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Governance Quality in Emerging Economies and its Implications for Green Finance: Empirical Evidence from Panel Linear and Nonlinear Analysis

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Abstract

Our study identified that poor governance quality in emerging economies, being detrimental concern to financial development, could also explain the poor depth and growth of the green finance market. This prompted the study to consider the influences of institutional quality and governance quality in explaining green finance development in twenty-one (21) emerging economies from 2010 to 2022. Due to data availability factor and nature of data, the most suitable technique is the linear and nonlinear panel ARDL/PMG and estimators to address the dynamic implications of governance on green finance market in emerging economies. The findings showed that green finance was improved when corruption control, government effectiveness and governance index in emerging economies are considered independently but impeded by political stability. However, when considered collectively, only government effectiveness was beneficial to green finance, even though insignificantly, while both political stability and corruption control exert significant negative effect on green finance. Dynamically the index of governance exerts proportional influences on green finance in emerging economics, with the positive shock supporting green finance as against the negative shock that impeded it. The findings offer options for integrated environmental policies into institutional reforms because of their significant influence on green finance development.

Keywords: *Green Finance, Governance, Political Stability, Corruption Control, Government Effectiveness, Panel Linear And Nonlinear ARDL/PMG.*

Introduction

Green finance is the result of the global response from the Paris Climate Agreement to address the environmental challenges brought on the world by industrialization (Dave & Akongwale, 2024). As countries strive to industrialize for growth, they need adopt measures that reduce favours environmental protection. This is where green finance comes in, and it involves providing financial remedies through green bond, green credits and green investment, that help to mitigate climate risks exposure for sustainable development (Gör & Tekin, 2023; Zheng et al., 2021). Green finance includes financial instruments like green bonds that serve the purpose of funding pro-environmental projects, and green banking and investments which prioritises funding to firms and projects that supports the reduction of environmental risk (Dave & Akongwale, 2024; Kaukilakeba & Singh, 2022). Among the many targets of green finance includes those that facilitate funding initiatives for reducing carbon emissions, natural resource conservation (Tran et al., 2020; Zheng et al., 2021). Drawing from the global initiatives that highlights the need for substantial investments in green projects (Xing et al., 2022; Gör & Tekin, 2023), the challenge now is putting in place the framework to support green finance in emerging economies where financial development is low. These frameworks in emerging economies act as determinants of green finance, and are capable of influencing the adoption and subscription of green finance in those countries.

Given the significance of green finance to sustainability, governance quality is very significant factors in emerging economies. Governance quality is concerned the processes, practices and systems by which political authorities exercise their powers which include government effectiveness, control of corruption, and political stability (Ellahi et al., 2021; Odhiambo & Musakwa, 2024). By basing green finance development as part of the entire financial development framework of a country, it is worthy of noteworthy to identify the prominence of governance quality, especially in emerging economies. The reason is that it sets the framework financial development and without this framework, green finance may not develop. Supportively, governance quality significantly boost the development of the financial sector (Khatami et al.,

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2023; Ejemeyovwi et al., 2023; Bekana, 2023). By extension, governance quality do not only independently determine financial sector growth but also supports other influencers (Odhiambo & Musakwa, 2024).

Governance quality are interrelated concepts and, in some studies, have been used interchangeably or used comprehensively as institutional governance quality (Ellahi et al., 2021; Nkot & Timbi, 2023; Bekana, 2023). In this context, institutional governance quality refers to the systems of political authority as well as institutional duties where neither is independent of the other. However, other studies have drawn a line of dichotomy between the two (Lisbinski & Burnquist, 2024; Abaidoo & Agyapong, 2022). The studies that treated them separately advocates for the benefits of governance quality as well as independent institutional duties. As institutional quality relates to the structural and functional characteristics of institutions, governance quality is concerned with the dynamic and relational management of these institutions. Understanding them as separate concepts allows for specific reforms: improving institutional quality can focus on strengthening regulation, rule of law and accountability, while at the same time governance quality can increase government effectiveness, political stability and corruption control.

