are also correlated with the time-varying explanatory variable in regression (A), the bid-ask spread. To test this, we also perform a Hausman test which indicates that the fixed effect estimator is more efficient and consistent than the random effect estimator.

We then perform robustness tests. First, we test for groupwise heteroscedasticity in the residuals using the modified Wald test as outlined in Greene (2002). This is achieved using -xttest3- in Stata as provided in Baum (2001) which allows for unbalanced panel data, in line with the dataset used in this paper. The test indicates the presence of heteroscedasticity as shown in table 1.

We also test for autocorrelation, meaning error terms that are correlated across time periods. Following Wooldridge (2010) we perform a Wooldridge test for autocorrelation in our panel data, using the command provided by Drukker (2003). The Wooldridge test tests the null hypothesis of no autocorrelation, which we reject with high significance as shown in table 1. As the robustness tests indicate the presence of both heteroscedasticity and autocorrelation in our panel data we invoke clustered robust standard errors, in the form of the Huber-White or sandwich estimators of standard errors following the work by Arellano (1987).

As the Hausman test outlined above does not support non-default standard errors we also perform a version of a test of overidentifying restrictions by using the module put forth by Schaffer and Stillman (2016). The test supports the results of the Hausman test and substantiates the indication that a within regression is the best specification for our data. Lastly, we perform a manual adaptation of the Ramsey RESET test for model misspecification as described by Ramsey (1969). As demonstrated in table 1 there is no statistically significant evidence of model misspecification for regression (A). By performing the RESET test manually, we are able to control the number of powers used. In addition, it allows us to perform the test using a correct covariance matrix which makes the test more robust. We perform the test by retrieving the powers of the fitted values of regression (A). We then include these additional variables as explanatory variables in regression (A) and test the significance of the regression including the powers and the liquidity measure.

Thus regression (A) is a fixed-effect panel regression with Huber-White robust standard errors. The test provides the fixed effect for the whole period for each green bond. As such, regression (A) produces the same number of estimated fixed effects, gp_i, as the number of green bonds analyzed.

After retrieving the green premium for each green bond, we divide the bonds into subsamples based on the categories project type, rating and currency. To verify the efficiency of the estimator for the green premium we calculate the mean of

the green premium for each sample and test if it significantly differs from zero. We determine the most appropriate procedure to do so through a Shapiro-Francia test with the null hypothesis that the subsample being tested comes from a normally distributed population, following Shapiro and Francia (1972). We only include subsamples containing more than 10 bonds, the smallest sample size allowed in the Shapiro-Francia test. We reject the hypothesis of normality for 9 out of the 11 constructed subsamples. The test indicates that we cannot reject the null hypothesis for AAA rated bonds or SEK-denominated bonds.

According to the results of the Shapiro-Francia tests we employ a variation of the two-sample t-test with unequal variances to test if the subsample mean is significantly different from zero. While the t-test assumes normality for the samples being tested, the t-test procedure used in STATA is robust to deviations from the assumption of normally distributed samples. We find that the subsamples transportation, SEK, A, and AA are significantly different from zero at a significance level of 0.1.

3.4.2. Finding the effect of the use of proceeds on the green premium – Regression (B)

We now examine the determining factors of the green premium. This entails finding which variables possess significant explanatory power. In line with the aim of this paper, the main focus of this exercise will thus be on the varying project types of the green bonds. In addition to project type, we also include variables for the maturity, the issue amount, the currency and the rating of the green bond. We develop two model specifications for the second regression, henceforth referred to as regression (B). The two specifications are motivated as being the ones with the highest R^2. In specification (1), we include the variables project type, rating, currency, maturity and the natural logarithm of the issue amount. In specification (2), we exclude the variables maturity and issue amount as these do not have a significant explanatory power. To avoid a situation where the estimates are not close to the true values for the population, we exclude subcategories with fewer than 4 observations from the categorical variables in the regression. With u_i being the error term, specification (1) is:

$$\widehat{gp_\iota} = \alpha + \beta_{1,project\ type_j} X_{project\ type_j} + \beta_{2,rating_j} X_{rating_j} + \beta_{3,currency_j} X_{currency_j} + \beta_4 Maturity + \beta_5 \log(Issue\ Amount) + u_i \quad (9)$$

