Governance quality and green bond issuance: An empirical assessment across sovereign and corporate issuers

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Introduction

The global urgency to address climate change has fostered a growing interest and exploration in sustainable finance. As result of the uprising green transition, green bonds, a debt instrument designed to provide funding for projects with an environmental scope, have risen as a highly relevant financing tool for both corporations and governments. The size of the market for green bonds is currently six times larger in comparison to that in 2018. According to Demski et al. (2025), this broad increase can be explained through an improved regulatory support towards environmental affairs and a higher investor demand for green assets. Furthermore, the growth of the green bond market has been more than proportional to that of the conventional bond market. This was shown by Flammer (2020), who reported that the share of green bonds increased by a factor of around 100 from 2007 to 2018, with Europe and Asia driving much of the comparatively rapid expansion in the share of green bonds issued. *Figure 1* illustrates this upward trend by showing the rise of green bonds relative to conventional ones, as well as the evolving share of both sovereign and corporate green bonds issued.

Figure 1. Share of green bonds over time

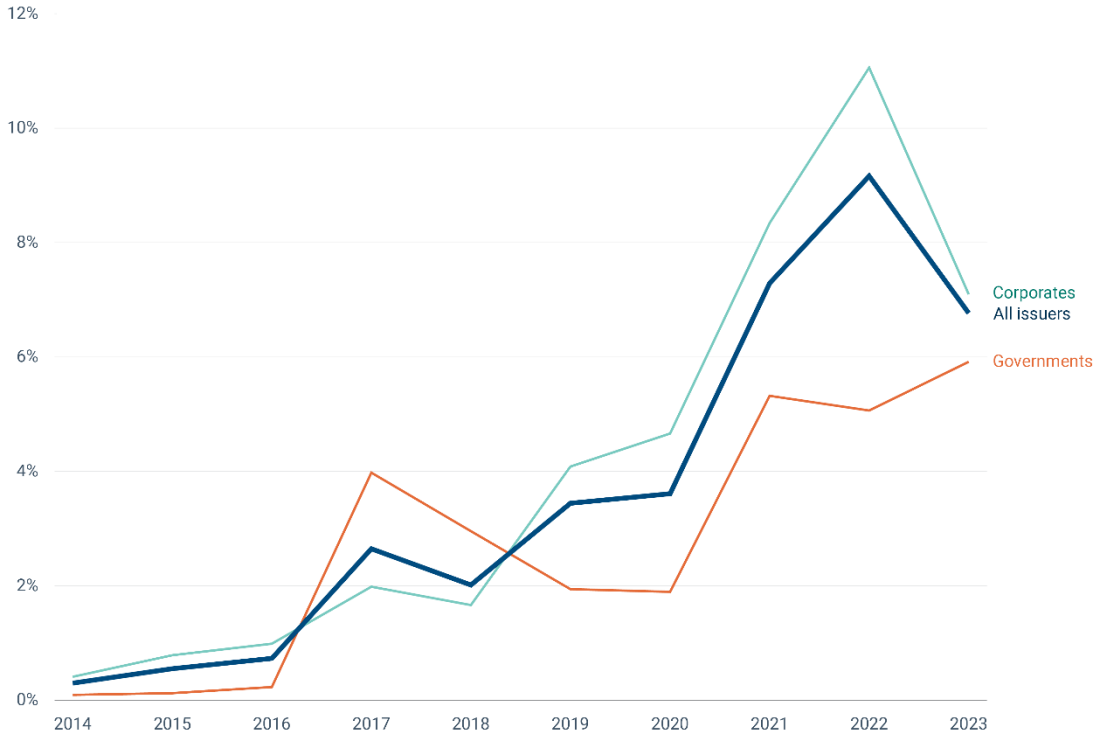

Figure 1. Green bond issuance as a percentage of total bonds issued by corporations, by governments, and by both corporations and governments in the EU-27, 2014-2023. European Environment Agency (2024). Retrieved from https://shorturl.at/sLGK6

The comparatively rapid expansion of green bonds relative to conventional ones in recent years is particularly noteworthy. According to Flammer (2021), green and conventional bonds have very similar financial terms, displaying no significant differences in coupons, maturity or yields-to-maturity. The overall stated similarity between these debt instruments would intuitively suggest for them to follow a similar issuance pace dynamic, which they do not display. Their primary distinction lies in the use of proceeds for environmentally leaned purposes, and in the additional layers of monitoring and certification required in the issuance of green bonds. This theoretically single difference between green and conventional bonds should therefore explain the comparatively rapid expansion of green bonds. For instance, the ability to ensure that funds are allocated as claimed must have a central role explaining the increase in the share of green bonds issued, as this is critical to green investors trust and to the demand for green relative to conventional bonds. Such assurance depends on the existence of effective institutional mechanisms for monitoring and enforcement. In this context, governance quality, including the strength of legal institutions, regulatory oversight, and political stability, may play a key role in enabling credible green finance, as countries with stronger governance frameworks may be more likely to implement and enforce the necessary standards for green bond issuance. Consequently, governance quality may be a key driver of the more-than-proportionate rise in green bond issuance relative to that of conventional bonds.

This thesis addresses the just mentioned hypothesis by asking the question of *to what extent can governance quality explain the differential growth of green relative to conventional bond issuance volumes*. To answer this question, I first perform an analysis on the impact of governance quality on green bond issued volumes. This serves as a comparative basis for the subsequent analysis of the impact of governance quality on the share of green bonds in the total bond market. This approach helps to determine if an improved governance capacity has a significant impact on the volumes of green bonds issued, to later determine if it actually influences its more than proportional growth in comparison to conventional bonds. The study also deepens on the impact of governance quality on the share of green bonds issued by studying *how it differs by type of issuer* (Corporate and Sovereign), and by analyzing *how relevant model specifications including interaction terms like the financial markets development or environmental awareness alter the conceived impact* of governance quality on green bond issued volumes.