The criticality of governance indicators as determinants of financial development, then the extensive rules and operational structures that guide investor confidence for green finance development cannot be overemphasized. Despite this, the governance quality indices, such as corruption control, for the selected emerging country from 2010 to 2023 is at the 45.56 percentile, and the political stability index averaged 35.68, all lower than the 50.00 average. Given these governance qualities concerns, green bond, being the most significant product of green finance, averaged only 0.005% of GDP. While this development is of concern to sustainable development, literatures are yet to unravel the connection between green finance and influences from governance quality. Based on this premise, this study has identified that there is a dearth of studies to show how governance affect green finance in emerging economies where these factors are challenges (Ejemeyovwi et al., 2023; Nkot & Timbi, 2023; Dosso, 2023; Lisbinski & Burnquist, 2024). The main argument is that, if enhancing governance is essential for tackling the foundational challenges to support financial markets development of emerging economies, then they can be pivotal for explaining the poor development of green finance in emerging economies. The are emerging countries with records of varying levels of successes and failures in governance indicators, while some also have experience fundamental shocks to the governance frameworks and institutions. while this observation is plausible, there are studies that are yet to capture these dynamic effects of governance to green finance in emerging economies. This study adopts the linear and nonlinear techniques to capture these dynamic effects with linear and nonlinear ARDL/PMG estimation techniques.

To this end, this study seeks to examine dynamic implications of governance to green finance development in emerging economies, where there is low level of financial development as well as challenging environmental concerns that are calling for urgent attention. Specifically, our study will examine the role of three governance indicators: political stability, government effectiveness, and corruption control. By attempting to fill in this gap from literature, our study will consider an independent and combined examination of governance in advancing or impeding green finance in emerging economies.

There are three main contributions that our study make to literature, especially about how governance affect green finance in emerging countries. In order to create frameworks that enhance or discourage the green finance, it first emphasizes the importance of governance as it has been to financial development. The second contribution is concerned with showing the dynamic role played by governance in promoting green finance in emerging economies, independently considering governance factors like government effectiveness, political stability, and corruption control, which altogether determine investor confidence and a sustainable economy. The final contribution of our study is filling the identified gap by analyzing the nonlinear influence of the overall governance on green finance growth. By so doing, it will be offering empirical evidence on how these factors, individually, collectively and asymmetrically combine to influence the green finance markets in emerging economies.

The remaining part of this study after the introduction are structured into four other sections. In section two, the study deals with literature reviews, including conceptual, theoretical, and empirical reviews. In

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section three, we dealt with data and methodology. Our section four considers results of analysis, and section five contains conclusions the study recommendations.

Literature Review

Theoretical and Conceptual Review

In emerging economies, institutional theory gives us a solid way to think about how governance factors like political stability, government efficiency, and corruption control affect green finance. The idea is that institutions, with their regulatory, cognitive, and moral parts, affect how people in the economy act and the economy as a whole. When it comes to green finance, the success of funds going to projects that are good for the environment depends a lot on how well the institutions are run. The growth of green finance depends on political stability because it helps to lower investment risk and increase the trust of investors in emerging economies. When political stability is high, the rate of policy change and crisis reduces, encouraging investors to participate in green investment for the long term. Behera et al. (2024) and Abaidoo and Agyapong (2022) both claimed that stability makes things more predictable and less uncertain, which are both very important for sustainable finance to work. Additionally, Lubinga and Mazenda (2024) empirical results add to the idea that government stability is good for climate finance flows.

Again, how well a government manages to identify and carry out policies matters a lot in terms of how green financing decisions are reached. Governments that work well are more likely to make and follow clear rules that support green finance methods. Abaidoo and Agyapong (2022) pointed out that the efficiency of the government is what makes sure that green policies are put into action. Lee et al. (2022) also posits that a government that works well builds trust and participation in green projects. Nkot and Timbi (2023), Feyisa et al. (2022) and Muhammad et al. (2021) showed that more effective government is linked to more widespread financial development, which is necessary for green finance systems to become institutionalized and grow.

Besides these, corruption control is also an important part of making the world a better place for green finance. Corruption makes it harder to see how funds are being spent and allocated, which is needed for long-term project support (Bekana, 2023), while poor controls on corruption can change policy goals and take funds away from projects that are good for the environment (Ülgen, 2024). According to Lubinga and Mazenda (2024), investors believe in countries more when they think they are doing a better job of controlling corruption. This leads to more climate finance coming in. Also, controlling corruption is beneficial to the climate and stability of the financial sector to support green finance (Alharbey & Ben-Salha, 2024). While the institutional theory suggests that governance and green finance are related in many ways, this relationship is dynamic and depends on country statuses. It can also be hard to move green finance forward because of the way different institutional elements, from official rules to informal cultural norms, interact with each other. So, the use of institutional theory determines the advancement of green finance in emerging economies.

