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Green bond underdevelopment in emerging economies: Exploring the dynamic roles of institutional quality

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Abstract

Purpose — The green bond market, as a financial innovation, faces institutional quality challenges common to emerging economies. This study examines the influence of institutional quality on the development of green bonds in emerging economies.

Method — The study relied on the panel Fully Modified Ordinary Least Squares (PFMOLS) to estimate long-run panel cointegration relationships between institutional quality and green bond development. The observation consists of twenty-one (21) emerging economies from 2010 to 2023.

Findings — Institutional factors can hinder the development of green bonds in emerging economies. This is mainly due to the adverse effect of voice and accountability, even though regulatory quality and the rule of law provide firm support. Policy efforts that improve overall institutional quality, along with measures for macroeconomic stability, will benefit green bond development.

Implications — The results recommend that emerging economies strengthen their existing institutional structures. In addition to reforms in voice and accountability, they need to improve enforcement in promoting regulatory quality and the rule of law. Encouraging inclusive institutional quality can build legitimacy and green investors' confidence, thereby supporting long-run green finance outcomes.

Originality — Providing a new and detailed understanding of the green bond market, this study examines the distinct and collective effects of regulatory quality, voice and accountability, and the rule of law on green bond development in emerging economies.

Keywords — Green bond, institutional quality, emerging economies, panel FMOLS, finance outcomes

Introduction

Green bonds have gained prominence within the concept of green finance, which refers to financial commitments aimed at mitigating the adverse effects of climate change on the world's economies (Xing et al., 2022; Zheng et al., 2021). This financial initiative is a global consensus leading from the Paris Climate Change Agreement. As the most significant financing option in the green finance initiative, green bonds are fixed-income securities designed to fund eco-friendly projects (García et al., 2023; Kanamura, 2020; Mertzanis, 2023; Smaoui et al., 2017). Green bonds are expected to benefit countries of the world by way of reduced carbon emissions, improved ecological values and overall sustainable development, but emerging countries have shown unimpressive records of

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green finance growth. Emerging economies are often referred to as latecomers to the green bond market despite their environmental challenges. Data from the International Monetary Fund (IMF) showed that none of the emerging economies has achieved more than 1% of their GDP. Only Mauritius in 2021 recorded the highest proportion of green bond-to-GDP ratio of 0.52%. However, the growth of green bonds is based on financial institutions such as banks, capital markets, and development finance institutions. To support green bonds in emerging economies, these financial institutions must be efficient enough to serve savers and investors. Thus, it highlights the significance of institutional quality in driving green bond growth in emerging economies.

How well a country's institutions can formulate and follow policies, enforce laws, protect property rights, maintain legal order, keep the government accountable, and implement contracts determines its institutional quality (Abaidoo & Agyapong, 2022; Ellahi et al., 2021; García et al., 2023; Kanamura, 2020; Mertzanis, 2023; Smaoui et al., 2017). It includes factors such as handling corruption, effective regulation, political stability, government effectiveness, the rule of law, and citizen engagement in politics. According to institutional theory, organisations function according to established rules and norms and cultural expectations to receive stakeholder validation from governments and regulators, as well as markets and society (Bae et al., 2022; Comyns, 2016). By extension, organisations and investors under institutional pressure to improve environmental and climate performance choose to invest in green finance initiatives while complying with financial regulations and advancing the ecological mitigation agenda. In this regard, institutional quality focuses less on efficiency-seeking behaviour and more on the social, ecological and economic goals of business organisations (Debrah et al., 2024).

Some prominent institutional challenges in emerging economies, like poor regulation, rule of law and voice and accountability, can be understood as systemic issues that manifest in heavy default culture, operational self-insufficiency, absence of adequate accountability and transparency and insufficient regulatory framework (Zheng et al., 2021). When this happens, institutional quality tends to fail to support green bond market development in emerging economies, as it does in the financial development of developed countries (Lisbinski & Burnquist, 2024; Mbulawa & Chingoiro, 2024). The reason is that it sets the framework for financial development, and without this framework, green bonds may face challenges of growing.