Most of the current academic literature on the determinants of green bond issuance primarily focus on financial terms as the dependent variable and on pricing dynamics as the major contributors to the green bond market expansion (*Baker et al. (2018); Fatica and Panzica (2021); Zerbib (2019); Bolton and Kacperczyk (2021)*). This study deviates from this approach and opts for issued volumes as a more straightforward measure to capture the growth of green finance. Rather than concentrating on measures like yields that may indirectly alter the issuance of green bonds, the target variable chosen aims to directly reflect the magnitude of the expansion of the green bond market. This paper also contributes to the existing literature by providing an analysis on the understudied sovereign green bond issuance, and by expanding the geographical scope of the study beyond Europe. Additionally, it evaluates the extent to which the development of financial markets and environmental awareness resonate with governance quality to enhance the growth of the green bond market.

The empirical analysis employs a panel dataset covering 30 countries from 2017 to 2021. Linear fixed effects regressions are employed with robust standard errors to account for unobserved heterogeneity across countries and years. The inclusion of country and year fixed effects aims to specifically control for time-invariant specific characteristics for each country, and to account for global time trends. Additional robustness checks are conducted to assess multicollinearity, correct models' specifications, heteroskedasticity, autocorrelation, and overall model significance.

This paper first provides a thorough literature review on the determinants of green bonds investment, the role of financial markets development and environmental awareness, and discusses the literature gap aimed to be filled. After, it establishes the methodology of the empirical study, describing the models, hypotheses and the data used in the paper. Subsequently, the results of the empirical models are shown and discussed with respect to the stated hypotheses. Later, limitations encountered in the study are exposed. Finally, conclusions are drawn regarding the impact of governance quality on green relative to conventional bond issuance.

Literature review

This section is divided into three subsections exploring the determinants of bond issuance. Section 2.1 focuses solely on the documented evidence of the drivers of green bond issuance, grouping these across main categories that are relevant for the study. After, Section 2.2 analyzes the documented role of financial markets development and environmental awareness on debt acquisition and investment decisions. Finally, a brief discussion on the academic relevance of the study is made in Section 2.3. This review aims to establish a theoretical ground highlighting the background of the variables used in this paper, and to provide a rigorous foundation for the empirical analysis performed.

2.1. The determinants of green bond issuance

The accelerated growth of green bond investment has been the subject of extensive research over recent years, with institutional quality and governance capacity being consistently identified as central drivers of the green bond market. This is shown by Tolliver et al. (2020), who exposes a significant causal effect of institutional drivers, mainly measured through the rule of law and regulatory quality indicators, on conventional and green bond issuance. This empirical result is further reinforced by Ng (2018), who demonstrates that the strength of institutional factors plays a relevant role in promoting green bond issuance and enhancing the overall quality of the green market. Similarly, Fatica and Panzica (2021) and La Porta et al. (1997), demonstrate that countries with robust legal frameworks and effective enforcement mechanisms experience higher levels of green and conventional bond issuance respectively.

These studies attribute the positive impact of governance quality on bond issuance by highlighting the importance of property rights and functioning legal systems on increasing the confidence of investors for securities with a lower perceived risk. This effect seems particularly true for corporate green bonds, as according to Eichengreen and Luengnaruemitchai (2004) and Agliardi and Agliardi (2019) institutional settings that reduce corruption and improve bureaucratic efficiency tend to foster green corporate issuance growth. A similar emphasis is presented by Tu et al. (2020) and Voica et al. (2015), who identify an improved legal infrastructure and politically anchored economic stability as strong drivers of green bond issuance. Moreover, the impact of political stability on the performance of bond markets is further claimed by Perry and Robertson

(1998) and McGee (2007). This set of findings provides a solid theoretical foundation to validate the claims on governance indicators improving green bond issuance.

In addition to governance quality, macroeconomic variables have also been recognized as having an important influence on green bond investment. Broadstock and Cheng (2019) emphasize that systemic macroeconomic conditions significantly shape green bond demand, thereby influencing their issuance volumes. Among the most influential macroeconomic variables, economic growth takes a highly relevant role. Ugbam al. (2023) and Pradhan et al. (2015) report a bidirectional causal effect between output growth and corporate bond issuance across both developed and developing economies. And while literature directly connecting economic growth and sovereign bond issuance is limited, Bernabé-Argandoña et al. (2022) provides evidence backing a positive relation between these variables on developing countries. This found scarcity of studies following the determinants of sovereign green bond issuance further motivates the research conducted in this paper.

Other macroeconomic variables such as inflation, fiscal balance, and sovereign risk are also noted for their influence on green bond issuance. Macchiarelli (2014) and Nishat et al. (2016) argue on the role that inflation has in generating macroeconomic instability, consequently negatively affecting investors' appetite for green bonds. This view contrasts with the evidence presented by Dan and Tiron-Tudor (2021), who emphasize on the positive impact of inflation, fiscal balance, and ESG risk on green bond issuance volumes in the European context. Further nuance is added by exploring the differential impact of sovereign risk across issuer types. Taghizadeh-Hesary and Yoshino (2020) suggest that elevated country risk rates can restrict green corporate issuance by increasing their risk premiums. Contrary, Dell'Atti et al. (2022) argue that an increase in sovereign risk fosters sovereign green bond issuance as a mitigation mechanism. These insights highlight the need for issuer differentiated models when assessing the determinants of green finance.

Lastly, currency stability is frequently cited in the literature as an important determinant of green bond issuance. As Moro and Zaghini (2024) argue on its effect on enlarging the so-called *greenium,* this is, the yield difference between green and conventional bonds. This enlarged greenium, provoked by the stability of the principal currency of the issued bond, enables issuers to access capital at a lower cost, thereby incentivizing green bond issuance. Reboredo and Ugolini

(2020) further support this view by documenting how issuance in hard currencies, particularly in USD, enhances the performance and attractiveness of green bonds, hence motivating its issuance.

This set of variables, backed by academic research as significantly determinant of green bond issuance, provides useful insights on the controls used in the empirical analysis. By including these variables in a comparative context between green and conventional bonds, the study provides further insights on the determinants of the green bond market expansion.

2.2. The role of financial market development and environmental awareness in investment decisions

In addition to macroeconomic variables, recent literature emphasizes on the crucial role of financial markets development in shaping green bond issuance dynamics. Claessens et al. (2007) identifies a strong positive relationship between the depth of financial markets and the expansion of bond issuance. This connection is further corroborated by Chordia et al. (2005), and McCauley et al. (2015), who underline the role of markets' efficiency and accessibility in driving bond issuance volumes. Gianfrate and Peri (2019) also show a positive effect of access to financial markets on the likelihood of issuing corporate green bonds. These findings align with the broader notion that a well-developed financial infrastructure reduces transaction costs and enhances firms' capacity to engage in conventional and green finance.