Empirical Reviews

Determinants of Green Finance

The first set of empirical studies explores what drives green finance development. Some studies have identified economic growth factors and financial development as influencers of green finance and growth (Arzova & Şahin, 2024; Liu, 2023; Xie et al., 2020; Eyraud et al., 2011). In these studies, national income growth, foreign direct investments, and economic development impacted green financial development in the Beijing-Tianjin-Hebei region. Xie et al. (2020) analyzed Yangtze River Delta region data between 2011-2017 with the fixed effects Durbin model to establish that financial development stimulated green finance through spillovers, but industrial structure optimization presented negative spillover effects for its development. The research by Eyraud et al. (2011) included 35 advanced and emerging economies to determine the factors that drive green investment. Economic growth affects green investment together with carbon pricing policy interventions, high fuel prices, and a sound financial system that supports low rates.

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The environmental risk mitigation tool known as green finance incorporates aspects of social responsibility alongside its main focus on reducing sustainable risks. Sustainable development is sought through investment projects that generate growth that benefits everyone, build social equity, and create positive impacts on community well-being. Zheng et al. (2021) and Yuan and Gallagher (2018) found green financing in Bangladesh is shaped by economic, social and environmental factors according to their research. Since firms are also integral to green financing, integral factors like corporate financial and managerial attributes of firms play a significant role in determining the funding allocated for green projects (Gör & Tekin, 2023; Bae et al., 2022; Kawabata, 2019). This point emphasizes the importance of green derivative assets, loans, tangible assets, equity capital, board representation, audit quality, financial constraints, international climate finance initiatives, and senior management engagement as significant drivers of green and climate finance in global financial institutions.

Besides the quantifiable factors, awareness is also important to the green investment component of green finance (Tran et al., 2020; Debrah et al., 2024). In this case, these studies recognize the nascent stage of green finance, the need to create knowledge about it, and the conscious greening commitment (Dave & Akongwale, 2024; Xing et al., 2022). Conceptually, green finance requires more attention because it helps drive the investment flow to sustainable projects alongside climate change mitigation and financial market stability enhancement by integrating environmental hazards in planning decisions. Through its activities it attracts funding and supports innovative financial instruments that guides financial flow toward UN SDGs and Paris Agreement goals. It also helps improve company reputations via sustainable practices, informs the public and companies on the advantages of green investments, and backs legislative efforts for favourable rules. There are another strand of studies that argued in favour of the roles of institutional, macroeconomic, and policy factors in green finance development (Debrah et al., 2024; Doku et al., 2021; Phuong, 2020). They argued in favour of factors like awareness of green finance initiatives, favourable macroeconomic conditions, investment returns, ease of doing business, rule of law, ICT usage, social inequality, and government support.

Governance and Green Finance/Financial Development

Studies have shown that governance has a significant boost on financial development (Nkot & Timbi, 2023; Feyisa et al., 2022; Muhammad et al., 2021). All these studies on the quality of governance and associated metrics, like political and economic outlook, positively support the improvement of financial development. These studies demonstrate that governance, together with its quality, drives sustainable fund mobilization, risk avoidance, and policy execution toward environmentally sustainable measures. A developed financial system is not just a reflection of stable and efficient financial resource intermediation, but also enhances the development of innovative financial solutions, just like green finance is developed for mitigating climate change hazards. Enhanced governance also improves financial inclusion (Ojo & Zond, 2021) along with serving as an enabling factor for green finance access in resource-reliant and low-income nations (Mbulawa & Chingoiro, 2024). On dynamic analysis, Odhiambo and Musakwa (2024) used the GMM method on 26 Sub-Saharan African countries to find that good governance is a reinforcer to the positive impact of remittance inflows on banking sector development. Through the Bayesian Vector Auto-Regressive VAR approach that Ejemeyovwi et al. (2023) applied, they confirmed that government effectiveness shocks led to positive changes in financial development. Between 1996 and 2018, Bekana (2023) applied Quantile Regression to 45 African countries for panel data to establish that governance quality effects on financial development changed across governance quality distribution quantiles based on the current financial development stage.

Based on some comparative regional considerations, governance has also shown to be positively relevant to financial development, which includes the development of green finance. Green finance development reflects the ability of the broader financial markets and institutions to mobilize and allocate funds to more effective needs. Khatami et al. (2023) used the GMM estimation method on 30 selected OECD member countries between 2010 and 2022 and their results include positive relationship between good governance quality index and financial development. Ondoa and Seabrook (2022) used data from 120 countries from 2002 to 2017 with the Dynamic Common Correlated Mean group technique. The finding showed that governance benefits high-income countries compared lower income counterpart. Ellahi et al. (2021) used

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the GMM approach on Asian economies to reveal that governance is a crucial driver of financial and stock market development. Abubakar et al. (2020) used the fixed effect estimator on data of West African countries from 2006 to 2017 to find that regulatory quality, absence of violence and political stability significantly influenced financial development in West Africa. Chinoda and Kwenda (2019) used the GMM on data from 2004 to 2016 with 49 countries to show that governance quality and institutional quality positively influences regional financial inclusion. However, Ojo and Zond (2021) proved otherwise, that governance quality and institutional quality had minimal impact on financial inclusion for women in South Africa. This could prove detrimental to the participation of women in green financing in South Africa.

