The Swiss Market of Green Bonds: Breaking Down the Barriers to Scale

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Cover picture: Derek Brumby via Adobe Stock)

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EXECUTIVE SUMMARY

Green bonds can foster financial flows towards environmental projects and are subject to a growing interest in Switzerland. Green bonds are used to finance projects with a positive environmental impact. While they are the predominant sustainable debt instrument worldwide, they still represent a small portion of total debt volumes. The interest of Swiss issuers towards green bonds has increased in recent years, with more and more issuances, including the one of the Swiss green Confederation bonds. However, little is known about the current state of the Swiss green-bond market and what could limit its growth. This analysis aims at filling this gap.

This market outlook displays the current state of the green-bond market and barriers to scale in Switzerland. It essentially focuses on CHF-denominated bonds outstanding on the SIX Swiss Exchange as of 2023. The analysis describes the current requirements for issuing a green bond, discusses the trends observed on the Swiss green-bond market, and analyses barriers to scale brought forward by market actors with market information and data.

From a regulatory perspective, Switzerland follows a market-based approach for green-bond issuance and reporting. In Switzerland, green-bond issuers are subject to the same legal requirements at issuance as when issuing standard bonds and no legal definition of green bonds exists. However, to be flagged as "green" on the SIX Swiss Exchange, bonds have to be (1) aligned with the Green Bond Principles of the International Capital Market Association and (2) listed on the Green Bond Database of the Climate Bonds Initiative.

While the Swiss green-bond market is growing, its size remains small. The annual volume of CHF-denominated green bonds issued on the Swiss exchange has regained traction in 2023, with 105 bonds outstanding. However, the share of green bonds in the Swiss market per amount issued (4.2%) is relatively smaller than its European counterparts (12.6%).

Green-bond issuers are mostly banks, real estate, and energy firms. The main issuers of Swiss green bonds are usually larger, and better performing than their peers, and often in need of financing. These firms use the proceeds from green bonds to invest in projects across a wide array of sectors, with the largest shares in sustainable buildings and sustainable energy.

Four main market barriers prevent the Swiss green-bond market from reaching scale. Interviews with market stakeholders in a workshop set-up helped identify four main barriers to scale. These barriers include high costs of issuance, which are a problem in the context of low demand that has characterised the Swiss green-bond market in the past. Other barriers are a lack of incentives to bear lower returns, the lack of uniform post-issuance reporting and the low climate impact of underlying projects.

Market actors, policy makers and academia can take action to help the market reach its potential. Discussions with these stakeholders brought forward three avenues of action, namely developing an open-source, centralised database with information on green bonds issued in Switzerland, testing decentralised finance solutions for reducing issuance costs, and creating a stakeholder-policymaker platform, or supporting the existing ones, to promote a policy and legislative agenda.

KEY TAKEAWAYS

1. Green bonds can foster financial flows towards environmental projects and are subject to a growing interest in Switzerland.
2. Market trends show that the size of the Swiss green-bond market remains small compared to its European counterparts. The largest issuers are banks, and real estate and energy firms, which use the bonds to invest mostly in sustainable buildings and energy.
3. While the Swiss green-bond market is growing, some market barriers prevent it from reaching scale, namely high cost of issuance, lack of incentives to bear lower returns, lack of uniform reporting and low climate impact.
4. Market actors, policy makers and academia can take action to help the market reach its potential, by centralising information, using decentralised finance and promoting legislation.

1 INTRODUCTION

Green bonds are used to finance projects with a positive environmental impact. Unlike standard bonds, green bonds raise capital, so called "proceeds of the bond", to finance the issuer's new or existing green projects, such as renewable-energy infrastructure and biodiversity conservation. For instance, the proceeds of a green bond issued by an energy company could be allocated to projects focusing on energy-efficiency and renewable-energy infrastructure.

Green bonds remain the predominant sustainable debt instrument worldwide (Box 1). In the first quarter of 2023, the total market size for green bonds amounted to CHF1,679 billion[5], which is 37.5% of the global sustainable-debt market and the first type of sustainable debt instrument [2].[6] Although this market has been growing significantly over the past years, the sustainable-bond volumes - half of which are green bonds - account for only a small portion (5%) of the total debt volumes [3].

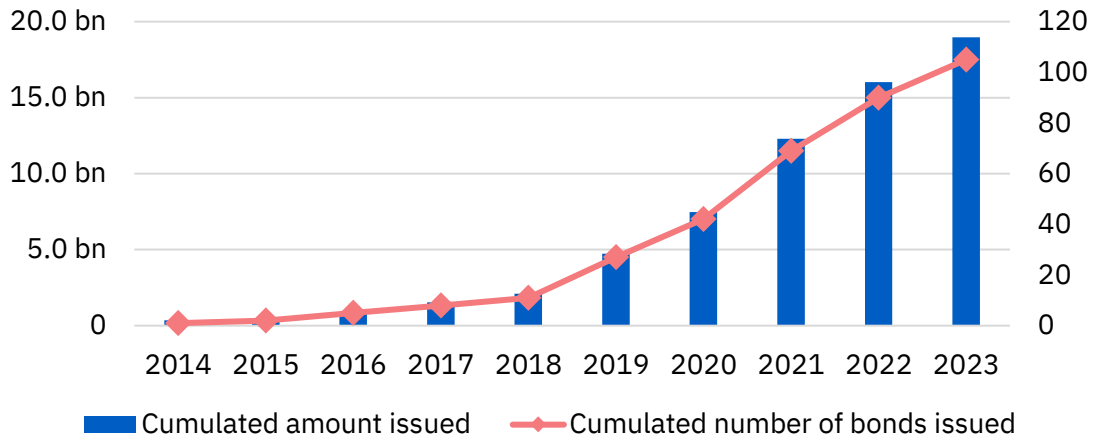
In Switzerland, corporations and governmental institutions started showing an interest in green bonds. Figure 1 shows that, over the past years, the SIX Swiss Exchange registered an increase in the issuance of green bonds, with 105 CHF-denominated green bonds trading at the end of the second quarter of 2023 (pink line), compared to about 69 at the end of 2021. Up until 2023, Swiss CHF-denominated green bonds raised around CHF19.0 billion (blue bars in Figure 1). In parallel, the Federal Council issued the first Swiss green Confederation bond in 2022. With this issuance, it wishes to strengthen the application of international standards in the issuance of green bonds in Switzerland, encourage other actors to issue this type of sustainable security and promote Switzerland as a leading financial centre for sustainable financial services [4].

Despite this growing interest, little is known about the current state of the Swiss green-bond market and what could limit its growth. This analysis aims at filling that gap. In particular, it describes the current requirements for issuing a green bond in Switzerland (Section 2), provides the trends observed on the Swiss green-bond market (Section 3), and analyses barriers to scale brought forward by market actors with market information and data (Section 4). Section 5 concludes with main remarks on the Swiss green-bond market and its barriers to scale.

[5] USD1,921 billion converted at the current monthly average of the USD/CHF exchange rate, equal to 0.8740 [1]

[6] The sustainable debt market includes green bonds, green asset-backed securities, social bonds, sustainability bonds, sustainability-linked bonds, green municipal bonds, green loans, and sustainability-linked loans.

Figure 1 - Cumulated amount issued and number of issuances of green bonds in Switzerland between 2014 and Q2 2023



Notes. This figure shows the total annual amount issued in billion CHF (left axis) and the associated number of issuances (right axis) of CHF-denominated green bonds trading on the SIX Swiss Exchange at the end of Q2 2023. Source: Eikon, SIX.

BOX 1: OVERVIEW OF SUSTAINABLE-DEBT INSTRUMENTS

Sustainable debt refers to fixed-income instruments with environmental or social purposes. Sustainable debt can be classified as (i) activity-based or (ii) behaviour-based debt instruments. Green bonds represent the most important sustainable-debt instrument, followed by sustainability-linked loans [2].

Activity-based debt instruments…

- finance or refinance specific environmental and/or social projects
- include green bonds and loans, as well as social and sustainability bonds[7]

Example: An energy company issues a green bond to finance new energy infrastructure. The proceeds are allocated to solar-energy infrastructures only.

Behaviour-based debt instruments…

- link firm-level ESG targets to the instrument's financing characteristics
- include sustainability-linked bonds and loans

Example: A cement company issues a sustainability-linked bond to finance general operations. If the company does not reduce the carbon emissions per ton of cement it produces to 500kg/ton by 2030, the coupon rate that it pays out to investors will increase by +1%

[7] Social bonds finance social projects, while sustainability bonds finance both environmental and social projects.

2 ISSUING GREEN BONDS IN SWITZERLAND

How to issue a green bond in Switzerland as a corporate or a public institution? The recent issuance of the first Swiss green Confederation bond, done on the SIX Swiss Exchange, provided guidance to corporate and other public actors and strengthened the application of the international industry standards [4]. In the current context, issuers need to comply with the legal requirements set by the Federal Act on Financial Services (Section 2.1) but also the requirements for green bonds of the SIX Swiss Exchange (Section 2.2).

2.1 GENERAL REQUIREMENTS FOR ISSUING GREEN BONDS IN SWITZERLAND

In Switzerland, green-bond issuers are subject to the same legal requirements at issuance as when issuing standard bonds. For now, there exists no legal requirements specific to green bonds in Switzerland. Hence, the offering and exchange of sustainable bonds remains regulated by the Federal Act on Financial Services (FinSA), as that of standard bonds [5]. In both cases, the two main issuance requirements at the issuer level include the publication of (1) a prospectus and, if the green bond is offered to retail investors, of (2) a key information document (KID).[8] Both documents should provide investors with information related to the risks associated with the green bond issued [6].

2.2 SPECIFIC REQUIREMENTS FOR ISSUING GREEN BONDS ON THE SIX SWISS EXCHANGE

To be flagged as "green" on the SIX Swiss Exchange, bonds have to fulfil two conditions based on international industry standards. They need to be (1) aligned with the Green Bond Principles (GBP) of the International Capital Market Association (ICMA) and (2) listed on the Green Bond Database of the Climate Bonds Initiative (CBI) [7].[9] [10] In addition to these requirements, any bonds need to have a minimum issuance amount of CHF 20m to be traded on the SIX Swiss Exchange and of CHF100m to be part of the Swiss Bond Index [9], [10].

The Green Bond Principles provide voluntary guidelines on pre-issuance and post-issuance reporting. Together, the pre-issuance and post-issuance reporting and their associated external reviews increase the green bond's credibility and transparency for the investors, effectively mitigating greenwashing risks[11]. Pre issu-

[8] In particular, the prospectus should include information on the issuer and guarantors (board of directors, auditors, business situation, annual financial reports, prospects, risks, and litigation), on the securities to be offered (rights, obligations and risks), and on the offer itself (type of placement and net proceeds) (FinSA, Art. 40). The KID should contain essential information for making an investment decision - among others, the risk/return profile of the securities offered (FinSA, Art. 60) [6].

[9] Note that being listed on the CBI Green Bonds Database is not equivalent to getting the CBI certification, as criteria and requirements are, for now, less stringent [8].

[10] For social bonds, sustainability bonds, and sustainability-linked bonds, issuers need to provide an "issuer commitment" and align with the related ICMA principles [7].

[11] Greenwashing occurs when a firm promotes an activity, product or policy as environmentally friendly while it effectively does not. For green bonds, the risk occurs when issuers falsely promote a climate-aligned activity to benefit from better financial conditions and signalling potential environmental commitment that could attract more capital.

ance, issuers following the GBP are recommended to disclose (1) a document called a Green Bond Framework as well as (2) an external review. The Green Bond Framework should highlight the alignment of the green bond with the four components of the GBP; that are the proposed use-of-proceeds (UoP), the process for project evaluation and selection, the management of the bond's proceeds, and reporting.[12] The pre-issuance external review assesses the Green Bond Framework and how it aligns with these four components and is completed by providers of second-party opinion services, such as ISS and Sustainalytics. Post issuance, issuers should disclose (1) annual reports but also (2) external reviews on these reports. These reports should focus on the green bond's UoP and impact, in particular the description of the projects financed by the proceeds, the amount allocated and their expected environmental as well as social impacts[13]. Post-issuance external reviews assess the internal tracking process of the UoP and verify the allocation of proceeds to eligible green projects [13]. Post-issuance reporting is already relatively widespread, notably for UoP: in 2020, 77% and 59% of issuers respectively provided UoP and impact reporting [14].

To be included in the CBI Green Bond Database, a green bond needs to go through the CBI screening process. This process is structured in three steps: (1) the identification of green bonds, (2) the screening of the sectors associated with the projects financed by the bond and (3) the evaluation of the UoP [8].[14] Bonds should be excluded from the database if either their proceeds are used for social projects, assets or working capital that do not align with the Climate Bonds Taxonomy, or if there is a lack of sufficient disclosure to determine this alignment. Also, if the proceeds of a bond are allocated to assets that are not aligned - as disclosed in post-issuance reporting -, the bond can be excluded from the database. Since its creation, no bond has been excluded from the database [14].[15]

2.3 Limits and recent developments

The lack of legal definition for green bonds can constitute a risk for investors. As there is no clear and legal definition, what qualifies as a green bond on the Swiss market could change over time, depending on the definition set by the SIX Swiss Exchange, the GBP, or the methodology of CBI Green Bond Database. This could potentially lead to the "downgrade" of green bonds to standard bonds and decrease the value of the bond. Not having a

[12] This information can be included in the bond's legal documentation instead of in a specific framework document.

[13] In its Handbook for Harmonised Framework for Impact Reporting of green bonds, the ICMA outlines general and sector-specific principles and recommendations for impact reporting. Within its sector-specific guidance, this Handbook provides core indicators and other indicators considering social impacts [11]. Social impact considerations within green bond funds appear to be on the rise [12].

[14] In the first step, bonds need to follow specific prerequisites to be eligible to the database: the bond should be a debt instrument that is consciously labelled with a "green" theme by the issuer and for which the issuer has disclosed sufficient public information. Such information should be sufficient to (1) determine if the financed activities are green and to (2) allow the inclusion of the debt instrument to its Green Bond Database e.g., amount outstanding and settlement date of the instrument. In the second step, pre-selected bonds are screened based on the eligible sectors for green activities; that in alignment with the Sector Criteria of the Climate Bonds Taxonomy. These criteria set climate change benchmarks by sectors, are determined by technical and industry working groups and frequently revised (CBI, 2022). For now, these criteria tend to be applied with less stringency in this screening process (CBI, 2022). In the third and final step, the remaining bonds are screened based on their UoP.