Various studies have found that economic development and the issuance of green bonds are primarily influenced by three factors: firms' practices, the state of governance in society, and the country's economic and institutional context. As stated by Wahyuni et al. (2024), firm influences include reasons for acting, a drive to create something new, building a good sustainability reputation, and transparency through reporting, all of which fall under accountability frameworks. Following García et al. (2023), Russo, Mariani, and Caragnano (2021), Mertzanis (2023), and Kanamura (2020), research on institutional and environmental governance has highlighted the influence of corporate sustainability factors on the issuance and performance of green bonds. Macroeconomic and institutional factors were highlighted by several authors, including Bhattacharyay (2013), Smaoui et al. (2017), and Tolliver, Keeley, and Managi (2020), who found that openness to global trade, the direction of investment, and the size of economic sectors promoted the issuance of green bonds. However, interest rate movements and macroeconomic factors had a greater impact than institutional quality.

On the other hand, the quality of institutions plays a similar role in green finance development as it does in general financial development. Studies reveal that there is a joint effort among institutional quality, governance structures, and financial development to achieve the main goals of green finance, mainly the reduction of carbon emissions (Agustin et al., 2025). Good institutions and financial innovation facilitate financial development, thereby improving the delivery of green finance services (Abaidoo & Agyapong, 2022; Alawi et al., 2022; Aman et al., 2023; Khan et al., 2022; Lisbinski & Burnquist, 2024). Combining them enables green finance to play a significant role in achieving sustainable development. Dosso (2023) showed that strong institutions mitigate the downside of relying on natural resources in terms of financial development, thereby helping achieve long-lasting environmental and economic ambitions. Nguyen and Ha

(2021) argue that institutional quality, along with GDP per capita, inflation, and human development, contributes to greater financial inclusion in ASEAN nations. On the other hand, Vo (2024) noted that although institutional quality helps increase financial inclusion in high- and middle-income countries, it does not appear to have a significant effect in lower-income economies. In addition, Khan et al. (2023) found that better institutions make financial systems work more efficiently, thereby strengthening the key role of institutions in advancing green finance through enhanced infrastructure.

The empirical literature relevant to this study is implied to range from determinants of green bonds to the influence of institutional quality on financial development. However, these studies fail to account for how institutional quality could explain green finance growth in emerging economies, as it has in the case of financial development (Abaidoo & Agyapong, 2022; Alawi et al., 2022). The main argument here is that green bonds differ from conventional corporate and government bonds because of their environmental and sustainability focus (Tolliver et al., 2020). The factors that determine them should be considered from the policy point of view. Based on this stance, this study identifies the dearth of institutional quality on green bonds in emerging economies. In the first instance, there is a dearth of empirical studies on the influence of institutional quality on green bonds, especially in emerging economies. This gap exists in understanding the impact of institutional quality on green bond development in emerging economies, as it does for financial growth in other regional countries. This study explores the individual roles of three main institutional qualities—regulatory quality, voice and accountability, and the rule of law—and the influence of their composite value. This approach presents a more comprehensive examination of institutional quality.

Existing empirical studies have highlighted the significance of many factors that can determine green finance, including firm-level factors, environmental factors, and the macroeconomic outlook. While these factors are essential to green finance, they are not devoid of institutional influences in emerging economies. Institutional effects on the green bond market are expected to be as vital as they have been for financial development. However, despite the relevance of institutional factors to economic growth, previous studies have not adequately incorporated them into the green bond market in emerging economies. Moreover, there is a distinct effect of some institutional factors, including regulatory quality, rule of law, and voice and accountability, in emerging economies, which are fundamental concerns in the field of institutional economics.

The associated research question is: What is the effect of institutional quality on green bond development in emerging economies, and how do their individual influences differ from their collective effect? The institutional qualities to be considered in this study are regulatory quality, rule of law, and voice and accountability, as they are the most prominent institutional challenges in emerging economies that bear on the financial market (Abaidoo & Agyapong, 2022). By examining the effects of institutional quality on the development of green finance in emerging economies, our study makes a significant contribution to the literature for the following reasons. While many studies have discussed the essential factors for green bonds, such as firm, environmental, and macroeconomic factors (including transparency, innovation, sustainability governance, and economic stability), little is known about how the quality of institutions in emerging economies contributes to the growth of green bonds. In addition, although strong institutions support financial development and inclusion, especially in richer countries, the impact of institutions on green bonds remains unclear. As a result, this study provides a new, detailed understanding by examining the distinct and collective effects of regulatory quality, voice and accountability, and the rule of law on green bond development in emerging economies.