Gap in Literature

Although there is much literature pointing to the role of governance quality on financial development in many regions, research is rare on how and to what extent it shapes green finance accessibility in emerging economies. A lot of studies show how effective governance contributes to overall financial growth, few are specific about how governance shapes the trend for green finance. Out of the many existing studies that discuss either all aspects of financial development, remittance flows or financial inclusion, but do not specifically consider the unique rules and types of funds in green finance, especially for places heavily involved in natural resource extraction and with low levels of income. Studies such as Khatami et al. (2023) and Ondoa and Seabrook (2022) tend to focus on groups of high- or mixed-income countries, providing little information on the specific problems faced by emerging economies. Hence, we know little about how governance matters, through for example political stability, corruption control and government effectiveness, shape sustainability finance, availability and effects in emerging economies.

Data and Methodology

Data and Variables

Our research uses data from 21 emerging economies starting from 2010 to 2022, since those years had the most available information for us to analyse. Among the included countries are Brazil, Thailand, Chile, Türkiye, China, South Africa, Colombia, the Russian Federation, Hungary, Nigeria, India, Indonesia, Vietnam, Malaysia, Mexico, Peru, Philippines, Poland, Argentina, United Arab Emirates (UAE) and Mauritius. For this study, we get our data from the World Development Indicators (WDI) and World Governance quality Indicators (WGI). The table below which details the study's variables, displays the data and where it came from.

Many empirical studies that dwelt on governance quality and green or financial development (Ellahi et al., 2021; Khatami et al., 2023; Nkot & Timbi, 2023; Ondoa & Seabrook, 2022; Feyisa et al., 2022; Bekana, 2023) have adopted some of the data used in this study. The study relied on emerging cross-country panel data that stretches from 2010 to 2022. The data in annual series, giving us fourteen observations per country. Table 1 presents the study variables and their sources.

Table 1: Principal Component Analysis for Governance Indicators

Indicator	Value	Diff.	Prop.	Cum. Value	Cum. Prop
Control of corruption	1.493	0.702	0.498	1.493	0.498
Government effectiveness	0.791	0.076	0.264	2.284	0.762
Political stability and absence of violence	0.716	-	0.239	3	1

Source: WDI, 2023

The aspect of governance quality we call control of corruption makes up 49.8 percent of the total variability. Political stability, government effectiveness and the lack of violence together make up about 26.4% and

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23.9% of governance quality, according to the second and third principal components. For the same reason, about 64.5% of variations shown in the data is described by its principal components: institutional quality, accountability, rule of law and regulatory quality. Every indicator for institutional and governance quality will be considered when computing the estimates of the final indices. These indices are estimated to run between -2.5 for the lowest and +2.5 for the highest performances. This index is important to measure to ensure us to be able to consider nonlinear effects of governance, this time the overall governance index, on green finance in emerging economies. This index will not only resolve the ambiguity of findings and recommendations of the different indicators used in nonlinear estimation, but will also ensure data harmonization.

All the factors selected are important for explaining the growth of green finance, as measured by green bond valuation against GDP. Table 2 presents explanations of variables and the literature they come from

Table 2: Variables and Their Sources

Variable	Acronym	Description	Source
Dependent			
Green finance	GRF	the ratio of green bond to GDP ratio	World Bank
Independent			
Governance quality	GOVN	Principal Component of Government Effectiveness, political stability, and corruption	PCA from WGI
Control			
Trade openness	TRADE	sum of imports and exports to GDP	World Bank
Foreign Direct Investment	FDI	Net inflows of foreign direct investment to GDP	World Bank
Financial Development	FIND	Credit to the private sector to GDP	World Bank

Source: Authors, 2025

Methodology

The research uses quantitative methods to focus on describing how quality, green finance and governance are assessed in institutions. Later in this study, applying suitable econometric approaches to examine the impact of governance quality on green finance development. Using the same frameworks as previous research (Bekana, 2023; Ellahi et al., 2021; Khatami et al., 2023; Ondoa & Seabrook, 2022), the study herein forms an econometric model as:

$$GRF_{it} = \emptyset_{it} + \partial_{1,it} GOV_{j,it} + \partial_{2,it} FDI_{it} + \partial_{3,it} FIND_{it} + \partial_{3,it} TRADE_{it} + \rho_{j,it} C_{it} + \varepsilon_{it}$$

In the equation, GRF_{it} is for green finance, and it is the dependent variable expressed as green bond valuation to GDP. GOV_{it} is for governance quality it is an index of emerging countries' levels of government indicators, political stability (PLSTB), control of corruption (CNTRC), government effectiveness (GVEFF). C_{it} is vector of control variables, identified to be foreign direct investments (FDI) and financial development (FIND). While FDI is measured as the net inflow of FDI to GDP ratio, FIND is measured as the value of private sector credit to GDP and TRADE is for trade openness, which is the sum of imports and exports to GDP.