[15] Note that the Green Bond Database of CBI is only accessible to Climate Bond Partners.

clear definition of what can be legally qualified as a green bond creates uncertainty around whether the label will be kept until the maturity of the bond [5]. Leaving the classification of green bonds solely to international standards could also overlook the specific features of the Swiss market. The European Union (EU)[15] and China [16] have adopted a different approach by defining what projects are eligible for green-bond financing (Box 2).

Although Switzerland does not provide such a definition, guidance and recommendations against greenwashing have been provided by regulators and industry associations [17]–[19]. In parallel, the Federal Council has mandated the Federal Department of Finance (FDF) to propose disclosure requirements for sustainable financial products and services. Hence, the definition of sustainable financial products and services, and associated disclosure requirements, should be proposed by the FDF in fall 2023 and should provide more clarity to the actors of the green-bond market [4].

Box 2: What is a green bond in the EU and in China?

China's Green Bond Endorsed Project Catalogue

China represents one of the largest issuing countries, experiencing a continuous growth on its green-bond market.[16] Despite the market decline, China kept growing its issuance volume in 2022 (22% YoY), while other leading issuing countries showed negative growth rates [20]. This performance could be attributed to continuous implementation of green finance policies [20] and to its commitment to harmonise and to bring clear guidelines to the local market through the Green Bond Endorsed Project Catalogue.

The Green Bond Endorsed Project Catalogue unifies the Chinese green-bond market by defining the eligible projects and fields [21]. This initiative stemmed from the desire to harmonise the definition of green bonds across the different types of bond instruments issued and traded on the Chinese market. The 2021 version also closes the gap between international and local standards for green-bond eligible projects, by removing clean coal projects from eligible projects and incorporating the "do-no-significant-harm" principle[17] [23]. The Catalogue acts as a type of taxonomy for eligible projects, similarly to the Sectoral Criteria from the Climate Bonds Taxonomy (Footnote 9), and is applicable to the entire Chinese green-bond market as part of the Chinese Green Bond Principles [20].[18] The Catalogue covers six sectors,[19] each divided into specific programs,

[16] Considering cumulative green bond volumes, China stands at the second position of top issuing countries with USD286.9 billion, behind the US. In 2022, China was the largest country of issuance, with USD85.4 billion recorded [20].

[17] The 'do-no-significant-harm' principle means not supporting or carrying out economic activities that do significant harm to any environmental objective [22]. This principle has been introduced by the EU Taxonomy Regulation.

[18] The Chinese Green Bond Principles comply with internationally accepted standards and refer to the ICMA's GBP and other relevant regulations [24].

[19] The six sectors covered are (1) Energy Saving and Environmental Protection Industry; (2) Clean Production Industry; (3) Clean Energy Industry; (4) Ecology and Environment-related sector; (5) Sustainable Upgrade of Infrastructure; (6) Green Services.

that lay out these specified conditions to be met [16]. Despite the harmonisation efforts for eligible projects, requirements for the management of proceeds, transparency and external reviews continue to differ depending on the type of bond at hand [21]. The supervisory structure on the Chinese green-bond market also remains fragmented [20].

The EU Green Bond Standard

As part of the EU Action Plan on Sustainable Finance, the EU has been developing a voluntary framework for green-bond issuance since 2019 [15], [25]. This framework aims to ensure the application of uniform requirements to the use of the designation "European green bonds" on the EU market, but also to establish a simple registration and supervisory system for external reviewers [21]. Early 2023, the EU Parliament and Council reached a provisional agreement on the EUGBS, which still needs to be confirmed and adopted by the two institutions before it is considered final [26].

Under the proposed framework, the proceeds of green bonds must exclusively be allocated to economic activities that meet the specific requirements of the EU Taxonomy Regulation [27]. For instance, a bond financing onshore solar electricity generation can be labelled as a green bond since (1) this economic activity substantially contributes to climate change adaptation according to the Taxonomy Regulation, but only as long as (2) it complies with science-based criteria[20], (3) it does not harm the other environmental objectives ("do-no-significantly-harm" principle) and (4) it complies with minimum safeguards [21].

Issuers of "European green bonds" are subject to transparency and external review obligations in the current proposal. Pre-issuance, issuers must publish a green-bond factsheet, along with its external review (Art. 8)[27]. Post-issuance, issuers must disclose an annual allocation report until the full allocation of the proceeds and an external review is required for the annual report following the full allocation of the proceeds (Art. 9) [27]. Also, issuers must publish at least one impact report, once all proceeds are allocated (Art. 10) [27]. External reviewers are subject to conditions and requirements, must register to the European Securities and Markets Authority (ESMA) (Art. 14) and are subject to ESMA's supervision (Art. 15) [27].

[20] These criteria are set as part of the Technical Screening Criteria of the Taxonomy Regulation.

3 TRENDS IN THE SWISS GREEN-BOND MARKET

The first green bond traded on the SIX Swiss Exchange was issued in 2014 by the European Investment Bank. Since then, various corporations and governmental institutions have been issuing green bonds on this exchange, which today trades more than 100 of them. This section explores the trends in the growing Swiss green-bond market. In particular, it delves into its current state compared to other markets (Section 3.1), the specificities of green bonds traded (Section 3.2), the characteristics of green-bond issuers (Section 3.3), and, finally, how green-bond proceeds are allocated (Section 3.4). This analysis focuses on CHF-denominated bonds outstanding on the SIX Swiss Exchange as of July 2023, which below will be referred to as the Swiss bond market.

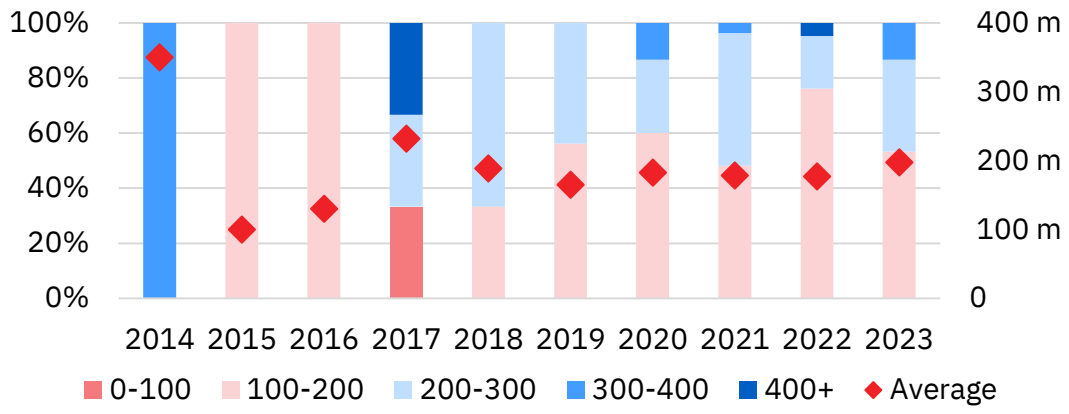
3.1 THE SWISS MARKET

Since its first issuance in 2014, the Swiss green-bond market has been growing substantially, in particular over the past five years. This section provides an overview of the current state of the Swiss green-bond market (Section 3.1.1) and compares it with that of other markets (Section 3.1.2).

3.1.1 Current state

Following the 2022 market decline, the annual volume of green bonds issued has regained traction in 2023, but deal size remains below the average. Beginning of July 2023, the Swiss market for green bonds accounted for 105 CHF-denominated bonds for a total amount issued of about CHF19.0 billion.[21] The year 2022, marked by geopolitical crises and increasing interest rates, saw a decrease of -22.8% year on year in the annual volume of green bonds issued, the largest decrease since 2018. This trend has been observed across green-bond markets globally [3]. Over the first half of 2023, the issued volume recovered, with 15 new issuances for around CHF3 billion; almost equivalent to the 2022 values.

Figure 2 - Split and average of issuance size of Swiss green bonds



Notes. The left axis of this figure gives the proportion of CHF-denominated green bonds belonging to the categories described in the legend, while the right axis provides the average amount issued in million CHF with CHF-denominated green bonds. Values for 2023 go until the end of Q2 2023. Source: Eikon, SIX.

[21] Both corporate and government bonds are considered here.

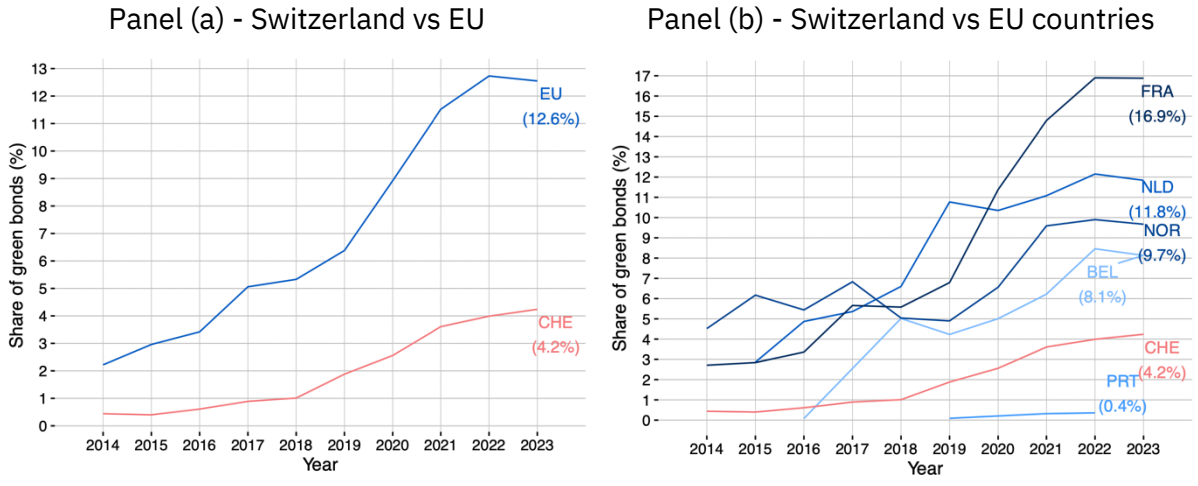
Since 2018, most issuances have raised between CHF100 and CHF300 million, stabilizing around CHF180 million on average (Figure 2). This is slightly lower than for CHF-denominated standard bonds, which have raised CHF216 million on average over the same period.

3.1.2 Comparison with other markets

The Swiss green-bond market is relatively smaller and is growing less than its European counterparts. Considering the size of the green-bond market relative to the overall bond market, Switzerland remains below EU average, with green bonds representing only 4.2% of the SIX Swiss Exchange's market (by issued amount), compared to 12.6% for Euronext (Figure 3 Panel (a)).[22] Today, the Swiss bond market has one of the lowest shares of green bonds compared to the exchanges within Euronext - only Lisbon is lower (Figure 3 Panel (b)). Amsterdam and Paris have the highest shares, with the latter ranking first with a share of 16.9%. Over the past years, the Swiss market also grew at a slower rate than European counterparts. Between 2016 and 2021, cumulated annual issuance volume grew at a compound annual growth rate (CAGR) of 65.3% on SIX Swiss Exchange, compared to 74.7% and 79.6% for the overall Euronext exchange and Brussels exchange, respectively.

Green bonds are still very much of a niche investment for Swiss investors, which could potentially explain their lower market share and deal sizes. According to Swiss Sustainable Finance (SSF), almost two third of Swiss asset managers and asset owners surveyed do not invest in sustainable debt instruments such as green bonds. In 2022, green bonds represented less than 2% of the annual sustainability-related investments [28].

Figure 3 - Shares of green bonds across markets



Notes. This graph shows the time series of the share of green bonds in the overall bond markets, across countries. The share is computed with the cumulated amount issued with green bonds denominated in local currency over the total cumulated amount issued with all other bonds denominated in local currency by year. The local currency is CHF for the Swiss market, NOK for Norwegian market, and EUR for all other markets. In Panel (a), the EU is the aggregate sum of the markets available on Euronext, namely Amsterdam (NLD), Paris (FRA), Brussels (BEL), Oslo (NOR) and Lisbon (PRT). Panel (b) shows the split between these markets and Switzerland (CHE). Source: Euronext, SIX, authors' calculations.

[22] For this analysis, the bonds on Euronext are the ones reported on the Euronext website, which includes the exchanges of Amsterdam (Belgium), Oslo (Norway), Paris (France), Brussels (Belgium) and Lisbon (Portugal).

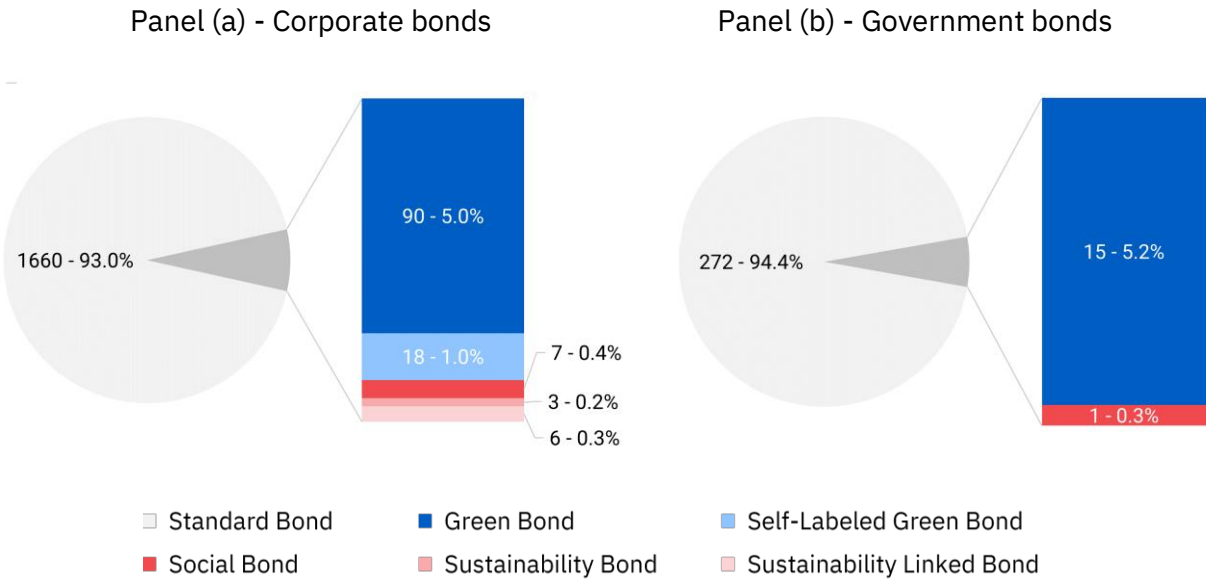
3.2 Swiss green bonds: What are their specificities?