Methods

Data Sources

Our study employs data from 21 emerging economies from 2010 to 2023. The composition of the sampled countries and the chosen period were primarily determined by the availability of relevant data, which the study seeks to investigate. The countries included are Brazil, Thailand, Chile,

Türkiye, China, South Africa, Colombia, the Russian Federation, Hungary, Nigeria, India, Indonesia, Vietnam, Malaysia, Mexico, Peru, the Philippines, Poland, Argentina, the United Arab Emirates (UAE), and Mauritius. The databases that serve of the data sources for our study include the World Development Indicators (WDI) and the World Governance Indicators (WGI).

Table 1. Variables and their sources

Variable	Acronym	Description	Source
Green bond	GRB	Fixed income securities that support environmental projects, the ratio of green bonds to GDP ratio	IMF climate dashboard (https://climatedata.imf.org/)
(Bhattacharyay, 2013; Smaoui et al., 2017) Regulatory Quality	REGQ	Ability of government institutions to formulate and implement policies	WDI (https://data.worldbank.org/indicator/RQ.EST)
Rule of Law	RUL	Ability of the legal system to uphold justice for all	WDI (https://data.worldbank.org/indicator/RL.EST)
Voice and accountability	VOACC	Freedom of participation, expression and transparency of processes	WDI (https://data.worldbank.org/indicator/VA.EST)
Institutional quality	INSQ	Principal Component of Regulatory quality, accountability and Rule of Law	PCA of the above
Financial Development	FIND	Credit to the private sector as a percentage of GDP	WDI (https://data.worldbank.org/indicator/FS.AST.PRVT.GD.ZS)
Inflation	IFL	Sustained increase in general prices	WDI (https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG)
Savings	SAV	Income portion not consumed	WDI (https://data.worldbank.org/indicator/NY.GNS.ICTR.ZS)
Investment	INV	Financial resources for fixed or capital assets	WDI (https://data.worldbank.org/indicator/NE.GDI.TOTL.ZS)
Exchange rates	EXR	Official rate of local currency to the US dollar	WDI (https://data.worldbank.org/indicator/PA.NUS.FCRF)
Trade openness	TRADE	Ratio of imports plus exports to GDP	WDI (https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS)

The three principal components of institutional quality — accountability, rule of law, and regulatory quality — explain about 64.5%, 32.4%, and 3.1% of the variation in the data, respectively. Given the significance of each of the institutional quality indicators, all will be included in the derivation of the final composite indices. Estimates of these indices range from approximately -2.5 (lowest) to 2.5 (highest) performances.

All the selected variables are relevant for explaining the growth of green bonds, as reflected in green bond valuation relative to GDP. Table 1 provides definitions of variables and their sources. Given the sensitivity of the green bond market to the macroeconomic environment, there is a need to control for some essential macroeconomic variables (Bhattacharyay, 2013; Smaoui et al., 2017).

The Model

The approach of this research is quantitative, focusing on the description of institutional quality, green finance, and governance indicators. Furthermore, the quantitative analysis in this study employs appropriate econometric methods to examine how institutional quality and governance shape the development of green finance. Following the tested empirical models of closely related

literature (Ellahi et al., 2021; Khan et al., 2023; Lisbinski & Burnquist, 2024; Muhammed et al., 2024; Tolliver et al., 2020; Vo, 2024), the standard form of the econometric model of this study is:

$$GRB_{it} = \varphi_{it} + \pi_{1,it} INSQ_{it} + \pi_{1,it} INSV_{it} + \pi_{j,it} C_{it} + \varepsilon_{it} \quad (1)$$