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The choice of control variables (C_{it}), including foreign direct investments, trade and financial development, is guided by past literature (see: Arzova & Şahin, 2024; Xie et al., 2020). Foreign direct investments capture the role of technological innovations that support environmental sustainability through renewable energy investments. Trade openness controls for the improvements in green finance by providing access to new environmental technologies, encouraging aligned international environmental practises and stimulating competition that motivates green investment. When institutions are strong in an open economy, it makes the positive effects more noticeable because clear rules, upheld environmental standards and efficient use of external funds help the green economy succeed. Again, financial development is included to account for the foundational capacity of the financial system to support green finance. These two factors are important in green finance because they combine to enhance and drive green finance based on favourable institutional quality and governance quality. The size of the control variables were kept low because of high incidence of collinearity encountered in including other variables.

Model Estimation Technique

We used Pesaran panel ARDL/PMG estimation technique to analyse data from emerging economies since the technique supports the use of mixed data integration. In addition, the PMG/ARDL estimator is especially more efficient when working with a small number of observations (Pesaran et al., 1999) like our own which is just from 2010 to 2022 due to data availability issues.

For panel data, the panel ARDL/PMG is based on the following specification:

$$\begin{aligned}\Delta GRF_t = {} & \alpha_i + \beta_i GRF_{i,t-1} + \gamma_1 CNTRC_{i,t-1} + \gamma_2 GVEFF_{i,t-1} + \gamma_3 PLSTB_{i,t-1} + \gamma_2 TRADE_{i,t-1} \\ & + \gamma_3 FDI_{i,t-1} + \gamma_4 FIND_{i,t-1} + \sum_{j=1}^{a} \beta_{1j} \Delta\, GRF_{i,t-j} + \sum_{j=1}^{b} \beta_{2ij} \Delta\, CNTRC_{i,t-j} \\ & + \sum_{j=1}^{c} \beta_{3ij} \Delta\, GVEFF_{i,t-j} + \sum_{j=1}^{d} \beta_{4ij} \Delta\, PLSTB_{i,t-j} + \sum_{j=1}^{e} \beta_{5ij} \Delta\, TRADE_{i,t-j} \\ & + \sum_{j=1}^{f} \beta_{6ij} \Delta\, FDI_{i,t-j} + \sum_{j=1}^{g} \beta_{7ij} \Delta\, FIND_{i,t-j} + \mu_{it} \qquad 2\end{aligned}$$

Where, i represents the country (1, 2, 3, …, 21), t is the period (2010-2022), and a, b, c, d, e, f and g are the optimum time lags. α_i is the country's specific effect, and μ_{it} refers to the error terms. Traditionally, most ARDL models and the panel ARDL model, as well, require that we determine the error corruption model (ECM) to include the error correction term (ECT). Because ECM parameters are estimated consistently and normally, ECM dynamics are assumed to be processor-independent and identically distributed. For analysing large sections of panel data (N) and time series data (T), PMG estimators are effective (Alam et al., 2025; Pesaran et al., 1999). Also, in panel ARDL, t statistics can be used to predict the long-term effects of error correction factors (ECT).

To show the dynamic effect, the panel nonlinear ARDL technique will also be used. This time is to show the dynamic effects of both positive and negative shocks in governance index. The specification used to test nonlinear panel nonlinear ARDL can be rewritten as:

$$\begin{aligned}&\Delta GRF_{i,t} \\ &= \alpha_0 + \sum_{i=1}^{n-1} \emptyset_1 \Delta\, GRF_{i,t} + \sum_{i=0}^{n} \delta_i^{+} \Delta\, GOV_{i,t}^{+} + \sum_{i=0}^{n} \delta_i^{-} \Delta\, GOV_{i,t}^{-} + \sum_{i=1}^{n} \theta_1 \Delta\, TRADE_{i,t} + \sum_{i=1}^{n} \theta_2 \Delta\, FDI_{i,t} \\ &+ \sum_{i=1}^{n} \theta_3 \Delta\, FIND_{i,t} + \rho GRF_{i,t} + \varphi_1^{+} GOV_{i,t-1}^{+} + \varphi_1^{-} GOV_{i,t-1}^{-} + \beta_1 TRADE_{i,t} + \beta_2 FDI_{i,t} + \beta_3 FIND_{i,t} \\ &+ \mu_{i,t} \qquad 3\end{aligned}$$

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In both cases the statistical expectation of the $\emptyset_i$ (the panel ARDL speed of adjustment) is less than unity, negative, and significant.