Different types of bonds are being issued in Switzerland: they differ by the type of issuers but also by their approach towards sustainability. The following sections provides additional insights on the composition of the Swiss markets for corporate and government bonds (Section 3.2.1) and compares the characteristics of green bonds and standard bonds, with a focus on corporate issuers (Section 3.2.2). Corporate bonds are bonds issued by private companies, private investment firms and public companies, while government bonds refer to bonds issued by government institutions. Standard bonds, which do not have any sustainability characteristics, remain predominant compared to green bonds and other sustainable bonds.

3.2.1 Market composition

Green bonds take up the greater share of sustainable debt instruments on the Swiss market. Among CHF-denominated bonds traded on the SIX Swiss Exchange, the amounts issued through corporate and government green bonds stand at, respectively, CHF15.4 and CHF3.6 billion in July 2023. That represents around 4.2% of the Swiss bond market (Figure 2). As of the end of Q2 2023, there were 105 green bonds on the Swiss market, of which 90 were corporate bonds and 15 were government bonds (Figure 4). Social, sustainability and sustainability-linked bonds are also traded on the SIX Swiss Exchange, but they represent a negligible share of the bond market, with 17 bonds currently traded.

Figure 4 – Number and proportion of bonds on the Swiss market by type



Notes. This figure shows the number of CHF-denominated bonds followed by the proportion over their respective sub-sample, outstanding as of Q2 2023, by bond type. *Green Bond* are bonds classified as green bonds on the SIX Swiss Exchange. The *Self-Labeled Green Bond* category includes bonds that have been labelled as green but are not considered as green on the SIX Swiss Exchange. *Social Bond*, *Sustainability Bond*, and *Sustainability Linked Bonds* are other categories of sustainable bonds on the SIX Swiss Exchange. *Standard Bond* are all remaining CHF-denominated bonds on the SIX Swiss Exchange. Panel (a) shows the split for corporate bonds while Panel (b) shows the split for government bonds. Source: SIX Swiss Exchange, Eikon.

3.2.2 Focus on corporate bonds: comparison between green bonds and standard bonds

How do green bonds compare to standard bonds? This section provides summary statistics of CHF-denominated bonds traded on the SIX Swiss Exchange as of July 2023, i.e. of what is referred below to the Swiss bond market. Figure 5 reports the average deal size, coupon rate, term to maturity and credit rating of corporate green and standard bonds on the Swiss market.[23] Figure A1 in Appendix A.1 reports similar figures for government green and standard bonds.

The deal size of corporate green bonds averages below that of standard bonds (Figure 5 Panel (a)). Corporate green bonds have an average amount issued of CHF171.2 million, which is about CHF50.4 million lower than for standard bonds. Most issuances are lower than CHF 200 million for both corporate (57.8%) and government (60.0%) green bonds. However, corporate standard bonds tend to raise higher amounts: about 20.4% of standard-bond issuance have a deal size higher than CHF 300 million, against less than 6.7% for green bonds.

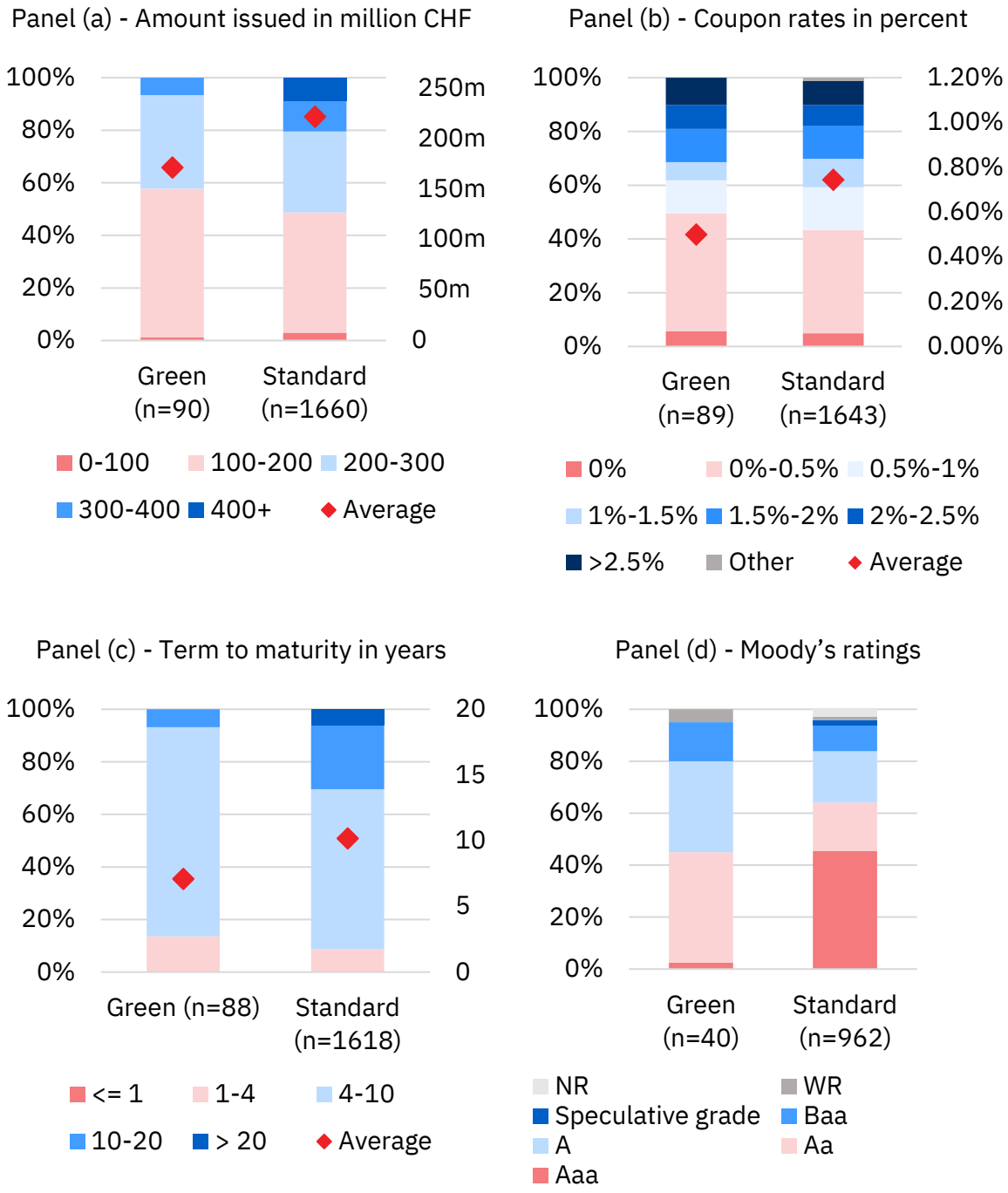
Average coupon rates for corporate green bonds are below that of standard bonds (Figure 5 Panel (b)). In corporate issuances, most green bonds (43.8%) have a coupon above 0% and below or equal to 0.5%. Around 40.4% have a coupon between 0.5% and 2.5%, while only 10.1% have a coupon of above 2.5%. Finally, 5.6% are zero-coupon bonds. Standard bonds tend to have slightly higher coupons, with an average coupon of 0.75% compared to 0.5% for green bonds. This difference could be explained by time effects, i.e., lower interest rates when green bonds were issued than when standard bonds were issued, or by shorter maturities (Figure 5 Panel (c))

Corporate green bonds tend to have lower terms to maturity than standard bonds (Figure 5 Panel (c)). Most corporate green bonds (80.0%) have maturity between 4 and 10 years, with an average maturity of 7 years. This average is 3 years lower than that of standard bonds, 30.4% of which have maturity above 20 years.

Corporate green bonds seem to have lower credit ratings than standard bonds (Figure 5 Panel (d)). The Moody's scale considers bonds to be investment-grade when they have a credit rating between Aaa and Baa - with Aaa providing the highest credit quality and worthiness as well as the lowest risk of default. As opposed to investment-grade, speculative-grade bonds are subject to substantial credit risk and have a rating below Baa [29]. 2.5% of green bonds have an Aaa Moody's credit rating, while around 77.5% are rated Aa and A. In contrast, 45.5% of standard bonds are rated Aaa. There are however no speculative-grade green bonds contrary to standard bonds, for which they represent 1.8% of the total. Note that data availability is lower for credit ratings and that sector-specific characteristics are not considered in this comparison.

[23] The deal size is the amount raised through a bond issuance, also referred to amount issued or issuance amount here. The coupon rate or coupon is the annual interest paid by the bond issuer to the investor. The term to maturity is time (in years) between the issuance of the bond and the date to maturity i.e. when the nominal value of the bond is repaid to the investor. Credit ratings, here Moody's ratings, provide an assessment of the bond's quality and creditworthiness.

Figure 5 - Corporate green bonds and standard bonds on the SIX Swiss Exchange



Notes. This figure provides a comparison of amount issued, coupon rate, term to maturity, and credit rating between CHF-denominated green bonds and CHF-denominated standard bonds. Green bonds are the ones labelled as such on the SIX Swiss Exchange, while standard bonds are all bonds on the SIX Swiss Exchange that do not have a sustainable label. The left axis of the graphs gives the proportion of bonds belonging to the categories described in the legend. In Panels (a), (b) and (c), the right axis shows the average of, respectively, the amount issued in million CHF, annual coupon rate and term to maturity. In Panel (d), WR indicates a withdrawn rating and NR an unrated bond under Moody's classification. Source: Eikon, SIX Swiss Exchange, authors' calculations.

3.3 Issuers: Who issues green bonds?

A firm's strategic decision to issue green bonds can stem from a desire to signal a transition towards greener activities and processes, and to diversify sources of financing. But other firm-level characteristics, linked to financial performance or the industry, could also influence a firm's decision to issue a green bond. This section describes the characteristics of green-bond issuers, by providing insights on the top issuers (Section 3.3.1) and comparing characteristics of green-bond issuers with that of other issuers (Section 3.3.2). Green-bond issuers here refer to corporates that have issued at least one CHF-denominated green bond on the SIX Swiss Exchange (outstanding in Q2 2023).

3.3.1 Top corporate issuers

For a total of 50 issuers of green bonds in Switzerland, 45 are corporations and 5 are government institutions. Corporations issued 90 green bonds, for an overall amount of CH15.4 billion. Of these 45 corporations, 24 are incorporated in Switzerland and 21 abroad. Governmental institutions, of which 3 are Swiss, have issued so far 5 green bonds, for an amount of CHF3.6 billion (Appendix A.1 Table A1). The latter are not considered in the following analysis.

The main issuers of corporate green bonds are financial institutions, real estate firms and energy firms. According to SIX data and following the reclassification of all its outstanding standard bonds in November 2022 [30], PSP Swiss Property AG is now the largest corporate issuer of green bonds in Switzerland, in both amount issued and in number of bonds (Figure 6 Panels (a) and (b) obtained with SIX data). Considering outright green bonds, the largest issuers are the banks Zuercher Kantonalbank and Muenchener Hypothekenbank with 5 green bonds issued each (Figure 5 Panel (a)). They are also second and third by issued amount, with respectively CHF910 and CHF855 million (Figure 6 Panel (b)). Following the Standard Industrial Classification (SIC), top issuing sectors are depository institutions, with 16 issuers and a total amount issued of CHF6,120 million, and non-depository credit institutions, with 8 issuers and a total amount issued of CHF3,020 million (Figure 6 Panels (c) and (d)). They are followed by real estate and electric, gas and sanitary services providers, with 5 and 3 issuers respectively (Figure 6 Panel (c)).

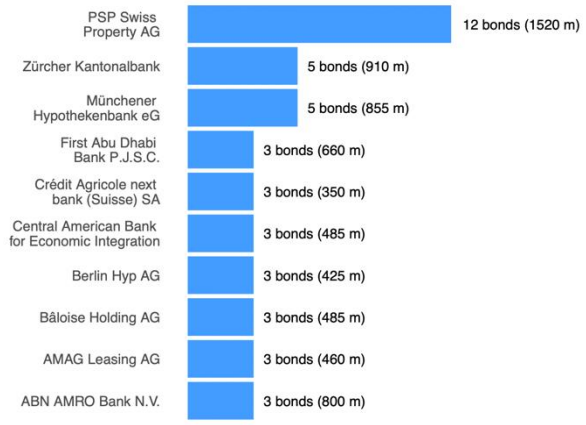
3.3.2 Characteristics and performance of green-bond issuers compared to other issuers

How do green-bond issuers compare to other issuers? The following analysis compares corporate issuers characteristics including size, operating performance, leverage, liquidity (Figure 7) and sustainability performance (Figure 8).

Green-bond issuers tend to be as large or larger than other issuers (Figure 7 Panel (a)). Considering the volume of assets as a proxy for firms' size, depository institutions and real estate companies that have issued green bonds tend to be as large as peer institutions that have not issued green bonds. Differently, non-depository credit institutions that have issued green bonds tend to be slightly larger than their peers. This aspect is more accentuated for issuers that operate in the electric, gas and sanitary-service sectors, where green-bond issuers are more than double the size than bond issuers that never issued a green bond.