Where, $\mathbf{GRB_{it}}$ green bond issuance to GDP, φ_{it} is the model intercept, $\mathbf{INSQ_{it}}$ is the composite index of institutional quality, $\mathbf{INSV_{it}}$ is the vector of institutional quality components, namely regulatory quality (REGQ), rule of law (RUL), and voice and accountability (VOACC). C_{it} represents the control variables made up of Financial Development (FIND), inflation (IFL), savings (SAV), investment (INV), exchange rates (EXR), and trade openness (TRADE). The reason for including financial development, inflation, savings, investment, exchange rates, and trade openness in the green bond development model is that each plays a significant role in shaping green finance. Evidence from Bhattacharyay (2013), Smaoui et al. (2017), and Tolliver et al. (2020) suggests that trade growth, increased foreign investment, and the size of major sectors are major drivers of green bond issuance. However, inflation and currency exchange rate fluctuations tend to discourage it. The progress of financial development strengthens institutions and drives the development of new financial methods that support green finance (Khan et al., 2022; Lisbinski & Burnquist, 2024). In the same way, mobilising savings and investing them helps direct the economy and is fundamental for financing green projects (Dosso, 2023). All of these factors, together, adjust for changes in the economy and the quality of regulatory frameworks that are important to green bonds (Nguyen & Ha, 2021).

The study relied on the panel Fully Modified Ordinary Least Squares (PFMOLS) to estimate long-run panel cointegration relationships between institutional quality and green bond development. The PFMOLS was designed to address the issues of inefficient and biased estimators and inherent endogeneity issues (Özdemir & Kayhan, 2021). The PFMOLS was developed by Phillips and Hansen (1990). It also addresses the issue of serial correlation problems using the Generalised Least Squares (GLS) method. With the benefit of heterogeneous cointegration, Hamit-Haggar (2012) availed that the FMOLS technique is ideal for panel analysis. For a panel FMOLS estimator, the coefficient β of the model in equation 1 was specified by Pedroni (1996) and Khan et al. (2019) to be:

$$\beta_{NT}^{*} - \beta = \left(\sum_{i=1}^{N} L_{22i}^{-2} \sum_{i=1}^{T} (\chi_{it} - \bar{\chi}_i)^2\right)^{-1} \sum_{i=1}^{N} L_{11i}^{-1} L_{22i}^{-1} \left(\sum_{i=1}^{T} (\chi_{it} - \bar{\chi}_i)\phi_{it}^{*} + T\hat{\gamma}_i^{*}\right) \quad (2)$$

Where, $\phi_{it}^{*} = \phi_{it} - \frac{\hat{L}_{21i}}{\hat{L}_{22i}} \Delta\chi_{it}, \hat{\gamma}_i^{*} = \hat{\Gamma}_{21i}\hat{\Omega}_{21i}^{0} - \frac{\hat{L}_{21i}}{\hat{L}_{22i}}\left(\hat{\Gamma}_{22i} - \hat{\Omega}_{22i}^{0}\right)$ and $\hat{L}_i$ was the lower triangulation of $\hat{\Omega}_i$. The PFMOLS will be conducted on four models of interest, in which we will consider stepwise independent individual effects of institutional quality indicators (regulatory quality, rule of law, voice and accountability, and the composite index of the three coded INSQ indicators).

Results and Discussion

The descriptive statistics in Table 2 provide valuable insights into the patterns and variability of the variables studied: green bonds (GRB), institutional indicators, and macroeconomic variables. From the perspective of the mean, GRB and institutional qualities are at average levels of 0.01% of GDP and 0.05 index, respectively, indicating that green bond activity and institutional qualities are approaching their baseline values. A situation that, on average, reflects low levels of green bond issuance and institutional quality in emerging economies. Their distributions do not vary much, with standard deviations of not more than 1.18 for INSTQ. Though GRB and institutional qualities tend to show minimal variation, their recorded maximum values of 0.53% and 2.98% indicate that these metrics can reach high outliers.

Among macroeconomic control variables, trade openness has the highest mean value, expressed as of percentage. In contrast, the high values of exchange rates are mainly due to Vietnam, which is struggling with low currency values relative to the panel. The highest levels of financial development and inflation were observed in China and Argentina, respectively.