Before using the panel linear and nonlinear ARDL/PMG methods, we will run a panel unit root test. Thus, the LLC, ADF-Fisher and PP-Fisher methods for panel unit root tests are applied in this research. Then, this study will count on the Kao Residual Cointegration Test and the Pedroni Residual Cointegration Test to confirm a long-run link between the variables in our model. Determining if the panel is a unit root will allow us to identify if the panel ARDL is suitable for the case at hand, with I (0), I (1) or a mix of I(0) and I(1).

The Nonlinear panel ARDL

The non-linear panel ARDL model differs from the conventional linear panel ARDL model by permitting asymmetric responses of green finance to changes in the aggregate outlook of governance indicators. The nonlinear panel ARDL method breaks the governance quality down into two partial sums, where ΔGOV_{it}^{+} is the positive partial sum of governance showing the upward changes in governance quality, and ΔGOV_{it}^{-} is the negative partial sum of governance quality, showing its expected downward changes. This is clearly expressed as $GOV_{i,t}^{+} = \sum_{j=1}^{t} \Delta GOV_{i,j}^{+} = \sum_{j=1}^{t} \max(\Delta GOV_{i,j}, 0)$ for positive changes in governance quality, and $GOV_{i,t}^{-} = \sum_{j=1}^{t} \Delta GOV_{i,j}^{-} = \sum_{j=1}^{t} \min(\Delta GOV_{i,j}, 0)$ for negative changes in governance quality.

With this established, the nonlinear Autoregressive Distributed Lag (ARDL), as developed by Shin, Yu and Greenwood-Nimmo, M. (2014), specifies the nonlinear effect of our governance quality as:

$$\Delta GRF_{i,t} = \alpha_0 + \sum_{i=1}^{n-1} \emptyset_1 \Delta GRF_{i,t-i} + \sum_{i=0}^{n} \delta_i^{+} \Delta GOV_{i,t-i}^{+} + \sum_{i=0}^{n} \delta_i^{-} \Delta GOV_{i,t-i}^{-} + \sum_{i=1}^{n} \vartheta_1 \Delta C_{i,t-i} + \rho GRF_{i,t-1} + \varphi_1^{+} GOV_{i,t-1}^{+} + \varphi_1^{-} GOV_{t-1}^{-} + \beta_1 C_{i,t-1} + \mu_t \quad 3$$

The governance quality considered for this is the composite index of all the six indicators. GOV^{+} represents a governance quality improvement, while GOV^{-} represent governance quality decline. To test for asymmetry, which is to determine the differential impact of GOV^{+} and GOV^{-}, Shine et al. (2014) proposed the Wald test for the relative similarities of the coefficient of green finance, that is ρ, against the coefficients of both positive and negative shocks of governance, that is φ_1^{+} and φ_1^{-}. We therefore construct statements of hypotheses as $H_0: \frac{-(\varphi_i^{+})}{\rho} = \frac{-(\varphi_i^{-})}{\rho}$ and $H_A: \frac{-(\varphi_i^{+})}{\rho} \neq \frac{-(\varphi_i^{-})}{\rho}$. If we reject H_0, it means there is a long-run asymmetry. In other words, the magnitude of the change in green finance when governance quality improves is not the same as when governance quality declines.

Analysis and Results

The descriptive statistics shown in Table 3 depict the basic understanding of the central tendencies and dispersion properties of the variables used in the study. Each variable has a uniform number of observations (294), suggesting that the dataset is balanced across the indicators. The aggregate governance index (GOV) exhibited a near symmetric distribution, as evidenced by the variance that varies from -4.50 to 4.86, notwithstanding the mean value of 0.00 and a standard deviation of 2.09. Significant institutional diversity was probably captured by this variable. Likewise, green finance (GRF) had a mean of 0.00 and a very low standard deviation of 0.04; this suggests that there was little variation in the sample and that green financing mechanisms were either underdeveloped or just beginning to be used. With a mean of -0.19, the control of corruption (CNC) indicated a general weakness in corruption control throughout the sampled emerging economies. The range of -1.28 to 1.54 shows that control of corruption is significantly different among emerging economies, while the standard deviation value of 0.60 means a moderate variation. The mean values for regulatory quality (RGQ), rule of law (RUL), and voice and accountability (VAC), respectively 0.16, -0.08, and -0.09, show that governance and institutions tend to be weak or underdeveloped in

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emerging economies. There is also little evidence of improving this situation in these groups of countries, as their standard deviations approximate 0.60 for all indicators, a discovery that shows moderate changes in governance.