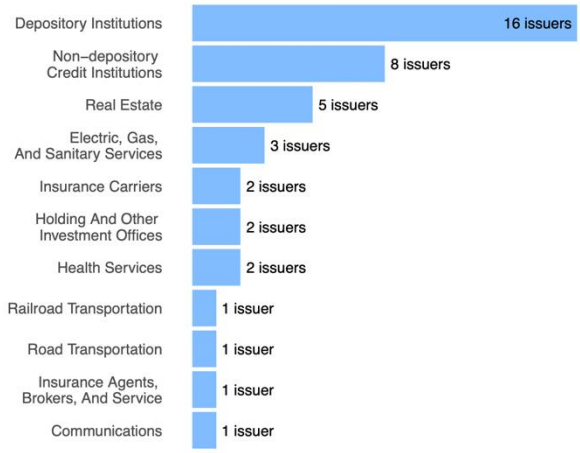
Figure 6 - Issuers of corporate green bonds in Switzerland

Panel (a) - Top 10 corporate issuers by number of bonds

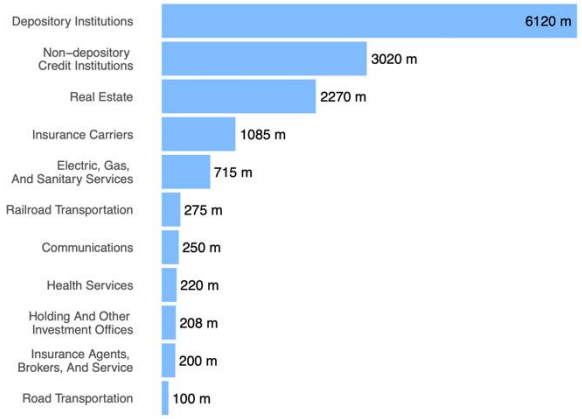


Panel (b) - Top 10 corporate issuers by amount issued in CHF

Panel (c) - Top issuing sectors by number of issuers



Panel (d) - Top 10 issuing sectors by amount issued in CHF

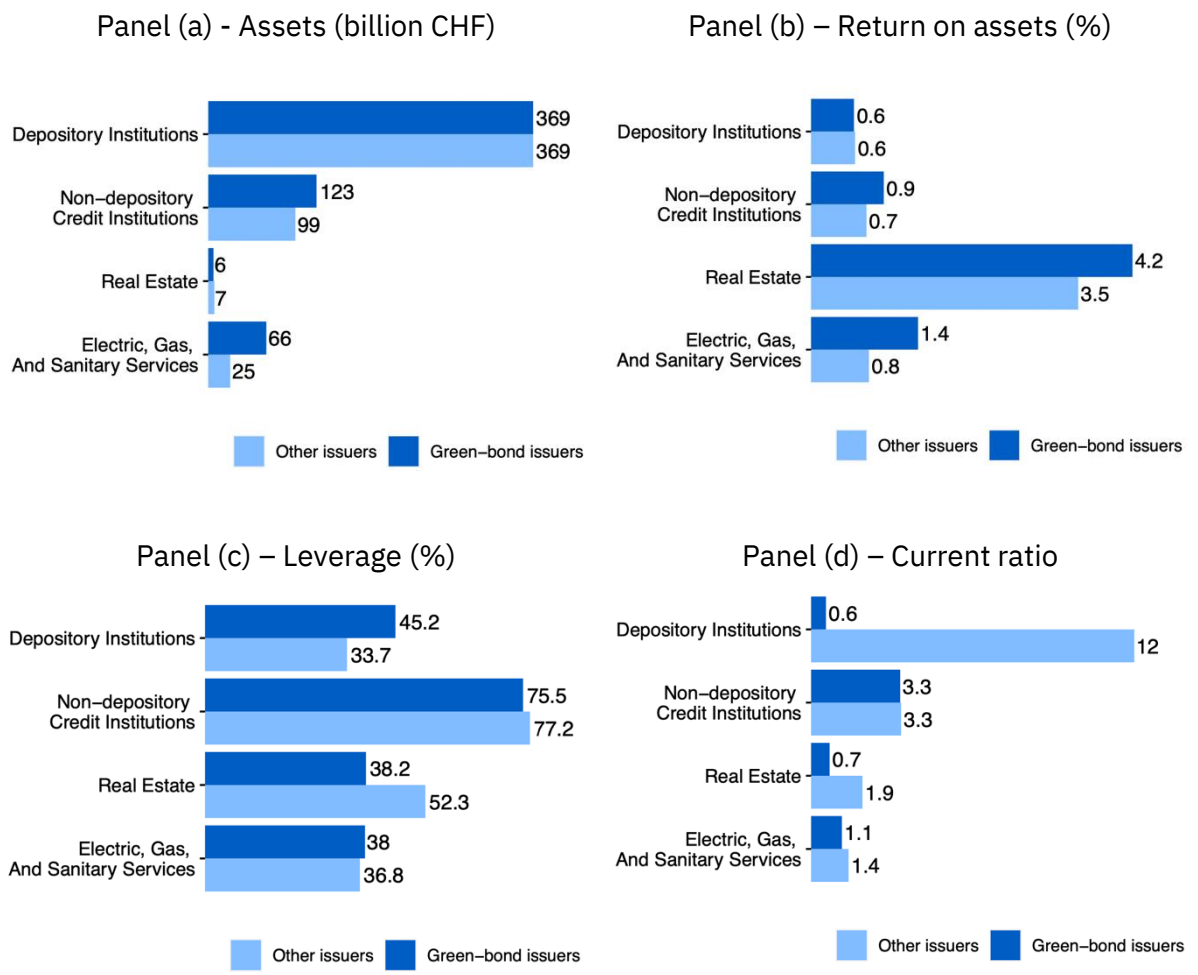


Notes. This figure shows the top-10 issuers of CHF-denominated green bonds in Switzerland (outstanding Q2 2023) by number of bonds (Panel (a)) and by amount issued (Panel (b)) as well as the top issuing sectors by number of issuers (Panel (c)) and by amount issued (Paned (d)). The sectors in Panels (c) and (d) are the descriptions of SIC classifications at the 2-digit level. Source: SIX Swiss Exchange for the specific issuers, and SIC and Eikon for the sectors.

Green bond issuers tend to have a better operating performance compared to peers that never issued green bonds (Figure 7 Panel (b)).[24] Depository institutions show an average return on assets (ROA) of 0.6% whether they issued green bonds or not. For non-depository credit institutions, real estate firms, electric, gas and sanitary services providers, green-bond issuers have, on average, a slightly higher ROA compared to other issuers. This difference is respectively of +0.2, +0.7 and +0.6 percentage points and implies that green-bond issuers of these sectors tend to be more profitable.

[24] Operating performance, here measured with returns on assets (ROA), provides an indication of how well a firm's assets are converted into revenues.

Figure 7 - Characteristics of green-bond issuers and other issuers



Notes. This figure shows the post-2015 averages of four company-level indicators, in the 4 top sectors for issuances of CHF-denominated green bonds in Switzerland (outstanding Q2 2023). The four indicators are, in order, total assets in billions, the return on assets expressed in percentages (net income over total assets), leverage expressed in percentages (total debt over total assets) and current ratio (total current assets over total current liabilities). Green-bond issuers are companies that issued at least one CHF-denominated green bond on the SIX Swiss Exchange. Other issuers are companies that have never issued a green bond on the SIX Swiss Exchange. These graphs exclude companies with current ratio above 100 and return on assets above 0.10 (outliers). Source: SIC, Eikon, authors' calculations.

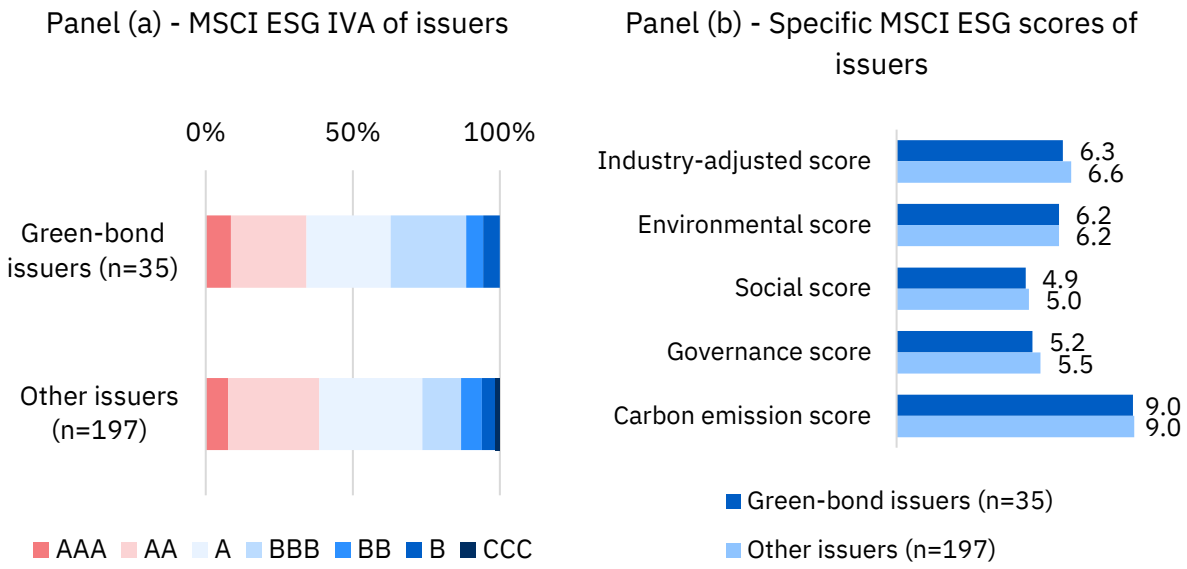
Aside from depository institutions, green-bond issuers tend to have either similar or lower debt than their peers (Figure 7 Panel (c)).[25] Depository institutions issuing green bonds have a higher leverage (level of debt over assets) compared to other issuers in the sector (11 percentage points). In real estate, however, this difference is of -14 percentage points. In the two remaining sectors, the difference in leverage, while in favour of green-bond issuers, is negligible.

[25] Leverage, here calculated as total debt to total asset, provides a measure of how much the firm has used debt to finance its assets.

Green-bond issuers tend to have more financing needs than their peers (Figure 7 Panel (d)).[26] Depository institutions and real estate companies issuing green bonds showed a substantially lower current ratio compared to peers and hence appears to be less able to repay short-term liabilities than peers. Current ratios (and differences with other issuers) for green-bond issuers of these sectors are 0.6 (-11.4 points) and 0.7 (-1.2 points), respectively. A similar pattern exists for electric, gas and sanitary services providers, although less pronounced.

Green-bond issuers do not have a substantially better ESG profile than peers (Figure 8). 34.3% of other issuers are part of ESG leader categories (AAA or AA ratings), compared to 38.6% for green-bond issuers. No green-bond issuers were part of the laggards, unlike other issuers. On average, green-bond issuers had specific ESG performance scores as good as or slightly lower than other issuers.

Figure 8 - ESG performance of issuers in 2021



Notes. Panel (a) shows the proportion of SIX issuers of CHF-denominated bonds (outstanding Q2 2023) per MSCI ESG Intangible Value Assessment (IVA) rating. MSCI ESG IVA rating is an overall company ESG ratings. It measures companies' risk and opportunities arising from Environmental, Social, and Governance issues and is expressed in a seven-tiered rating system (AAA to CCC) where each company is rated relative to sector peers. Leaders are associated to AAA and AA ratings, average performers to A, BBB, and BB ratings, and laggards to B and CCC ratings. Panel (b) provides a more granular comparison of the average ESG-specific scores of SIX issuers of bonds (outstanding Q2 2023). These five variables range from 10 (best) to 0 (worst) (MSCI, 2020).[27] Source: SIX, MSCI, Eikon.

[26] Liquidity, here computed as current assets divided by current liabilities, indicates a firm's ability to pay short-term obligations (current liabilities) with short-term assets (current assets). A current ratio below (above) 1 means that the firm might (will not) have difficulties repaying short-term liabilities with its short-term assets.

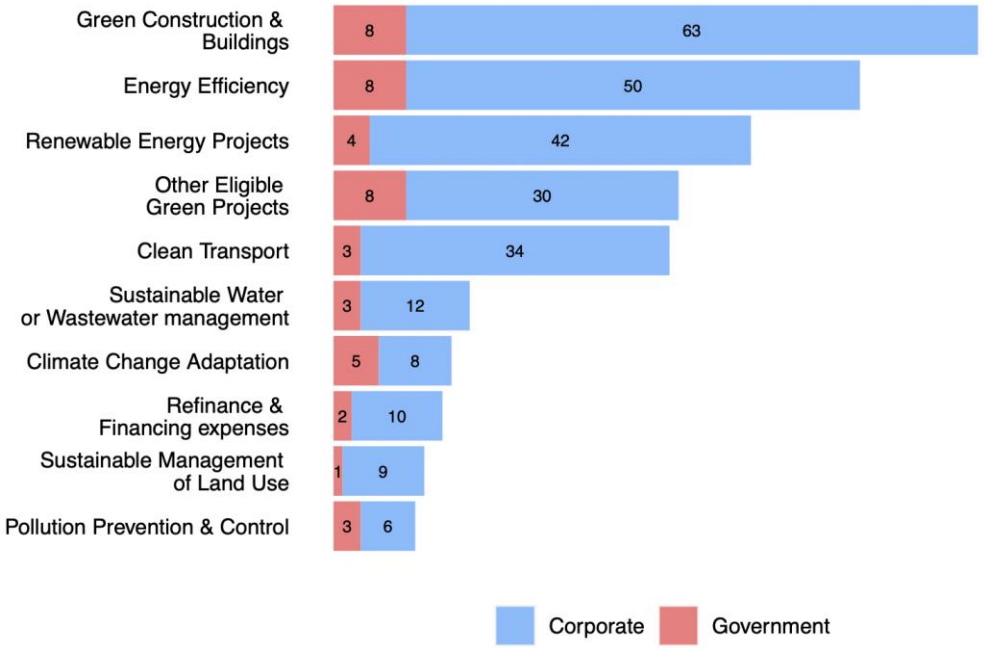
[27] Industry-adjusted score refers to the average of issuers' MSCI ESG Industry-Adjusted Score, which an issuer's ESG score relative to the standards and performance of an issuer's industry peers. Environmental score refers to the average of issuers' MSCI Environmental Pillar Score measuring an issuer's management of and exposure to key environmental risks and opportunities. Social score refers to the average of issuers' MSCI Social Pillar Score measuring an issuer's management of and exposure to key social risks and opportunities. Governance score refers to the average of issuers' MSCI Governance Pillar Score measuring an issuer's management of and exposure to key governance risks and opportunities. Carbon emission score refers to the average

3.4 Proceeds: What projects are green bonds financing?

When issuing a green bond, issuers need to disclose how they are going to use proceeds, to demonstrate the environmental benefits created. How proceeds are allocated might differ depending on the issuer's environmental objectives but also on its sector. This section examines the most frequent use-of-proceeds of Swiss green bonds (Figure 9) and the preferred categories of use-of-proceeds for the top sectors issuing green bonds (Figure 10).