Reboredo and Ugolini (2020) expand on this conclusion by demonstrating that a higher financial development index correlates with lower issuance costs and with a broader base of investors for green bonds. Similarly, Ehlers and Packer (2017) expose the relevance of transparent and robust financial markets, especially those that allow for external reviewing, in promoting green bond credibility. These findings show that understanding the relation between financial markets development and governance quality is critical to analyze the effect of institutional capacity on green bond issuance.

Beyond institutional and market-related drivers, environmental awareness has been increasingly considered as a relevant factor in the green bond market expansion. Significant academic literature currently investigates on the role that an increasing pro-environmental sentiment among investors may have in the increase of green finance. Wang et al. (2020) and

Baulkaran (2019) document a notable increase in investor demand for green financial products, which suggests a shift of preferences towards sustainability-focused financial instruments.

Building on investor's preferences, Pham and Huynh (2020) provide evidence on the effects that a heightened environmental awareness has on green bond returns and volatility. Their findings suggest that environmental considerations are becoming increasingly embedded in investors' financial decision-making. Coherently, Baker et al. (2018) reports how most asset managers see compliance with ESG objectives as a key driver for green bond investment, surpassing reputational motives or diversification benefits. Chatzitheodorou et al. (2019) expands this by arguing on the great appeal that this green instruments have, mostly to newly socially responsible investors, who have been greatly contributing to the green bond market expansion. However, the claim that environmental consciousness plays a primary role in green bond issuance is not widely accepted. Zerbib (2019) explicitly questions the capacity of pro-environmental preferences on altering investment behavior, suggesting its effect as limited. This opposing view is echoed by Fatica and Panzica (2021), who highlight the insignificant effect of investor's environmental preferences on green bonds premiums. Such skepticism further encourages the notion that green bonds are often issued for strategic reasons rather than purely out of environmental conviction.

Flammer (2021) reinforces this view by showing that most corporate green bond issuers act in response to anticipated regulatory requirements rather than to intrinsic environmental motivations. This interpretation is shared by Bolton and Kacperczyk (2021), who report a negative relationship between ESG company scores and green bond yields, implying that the provoked greenium may attract issuers who merely seek favorable financial terms and risk-return improvements rather than those driven by environmental motives.

Notably, most empirical evidence focuses on corporate green bond issuance, with scarce evidence on the role of environmental awareness on sovereign green bond issuance. This absence indicates a clear gap in the literature and exposes the need for a more profound investigation into how environmental sentiment may interact with governance quality in shaping both corporate and sovereign green bond markets.

2.3. *About the academic relevance of the study*

Despite the rapid growth of the green bond market, due to the instrument's novelty, academic literature on its determinants remains relatively limited. However, the studies reviewed in the previous sections so far identify governance quality, financial markets development, environmental awareness, and macroeconomic conditions as the principal drivers shaping green bond issuance dynamics. These, consequently, serve as the foundation for the empirical analysis performed.

As mentioned, much of the existing research in this field prioritize the pricing of green bonds, particularly yield determinants, over their issuance volumes. While yield dynamics, such as the greenium, provide important insights into the motivation of investor's behavior, they do not directly measure the extent to which the green bond market is expanding. Among the literature revised, only Dan and Tiron-Tudor (2021) consider green bond issuance volumes as the measure to study the determinants of the green market expansion, however, they fail to extend their analysis beyond Europe. This presents a gap in the literature I intend to address in this paper.

Additionally, few studies have investigated the growth of green bonds relative to conventional ones. As highlighted by Banga (2019), the drivers of the green bond market are similar to those of conventional bonds. Since many of the proposed determinants of green bonds may also influence the broader bond market, not controlling for their impact with a comparative approach could risk wrongly attributing the more-than-proportionate increase of green bond issuance to these drivers. This research contributes to the literature by explicitly performing this much needed comparison, which serves as the major motivator of the paper.

Another important gap relates to the type of issuer. Existing studies tend to focus disproportionately on corporate issuance, often leveraging firm-level datasets that limit the analysis of sovereign bond behavior. Government issuance represents a significant share of the green bond market, which motivates studying their issuance drivers as much as those from private corporations. A dual perspective on corporate and sovereign green bond issuance, sharing a consistent set of explanatory variables, is thus essential to achieve a more holistic understanding of the green bond market behavior.

Finally, while institutional quality has been widely cited as a fundamental determinant of green bond issuance, less attention has been paid to its interaction with environmental sentiment. Lee (2022) explains how governance frameworks and environmentally intended financial decisions may deeply affect each other. Still, the degree to which environmental awareness strengthens or modifies the role of governance in green finance remains an open question. Also, in line with Ehlers and Packer (2017) notion on the interconnection between financial markets and institutional quality, this study additionally examines the unaddressed matter of how financial markets development interacts with governance capacity to shape green issuance patterns.

Together, these contributions aim to provide a more comprehensive and comparative perspective on the factors driving the increase in the share of green bonds issued, with a special focus on governance quality. The following chapter sets the specific framework of the empirical study.

Methodology

This study investigates the question of to what extent can governance quality explain the differential growth of green relative to conventional bond issuance volumes. This objective is approached by empirically examining the influence of key determinants, outlined in the preceding literature review, on green bond issuance levels. These results are then compared with the effects of the same variables on the share of green bonds issued, allowing for a comparative assessment of whether these factors, particularly governance quality, explain the expansion of the share of green bonds.

This analysis distinguishes between sovereign and corporate issuers to assess whether institutional capacity affects the issuance dynamics of green bonds depending on the type of issuer. Additionally, it explores the individual and interacting effects of financial markets development and environmental awareness on green bond issuance. This setup explores how these variables may complement governance quality on fostering the green bond market growth.

The dataset used in this paper covers the period between 2017 and 2021 for the 30 countries presented in the Appendix. These are primarily from Europe and Asia, and are selected due to their consistent green bond activity since first issuance. The timeframe chosen aims to exclude policy shocks like the implementation of the 2016-Paris agreement, which reduces the risk of exogenous regulatory effects distorting the empirical findings.