Table 3: Descriptive Statistics

Statistic	Obs.	Mean	Max.	Min.	SD
CNC	294	-0.19	1.54	-1.28	0.60
FDI	294	3.04	106.43	-40.26	8.60
FIND	294	65.01	194.67	0.00	44.25
GEF	294	0.19	1.60	-1.21	0.56
GOV	294	0.00	4.86	-4.50	2.09
GRF	294	0.00	0.53	0.00	0.04
PLS	294	-0.34	1.07	-2.21	0.76
RGQ	294	0.16	1.54	-1.16	0.59
RUL	294	-0.08	1.35	-1.20	0.57
TRADE	294	77.15	202.33	16.35	46.32
VAC	294	-0.09	1.11	-1.68	0.75

Note. CNC = control of corruption; FDI = Foreign Direct Investment; FIND = Financial Development; GEF = Government Effectiveness; GOV = index of governance indicators; GRF = Green Finance; PLS = Political Stability; RGQ = Regulatory Quality; RUL = Rule of Law; TRADE = Trade Openness; VAC = Voice and Accountability. All values rounded to two decimal places.

With a wide range of -40.26 to 106.43 and a large standard deviation of 8.60, foreign direct investment (FDI) was highly volatile. In certain cases, the presence of disinvestment or the withdrawal of foreign capital is implied by the negative minimum value. The wide variance is proof that investor confidence varies significantly across countries due, probably, to institutional or macroeconomic factors. With a high mean value of 65.01 and a standard deviation of 44.25, financial development (FIND) indicated that the dataset's depth and sophistication were widely distributed. Significant differences between nations or eras in the development of the financial sector may be reflected in the wide range between the minimum (0.00) and maximum (194.67) values. Although some cases showed relatively strong governance practices, the government effectiveness (GEF) score of 0.19 and 0.56 indicates a generally weak administrative capacity. With a comparatively high degree of variability, the 0.76 value standard deviation of political stability (PLS) was negative on average (-0.34), indicating a general propensity towards instability. The existence of both conflict-prone emerging economies contexts was highlighted by the range between -2.21 and 1.07. With a standard deviation of 46.32 and a notable high mean value of 77.15, trade openness (TRADE) ranged widely from 16.35 to 202.33. This also suggests a gap in trade integration across emerging economies, due to structural variations in trade policies, geographic trade advantages, or economic openness.

Table 4: Correlation Analysis

Variables	CNC	FDI	FIND	GEF	GOV	GRF	PLS	RGQ	RUL	TRADE	VAC
CNC	1										
FDI	0.10*	1									
FIND	0.28***	-0.00	1								

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GEF	0.85***	0.08	0.39***	1							
GOV	0.94***	0.11*	0.29***	0.90***	1						
GRF	0.12**	-0.00	0.06	0.15**	0.19***	1					
PLS	0.73***	0.12**	0.19***	0.73***	0.84***	0.19***	1				
RGQ	0.82***	0.10*	0.24***	0.79***	0.91***	0.20***	0.65***	1			
RUL	0.91***	0.11*	0.39***	0.87***	0.96***	0.19***	0.77***	0.85***	1		
TRADE	0.46***	0.13**	0.23***	0.60***	0.53***	0.07	0.58***	0.45***	0.56***	1	
VAC	0.33***	0.04	-0.18***	0.14**	0.45***	0.13**	0.31***	0.47***	0.41***	-0.18***	1

Note. Significance: ***p < 0.01, **p < 0.05, *p < 0.10.

Table 4 shows that the correlation analysis found strong and statistically significant links between the main governance indicators. The correlation analysis showed that green finance demonstrated weak, but statistically significant, positive relationships with all the governance-related variables. This suggests that improvements in institutional quality are linked to slight increases in green finance activities. The significant correlation between green finance and most of the governance indices, though weak, shows that there exists some kind of alignment between environmental financing and governance quality. Green finance did not, however, significantly correlate with either financial development or foreign direct investment, suggesting that institutional strength may be more important to its growth than financial development or foreign financial flows. These results show how important governance frameworks are for promoting environmentally friendly financial practices.