We perform a logarithmic transformation of issue amount to linearize the estimated effect of the variable on the green premium. As such, given a certain percentage increase in issue amount, we will see the same difference in its effect on the green premium regardless what the base level of the green premium is. The variables rating, currency and project type are factor variables containing subcategories which can be interpreted as dummy variables.

We again perform robustness tests to verify the validity of our model specification and the nature of our data. We first conduct a Breusch-Pagan test to check for heteroscedasticity. As described in Breusch and Pagan (1979) this is a test of the null hypothesis that the error variances are equal. The test rejects the null hypothesis with high statistical significance and thus indicates that our data suffers from heteroscedasticity. This test is performed for all specifications of the step 2 regression, with the same results, as given in table 2.

Table 2. Results from Tests Performed on Regression (B). This table shows tests performed on the OLS regression, regression (B), $\widehat{gp}_i = \alpha + \beta_{1,project\ type_j} X_{project\ type_j} + \beta_{2,rating_j} X_{rating_j} + \beta_{3,currency_j} X_{currency_j} + \beta_4 Maturity + \beta_5 \log(Issue\ Amount) + u_i$, their statistics, P-values and implications on both specifications, (1) & (2).

Testing for	Test	(1) Statistic (1) P-Value	(2) Statistic (2) P-Value	Conclusion
Heteroscedasticity	Breusch-Pagan	12.39 0.0004	16.62 0.0000	Heteroscedasticity

Regression (B) is a cross-sectional OLS regression with robust standard errors. Since the independent variables in the regression are constant (i.e. do not vary over time for each bond) and the dependent variable is the fixed effect of regression (A), it is important to emphasize that we no longer have panel data. As such, regression (B) is an ordinary OLS regression. Whereas in regression (A) we also had longitudinal observations, only one observation per bond is examined in regression (B) as the green premium constitutes only one observation per bond.

4. Results

4.1. The green bond premium

As shown in table 3, regression (A) indicates that the liquidity measure, as given by the difference in the bid-ask spread between the green bond and the matched synthetic bond, is statistically significant at a significance level of 0.01. As such, the bid-ask spread differential has explanatory power for the yield differential. However, the relatively small beta coefficient shows that a change in the liquidity variable does not have a large effect on the yield differential. An increase of 1 % in the liquidity measure causes a decrease of 28.39 bp in the yield differential. As given by the definition of the yield differential in equation (2), this can be interpreted as a reduction in the difference between the yield of the green bond and the yield of synthetic conventional bond. The low R^2 of 5.04% for regression (A) indicates that the liquidity measure does not capture a large portion of the variance in the yield differential. However, this is to be expected and is simply a consequence of the model specification.

Table 3. Results for Regression (A). This table shows the results of a fixed-effect panel regression of the yield difference performed on the liquidity difference, i.e. $\Delta \widetilde{Yield}_{i,t} = gp_i + \beta \Delta Liquidity_{i,t} + \varepsilon_{i,t}$. The fixed effect is the green bond premium, $\widehat{gp}_i$, for all dates with data.

Dependent Variable: $\Delta \widetilde{Yield}_{i,t}$	
	Coefficient
Constant	0.0158***
Bid-ask Spread	-0.2840***
Observations	44,751
R^2	0.0485
F Statistic	1130.58***
	(df = 165; 44584)

Note: *p<0.1; **p<0.05; ***p<0.01

Through regression (A) we are able to retrieve the value of the fixed effect estimator which is the green premium for each green bond. Table 4 shows descriptive statistics for the green premium for the entire sample of 166 green bonds.