3.1. Empirical models and robustness checks

To estimate the impact of governance quality on the share green bond issuance, a series of fixed effects linear regressions with robust standard errors are performed. Each of these controls for country and year fixed effects to account for time-invariant characteristics of each country, and for time trends among the country sample. This regression setup follows the same structure that Dan and Tiron-Tudor (2021) use in their academic research on green bond issued volumes. Every model included in the empirical analysis controls for the macroeconomic drivers of green bond issuance discussed in the literature review, as well as for financial markets development and a *proxy* for environmental awareness, which are shown as relevant in the previous section. From now on these variables will be referred as the *controls*, which are explicitly mentioned in the Appendix.

The empirical strategy used relies on two sets of four models, each employing an identical configuration of independent variables but differing in the dependent variable worked with. The first group, covering Models 1 to 4, attempts to explain the growth in green bond issuance, while the second one, covering Models 5 to 8, focuses on the growth in the share of green bonds relative to total bond issuance. The second set of regressions directly addresses the core research question of this study by examining the determinants of the share of green bonds issued. The first set, in turn, provides a complementary perspective by focusing uniquely on the level of green bond issuance. Since changes in the green bond share may reflect shifts in either green or conventional bond issuance, isolating the response of the explanatory variables on green bond volumes provides a necessary benchmark to interpret the dynamics observed in the share-based regressions.

Deepening into the empirical specification, Models 1 and 2 address the effect of governance quality on green bond issuance while considering the effect of financial markets development on the impact of governance quality on green bond issuance. Model 1 is set for corporate issuers, while Model 2 is set for sovereign issuers.

1. $$\log(GreenCorporateIssued_{it}) = GovernanceQuality_{it} + GovernanceQuality\ x\ FinancialMarketsDevelopment_{it} + Controls_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

2. $$\log(GreenSovereignIssued_{it}) = GovernanceQuality_{it} + GovernanceQuality\ x\ FinancialMarketsDevelopment_{it} + Controls_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

Models 3 and 4 explore environmental awareness, *proxied* by ESG-country-scores, as an alternative variable influencing the impact that governance quality may have on green issuance. Following the same structure as with the previous regressions, Model 3 is set for corporate, while Model 4 is set for sovereign issuers.

3. $$\log(GreenCorporateIssued_{it}) = GovernanceQuality_{it} + GovernanceQuality\ x\ ESGScore_{it} + Controls_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

4. $$\log(GreenSovereignIssued_{it}) = GovernanceQuality_{it} + GovernanceQuality\ x\ ESGScore_{it} + Controls_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

The second set of regressions takes as a dependent variable the growth of the share of green bonds issued. Models 5 and 6 emulate Models 1 and 2 respectively. These display the interaction

of financial markets development and governance quality for corporate and sovereign issuers respectively.

5. $$\log\left(\frac{GreenCorporateIssued_{it}}{TotalCorporateIssued_{it}}\right) = GovernanceQuality_{it} + GovernanceQuality\ x\ FinancialMarketsDevelopment_{it} + Controls_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

6. $$\log\left(\frac{GreenSovereignIssued_{it}}{TotalSovereignIssued_{it}}\right) = GovernanceQuality_{it} + GovernanceQuality\ x\ FinancialMarketsDevelopment_{it} + Controls_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

Models 7 and 8 mirror Models 3 and 4 respectively. These show the interaction of the *proxy* for environmental awareness and governance quality for corporate and sovereign issuers respectively.

7. $$\log\left(\frac{GreenCorporateIssued_{it}}{TotalCorporateIssued_{it}}\right) = GovernanceQuality_{it} + GovernanceQuality\ x\ ESGScore_{it} + Controls_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

8. $$\log\left(\frac{GreenSovereignIssued_{it}}{TotalSovereignIssued_{it}}\right) = GovernanceQuality_{it} + GovernanceQuality\ x\ ESGScore_{it} + Controls_{it} + \alpha_i + \gamma_t + \epsilon_{it}$$

Regarding the robustness of these models, several checks are conducted to strengthen the validity of the empirical findings. A variance inflation test (VIF) is performed to assess for multicollinearity issues among variables for each model. The VIF test only shows multicollinearity between governance quality and the interaction term for all model specifications. This generally rejects multicollinearity problems, as a high covariance between a variable and its interaction term is deemed as normal. A Breusch-Pagan and a Wooldridge test are also implemented to reject the presence of heteroskedasticity, and autocorrelation concerns respectively. For both tests all regressions revealed a p-value larger than 0.1, which rejects the presence of these endogeneity issues for all models.

Furthermore, a Regression Equation Specification Error Test (RESET) is employed to detect the pertinence of a linear functional form for each model. The result of this test indicates a functional form misspecification only for Models 6 and 8. This suggests either that the share of issued sovereign green bonds follows a nonlinear dynamic, or that there exists an unconsidered

variable that could better help explain the impact of governance quality on the dependent variable in these two models. Finally, alluding to explanatory power, the significance of the F-statistics for the first set of regressions provides evidence on the overall strong fit of the models measuring the determinants of green bond issuance. This is not the case for the second set of regressions, whose F-statistics suggest a lack of significance on the models aimed at explaining the growth of the share of green bond issued volumes.

3.2. Hypotheses

This study is based on the hypothesis that governance quality plays a significant role in explaining the increase in the share of green bonds issued. It intuitively derives from the impact that institutional quality may have on assuring an improved monitoring of the use of proceeds, which is the fundamental difference for which some investors may opt for green finance instruments instead of conventional ones. Two parallel lines of investigation are pursued to test this main hypothesis, with each having its own set of hypotheses.

The first line one follows the first set of regressions, and focuses on evaluating the secondary hypothesis that governance quality has a positive impact in the issuance of green bonds. This hypothesis is set to confirm the findings from the academic research previously shown. This is tested separately for corporate and sovereign bonds issuance through Models 1 and 3, and Models 2 and 4 respectively. These tests are expected to show a positive and statistically significant effect of governance quality on the growth of green bond issuance for both types of issuers. To deepen the analysis, I examine whether the degree of the development of financial markets amplifies the analyzed relationship, and if it does it in a different way compared to the amplification that environmental awareness may induce. This is done by analyzing the interaction terms from Models 1 and 2 against those from Models 3 and 4. Following the literature review, it is expected for both financial markets development and environmental awareness to enhance the positive impact of governance quality on green bond issuance. However, the amplifying effect of financial markets development is expected to be stronger given the documented ambiguity of environmental awareness on altering green investors' appetite.