Most Swiss green bonds finance green construction and energy projects. In Switzerland, the proceeds of 71 green bonds are used to finance green-construction projects - 63 of which are corporate green bonds. A substantial number of green bonds also finance projects in the energy sector, namely projects for energy efficiency (58 bonds) and renewable energy infrastructure (46 bonds). A large number of bonds' proceeds are also used to finance clean transport and eligible green projects outside of the main categories laid out by the GBP. Finally, only a small portion of green bonds currently finance projects in climate-change adaptation, sustainable land use and pollution prevention. Figure 9 shows the categories of the use-of-proceeds for green bonds, including how many bonds invest in each sector. The proceeds of one bond can be invested in several more sectors, explaining why the total number of bonds in Figure 9 is higher than the number of bonds in the market.

Figure 9 - Bonds per category of use-of-proceeds



Notes. This figure reports the amount of CHF-denominated green bonds (outstanding Q2 2023) per sector of use-of-proceeds, for both corporate and government bonds. *Refinance and Financing Expenses* means that all or a portion of the proceeds has been used to refinance eligible green projects. *Other Eligible Green Projects* refer to eligible green projects that are not listed in the GBP eligible green projects categories. All other categories relates to the eligible green projects categories laid out in the GBP [13]. The sectors for use-of-proceeds are defined by Eikon. One bond's proceeds can be invested either in one or multiple sectors. Source: Eikon.

of issuers' MSCI Carbon Emissions Score integrating to what extent an issuer's business is vulnerable to the carbon emission risk and how well an issuer manages carbon emission risk and opportunities (MSCI, 2020).

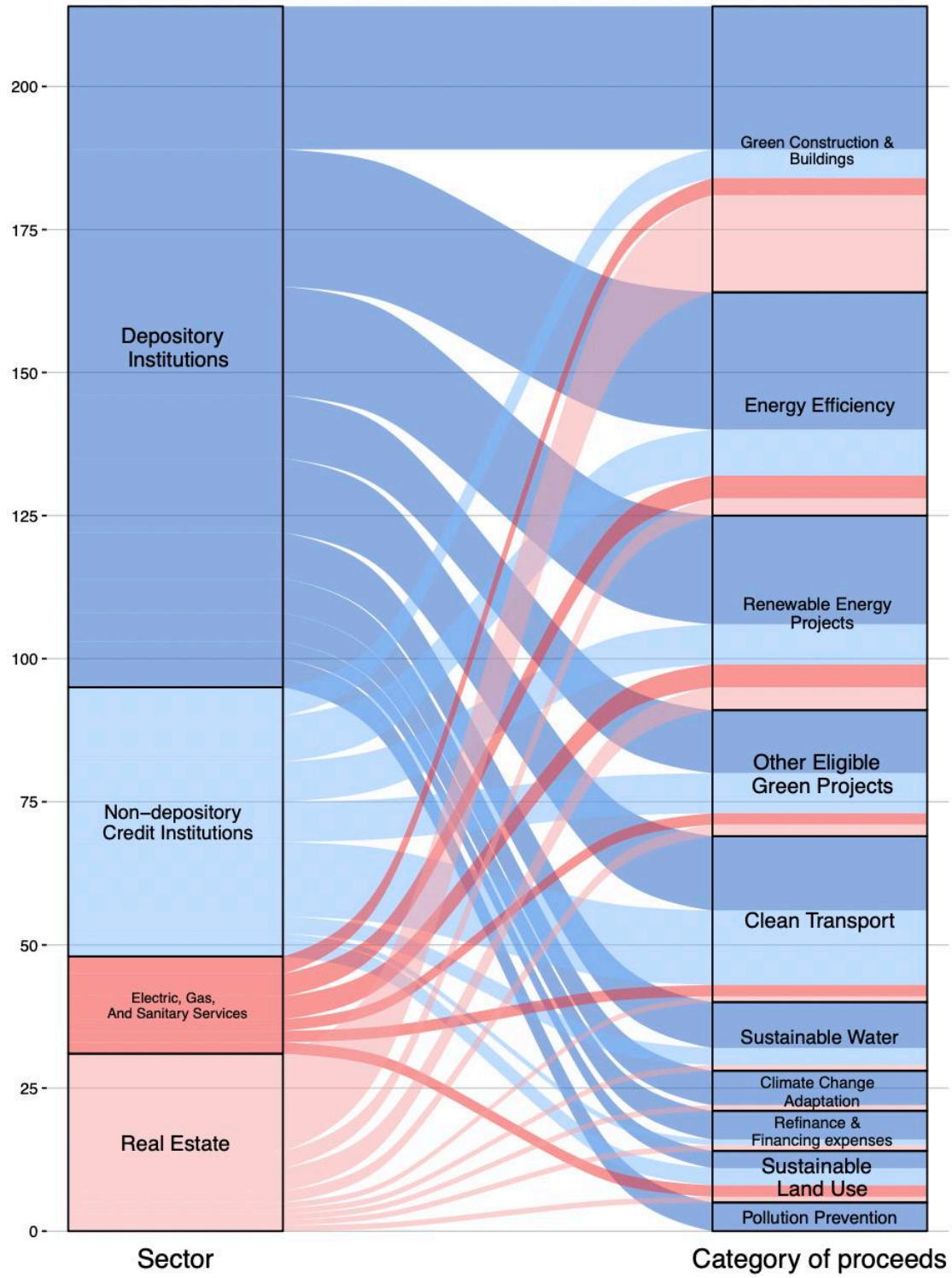
What are the top sectors financing? Figure 10 shows how corporations in each sector invests its green-bond proceeds. The height of the groups (left and right blocks) and flows reflects the number of green bonds issued by each of the top-issuing sectors (left) and used to invest in determined categories of use-of-proceeds (right).

Financial institutions issuing green bonds finance all categories of use-of-proceeds, as could be expected given their business activities (Figure 10). Depository institutions are using green bonds to finance projects across all categories of use-of-proceeds but most of their proceeds are allocated towards green construction (21%), energy efficiency (20.2%), renewable energy (16%) and clean transport (10.9%). Financial institutions, in particular depository institutions, can use green bonds to finance their clients' green debt [31], which could explain the variety observed in the allocation of their use-of-proceeds.

Real estate and energy firms focus on their own sector. As can be expected, firms in the sectors of real estate and of electric, gas and sanitary services use green bonds to finance projects in their respective sectors. Real-estate firms are however doing it to a higher degree, with twice as many green bonds issued. They invest most of their green bond's proceeds in green buildings (17 bonds), although to a lower level than depository institutions (25 bonds). Electric, gas and sanitary services providers use the proceeds to finance projects in energy efficiency and renewable energy. Both categories represent in total 47% of the sector's use-of-proceeds.

Despite this focus, firms in all sectors invest proceeds in at least 6 categories, which could be both within and outside of their business scope. For instance, the proceed category "Sustainable Management of Land Use" is less material to the top 4 sectors compared to the agriculture or forestry sectors. Still, these top 4 sectors, and especially the energy firms, have 2.5% to 11.8% of their green bonds allocated to this proceed category.

Figure 10 - Sectors and categories of use-of-proceeds for corporate bonds



Notes. This figure shows the top-4 SIC sectors for issuance of CHF-denominated green bonds (left) and the related categories of use-of-proceeds (right). These categories include in alphabetical order, *Clean Transport, Climate Change Adaptation, Other Eligible Green Projects, Energy Efficiency, Green Buildings, Pollution Prevention and Control, Refinance and Financing Expenses, Renewable Energy, Sustainable Management of Land Use, Sustainable Water and Wastewater management*. These categories, except *Other Eligible Green Projects* and *Refinance and Financing Expenses*, are part the eligible green projects categories proposed by the GBP *Refinance and Financing Expenses* means that all or a portion of the proceeds has been used to refinance eligible green projects. *Other Eligible Green Projects* refer to eligible green projects that are not listed in the GBP eligible green projects categories. The y axis reports the number of issued CHF-denominated green bonds (outstanding Q2 2023) considering that a bond can be counted as many times as its different categories of use-of-proceeds. The height of the groups (left and right blocks) and flows reflects the number of green bonds issued by SIC sector (left) and used to invest in determined categories of use-of-proceeds (right). Source: SIC, Eikon.

4 ISSUES OF THE SWISS GREEN-BOND MARKET

To identify the main issues and barriers to scale in the Swiss green-bond market, we have conducted a workshop with 20 actors active in this market. The workshop took place in June 2022 and welcomed participants from five different stakeholder groups, namely investors, issuers, policy-makers, Non-Governmental Organisations (NGOs) and researchers. Participants were divided in homogeneous working groups by type of stakeholder and were asked to list the current issues in the Swiss green-bond market from their perspective. The groups identified four main issues, namely (1) high costs for issuers, (2) lack of incentives for investors to receive lower returns, (3) lack of official reporting standards, transparency, and credibility, and (4) low climate impact of underlying projects.[28] In this section we will analyse each of these issues, combining the workshop takeaways with market information and data.

4.1 HIGH COSTS FOR ISSUERS

According to the literature, green-bond issuers face higher issuance costs, and obtain lower yields. Baker et al (2018) suggest that issuance costs for green bonds can be divided between internal costs to cover issuance and monitoring, and external costs to pay third parties for certification[29] [33]. The former includes identification of strategic proceeds, development and review of a green bond framework, liaison with second-party opinions, and others [34]. The latter is usually negotiable and, in the authors' example of US bonds, falls between USD10,000 and USD50,000. In addition, considering that certifying the bond with the Climate Bonds Standard Board requires a further fee of one-tenth of a basis point of the bond principal, the overall certification fee should remain below USD100,000.[30] Daubanes et al (2022) suggest that firms experience an increase in stock price when issuing a green bond, which could offset some of these additional issuance costs [35]. Alternatively, Baker et al (2018) and Ehlers and Packers (2017) suggest that the extra fees for certification are more than compensated by the lower yields of green bonds (vis-a-vis standard bonds), so in the end green-bond issuers gain (and not lose) by issuing a green bond [33], [36]. This "free lunch" is also documented for some issuers of sustainability-linked bonds, thus increasing the risk of greenwashing for these products [37].

Swiss green-bond issuers are however reporting that issuance costs are still high, especially in times of lower demand. At the workshop, issuers pointed out that the cost of issuance of green bonds, which may include underwriting and certification fees, is still very high in Switzerland, in particular for smaller issuers. This cost might

[28] These four issues are classified as "main" issues as more than one group indicated them, or they were deemed important after a final discussion. We will be focusing on them in what follows. In the workshop, the participants identified 5 main issues, as they included a low issuer-investor interaction. In this report, we will be elaborating about this issue within the lack of reporting standards and transparency (Section 4.3). Two other secondary issues were identified during the workshop, namely lack of policies setting carbon prices and lack of regulation restraining brown companies to issue green bonds. However, they were not classified as "main", and we will not discuss them here.

[29] Through their voluntary labelling schemes, certification providers such as CBI provide an endorsement of green credentials using science-based eligibility criteria. [32]

[30] The certification under the Climate Bonds Standard is a labelling scheme for green bonds, which requires additional reporting on top of what international market standards require [32].

be particularly felt by the issuers when demand for green bonds is low relative to supply and the yields they need to offer on the market are high. This can be the case in the Swiss context, as we will see below. Researchers also emphasized that green bonds usually have higher transaction and monitoring costs than standard bonds. In addition, issuers highlighted a lack of support from Swiss governmental agencies in the issuance process. Such support could come in form of either financial help or guidance. The Swiss Confederation addressed this specific concern in October 2022 by issuing the first green Confederation bond and showcasing how an issuance of green bonds can be conducted, with related guidelines [38]. On the top of that, the Swiss regulatory bodies could put in place incentive schemes tackling issuance costs, as it is done in Singapore[31]. Furthermore, the SIX Exchange could lower the ticket (at CHF100 million) for green bonds to be listed on the Swiss Bond Index.

4.2 LACK OF INCENTIVES TO RECEIVE LOWER RETURNS

Green bonds can be sold at a lower yield (higher price) than standard bonds, depending on market specificities. The recent literature has focused on estimating the so-called "green premium" or "greenium". Having a green premium means that the yield an investor is willing to accept for a "green" asset is lower than that of conventional counterparts (e.g. MacAskill et al., 2021)[40]. The existence of a greenium would be the first evidence of a measurable contribution of green bonds to the green transition: green projects being financed at lower cost than alternative brown projects. The literature, however, finds conflicting results, as only 56% of the studies published between 2007 and 2019 find that green bonds have lower yields than standard bonds in the primary market. On the other hand, there is larger consensus in favour of a green premium in the secondary market (70% of the studies) [40]. In general, the presence of a green premium depends on the characteristics of the market at hand, for both supply and demand factors.

It is uncertain if such green premium exists on the Swiss market. In the workshop, researchers pointed out that the current characteristics of Swiss green bonds give little incentives to investors for bearing the cost of lower yields. While investors might still be willing to pay for the green premium (if any), the lack of incentives could be a barrier for the market to reach scale.

Considering yield at issuance, Swiss green bonds are not sold at a lower yield than standard bonds, quite the opposite. We build on the work done in the literature to estimate the status of yields at the issuance of green bonds, compared to that of traditional bonds. Specifically, we consider the methodology proposed by Flammer (2021) and compare green bonds with standard bonds issued by the same firm, with similar characteristics [41]. For a detailed explanation of the methodology, see the Appendix A.2. Table 1 reports the results of this analysis. For this exercise, we have a sub-sample of 49 corporate green bonds, against 49 matched corporate standard bonds - all issued on the SIX

[31] Until end of 2028, the Monetary Authority of Singapore is offering a Sustainable Bond Grant Scheme for offsetting up to S$125,000 (about CHF 84,000) for the expenses related to external reviews at pre-issuance and post-issuance and for taxonomy alignment [39].