Table 4. The Distribution of the Green Premium Found in Regression (A). This table presents the distribution of the fixed effect of regression (A), $\Delta \widetilde{Yield}_{i,t} = gp_i + \beta \Delta Liquidity_{i,t} + \varepsilon_{i,t}$, the green bond premium. The numbers are presented in basis points.

	$\widehat{gp}_i$ (%)					
	Min	1st Quartile	Median	Mean	3rd Quartile	Max
n=166	-103.53	-4.27	-1.67	-1.39	2.05	52.77

The green premium ranges between -103.5 bps and 52.8 bps with an average green premium of -1.4 bps and a median of -1.67 bps. The wide distribution of the green premium can to some extent be explained by the fact that the green bonds are issued in different currencies which differ in yield. For example, the average yield of green bonds issued in IDR is much larger than bonds issued in USD.

In table 5 we show the green premium for the different project types, as well as for the subsamples for currency and rating. The results of the t-tests indicate that green bonds with the project type transportation have a mean green premium of +7.88 bps, i.e. they are priced lower than the conventional bond, and are significantly different from zero at an alpha of 0.1. SEK-denominated green bonds have a mean green premium of -1.96 bps at the same level of significance. Lastly, A-rated green bonds have a green premium of -5.26 bps while AA-rated green bonds carry a green premium of +4.04 bps.

Table 5. Descriptive Statistics for the Green Premium in Different Segments. The table presents the mean for the green premium for different green project types, ratings and currencies with more than four observations. The table shows the p-value of the significant variables in the modified t-test which was performed to test if the mean of the subsample is significantly different from zero. The mean is presented in basis points.

		Mean ($\widehat{gp}_i$)	P-Value
Project Type	Energy	-2.67	
	Buildings	-1.10	
	Transportation	7.88*	0.070
	Unidentifiable	-2.84	
	Water	-4.96	
Currency	USD	1.08	
	EUR	-3.33	
	SEK	-1.96*	0.085
	AUD	0.97	
	HKD	7.43	
Rating	A	-5.26*	0.076
	AAA	-2.09	
	AA	4.04*	0.096
	Non-rated	-0.67	
	BBB	2.21	

Note: *p<0.1; **p<0.05; ***p<0.01

4.2. The effect of the use of proceeds on the green bond premium

The determining factors of the green premium are examined through a panel regression, referred to as regression (B). The results of specification (2) can be found in table 6. Following we present the results from specification (1). The base levels in regression (B) are transportation, USD and AAA. At a significance of 0.023, the project type energy affects the green premium by -9.5 bps with respect to the base level. The project type buildings affect the green premium by -7.1 bps at a significance of 0.082. Unidentifiable project types affect the green premium by -11.7 bps at a significance of 0.051. We find that the project type water also makes the green premium more negative, but not with statistical significance. In addition to the project types, we find that the rating AA has significant influence on the green premium in both specifications. It is observed that the rating AA causes the green premium to become less negative with +6.3 bps with respect to the AAA rating. Taking the other ratings into account, however, we cannot recognize any pattern based on the rating tiers. Neither currency, maturity nor issue amount significantly affects the green bond premium in any of the two specifications.

Table 6. Results from Regression (B). In this table, the results of the OLS regression show how different bond characteristics affect the green bond premium through specifications (1) and (2), given by the equation $\widehat{gp}_i = \alpha + \beta_{1,project\ type_j} X_{project\ type_j} + \beta_{2,rating_j} X_{rating_j} + \beta_{3,currency_j} X_{currency_j} + \beta_4 Maturity + \beta_5 \log(Issue\ Amount) + u_i$. Project type is a qualitative variable which has six categories, including transportation (base level), buildings, energy, land use, waste management and water. The qualitative variable currency has five categories, USD (base level), AUD, EUR, HKD and SEK. Another qualitative variable is rating which includes AAA (base level), AA, A, BBB, and non-rated. Maturity is in years as of December 30, 2018. The issue amount has been logarithmically transformed. In specification (2), the variables maturity and issue amount are excluded.