Table 2. Descriptive analysis

	Obs.	Mean	SD	Max.	Min.
GRB	287	0.01	0.04	0.53	0.00
INSQ	287	0.05	1.18	2.98	-2.06
REGQ	287	0.19	0.57	1.54	-1.02
RUL	287	-0.06	0.57	1.35	-1.18
VOACC	287	-0.08	0.75	1.11	-1.68
FIND	287	66.23	44.06	194.67	0.00
IFL	287	6.51	11.56	133.49	-2.08
SAV	287	26.02	10.15	59.22	8.78
INV	287	24.88	6.93	46.66	12.35
EXR	287	1899.34	5344.68	23787.32	1.50
TRADE	287	78.28	46.29	202.33	16.35

Source: Researchers' computation of data from WDI

Table 3. Correlation analysis

	GRB	INSQ	REGQ	RUL	VOACC	FIND	IFL	SAV	INV	EXR	TRADE
GRB	1										
INSQ	0.21***	1									
REGQ	0.20***	0.93***	1								
RUL	0.19***	0.89***	0.84***	1							
VOACC	0.13**	0.71***	0.48***	0.40***	1						
FIND	0.06	0.16***	0.20***	0.37***	0.20***	1					
IFL	0.03	0.19***	0.30***	0.22***	0.06	0.28***	1				
SAV	0.16***	0.13**	0.02***	0.19***	0.60***	0.27***	0.17***	1			
INV	0.08	0.28***	0.20***	0.05	0.51***	0.30***	0.10	0.67***	1		
EXR	0.04	0.27***	0.26***	0.13***	0.30***	0.02	0.05	0.21***	0.33***	1	
TRADE	0.06	0.34***	0.43***	0.55***	0.19***	0.21***	0.22***	0.40***	0.03	0.21***	1

Note: ***, **, and * indicate significant at 1%, 5% & 10%, respectively

Correlation analysis, besides showing the nature of the association between two variables, is also a tool for detecting multicollinearity and determining the appropriateness of including certain variables. To this end, a correlation of 0.80 is considered sufficient to indicate multicollinearity. The correlation results between some of the variables clearly violate this rule. For instance, there was a powerful positive relationship between INSQ and each of REGQ, RUL and VOACC (Table 3). Given the potential for our results to be compromised, a panel stepwise FMOLS will be most appropriate to avoid modelling them together.

The correlation analysis highlights the vital contributions of institutional quality indicators in fostering green bond development and, in turn, influencing other variables. Table 3 shows that institutional quality indicators exhibit mostly significant positive relationships with green bonds and macroeconomic variables. Stronger institutions ensure the effective implementation of environmental policies, while they offer regulatory oversight and enhanced credibility that will attract green investments (Alawi et al., 2022; Khan et al., 2022; Khan et al., 2023). By reducing risks and signalling policy stability, this institution enhances investor confidence in green bonds and broader sustainability initiatives.

The high correlation between GRB and institutional quality indicators underscores how, together, they provide a firm foundation for green bond development. It reduces transaction costs, ensures regulatory compliance, enhances the credibility of green bond instruments, and, therefore, this combination is much more effective.

The unit roots of the variables are checked using three panel tests: the LLC (Levin, Lin, and Chu) test and the IM tests. The rule for deciding based on the test results is that both tests' results must agree for a decision to be made. For instance, GRB, INSTQ, REGQ, RUL, VOACC, FIND, SAV, and TRADE were stationary at levels in the LLC results but not in the IM results, and thus do not provide overwhelming evidence of stationarity at levels. However, they became stationary after the first difference. From our panel stationarity tests in Table 4, we observe that all variables become overwhelmingly stationary after first differencing, prompting us to conclude that

all series are I(1). Exchange rates (EXR) and inflation (IFL) were unarguably I(I) series because of their nonstationary outcome at levels, except after first differencing. So, our data are all I(I) series, and the chosen model supports this characteristic.