The second analytical stream uses the second set of regressions to address if governance quality is positively related to the share of green bonds issued. As in the first line of investigation, this hypothesis is tested for corporate and sovereign issuers through Models 5 and 7, and Models

6 and 8 respectively. Similarly, these tests are expected to show a positive and statistically significant effect of governance quality on the growth of the share of green bonds for both types of issuers. Furthermore, as in the previous line of investigation, a comparison of the interaction terms from Models 5 and 6 against those from Models 7 and 8 is done to evaluate the hypotheses of financial markets development and environmental awareness positively mediating the role of governance quality on the share of green bonds. In this setup, the development of financial markets is also expected to enhance the relationship between governance and the share of green investment more than environmental awareness is expected to.

This dual approach helps differentiating between absolute issuance dynamics and relative changes in market composition. Confirming the secondary hypotheses of both analytical streams is expected to confirm the main hypothesis. Such scenario would imply that governance quality improves absolute green bond issuance, and that it does so in a more than proportional manner with respect to the total bond issuance. These results suggest a targeted impact of governance on green finance, whereas parallel effects across green and conventional bonds would imply a more generalized institutional influence of governance quality on the bond market as a whole.

3.3. Data and variables description

This study considers two main dependent variables. The first one is the *volume of green bonds issued*, which is used in the first set of regressions to analyze the impact of governance quality on green bond issuance. To construct this variable, I retrieved the granular data on green bond issuance from the Refinitiv Workspace Sustainability Dashboard and aggregated it by country and year, maintaining a distinction between corporate and sovereign green bonds issued per country and year. The second dependent variable is the *share of green bonds volumes issued*, which is used in the second set of regressions to capture the impact of governance quality on the share of green bonds issued. To construct this variable, the aggregated data for green bonds from the first dependent variable is used, as well as aggregated data on conventional bonds I built from the granular bond data also retrieved from the Refinitiv Workspace. The second dependent variable is then formed by the ratio between green and green plus conventional bonds issued volumes, and changes depending on the type of issuer.

The independent variable of the study is *governance quality*. This variable intends to cluster institutional indicators deemed as relevant for green bond issuance by Tolliver et al. (2020) such

as regulatory quality, rule of law, and political stability. The data for these variables was retrieved directly from the World Development Indicators Database. As including these three variables induces multicollinearity issues, the governance quality variable was constructed using a principal component analysis (PCA) of these indicators. As a result of this method, the interpretation of results focuses only on the direction, not the magnitude, of the impact of governance quality is the only thing that can be discussed about.

Regarding the controls employed in the regressions, the interaction terms of *financial markets development* and *environmental awareness* are considered, as well as a set of macroeconomic controls revised as relevant for the study. The financial markets development data is retrieved from the Financial Markets Index publicly available on the IMF Legacy Data webpage. It is built considering the depth, efficiency and accessibility to financial markets variables deemed as relevant to explain green bond issuance in the literature review section. The environmental awareness was estimated through the ESG country-scores, based on the idea that environmentally aware countries are more likely to act against environmental degradation, hence reporting a higher ESG score. The data of this variable for each country was downloaded from the Refinitiv Workspace, and compiled under a single panel dataset.

Regarding the macroeconomic factors I included the data for inflation, economic growth and fiscal balance retrieved through the World Development Indicators database from the World Bank Data Portal. Regarding the latter, fiscal balance is captured through the net lending/borrowing from government with respect to GDP to avoid omitted variable biases due to the size of each economy. I used lags for these variables to account for the fact that investors and issuers react considering the report of these variables, which is done time after they actually are occurring. Sovereign risk, the spread of the 10-year government yields with respect to the United States, is also included in the controls to account for the impact of risk premiums on issuers cost of debt. This variable is built by downloading the relevant yields from the Refinitiv Workspace and subtracting for each year the corresponding value from that reported by the United States. Lastly, the hard currency shares, deemed as relevant for green bond issuance by Reboredo and Ugolini (2020), are built using the downloaded data for green and conventional bonds, filtering the currency of the principal of the bond for US dollars and Euros.

Empirical results

This chapter displays and discusses the empirical results from the regressions presented, as well as it provides comments on the limitations of the study. The results and interpretation are divided, first analyzing the initial set of regressions, followed by the second.. For each set, the results on the governance quality variable are revised for corporate and for sovereign issuers. Additionally, the interaction of financial markets development and environmental awareness by issuer type is checked upon. Afterwards, a discussion on the reasoning behind the unexpected results is presented.

4.1. Results

This section focuses on presenting the results from the empirical analysis. It first describes the relevant coefficients from the paper, then contrasts these results to the academic findings described in the literature review, and ends by providing an interpretation and contrast of the findings against the correspondent hypotheses formulated.

Table 1: Effect of governance quality, financial markets, environmental awareness and macro variables on green bond issued volumes

	Dependent variable:			
	Growth of green corporate bonds (1)	Growth of green government bonds (2)	Growth of green corporate bonds (3)	Growth of green government bonds (4)
Sovereign Risk	0.116	0.544*	0.111	0.689*
	(0.106)	(0.309)	(0.117)	(0.364)
Lagged Inflation	-0.029	-0.055	-0.146	0.095
	(0.093)	(0.244)	(0.123)	(0.274)
Lagged Economic Growth	0.088***	-0.099	0.069**	-0.085
	(0.030)	(0.065)	(0.035)	(0.076)
Lagged Fiscal Balance	-0.001	-0.251***	-0.005	-0.263**
	(0.043)	(0.091)	(0.045)	(0.104)
Green Corporate Hard Currency Share	1.324**		1.239*	
	(0.649)		(0.646)	
Green Sovereign Hard Currency Share		-0.162		0.237
		(0.482)		(0.517)
Environmental Awareness	0.276	-0.387	0.326*	-0.264
	(0.188)	(0.346)	(0.170)	(0.345)
Financial Markets Development	-1.538	-3.639	-4.045	2.777
	(2.857)	(2.825)	(2.595)	(3.702)
Governance Quality	2.469**	-5.811***	9.039**	-7.575
	(1.138)	(1.765)	(3.523)	(9.053)
Governance Quality x Financial Markets Development	-3.850***	9.672***		
	(1.433)	(2.264)		
Governance Quality x Environmental Awareness			-0.114***	0.112
			(0.044)	(0.107)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	126	101	126	101
R^2	0.268	0.342	0.264	0.255
F Statistic	3.490*** (df = 9; 86)	3.635*** (df = 9; 63)	3.422*** (df = 9; 86)	2.401** (df = 9; 63)

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

The dependent variables display the growth of green bond issuance volumes in US dollars. These are divided by type of issuer, exposing (corporate for columns 1 and 3, and government for columns 2 and 4).