Dependent Variable: *Green Premium,* $\widehat{gp}_i$
OLS regression with Huber-White robust standard errors

	(1) Coefficient (Std. Err.)	(2) Coefficient (Std. Err.)
Constant	0.243	0.071*
	(0.416)	(0.042)
Project Type Buildings	-0.071*	-0.068*
	(0.041)	(0.041)
Project Type Energy	-0.095**	-0.092**
	(0.042)	(0.041)
Project Type Water	-0.146	-0.144
	(0.121)	(0.119)
Unidentifiable Project Type	-0.117*	-0.101
	(0.059)	(0.073)
Currency AUD	-0.047	-0.043
	(0.035)	(0.032)
Currency EUR	-0.038	-0.039
	(0.039)	(0.033)
Currency HKD	-0.017	-0.005
	(0.055)	(0.044)
Currency SEK	-0.035	-0.039
	(0.025)	(0.025)
Rating AA	0.061*	0.063**

	(0.031)	(0.032)
Rating A	-0.016	-0.012
	(0.034)	(0.038)
Rating BBB	0.034	0.038
	(0.030)	(0.033)
Non-rated	0.015	0.022
	(0.028)	(0.033)
Maturity	0.001	
	(0.007)	
log(Issue Amount)	-0.009	
	(0.021)	
Observations	150	150
R^2	0.103	0.101
F Statistic	1.72*	2.01**
	(df = 14; 135)	(df=12; 137)

Note: *p<0.1; **p<0.05; ***p<0.01

5. Discussion

5.1. Comparing the results to literature

The finding that energy is the project type with the largest impact on the green premium is consistent with the only literature on the subject — the previously referenced report by NN Investment Partners (2018), which states that energy projects generate the largest yield difference. The green premiums found in this paper are more negative than the yield differences shown in the report. Additionally, this paper finds a positive green premium for the project type transportation while the report by NN Investment Partners finds a negative yield difference for transportation. While NN Investment Partners find a yield difference of -1.3 bps for alternative energy projects, this paper identifies a green premium of -3.4 bps for the project type energy. The report examines differences in yield, rather than the green premium itself. Thus, the report should be interpreted as further evidence that the project types affect the yield, and consequently, the green premium. However, it should not be interpreted as a reflection of the magnitude of the green premium.

Zerbib (2018) does not include a variable for project type but finds that the issuer's sector and rating significantly affect the green bond premium. We show that three out of five green project types significantly explain the green premium while Zerbib shows statistical significance for two out of four rating categories. Thus, this paper complements the findings in Zerbib's study by identifying further statistically significant explanatory variables.

The difference in cost of debt between conventional and green bonds found by Gianfrate and Peri (2019) could be applied to our project types. As this difference in financial costs consists of the green bond premium, and the premium itself differs between project types, this should indicate a difference in cost of debt between different project types.

5.2. Implications for issuers, investors and policymakers

Under the assumption that issuers of bonds seek to minimize their cost of debt, these issuers may base their choice of financing based on the yield differentials observed in the secondary market. As such, the green premium observed in the secondary market could influence the outflow of bonds in the future. According to our results, issuers benefit from a lower cost of debt when issuing green bonds used to finance projects in energy and buildings. While it is reasonable to assume that issuers will seek to minimize the cost of debt, the magnitude of the difference in green premium must also be taken into account. While the difference of around 9 basis points for projects in energy as compared to projects in transportation will be of interest to issuers, the difference in cost of borrowing may not be enough to have an effect on issuer preferences.