Table 4. Panel stationarity tests

Variables	Levels		First difference		Order of Integration
	LLC	IM	LLC	IM	
GRB	-1.90**	-1.48*	-18.40***	-18.30***	*I*(1)
	(0.0288)	(0.0698)	(0.0000)	(0.0000)	
INSQ	-2.81***	0.75	-11.63***	-8.64***	*I*(1)
	(0.0024)	(0.7726)	(0.0000)	(0.0000)	
REGQ	-1.65**	0.45	-13.69***	-10.20***	*I*(1)
	(0.0499)	(0.6746)	(0.0000)	(0.0000)	
RUL	-2.32***	0.82	-13.67***	-9.94***	*I*(1)
	(0.0100)	(0.7926)	(0.0000)	(0.0000)	
VOACC	-2.28**	0.71	-9.37***	-6.18***	*I*(1)
	(0.0114)	(0.7614)	(0.0000)	(0.0000)	
FIND	-3.94***	-1.26	-8.02***	-4.68***	*I*(1)
	(0.0000)	(0.1046)	(0.0000)	(0.0000)	
IFL	-1.32*	-0.190	-13.92***	-9.59***	*I*(1)
	(0.0933)	(0.4260)	(0.0000)	(0.0000)	
SAV	-3.23***	-1.45*	-12.80***	-10.31***	*I*(1)
	(0.0006)	(0.0735).	(0.0000)	(0.0000)	
INV	-1.160	-1.260	-10.02***	-8.87***	*I*(1)
	(0.1237)	(0.1032)	(0.0000)	(0.0000)	
EXR	0.65	4.94	-10.60***	-6.43***	*I*(1)
	(0.7434)	(1.0000)	(0.0000)	(0.0000)	
TRADE	-3.78***	-1.520	-12.11***	-10.22***	*I*(1)
	(0.0001)	(0.0647)	(0.0000)	(0.0000)	

Note: ***, **, and * indicate significant at 1%, 5% & 10%, respectively

Table 5. Panel cointegration tests

		Model 1	Model 2	Model 3	Model 4
Kao Tests for Cointegration	Stat.	-3.88***	-3.82***	-4.06***	-3.82***
	prob.	(0.0001)	(0.0001)	(0.0000)	(0.0001)

Note: ***, ** & * are significant at 1%, 5% & 10%, respectively

The results from the Kao cointegration tests provide helpful information on whether the variables are in a long-run equilibrium relationship. In Table 5, the Kao statistic is -3.88, -3.82, -4.06, and -3.82, while their respective p-values were never more than 0.0001 for all four models of the study. This strongly indicates a significant cointegration relationship between institutional qualities and green bonds, hence supporting the hypothesis of long-run equilibrium.

In the first instance, the results of the panel FMOLS in Table 6 provide overwhelming evidence that institutional qualities in regulatory quality, rule of law, and voice and accountability are individually significant to green bond development. From these results, the rule of law (RUL) and regulatory quality (REGQ) components of institutional quality significantly supported the long-run growth of green bonds in emerging economies. This finding is an affirmation of the earlier positions of Lisbinski and Burnquist (2024), Alawi et al. (2022), Abaidoo and Agyapong (2022), Khan et al. (2022) and Aman et al. (2023) that innovation and good institutional quality are relevant for promoting the effectiveness of green bonds. Green bond issuance in emerging economies is highly dependent on improved regulation and the rule of law to fund environmental projects.

A study by Mbulawa and Chingoiro (2024) affirms the significance of institutional quality in developing the financial sector and, by extension, the economy as a whole. It emphasises that institutional quality is the long-term foundation for financial progress. Lisbinski and Burnquist (2024) argue that institutional quality is not only relevant to financial development in low-income

countries but also a reason advanced countries have made significant progress in their financial sectors. These studies have shown that institutional quality is essential, thereby underscoring its indispensable role in green bond financial development (Abaidoo & Agyapong, 2022; Alawi et al., 2022; Aman et al., 2023; Khan et al., 2022).