Swiss Exchange. Column 2 of Table 1 reports the means of the yields at issuance for the two groups of bonds. The average yield at issuance for green bonds is 2.32%, which is higher than the average yield at issuance for matched standard bonds (2.2%). In addition, this difference (+0.12 percentage points in Column 3) is statistically significant at the 5% level (p-value of 0.002 in Column 4). This is the contrary of having a green premium, i.e., in Switzerland green bonds have higher yields at issuance than standard bonds. Such an aspect reflects a relatively low demand for green bonds, as issuers must offer high returns to investors to convince them to hold green bonds. The ecological contribution of green bonds is therefore in question. In addition, within this context it is no surprise that issuers believe the fees related to green bonds are too high, as there is no compensation from being able to charge lower yields than for traditional bonds.

Considering yields on the secondary market, the difference between green and standard bonds is more nuanced. We have also looked at yields for the same groups of bonds in the secondary market, i.e. transactions that take place on bonds that were already issued and held by an investor who is willing to sell. Specifically, we consider the yields buyers are willing to receive to buy green and standard bonds, so-called bid yields.[32] We consider monthly averages of bid yields across our two groups of bonds from January 2019 to July 2023, which are reported in Figure 11. Figure A2 of the Appendix shows that results remain the same when considering ask yields.

Before COVID, buyers were willing to receive lower yields from green bonds than from standard bonds. The first dashed vertical line in Figure 11 marks the beginning of the COVID pandemic (March 16th 2020). Before the COVID crisis hit, the average bid yield of green bonds (blue) was lower than the average bid yield of standard matched bonds (red). In addition, as the confidence intervals for these averages (shaded areas around time series) did not cross each other, the difference in means of bid yields was also statistically significant. This indicates a context of high demand, as investors were willing to pay more - and so receive less - for holding a green security.

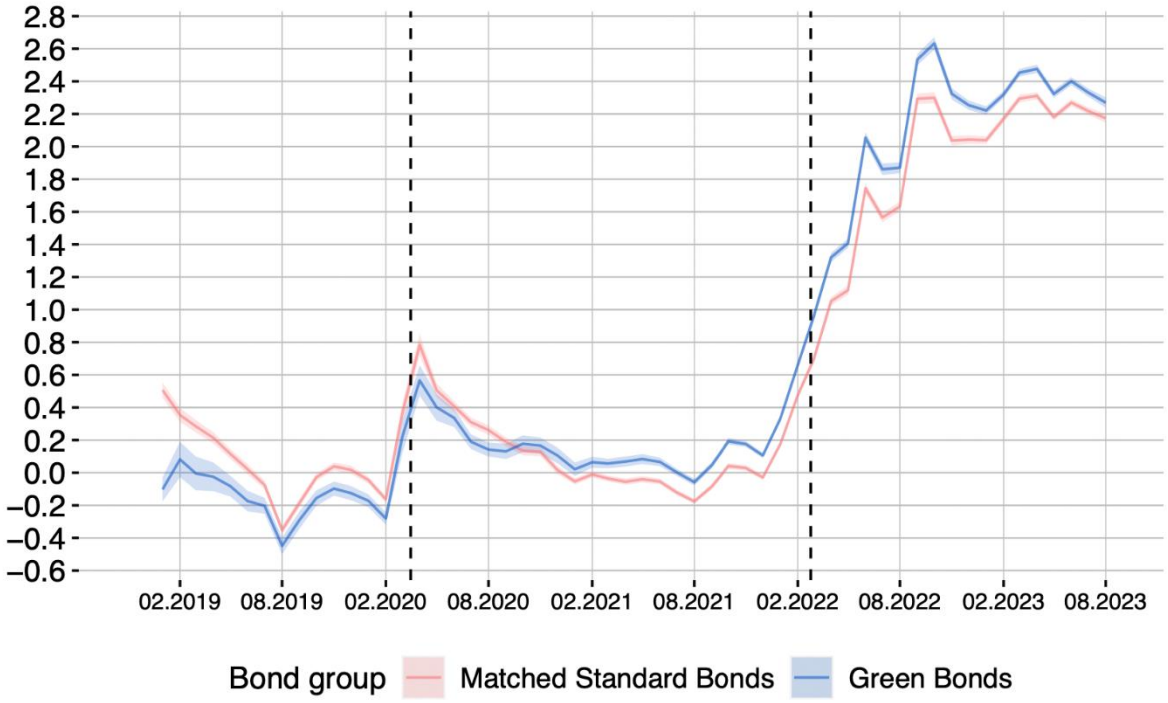
Table 1 - Yields of green and standard bonds at issuance

	Observations	Mean	Difference in means	P-value of difference in means
	(1)	(2)	(3)	(4)
Green bonds	49	2.32	0.12	0.002
Matched standard bonds	49	2.2		

Notes. This table reports the comparison of yields at issuance between CHF-denominated corporate green bonds and matched standard bonds issued on the SIX Swiss Exchange. In this table, corporate green bonds (49) are a subsample of the total corporate green bonds on SIX (90), for which data for the matching is available. The matching is done within issuers, following Flammer (2021). Columns (1) and (2) show the number of bonds per group and related mean. Column (3) and (4) report the difference in the means of the groups and the p-value for this difference in means. A positive difference indicates that investors of green bonds are earning a higher yield at issuance than investors of standard bonds (opposite of a green premium). A p-value lower than 0.05 indicates that the difference in means between the two groups is statistically significant at the 5-% level. Source: Eikon, authors' calculations.

[32] Note that the fact that there is data for bid yields does not mean that there is a transaction taking place. Those yields are simply the ones registered in the market system and show the level of demands for green bonds.

Figure 11 - Yields of green and standard bonds on the secondary market in times of crisis



Notes. This figure reports the monthly means for bid yields over time by groups of CHF-denominated green bonds and matched standard bonds on the SIX Swiss Exchange (secondary market). The first vertical dashed line represents the beginning of the COVID period (2020-03-16). The second vertical dashed line represents the beginning of the invasion of Ukraine (2022-02-24). The matching is done within issuers, following Flammer (2021). The shaded areas around the monthly means are the confidence intervals at the 95-% level for the monthly means. A higher bid yield for green bonds (blue) than for matched standard bonds (red) indicates that bond holders need to offer higher yields than usual to sell their bonds (high supply, or low demand). If the confidence intervals for the green bonds do not cross the confidence intervals for the matched standard bonds, then the difference in means is statistically significant at the 5-% level. Note that the fact that data for bid yields are available for a specific month does not necessarily imply that transactions took place on the exchange. Source: Eikon, Datastream, authors' calculations.

After COVID, investors went away from green bonds to buy more standard bonds. As the COVID crisis unveiled, the increased uncertainty made investors going back to the bond market. As demand for all bonds increased, prices went up, and yields dropped. However, the average bid yield of green bonds (blue) decreased less than the average bid yield of standard matched bonds (red). In other words, the demand for green bonds did not pick up as much as the demand for standard bonds. After August 2020, the Swiss market thus switched into a context of relatively low demand for green bonds, where the yield investors were willing to receive to hold green bonds was higher than for standard bonds.

This relatively low demand for green bonds still persists today. As the invasion of Ukraine started on February 24th 2022 (second dashed vertical line), bid yields for all bonds increased dramatically, going from around 0% to around 2%, reflecting the general increase in interest rates. As this sharp increase took place in the same measure for both green and matched standard bonds, the relative context described above remained the same. Today, the yield investors are willing to receive to hold a green bond is still higher than for standard bonds, which indicates a relatively low demand for green bonds in the Swiss market.

Overall, the analyses on both the primary and secondary markets show that investors in the Swiss market are not willing to receive lower yields to hold a green bond. As a result, green-bond issuers and holders must offer either higher or similar yields than for standard bonds to be able to sell them. As there is no monetary compensation for the issuers to issuing a green bond, issuers must be doing so - and at an increasing pace - for other indirect reasons. They could in fact signal their commitment to invest in green assets, effectively reduce their emissions or benefit from an increase in stock prices [35].

4.3 LACK OF UNIFORM REPORTING STANDARDS

The market-based standards applied in Switzerland do not allow for comparability across the post-issuance disclosures of green bonds, as such disclosures are generally non-mandatory. Indeed, both the ICMA's GBP and the methodology CBI's Green Bond Database solely issue recommendations on post-issuance reporting [8], [13] and suggest impact reporting metrics and related sector-specific guidance [11]. For example, consider a hypothetical issuer A that publishes an UoP allocation report and impact report every year. Then, a hypothetical issuer B that abides by the same rules, can choose to disclose an annual UoP allocation report and, only at the bond maturity, an impact report. Also, another issuer C that abides by the same rules can simply choose to disclose an annual UoP allocation report. In addition, in their impact report, issuer A can disclose GHG emissions avoided, annual energy savings, and annual additional photovoltaic capacities, while issuer B may only publish the overall GHG emissions avoided and qualitative assessments. In this context, it may be difficult to compare the environmental impact across green bonds.[33]

During the workshop, participants confirmed the lack of uniformity in reporting on the Swiss market. Investors, policymakers, issuers, and NGOs highlighted that there is a general lack of official reporting standards for the green-bond issuances and the financed projects. While market actors have put forward some voluntary guidelines for reporting standards, there is no legislation enforcing reporting requirements. In addition, it was reported that it is difficult to find information on green bonds and underlying projects in a centralised way. This context generally leads to low transparency and credibility of green bonds, which is a barrier for investment. Surveys of global practitioners by the NGO Environmental Finance on impact reporting showed corroborating results but underlined improvements on reporting practices, greenwashing concerns and data quality between 2022 and 2023. Aggregating impact data at the portfolio level appears to be the main challenge for investment professionals [12].

Here we report a first attempt to homogenize information from the public post-issuance reports of Swiss issuers, which are quite heterogeneous. To show how the process of centralising public information would look like, we report here an example of homogenous reporting for 10 green bonds issued on the SIX Swiss Exchange. For this subsample, we considered the issuers of green bonds that were

[33] Other jurisdictions, such as the EU through its EUGBS, are trying to standardise the type of reports and their frequency post issuance (EUGBS Art. 9-10, 2023) but do not necessarily provide mandatory impact metrics to report on (EUGBS Annex III, 2023).

listed on the ICMA platform in June 2022.[34] We hand collected the reported information from the public post-issuance reports published by the issuers, from 2017 until 2021. Table 2 reports some of the collected information for 2021.

The first four columns report standard bond-level variables, while the last three columns report information on the projects that were financed by the bonds. As the reports are quite heterogeneous, summarizing the project-level information in a homogeneous way is challenging. One of the issues is that, while most of the issuers reported indicators at the bond level, some issuers, like Swisscom, reported impacts at the project level while the project was only partly financed by the green bond in question. More information on the methodology we used to standardize information can be found in the Appendix A.3.

Proceeds spent and GHG emissions avoided could be the minimum variables to be reported for all green bonds. With these caveats in mind, the two main variables that we believe could be reported uniformly for all bonds in Switzerland are proceeds spent and GHG emissions avoided (here cumulated up until 2021). In addition, all green bonds that finance the installation of energy projects should report capacity installed and energy produced. We have this information for the first two bonds of the table, though we have not reported them here. As you can see from the table, while proceeds spent can be obtained for all bonds, we could not find information on GHG emissions avoided for 4 out of 10 considered bonds. In addition, of the 5 bonds that invest in renewables, only 2 of them had information on installed capacity and energy produced. While data on GHG emissions avoided might be challenging to collect, it should be feasible to gather data on how much energy the renewable-energy projects are producing per year.

Figure A4 in Appendix A.3 shows data on proceeds spent and GHG emissions avoided per sector of financed project. This is another data point that could be homogeneously reported by all issuers, following the example of the bonds reported in Figure A4.

Finally, during the workshop NGOs highlighted a low level of interaction between issuers and investors. As such, it appears that the set of information that is currently shared by issuers – investor reports, issuance documents, etc. – is not enough, and NGOs would support more ways of sharing information between issuers and investors. Some platforms to increase such interactions are currently being developed for other markets, such as the Nasdaq Sustainable Bond Network (not public) and the Green Bond Transparency Platform by the Inter-American Development Bank (public). The participants expressed the need for a similar platform that is specific for the Swiss market and open source.

[34] Here we report only one bond per issuer, the bonds were overall 17 in the entire sample.

Table 2 - Disclosed information on green bonds between 2017 and 2021

Issuer	ISIN	Issuance year	Amount issued (m CHF)	Category of proceeds	Pro-ceeds spent (m CHF)	Emission avoided (tCO2e)
Axpo Holding AG	CH0468581571	2020	133	renewables	8.53	3611
BKW AG	CH0487087295	2019	200	renewables	200	14622.7
Canton of Geneva	CH0387879031	2017	420	buildings	420	1151
Crédit Suisse AG	XS2176686546	2020	545.7	renewables, buildings, transportation	545.7	
Kraftwerke Oberhasli AG	CH0593093211	2021	100	renewables, transportation	88.1	
Swiss Life Holding AG	CH0461238906	2019	250	buildings	193.38	1217.58
Swiss Prime Site Finance AG	CH0581947733	2020	300	buildings, others	284.79	
Swisscom	CH1112455766	2021	100	renewables, buildings, transportation	100	917.6
UBS	CH1120085670	2021	250	buildings	250	
Zürcher Kan-tonalbank	CH1131931342	2021	150	buildings	150	1898

Notes. This table summarises information disclosed for 10 green bonds quoted on the SIX Swiss Exchange. This subsample was obtained by considering the green bonds that were present on the ICMA platform in 2022. All amounts are cumulated until 2021 and are obtained from issuers' reports for either 2021 or fiscal year 2020/2021 (published at the end of 2021). Issued amount and proceeds spent are in millions of CHF. GHG avoided are in tons of CO2 equivalent. Capacity installed (megawatts) and energy produced (gigawatts per hour) are for bonds that employ the proceeds to finance energy projects. Source: issuers' reports, authors' calculations.