On the other hand, the implications for investors are the opposite. Under the assumption that investors seek to maximize the yield of their investment, they will benefit from investing in the type of project which is shown to have the lowest green premium, i.e. transportation. Again, the scale of the difference in the yield between green bonds used to finance different project types is of importance. As some investors take other criteria than solely yield into account when making an investment decision, it is likely that the difference in yield will have to be of a certain magnitude for it to have an effect on their decision. This difference would, as shown, arise due to imbalances in supply and demand caused by a change in the green premium based on the use of proceeds. That said, it is difficult to determine the difference required for there to be structural changes in the secondary market for green bonds.

This raises an interesting question regarding the use of proceeds. While it makes intuitive sense that investors seek to maximize their yield, there may be other criteria taken into account when the decision on which project to invest in is made. Should investors have a preference for certain types of projects due to their investment mandate, a small difference in the green premium may not be enough to affect their investment decisions to a larger degree. Such is often the case for institutional investors such as pension funds whose strategic investment plans include a mandatory allocation of capital to certain types of assets, for example the Swedish pension fund AP4 (Fjärde AP-fonden, 2018).

Regardless of whether investors have a preference for financing particular kinds of projects or maximizing the return on their investment, this paper indicates that the bonds' use of proceeds will be of interest to investors in both the primary and secondary market. Improving the transparency surrounding the use of proceeds in green bonds would allow investors to make investment decisions more in line with any such preferences. As a consequence of the lack of a widely adopted taxonomy in the green bond market there are as of yet no binding regulations which require that the use of proceeds are reported in detail. While the GBP include guidelines around reporting the

use of proceeds both before and after the issue of a green bond, these are only recommendations and are not mandatory. In practice most issuers are not reporting the use of proceeds on a detailed project-by-project basis but rather in larger categories of the different project types being financed.

Greater transparency would be beneficial for issuers as well, since access to more complete information would make the market for green bonds more efficient and ensure that the bonds are fairly priced (Thuesen, 2004). More transparency leading to fair prices would also more accurately reflect the supply and demand in the market, which is important for attracting both investor and issuer appetite for green bonds. The publication by Nationalbanken argues that pre-trade information is of high importance to ensure that investors can trade assets at fair prices (Thuesen, 2004). Requiring more extensive reporting of the use of proceeds in the green bond market may thus improve the pricing of green bonds to the benefit of all market participants.

This would have implications for policymakers and regulators in sustainable finance. In March 2018, the European Commission published an action plan for financing sustainable growth in the EU to meet the goals set out in the Paris Agreement (European Commission, 2018). In addition to establishing a goal of boosting the issuance of green bonds, the report sets out that the EU will establish a unified classification system including EU standards for sustainable financial assets as a whole, and green bonds in particular. Stipulating more detailed reporting of the use of proceeds, including project types, would thus be an important aspect to include in future regulations of the green bond market such as the one proposed by the European Commission.

5.3. Suggestions for future research

As the demand for green bonds increases, so does the need for further research into green bonds to improve the transparency and access to information for investors, issuers and policymakers alike. Given the low R^2 in regression (B), it is evident that further examinations of the determinants of the green premium is needed. As the yearly issuance of green bonds is still rapidly increasing, future studies examining similar variables such as the ones included in this paper would be beneficial to conduct in the coming years as the market for green bonds grows larger and access to data on green bonds with it. Additionally, studies focusing on identifying other variables with explanatory power to further uncover the determinants of the green premium would be a positive contribution to the research on green bonds.

As touched upon in section 5.2, it would also be interesting to examine investor motives and preferences when investing in green bonds. It could for example be hypothesized that the environmental benefits found by Flammer (2018) differ between project types and that this is the underlying cause behind the observed difference in the green premium as investors seek to maximize the impact of their investments. Specifically, future research could conduct survey analysis on whether investors have a preference for investing in certain project types, rather than certain sustainable financial products as a whole. This would shed light on whether the scale of the difference in the green premium between different project types is enough to have a noticeable effect on the market for green bonds.