Table 6. Panel fully modified ordinary least squares estimates

	Model 1	Model 2	Model 3	Model 4
FIND	-0.000**	-0.000***	-0.000***	-0.000***
	(0.010)	(0.007)	(0.008)	-0.003
IFL	0.0003**	0.0001	-0.000	0.000
	(0.029)	(0.333)	(0.815)	(0.560)
SAV	-0.001***	-0.0014***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
INV	-0.0001	0.0002	0.0002	0.0001
	(0.785)	(0.425)	(0.608)	(0.637)
EXR	0.0000003	0.000002*	0.000002	0.000002
	(0.817)	(0.056)	(0.140)	(0.096)
TRADE	-0.0003***	-0.0003***	-0.0003***	-0.0003***
	(0.003)	(0.000)	(0.001)	(0.000)
REGQ	0.0105**			
	(0.048)			
RUL		0.0188***		
		(0.000)		
VOACC			-0.0377***	
			(0.000)	
INSTQ				-0.0086***
				(0.002)
Obs.	243	243	243	243
R-Square.	0.28	0.28	0.29	0.28
Adj. R-Square.	0.19	0.20	0.21	0.20

Note: ***, **, and * indicate significant at 1%, 5% & 10%, respectively

The results of model three showed that voice and accountability had a detrimental effect on green bond development in emerging economies. Further, in model four, the results revealed that the composite index of institutional quality also negatively influences green bonds in emerging economies. These findings are in variance with Nguyen and Nguyen and Ha (2021), Khan et al. (2023), and Vo (2024), who found that institutional quality improved financial inclusion and efficiency. Despite the supportive individual roles of regulation and the rule of law, the weight of the detrimental effects of voice and accountability was enough to make the overall effect of institutional quality problematic for green bond development. The uniqueness of our findings is relevant to the recommendation that partial institutional quality will not benefit the development of the green bond market in emerging economies. These findings imply that institutional reforms that are not holistic and comprehensive will be detrimental to green bond issuance. Finally, the effectiveness of institutional quality in promoting the green bond market may need to be complemented by macroeconomic support, such as proper regulation for redirecting savings to green bonds, promoting interment culture, trade openness policies that promote environmental conservation and promoting more financial depth (Bhattacharyay, 2013; Smaoui et al., 2017; Tolliver et al., 2020).

Conclusion

The underdevelopment of the green bond market in emerging economies led the study to consider the influences of institutional quality in explaining green bond development in twenty-one (21) emerging economies, from 2010 to 2023. Given data availability and the nature of the data, the most suitable technique is the panel Fully Modified Ordinary Least Squares (PFMOLS) estimator.

The proxy for institutional quality data is regulatory quality, voice and accountability, and the rule of law. The influence of institutional attributes in this study led to three distinct relationships with the green bond. First, efforts in emerging economies that independently prioritise regulation and rule of law will benefit green bond development in those countries. Second, voice and accountability are individually detrimental to the development of green bonds in emerging economies. Finally, the overall composite index of institutional quality is sensitive to the shortcomings of a single indicator, and the detrimental effect of voice and accountability weighs on the overall quality of institutions, thereby harming green bonds.

Based on the study's findings, we offer the following recommendations. It is recommended that emerging economies strengthen their existing institutional structures. Rather than isolated reforms in voice and accountability, enforcement should also be improved in promoting regulatory quality and the rule of law. This is because the detrimental effect of a troubled voice and accountability can weigh on the overall challenge of the entire institutional structure. Encouraging inclusive institutional quality can build legitimacy and green investors' confidence, thereby supporting long-run green finance outcomes.

The main challenge in the study stemmed from the data, which was available only in panel form. Therefore, the best approach was restricted to the panel Fully Modified Ordinary Least Squares estimator. Additionally, the complex interaction between institutional policies and macroeconomic factors shaping green bond markets suggests that other unobserved factors or economic conditions may also influence outcomes, which the current study could not comprehensively address. For further research, it would be valuable to incorporate additional supporting economic variables, such as financial stability, in greater detail, and to proffer a comparative analysis between developed and developing economies when more data are appreciably available. Again, further studies can be carried out on how macroeconomic and external (global) shocks affect the green bond market in emerging and developing economies.

Use of AI tools declaration

The authors used AI tools (ChatGPT and DeepSeek) for language editing and grammar review of this manuscript. The authors are fully responsible for the content of this publication.

Conflict of interest

The authors declare no conflicts of interest.

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