The independent variables include macroeconomic controls, environmental awareness, financial markets development, governance quality and interaction terms of governance quality with both financial markets development and environmental awareness. Columns 1 and 2 consider the interaction of governance quality with financial markets development, while Columns 3 and for shows that with environmental awareness.

Table 1 presents the results estimating the first set of regressions, which includes Models 1 to 4. Columns 1 and 3 display the coefficients for corporate green bond issuance growth. These differ as Column 1 exposes the results for the model specification considering the interaction term of governance quality and financial markets development, while Column 3 exposes the interaction term with environmental awareness. Conversely, Columns 2 and 4 exhibit the coefficients for sovereign green bond issuance growth, with Column 2 addressing the interaction term with financial markets development, and Column 4 showing the interaction term with environmental awareness.

The table shows a significant positive impact of governance quality on the growth of corporate green bond issuance. Despite the fact that interpretations on the magnitude of the coefficients of governance quality cannot be done due to the PCA variable construction, for both Columns' 1 and 3 the positive and statistically significant 2.469 and 9.039 respective coefficients, reveal a positive effect of governance quality on the dependent variable for both interaction term specifications. This result confirms the findings of *Tolliver et al. (2020), Eichengreen and Luengnaruemitchai (2004) and Agliardi and Agliardi (2019)*, who state that improved institutional drivers and a solid legal infrastructure positively influences corporate green bond issuance. It suggests that, as stated in the introduction, an improved governance quality does contribute to green investors' confidence in the execution of the use of proceeds, which increases the demand, hence issuance of green bonds.

However, this general conclusion is contradicted by the results reported for the impact of governance quality on sovereign green bond issuance. The coefficients from Columns 2 and 4 report a negative impact of institutional capacity on the explanatory variable. While this result is statistically significant only for the interaction with the financial markets development specification, the -5.811 coefficient suggests that an improved governance quality has a negative impact in the growth at which sovereign green bonds are issued. This result, though new for the existing literature, does turn as surprising considering the just stated intuitive mechanism of governance quality on green bond issuance. An exploration on the potential determinants of this sovereign issuance dynamic towards an increase in the governance capacity is explored in the following section. Overall, these findings provide evidence to mostly reject the secondary

hypothesis of governance quality positively impacting green bond issuance, as it depends highly on the type of issuer.

The effect of both interaction variables on the impact of governance quality on green bond issuance are statistically significant in general terms, however these have the opposite effect than expected. Columns 1 and 3 show for both specifications how the interaction term of both financial markets development and environmental awareness dampen the positive effect of governance quality on corporate green bonds. Both statistically significant coefficients of -3.850 and -0.114 respectively exhibit that, contrary to the academic literature revised (*Ehlers and Packer (2017), Pham and Huynh (2020)*), neither of these complementary determinants of green bond issuance improves the effect of governance quality on corporate green bond issuance. Notably, as predicted, the effect of financial markets development on the impact of governance quality on the dependent variable is stronger than that of environmental awareness, however, this is still in the opposite direction of what predicted.

In the case of sovereign green bond issued volumes, Columns 2 and 4 show positive interaction term coefficients for both specifications, with the interaction with financial markets development being the only statistically significant one. Given that the impact of governance quality on sovereign green issuance is negative, the 9.672 and 0.112 positive coefficients for the financial markets and environmental awareness interaction terms respectively imply that these terms induce a decrease in sovereign green issuance further than that linked to the impact of governance quality. As in the corporate green issuance result analysis, these results oppose to those expected, and are discussed in the following section. In general, these findings on the interaction terms lead to reject the hypothesis that financial markets development and environmental awareness would enhance any positive impact of governance quality on green bond issuance, both for corporate and sovereign issuers.

Moving forward with the results regarding the analysis of the share of green bonds issuance, Table 2 presents the results estimating the second set of regressions, which includes Models 5 to 8. This tables follows the same structure as that of Table 1; the only difference relies in the dependent variable used. For instance, Columns 1 and 3, representing Models 5 and 7, display the results for the growth of the share of corporate green bonds issued, and Columns 2 and 4, representing Models 6 and 8, show the coefficients for sovereign issuers. As before, Columns 1

and 2 expose the specification with financial markets development as the interaction term, while Columns 3 and 4 show the specification with the environmental awareness term.

Table 2: Effect of governance quality, financial markets, environmental awareness and macro variables on share of green bond issued volumes

	Dependent variable:			
	Growth of share of green corporate bonds (1)	Growth of share of green government bonds (2)	Growth of share of green corporate bonds (3)	Growth of share of green government bonds (4)
Sovereign Risk	-0.385***	0.229	-0.424**	0.345
	(0.141)	(0.374)	(0.179)	(0.342)
Lagged Inflation	0.374***	0.186	0.373***	-0.133
	(0.102)	(0.345)	(0.142)	(0.345)
Lagged Economic Growth	0.042	0.097	0.044	0.048
	(0.048)	(0.148)	(0.051)	(0.135)
Lagged Fiscal Balance	-0.008	-0.006	-0.020	0.044
	(0.069)	(0.201)	(0.067)	(0.181)
Ratio of Green Corporate Hard Currency Share	-0.053*		-0.053*	
	(0.027)		(0.028)	
Ratio of Green Sovereign Hard Currency Share		-0.020***		-0.020***
		(0.005)		(0.005)
Environmental Awareness	-0.029	0.060	-0.028	0.144
	(0.230)	(0.424)	(0.234)	(0.419)
Financial Markets Development	-0.509	-2.016	-0.472	-11.394
	(2.425)	(11.189)	(2.444)	(12.659)
Governance Quality	1.610	3.202	0.097	17.075*
	(1.319)	(4.014)	(4.876)	(10.275)
Governance Quality x Financial Markets Development	-0.928	-2.513		
	(1.384)	(6.016)		
Governance Quality x Environmental Awareness			0.012	-0.198
			(0.064)	(0.126)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	124	95	124	95
R^2	0.125	0.117	0.123	0.158
F Statistic	1.328 (df = 9; 84)	0.813 (df = 9; 55)	1.309 (df = 9; 84)	1.144 (df = 9; 55)