Lastly, as there exists only a limited amount of research on the link between the use of proceeds and yield premiums, applying similar methods in other areas of sustainable finance such as social impact bonds and ethical bonds would further reveal whether the use of proceeds is a determinant of bond yields.

6. Limitations

6.1. Data

6.1.1. Project type

The categorization of project types used in this paper does not perfectly mirror the actual use of proceeds for each bond. Often, the green bonds' proceeds are dedicated to multiple project types. Our categorization only reflects the majority project type, i.e. the one that the majority of proceeds are earmarked for. As we categorize a bond as a certain project type when more than 60 % of the proceeds are dedicated to a particular project, the remaining share of proceeds could still affect the green premium. For example, if investors invest in a bond because a certain portion of the issue amount of that bond is used to finance a land use project but we define the green bond's project as water, the defined bond project does not completely represent the underlying bond's use of proceeds. Thus, the difference in yield between water and other projects on the market does not in this case represent the actual demand for that project type.

Another limitation comes from the subsample sizes of the different project types. Waste management, land use and water consist of less than 10 bond pairs and are therefore not included in regression (B). This limits the scope of the research conducted in this paper.

6.1.2. Rating

Our sample consists of 166 triplets or 498 individual bonds. Based on their characteristics, they were divided into subsamples. The raw data from Thomson Reuters Eikon includes 35 different rating categories. The large number of categories is the outcome of differently titled and defined rating tiers by various credit rating agencies as well as the different credit ratings between bonds. To be able to construct statistically usable subsamples, the number of rating categories were limited to four broader categories and the ratings rounded off. Thus, the rating subsamples include more rating tiers than what their subsample title indicates. Because of this, it may be that the credit rating tiers AAA, AA, A and BBB, have an actual effect on the green bond premium that is different from our findings.

6.1.3. Currency effects

There may be a bias caused by bonds issued in a currency where overall yields are comparably large. Even if the percentage difference between the green bonds and the conventional should be about the same for all currencies, the absolute values between the green and conventional bonds may be higher for bonds denoted in volatile currencies. This would not impact the interpretability of the beta coefficients in

regression (B) but may make the mean green premium for the entire sample not entirely representative of the larger population of green bonds.

6.2. Model

A limitation in the cross-sectional regression, denoted regression (B), is the risk of model misspecification due to omitted variable bias. Specifically, it may be the case that the project type-variable included in the model acts as a proxy for a missing variable which is the actual underlying cause of the difference in the green premium. For example, Zerbib (2018) does not include project type as an explanatory variable but instead finds that the sector type of the issuer significantly affects the green premium. When contrasted with the result found by Zerbib, it may be that the project type-variable included in regression (B) is not the cause of the difference in the green premium, but that such an effect should instead be attributed to the sector type of the issuer. This would be the case if there exists a correlation between project type and issuer sector. However, it should be noted that it may also be the case that the project type is the causal factor, not the sector type.

There is also a risk of availability bias in the project types included as category variables in regression (B). As subsamples with fewer than 4 observations were excluded, there is a risk that certain project types are more likely to be excluded from the regression due to an imbalance in data availability between green bonds financing different types of projects. This would mean that the results outlined above are not representative of the wider green bond universe as a whole.

One shortcoming of the Breusch-Pagan test is that it only tests for linear forms of heteroscedasticity, meaning that as gp_i increases, so does the variances of the errors. Accordingly, the test is not suitable for non-linear forms of heteroscedasticity nor when the errors are not normally distributed. To supplement the Breusch-Pagan test one could perform the White general test for heteroscedasticity (White, 1980). However, this test does not work well for smaller datasets such as the one used in this paper. As such, there is a risk that the result of the Breusch-Pagan test does not completely reflect the nature of our data. Nevertheless, as we invoke clustered robust standard errors this would not affect the results of the two regressions.