4.4 LOW CLIMATE IMPACT OF UNDERLYING PROJECTS

It is currently not clear whether projects financed by green bonds improve the issuer's environmental performance. The academic literature remains ambiguous on whether the projects financed by green bonds contribute to reducing emissions at the issuer level. On the one hand, Ehlers et al. (2020) find out that the current labelling system for green bonds does not necessarily imply reductions in emissions related to the issuance [36]. On the other, Flammer (2021) shows that, after issuance, issuers of certified green bonds have higher environmental ratings, less CO2 emissions, and more long-term and greener investors [41]. This juxtaposing result is also highlighted in the communiqué of the Federal Finance Administration which states that "Green Confederation bonds will not have a direct environmental impact on their own: political decisions are needed for concrete measures to protect the climate and the environment" [42].

The proceeds of green bonds should be allocated to projects that are financially material to the firm's activities. During the workshop, NGOs reported that green bonds' underlying projects often have a low climate impact. In addition, policymakers and other participants highlighted the low relevance of green projects' climate impact with respect to the issuers' core business. In this regard, a green project is "financially material" for a company when it impacts the value or the financial performance of the company itself. A green bond is irrelevant if it finances a project that is (financially) immaterial for the issuer.[35] In addition, if ESG ratings, which are computed at the company level, consider financial materiality, a non-material green-bond project contributes little to improving the ESG performance. Finally, when companies finance projects in sectors unrelated to their core business, concerns of greenwashing and of credibility increase. As seen in Section 3.4, credit institutions and firms in energy, gas, sanitary services, and real estate invest the proceeds across a large range of sectors, highlighting a potential risk that some of these investments could be immaterial for the firms.

To confirm this discussion, we have applied the methodology proposed by Flammer (2021) to compare 9 green-bond issuers to other 9 matched standard-bond issuers with similar characteristics. The methodology is described in more details in the Appendix A.4. As we obtained these two groups, we then compared ESG scores of green-bond issuers before and after the issuance of green bonds with the ESG scores of standard-bond issuers. The ESG scores we consider come from MSCI and range from 0 (worst) to 10 (best). Results are summarized in Figure 12.

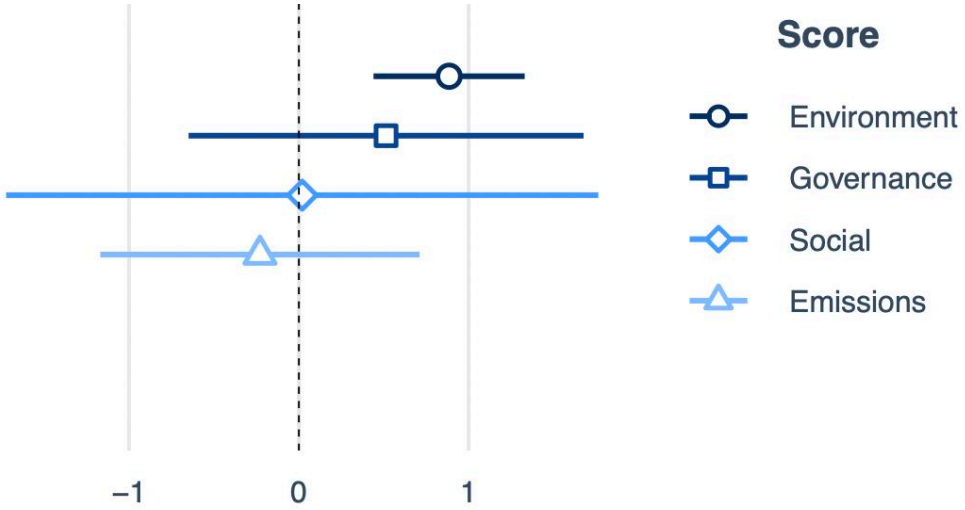
Issuing green bonds improves the environment score, but not the others. Figure 12 reports these differences in means of ESG scores between the two groups of issuers, before and after the issuance of the green bond. If we consider the Environmental score (first coefficient in dark blue), the positive value of 0.9 indicates that green-bond issuers improved their Environmental score after the issuance of the green bond, compared to standard-bond

[35] For example, if a cement company issues a green bond financing a project to recycle cement, then the project's impact is financially material and relevant for the company's business. On the other hand, if the same company issues a green bond financing a project that restores a species of frogs, then the project's impact is financially immaterial and not relevant for the company's business.

issuers. This result is also statistically significant, as the confidence interval (horizontal dark-blue line) does not cross the zero line. The same principle does not hold for Governance, Social and Emissions scores. These results must be considered with caution, as the sample is small (82 observations for 18 firms), and the matched sample is optimal in terms of statistical validity. Note that green-bond issuance can be used as an indicator for Environmental, Governance or Emissions scores by score providers, potentially creating some endogeneity, i.e. a score could be increasing simply because, by definition, it registers the issuance of the green bond. A more detailed explanation is reported in Section A.4. of the Appendix.

Overall, the results from this small-sample analysis are in line with the outcome of the workshop. The projects financed by green bonds appear not to contribute much to improving the issuers' overall ESG and emission performance.

Figure 12 - Sustainability performance after green-bond issuance



Notes. This figure shows the difference in means for sustainability scores between issuers of CHF-denominated green bonds and matched issuers of standard CHF-denominated bonds, before and after the issuance. All considered issuers are corporations (not governments). The considered sustainability scores are sourced from MSCI and are on environmental, governance, social and carbon emissions' risk management. See Footnote 24 for more details on the scores. The scores range from 10 (best) to 0 (worst). The matching is done following Flammer (2021). The graph reports both the point estimates for the difference in differences of the means and the related 95% confidence intervals (horizontal lines). If the confidence intervals cross the vertical dashed line at zero, then the point estimate is not statistically different from zero at the 5-% level. Source: Capital IQ, MSCI, Eikon, authors' calculations.

5 CONCLUDING REMARKS

This market outlook has reviewed the current market and government guidelines for issuing a green bond, and general trends and barriers of the market of green bonds in Switzerland.

While in Switzerland there is no official definition of green bonds, the government has published guidelines on issuance, and the SIX Swiss Exchange demands specific requirements to give a bond the green label. From a regulatory perspective, green-bond issuers are subject to the same legal requirements at issuance as when issuing standard bonds. In addition, to be flagged as "green" on the SIX Swiss Exchange, bonds have to fulfil two conditions, namely following the Green Bond Principles of the International Capital Market Association and appearing in the Green-Bond Database of the Climate Bonds Initiative. While Switzerland still lacks a legal definition for green bonds, guidance and recommendations against greenwashing have been provided by governmental institutions and the industry. Also, a definition for sustainable financial products and services, and its associated disclosure requirements should be proposed by the FDF at the end of September 2023, bringing more clarity to the actors of the green-bond market.

The size of the Swiss green-bond market remains limited compared to European counterparts, and Swiss green bonds remain a niche investment. Concerning market trends, the annual volume of green bonds issued has regained traction in 2023. However, the deal size remains below the average for the bond market, and the Swiss market is relatively smaller than its European counterparts. Overall, while to date green bonds take up the greater share of sustainable debt instruments on the Swiss market, they still remain very much of a niche investment for Swiss investors.

Issuers of green bonds on the Swiss market are large, well-performing firms in need of financing. In Switzerland, the main issuers of corporate green bonds are financial institutions, real estate firms and energy firms. Green-bond issuers are usually larger, well-performing corporations, though with higher financing need than their peers. Issuers use green bonds mostly to finance green construction and energy projects. While real estate and energy firms use them to finance projects in their own sectors, companies still invest the green bonds' proceeds in projects from a wide array of sectors, which could be both within and outside of their business scope.

The Swiss green-bond market has four main barriers to scale. While the Swiss green-bond market is growing, there are still market barriers that prevent it from reaching scale. By interviewing market stakeholders in a workshop setup, we identified four main barriers.

1. **High costs of issuance**. In Switzerland the costs of issuance for green bonds are still high. This is an issue especially in a context of low demand, where yields of green bonds are not low enough to compensate for the high issuance costs.

2. **Lack of incentives to receive lower yields**. The lack of incentives for green bonds' investors to bear the financial burden of potentially lower yields, if

any, can contribute to "scare inventors away". In this regard, the data suggests that yields at issuance of green bonds are actually slightly higher than of standard bonds. If we look at time trends in the secondary markets, before the Covid-19 crisis Swiss investors were willing to receive lower yields from green bonds. After Covid-19 hit, investors went back to more standard bonds, and since then the demand for green bonds remained relatively low.

3. **Lack of uniform post-issuance reporting**. Looking at the public post-issuance reports of issuers, we found that information on the financed green projects is presented in very different ways across issuers. Overall, proceeds spent and GHG emissions avoided should be the minimum variables to be reported homogeneously for all green bonds.

4. **Low climate impact of underlying projects**. It is currently not clear whether the climate impact of the projects financed by green bonds is high enough to improve the issuer's environmental performance. In addition, it is not always the case that the proceeds of green bonds are allocated to projects that are material to the firm's activities. Indeed, data suggests that issuers of green bonds on the Swiss market do not necessarily improve their ESG and emission scores after issuance.

As the Swiss market for green bonds is still far from reaching scale, there are things that market actors, policy makers and academia can do to help the market reach its potential. As a result of the workshop and interviews, the Enterprise for Society Center has started three main projects to attempt to answer to the market's barriers to scale.

Open-source database for Swiss green bonds. The first project plans to build an open-source, granular database on the projects financed by green bonds in Switzerland. This database would centralise key project-level metrics, such as specific sectors and topics in which the proceeds are invested (i.e., circular economy), and combine these metrics with firm-level ESG metrics.

Decentralised finance platform to scale green bonds in Switzerland. The second project, in collaboration with the University of Zurich, plans to assess how to scale up the green-bond market through decentralised finance (DeFi). As standard green bonds bear relatively high issuing and transaction fees, the tokenization of underlying assets allows lower costs and a larger capital market access to the green-infrastructure asset class.

Swiss platform for stakeholders-policy-makers. The third project plans to create a network of market stakeholders and policymakers or potentiate an existing one to increase communication between market actors and promote a policy and legislative agenda to improve the market of green bonds in Switzerland.

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APPENDICES

A.1. TRENDS IN THE SWISS GREEN-BOND MARKET: ADDITIONAL INFORMATION

Figure A1: Government green bonds and standard bonds on the SIX Swiss Exchange

Notes. These three graphs provide a comparison of the amount issued, the coupon rates, and the term to maturity between CHF-denominated green and standard bonds. Data on credit ratings similar to Figure 5 Panel (d) were not available. The left axis of the graphs gives the proportion of bonds belonging to the categories described in the legend. In Panels (a), (b) and (c), the right axis represents, respectively, the average of the amount issued in million CHF of the annual coupon rates and of the term to maturity. Source: Eikon, SIX.

Figure A1 reports summary figures on amount issued, coupon rates and term to maturity for CHF-denominated government green and standard bonds on the SIX Swiss Exchange. The same information is reported in the first three panels of Figure 5 in Section 3.2 for corporate green bonds. Government green bonds have, on average, a higher amount issued (around CHF238 million) than government standard bonds (CHF201 million) (Panel a); contrary to what is observed with corporate bonds. The conclusions for coupon rates and term to maturity are similar to the ones for corporate bonds. Government green bonds have, on average, much lower coupons and present a higher share of zero-coupon bonds compared to government standard bonds (Panel b). Government green bonds have on average lower term to maturity (Panel c).

Table A1 reports the number of green-bond issuers (column 1), number of green-bonds issued (column 2) and amount issued with green bonds per type of issuers, namely government institutions, private companies, private investment firms and public companies. It also reports the split between Swiss (issuers incorporated in Switzerland) and Foreign (issuers incorporated abroad). The table is in support of Section 3.2 and 3.3. The differentiation by type of issuers is the one provided by Capital IQ. In our analysis, we call "government green bonds" the green bonds issued by "Government Institution" and "corporate green bonds" the green bonds issued by the three other types of institutions.

Table A1 - Issuers of green bonds in Switzerland

		Number of issuers (1)	Number of green bonds (2)	Amount issued in CHF billion (3)
Government Institution	Swiss	3	10	2.91
	Foreign	2	5	0.66
Private Company	Swiss	14	23	3.35
	Foreign	12	25	4.66
Private Investment Firm	Swiss	0	0	0
	Foreign	2	2	0.62
Public Company	Swiss	10	28	4.03
	Foreign	7	12	2.74
Total		**50**	**105**	**18.97**

Notes. This table reports the numbers of issuers (column 1), number of green bonds issued (column 2), and issued amount for green bonds in CHF billion (column 3) for CHF-denominated green bonds, by type of green-bond issuer and by the nationality of the issuer (country of incorporation). The types of green bond issuers are defined by Capital IQ. We consider "corporations" the companies in the categories Private Company, Private Investment Firm and Public Company, while "governments" are classified as Government Institution. The figures are outstanding for 2023 for Switzerland. Source: CapitalIQ, Eikon.

A.2. Issues of the Swiss green-bond market: Additional information on yields

In Section 4.2 we report a comparison of the yields at issuance and in the secondary market between green bonds and matched standard bonds. "Matching" bonds means finding a standard bond that is issued by the green-bond issuer that is as similar as possible to the green bond in question, so called "nearest neighbour". To do so we use the methodology proposed in Flammer (2021). The nearest neighbour (using the Mahalanobis distance) is picked based on four characteristics: (i) log(issuance amount), (ii) maturity, (iii) coupon, and (iv) the number of days in between the green and brown bond issuance. If the matching is good, the difference between these characteristics must be statistically insignificant. Table A2 reports these differences for (i) log(issuance amount), (ii) maturity, (iii) coupon. The number of days in between the green and brown bond issuance is excluded here as this variable is built at the pair level, so by construction its value is zero for green bonds and non-zero for standard bonds.