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

The dependent variables display the growth of the share of green bond issuance volumes in US dollars relative to total bond issuance volumes. These are divided by type of issuer, exposing (corporate for columns 1 and 3, and government for columns 2 and 4).

The independent variables include macroeconomic controls, environmental awareness, financial markets development, governance quality and interaction terms of governance quality with both financial markets development and environmental awareness. Columns 1 and 2 consider the interaction of governance quality with financial markets development, while Columns 3 and for shows that with environmental awareness.

From Table 2, it can be seen that in general terms no impact of governance quality on the growth of the share of green bonds issued is found. While there is limited literature focusing explicitly on the share of green bond issuance relative to conventional bonds, this result remains unexpected. Interestingly, while in the first set of regressions governance quality had a negative but insignificant effect on the issuance of sovereign green bonds, from Column 4 of Table 2 it can be seen that the impact of governance quality on the share of sovereign green bonds issued is the only significant one. This hints on the idea that sovereign conventional bonds are even more negatively affected by governance quality than green bonds, hence explaining the positive 17.075 coefficient.

The findings from the second set of regressions allow us to reject the secondary hypothesis that governance quality is positively associated with the share of green bonds issued. Moreover, the results from the first set of regressions, where governance quality shows a significant positive

effect for corporate bonds and a significant negative effect for sovereign bonds, suggest that governance capacity influences overall green bond issuance volumes. However, given that no corresponding effect is found in the regressions analyzing the share of green bond issuance, it can be inferred that the impact of governance quality is mirrored in the conventional bond market. In other words, governance improvements appear to affect both green and conventional bond issuance in a similar direction and magnitude, thereby neutralizing their influence on the relative share of green bonds. This pattern provides sufficient evidence to reject the main hypothesis of the study, hence leading to the statement that *governance quality does not significantly explain the increase in the share of green bonds issued.*

The mirroring dynamic described also translates into the coefficients regarding the interaction terms. Columns 1 and 2 display negative insignificant coefficients on the effect that financial markets development has on the impact of governance quality on the growth of the share of green bonds issued, regardless of the issuer type. Columns 3 and 4 show the same pattern for the environmental awareness interaction term. In general, these findings on the interaction terms lead to reject the hypothesis that financial markets development and environmental awareness would enhance any positive impact of governance quality on the share green bond issuance, both for corporate and sovereign issuers. As before, it seems that any enhancing or dampening effect of these variables on the impact generated by governance quality is also generated for the conventional bond market.

Interestingly, for the first set of regressions, sovereign risk and lagged fiscal balance are deemed as significant drivers of sovereign green bond issuance, with a positive and negative impact respectively. In the case of corporate issuers, both lagged economic growth and the share of hard currency green bonds are significantly positively related to green issuance. What is more, unalike governance quality, some macroeconomic control variables do impact the share of green bond issued. Sovereign risk, lagged inflation, and currency stability were negatively, positively and negatively respectively related to changes in the share of green corporate issuance. For sovereign issuers currency stability also had a negative significant impact.

4.2. Discussion

Among the unexpected findings of the empirical analysis, the most notable is the negative impact of governance quality on sovereign green bond issuance. This suggests that conclusions

from the existing literature, mainly focused on corporate issuance, may not translate directly to sovereign issuers. A possible explanation for this dynamic may relate to the evolving role of the public sector in financial markets as governance capacity strengthens. In contexts characterized by strong governance, the need for direct government intervention to compensate for private financial underdevelopment decreases. In these settings, the public sector may act more as a facilitator to corporate issuance initiatives, and less as a financier promoting green investments. Cevik and Tovar (2024) supports this notion by showing how as governance improves, sovereign green bond issuance plays a catalytic role encouraging corporate green bond issuance, which ultimately partially substitutes the existing sovereign green debt instruments. Further support for this interpretation is provided by Bedendo and Kaleva (2024), who explicitly refer to corporate green bonds as a substitute for sovereign ones, as corporate issuers capitalize on the foundation built by sovereign issuers. As governance improves, corporate actors increasingly raise green capital independently, reducing the need for and substituting sovereign issuance.

For instance, high levels of governance quality may reflect a shift in the type of issuers financing environmental projects, going from the sovereign to the corporate sector. This mechanism would explain why an increase in governance quality would decrease sovereign green bond issuance, as *corporate issuance seems to start substituting sovereign issuance* in a more than proportional way, which would justify the overall green bond market expansion. This explanation aligns with the empirical evidence provided regarding the impact of governance quality on green bond issued volumes for both types of issuers.

This mechanism may also explain why financial market development amplifies the negative impact of governance quality on sovereign green bond issuance. Corporate bonds are widely known for being more responsive to changes in the market sentiment and credit conditions than sovereign ones. As a result, improvements in the degree of development of financial markets are likely to accelerate the substitution of sovereign for corporate green bond issuance, thereby increasing the pace at which the issuance of sovereign green bonds decreases. This explains the positive interaction coefficient with financial markets development observed in Column 2 from Table 1. Additionally, a similar argument can be made about the environmental awareness interaction term as an increased market sentiment for green finance would also stimulate a more

rapid switch of sovereign to corporate green bonds, hence explaining the same direction of this interaction term with respect to the financial markets' development one.

Furthermore, the intuition of the argument would suggest that, as hypothesized and expected from academic literature, the development of financial markets would enhance the positive effect of governance quality on green bond issuance. However, the data contradict this expectation, as financial market development appears to dampen the positive effect of governance quality on corporate green bond issuance.