Lastly, the estimation of the synthetic bond with which we construct the matched triplets may suffer from inconsistencies in the interpolated yield and liquidity. If the two conventional bonds differ from their matched green bond to a large degree then both the yield and the liquidity of the synthetic bond may not be an accurate measure with which to compare the green bond. Even though we control for liquidity in the matching method as well as in the inclusion of the liquidity proxy in regression (A), there may be a small residual liquidity bias in regression (B).

7. Conclusion

The demand for sustainable financial products has increased as a response to a growing need for structural changes in global infrastructure and energy systems due to climate change. In line with this demand, there is a need to maintain information access and transparency in novel financial products aiming to increase the flow of funds to sustainable solutions. To examine the effect that the project type being funded has on the green premium, we use a matching method to identify 166 green bonds which we subsequently match with a synthetic conventional bond. By controlling for residual liquidity, we isolate the green premium.

In the first step we find the existence of a green premium, in line with the findings of Zerbib (2018) and Gianfrate and Peri (2019). We find a mean green premium of -1.4 bps and a median of -1.67 bps. In the second step, the main focus of this study, we find that the use of proceeds has a significant impact on the green premium for three of the five project types. We find that energy has the largest effect on the green premium out of the project types studied, while transportation is found to have a positive premium, i.e. is priced lower than a corresponding conventional bond. three of the five project types included are found to have a statistical significance, suggesting that the use of proceeds is of interest to both issuers and investors in the green bond market. In conclusion, this paper nuances the current research on green bonds by introducing the underlying project being funded as a significant determinant of the green premium.

8. References

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A. Appendix

Table A1. Number of Green Bonds in Each Category. The table presents the different categorizations of bond pairs used in this paper as well as the number of green bonds in each category.

		Number of Green Bonds
Project Type	Energy	69
	Buildings	56
	Transportation	20
	Unidentifiable	11
	Water	6
	Land Use	3
	Waste Management	1
Currency	USD	57
	EUR	49
	SEK	36
	AUD	7
	HKD	5
	CHF	3
	CAD	2
	INR	2
	NOK	2
	NZD	2
	IDR	1
Rating	A	44
	AAA	39
	AA	35
	Non-rated	28
	BBB	20

Table A2. Descriptive Statistics of the Difference in Bid-Ask Spread. This table shows the distribution of the difference in the bid-ask spreads, $\Delta\widetilde{BAS}_{i,t}$, between the green bonds' bid ask spread, $\widetilde{BAS}_{i,t}^{GB}$, and synthetic conventional bonds' bid-ask spread, $\widetilde{BAS}_{i,t}^{CBs}$. The synthetic conventional bond's bid-ask spread is constructed from the underlying two conventional bonds' bid-ask spreads, weighted based on the distance of their maturity to the paired green bond's. The difference is presented in basis points.

	Min	1st Quartile	Median	Mean	3rd Quartile	Max
Bid-Ask Spread						
n=54,402	-86.39	-1.75	0.00	0.82	1.81	106.48

Table A3. Descriptive Statistics of the Yield Difference. This table summarizes the distribution of the yield difference, $\Delta\widetilde{Yield}_{i,t}$, which is based on the ask yield difference between the green bond, $\widetilde{Yield}_{i,t}^{GB}$, and the interpolated conventional bonds, the synthetic bond, $\widetilde{Yield}_{i,t}^{CBs}$, for each tradable day in our sample. The difference is presented in basis points.

	Min	1st Quartile	Median	Mean	3rd Quartile	Max
Yield Difference						
n=51,436	-113.36	-3.53	0.19	0.63	4.51	91.68

Table A4. Currency Acronyms Explained. This table gives the full name of the currencies used as acronyms in the text.

Code	Currency
USD	United States Dollar
EUR	Euro
SEK	Swedish Krona
AUD	Australian Dollar
HKD	Hong Kong Dollar
CHF	Swiss Franc
CAD	Canadian Dollar
INR	Indian Rupee
NOK	Norwegian Krone
NZD	New Zealand Dollar
IDR	Indonesian Rupiah