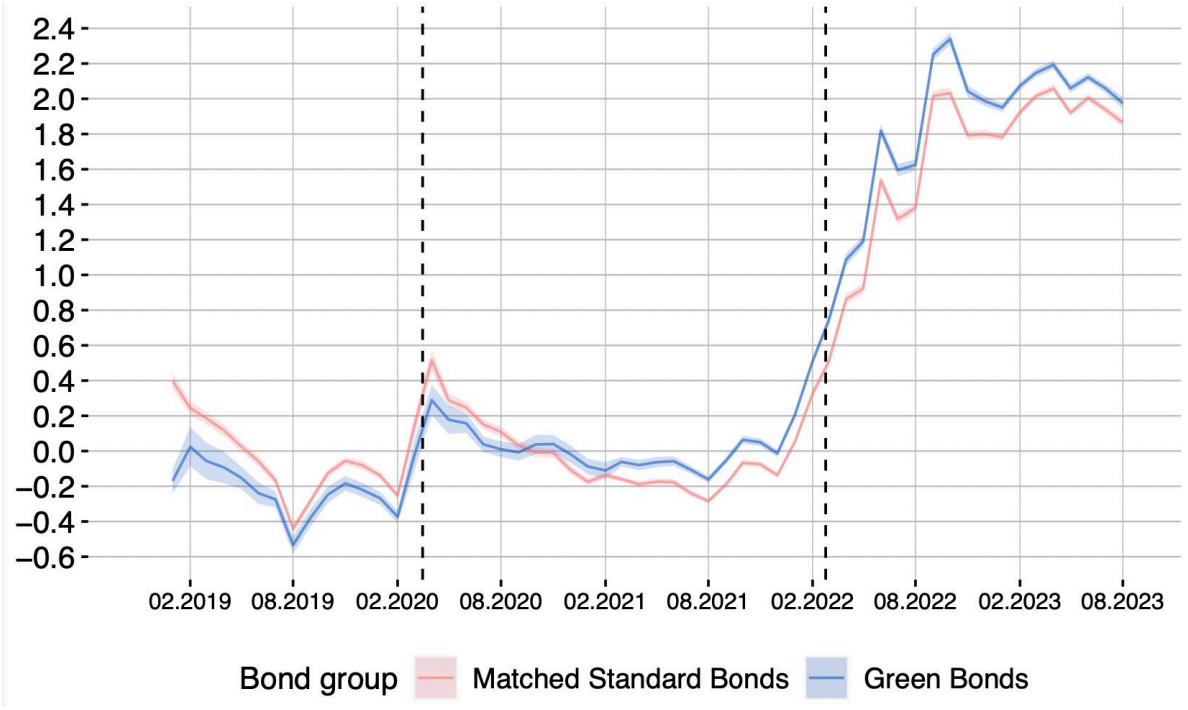
Table A2 - Sample of matched bonds and characteristics used for matching

Variable	Bond group	Observations	Mean	Difference in means	P-value difference in means
(1)	(2)	(3)	(4)	(5)	(6)
Amount issued (log)	Green bonds	49	18.94	0.02	0.83
	Matched bonds	49	18.93		
Maturity (# years)	Green bonds	49	7.55	-0.07	0.91
	Matched bonds	49	7.62		
Coupon rate (%)	Green bonds	49	0.61	0.07	0.64
	Matched bonds	49	0.54		

Notes. This table reports the difference in bond's characteristics between the group of CHF-denominated green bonds and matched standard bonds. These groups include only corporate bonds issued on the SIX Swiss Exchange. In this table, corporate green bonds (49) are a subsample of the total corporate green bonds on SIX (90), for which data for the matching is available. The matching is done within issuers, following Flammer (2021). The nearest neighbour (using the Mahalanobis distance) is picked based on four characteristics: (i) log(issuance amount), (ii) maturity, (iii) coupon, and (iv) the number of days in between the green and brown bond issuance. Columns (1) and (2) report, respectively, variable considered and bond group. Columns (3) and (4) show the number of bonds per group and related mean. Column (5) and (6) report the difference in the means of the groups and the p-value for this difference in means. A positive difference indicates that characteristics differ. A p-value higher than 0.05 indicates that the differences in means between the two groups are not statistically significant at the 5-% level. Source: Eikon, authors' calculations.

For example, the first two rows of column 4 report the mean value of the natural logarithm of the amount issued for green bonds (18.94 in row 1) and standard matched bonds (18.93 row 2). Column (5) reports the difference between these two means, which is 0.02 log points. Column (6) reports the p-value of this difference, which is 0.83, and which suggests that the difference between the two values is statistically insignificant at the 5% level. As a result, we can say that the matched standard bonds have statistically the same amount issued than the considered green bonds. As the table shows, this holds also for Maturity (rows 3 and 4) and Coupon rate (rows 5 and 6). Overall, we can say that the matched standard bonds are very similar to the green bonds along the considered characteristics (good match).

Figure A2 - Ask yields of green bonds vs matched bonds over full time period



Notes. This figure reports the monthly means for ask yields over time by groups of green bonds and matched standard bonds on the SIX Swiss Exchange (secondary market) over January 2019 and August 2023. The vertical dashed lines represent, respectively, the beginning of the Covid-19 crisis (2020-03-16) and the beginning of the invasion of Ukraine (2022-02-24). The matching is done within issuers, following Flammer (2021). The nearest neighbour (using the Mahalanobis distance) is picked based on four characteristics: (i) log(issuance amount), (ii) maturity, (iii) coupon, and (iv) the number of days in between the green and brown bond issuance. The shaded areas around the monthly means are the confidence intervals at the 95-% level for the monthly means. A higher ask yield for green bonds (blue) than for matched standard bonds (red) indicates that bond holders need to offer higher yields than usual to sell their bonds (high supply, or low demand). If the confidence intervals for the green bonds do not cross the confidence intervals for the matched standard bonds, then the difference in means is statistically significant at the 5-% level. Note that the fact that data for ask yields are available for a specific month does not necessarily imply that transactions took place on the exchange. Source: Eikon, Datastream, authors' calculations.

In Section 4.2. we have also compared yields in the secondary market for the sample with green bonds and matched standard bonds. Figure 11 of Section 4.2 shows the bid yields for green and matched standard bonds. For robustness, we have computed the same averages for the ask yield, which is the yield bond holders ask when selling their bond in the secondary market. Figure A2 reports the results for ask yields also for the full period. The conclusion remains the same, i.e., green-bond holders were willing to sell their bonds at higher yields than standard-bond holders until 2022. From the beginning of 2022, and through 2023, this difference became statistically insignificant.

A.3. Issues of the Swiss green-bond market: Additional information on post-issuance reporting

Table 2 of Section 4.3 showcases how a simple centralization of information on Swiss green bonds could be carried over for 10 bonds that are present on the ICMA website (we did it for 17 and reported just 10 of them for exposition purposes). To do so, we sourced our data directly from reports published by the issuers post-issuance. For some recent green bonds, there is no available green bond report in which we can find information on the use of proceeds and impacts.[36]

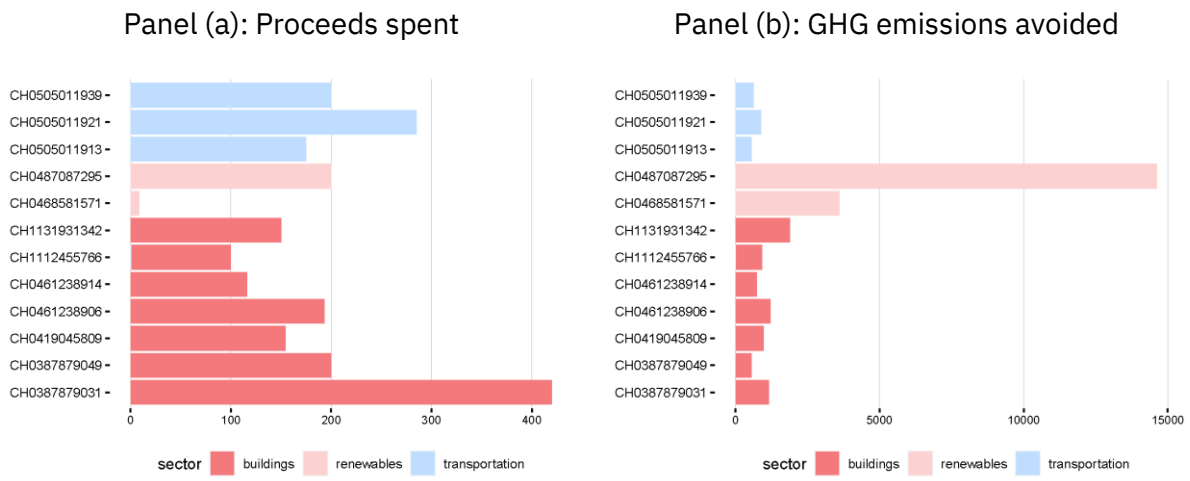
Some issuers like Swiss Life Holding, issued in 2019 many bonds at the same time under different tranches with different tenure and other financial conditions such as coupons. However, they report impacts based on the total proceeds used to finance projects and do not allocate the impact to every tranche of the bond. Hence, we computed a pro-rata impact which means that in the case of Swiss Life Holding, they reported in 2020 savings of 907 tons of CO2 that will account for 250/600 = 42% for the tranche that issued CHF 250 million out of the total amount raised which is 600 million. As a result, the number reported for the year 2020 specific for this tranche will be 907 x 250/600 = 378. In total, when considering the three tranches, we will again have the 907 tons of CO2 avoided.

Most of the issuers reported impacts at the bond level. But some issuers like Swisscom reported impacts at the project level while the project was only partly financed by the green bond. Hence, we also converted the impact to allocate the emissions saved only for the green bond and not the other part of the financing. More precisely, they reported in 2021 that the renovation of buildings allowed to save 14,429 tons of CO2 equivalent. But the total investment in these projects reached 1,564,591'000 CHF while the bond issued in the same year reached CHF100 million. Moreover, the proceeds were used to finance projects in three sectors that are energy efficiency, transportation, and renewables. The proceeds used to finance projects in energy efficiency in buildings reach CHF99.45 million. Hence, the assigned amount of emissions saved in 2021 corresponding to this bond for the energy efficiency in buildings will be 14,429 x 99.45/1,564.591 = 917.1 tons of CO2 equivalent.

For simplicity, Table 2 in Section 4.3 did not report the data for each sector of the use of proceeds. Figure A3 reports this data for 12 of the 17 bonds analysed.

[36] It is the case for instance of the bond issued by Crédit Agricole Next Bank SA in 2021 for an amount of CHF 150 millions.

Figure A3 - Disclosed information on green bonds for sectors of use-of-proceeds



Notes. This graph reports the cumulated proceeds spent (Panel (a)) and GHG emissions avoided (Panel (b)) as of 2021 for 12 green bonds quoted on the SIX Swiss Exchange. This subsample was obtained by considering the green bonds that were present on the ICMA platform in 2022 and for which we were able to calculate both proceeds spent and GHG emissions avoided at the level of the sector of the use of proceeds. The projects financed with the bonds' use-of-proceeds are in three main sectors, namely buildings, renewables, and transportation. Proceeds spent are in millions of CHF, while GHG emissions avoided are in tons of CO2 equivalent. Source: issuers' reports, authors' calculations.

A.4. Issues of the Swiss green-bond market: Additional information on the climate impact of underlying projects

In Section 4.4., we compared ESG indicators of green-bond issuers with standard-bond issuers. These latter were selected with a matching logic: for each green-bond issuer, the goal is to select a company that issued only standard bonds, but never a sustainable bond (green bond, sustainability-linked bond, etc). Among the different matching logics, we consider the one of Flammer (2021) - note the difference with the matching explained in Appendix A.2 [41]. is that in that case we were matching within firms, and now we are matching between firms.

First, for the matched issuers of standard green bonds, we only consider those that have never issued either a green bond or any other types of ESG bonds. Second, we require that the matched issuer operates in the same country and the same two-digit SIC of the green-bond issuer. Third, out of the remaining candidates, we select the nearest neighbour based on firms' size (log of assets), return on assets (net income over total assets), and leverage (total debt over total assets). Note that we did not use Tobin's Q because of low data availability. For each characteristic, we consider the variable in the year preceding the green-bond issuance as well as the "pre-trend". As a result, 8 matching variables are used. The nearest neighbour is the firm with the lowest Mahalanobis distance to the treated firm across these 8 matching characteristics.

If the matching is good, the difference across these 8 variables must be statistically insignificant. Table A3 reports the means of these variables across the 2 groups of green-bond issuers and matched issuers. For example, rows 1 and 2 of column (4) shows that the mean of the leverage ratio for green-bond and matched issuers in the year before issuance (t-1) is respectively 0.02 and 0.04. The difference is -0,02 (column 5), which is statistically insignificant at, say, the 5% level (column 6). The same holds for the level of the natural logarithm of assets before issuance (p-value is 0.14). However, the same does not hold for the other 4 variables we used for the matching.

Overall, this means that the matching methodology did not deliver a good matched sample on all the variables, and therefore the related results on ESG scores must be taken with caution. This caveat most likely stems from the low sample size of issuers of bonds in Switzerland for which we have data on the matching variables.

Table A3 - Sample of matched issuers and characteristics used for matching

Variable	Issuer group	Observations	Mean	Difference in means	P-Value difference in means
(1)	(2)	(3)	(4)	(5)	(6)
$Leverage_{t-1}$	Green-Bond issuer	9	0.02	-0.02	0.07
	Matched issuer	9	0.04		
ROA_{t-1}	Green-Bond issuer	9	0.5	0.87	0
	Matched issuer	9	-0.36		
$log(Assets_{t-1})$	Green-Bond issuer	9	0.01	0	0.56
	Matched issuer	9	0.01		
$\Delta Leverage_{t-1}$	Green-Bond issuer	9	0.35	-0.05	0.02
	Matched issuer	9	0.4		
ΔROA_{t-1}	Green-Bond issuer	9	0.01	0.01	0
	Matched issuer	9	0		
$\Delta log(Assets_{t-1})$	Green-Bond issuer	9	11.3	0.51	0.05
	Matched issuer	9	10.79		

Notes. This table reports the difference in firms' characteristics between issuers of green bonds and matched issuers of standard bonds, before and after the issuance. All considered issuers are corporations (not governments) and all considered bonds are CHF-denominated. The matching is done following Flammer (2021). Columns (1) and (2) report, respectively, variable considered and issuer group. Columns (3) and (4) show the number of firms per group and related mean. Column (5) and (6) report the difference in the means of the groups and the p-value for this difference in means. A positive difference indicates that characteristics differ. A p-value higher than 0.05 indicates that the differences in means between the two groups are not statistically significant at the 5-% level. Source: Eikon, Capital IQ, authors' calculations.

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1. Scientific excellence, academic integrity and autonomy
2. Focus on major societal challenges
3. Transdisciplinary and inclusive dialogue

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Coalition Partners