An alternative explanation for the negative interaction term between governance quality and financial markets development may relate to the presence of diminishing marginal returns in high-governance-capacity settings. In countries with already strong governance frameworks and developed financial markets, such as those included in this study, the space for further expansion in green bond issuance narrows. In such contexts, while governance quality and financial market development may individually foster green bond issuance, their joint effect may not be additive. The overlap of the impact of both explanatory variables on risk reduction or investor confidence building could create diminishing returns. This dynamic could explain the negative coefficient on the financial markets' development interaction term, as the governance quality mechanism that drives green bond issuance may be constrained by a structural saturation in high-governance-capacity environments. A similar logic can be applied to the dampening effect observed for the environmental awareness interaction.

4.3. Limitations

Given the technical details of this thesis, several limitations arise that suggest to be cautious with the results hereby presented. First, as seen in the previous section, I was not able to find a coherent argumentative line that would explain the unexpected coefficients on sovereign green bond issuance and the interaction terms for both types of issuers. This hints about the possibility of some of these coefficients not aligning with the factual evidence.

Moreover, regarding model significance, the first set of regressions reports statistically significant F-statistics, suggesting a good model fit. In contrast, the second set of regressions does not yield significant F-statistics, which may indicate potential model's misspecification. This structural issue is reinforced by the results from the RESET test in models 6 and 8, which further

suggest omitted nonlinearities or relevant variables. One plausible explanation for this issue is the reduced number of observations relative to the number of explanatory variables, a concern particularly relevant for the sovereign green bond data sample. The resulting loss of degrees of freedom may contribute to the observed lack of significance. Alternatively, an omitted variable bias could also explain the low F-statistics described. The lack of academic research on the share of green bonds issued, especially for sovereign issuers, could imply that there exists an unconsidered variable that drives the green bond market expansion, and that would therefore provide statistical significance to the second set of models.

Additional limitations relate to data quality, as a review of the granular dataset revealed inconsistencies between the Refinitiv Workspace data on green bond issuance and that data from alternative sources such as the Climate Bond Initiative. Although data discrepancies are beyond my control, and the assumption of uniformly distributed across countries could rule out any bias in the data, this may still affect the precision of the results.

Finally, the scope of the analysis limits the extent and depth of the conclusions hereby presented. Future research could strengthen the theoretical and empirical set-up of the study by incorporating more detailed variables on bond characteristics, expanding the analysis on conventional bond issuance, and further evaluating other macroeconomic determinants. The latter is partially confirmed through the undescribed macroeconomic controls from the empirical analysis. This approach, which resembles more that used in the pricing-dynamics-guided papers, could provide a more robust framework to assess the structural factors driving the expansion of the green bond market.

Conclusion

This thesis examines whether governance quality is a determinant factor explaining the relative expansion of green bond issuance relative to conventional bond issuance. It is motivated by the idea that the unique feature motivating the issuance of green bonds, which is its high dependence on credible certification and monitoring mechanisms to assure a proper use of proceeds, is highly determined by the strength of institutional frameworks. Based on this premise, it was hypothesized that an increase in governance quality would exhibit both greater issuance volumes of green bonds, and, most importantly, an increasing share of green bonds relative to total bond issuance. In addition, this study explores whether financial markets development and environmental awareness enhances this expected impact.

The empirical analysis, based on a panel of 30 countries mostly from Europe and Asia, covering the timeframe from 2017 to 2021, produced nuanced results. Governance quality is found positively and significantly impact corporate green bond issuance, as predicted by the consulted academic literature. However, its effect on sovereign green bond issuance is found to be mostly negative and significant. More notably, for both types of issuers, governance quality does not appear to influence the share of green bonds issued, which suggests that institutional improvements do not necessarily favor green instruments over conventional ones.

The addition of interaction terms further challenges the initial hypotheses. Contrary to expectations, the moderating effects of financial market development and environmental awareness do not amplify a positive impact of governance quality. Both terms are found to contribute to actually decreasing the amounts of green bonds issued, dampening the increase of governance quality on green corporates, and enhancing the decrease of governance quality on green sovereigns.

The unexpected results for sovereign green bond issuance are alternatively explained through the presence of a substitution effect that replaces sovereign for corporate bond issuance as governance quality increases. As governance capacity increases, the role of the government shifts from issuers of green bonds to facilitators of an increase in the issuance of corporate green bonds. Additionally, to address the unforeseen dampening effect of the interaction terms on corporate

green issuance, a proposition on the presence of decreasing marginal issuance towards financial markets and institutional improvements in high-governance settings is made.

Overall, the findings suggest that governance quality is not a decisive factor in differentiating green bond market growth from the general bond market growth. This result leads to reconsider the weight assigned to governance quality when discussing about the determinants of the expansion of the green bond market share. Moreover, macroeconomic variables like sovereign risk, economic growth, fiscal balance currency stability and inflation are found to significantly partially explain the increase in the share of green bonds relative to conventional ones. This suggests that deepening in macroeconomic determinants, as well as in the of pricing mechanisms and investor preferences often emphasized in the literature, could provide better conclusions regarding the growth of the green bond market. This study contributes to the ongoing debate by showing the limitations of governance quality as a differentiating factor and by claiming for a broader framework that accounts for holistic analyses including the issuer type and both absolute and relative patterns of green bond issuance.

Appendix

A. List of countries considered in the study

Australia, Austria, Brazil, Canada, China, Denmark, Finland, France Germany, Hong Kong, India, Indonesia, Italy, Japan, South Korea, Luxembourg, Malaysia, Mexico, The Netherlands, New Zealand, Norway, The Philippines, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, United Kingdom and United States.

B. Controls specification

$$Controls_{it} = CountyRisk_{it} + LaggedInflation_{it} + LaggedEconomicGrowth_{it} + LaggedFiscalBalance_{it} + HardCurrencyShare_{it} + ESGScores_{it} + FinancialMarketsDevelopment_{it}$$

With $HardCurrencyShare_{it}$ differing across models depending on the type of issuer and on the set of regressions that the model belongs to. In the case of the second one, a ratio on the share of hard currency of green bond issued and a weighted average of the total bonds issued is employed. The weights for this measure depend on the share of green bonds in the total bond market.

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