Corruption of corruption was very strongly linked to government effectiveness especially with the overall governance index, rule of law, and regulatory quality. These results show that when one area of governance gets better, it's likely that other areas will also get better. Political stability was also strongly and positively linked to the overall governance index and the rule of law, which shows that political conditions and institutional quality are very similar. Financial development had strong links to some governance measures, like the rule of law and government effectiveness, but these links were not as strong as those between the institutional variables. There was a weak and small correlation between foreign direct investment and most governance indicators, such as control of corruption, the overall governance index, and trade openness. This suggests that the quality of institutions may not have a big effect on foreign investment decisions in the observed context. It is interesting to note that voice and accountability were negatively and significantly correlated with financial development and trade openness. This suggests that settings with weaker democratic accountability may see more economic liberalisation or expansion of the financial sector.

Table 5: Panel Unit Root Tests: First and Second Generation

Variables	Levels		First difference		Order of Integration
	IPS	CIPS	IPS	CIPS	
GRF	-3.24***	-4.34***			I(0)
GOV	-0.78	-1.24	-10.29***	-3.34***	I(1)
RGQ	0.44	-1.43	-10.05***	-3.45***	I(1)
RUL	0.81	-0.82	-9.90***	-3.22***	I(1)
VAC	1.46	-1.69	-3.80***	-2.87***	I(1)

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CNC	-2.44***	-1.69		-2.88***	I(1)
GEF	1.04	-0.93	-9.80***	-3.39***	I(1)
PLS	-2.29**	-2.05		-4.35***	I(1)
FDI	-5.11**	-2.46***			I(0)
FIND	-0.96	-1.22	-3.08***	-3.20***	I(1)
TRADE	-1.52	-1.65	-10.22***	-3.07***	I(1)

The panel unit root results in Table 5 showed that there were both stationary and non-stationary variables at levels. Both first-generation (IPS) and second-generation (CIPS) tests were used. Green finance and foreign direct investment were stationary at levels, indicating they are integrated of order zero, I(0), while most governance indicators, including the aggregate governance index, regulatory quality, rule of law, voice and accountability, government effectiveness, and political stability, became stationary only after first differencing, thus classified as I(1). The same order of integration applied to financial development and trade openness. Control of corruption had different levels of stationarity across tests, but it was finally labelled as I(1) based on its CIPS result at first difference. These results suggest that estimation methods that can handle mixed integration orders, like the panel ARDL or PMG estimators, are good to use to avoid false regressions and make sure that long-run conclusions are correct.

Table 6: Panel Cointegration Tests

Tests	**Test Statistic**	**GOV**	**CNC**	**GEF**	**PLS**	**RUL**	**RGQ**	**VAC**
Pedroni cointegration tests	Panel v-Stat	1.81*	2.48***	2.95***	-0.56	-0.39	2.67***	4.16***
	Weighted Panel v-Stat	-3.17	-4.04	-3.56	-4.45	-4.15	-1.92	-3.94
	Panel rho-Stat	4.88	3.78	3.69	4.42	5.35	4.03	1.49
	Weighted Panel rho-Stat	2.75	2.78	2.57	3.09	2.9	2.2	2.93
	Panel PP-Stat	-5.65***	-13.53***	-11.75***	-10.29***	-2.54***	-9.52***	-28.10***
	Weighted Panel PP-Stat	-16.74***	-19.16***	-16.30***	-13.89***	-14.04***	-14.18***	-17.35***
	Panel ADF-Stat	-3.35***	-7.31***	-7.04***	-5.40***	-1.57*	-5.83***	-16.25***
	Weighted Panel ADF-Stat	-9.82***	-10.92***	-11.27***	-8.62***	-9.67***	-11.43***	-9.54***
	Group rho-Stat	4.00	4.00	3.87	4.43	4.29	3.64	3.90
	Group PP-Stat	-22.36***	-23.44***	-19.41***	-17.25***	-22.36***	-18.41***	-26.81***
	Group ADF-Stat	-11.62***	-11.29***	-11.38***	-8.65***	-10.79***	-12.46***	-10.82***

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Kao residual cointegration Stat.	ADF-Stat	-7.08***	-7.07***	-7.15***	-7.10***	-7.09***	-7.10***	-7.27***

Note. Significance: ***p < 0.01, **p < 0.05, *p < 0.10.

The panel cointegration results in Table 6 show that there are strong long-run relationships between green finance and all of the governance indicators that were considered. At the 1% level, most of the Pedroni test statistics, especially the Panel PP-Stat, Weighted Panel PP-Stat, Panel ADF-Stat, and Group ADF-Stat, are significantly negative. This means that the null hypothesis of no cointegration was strongly rejected, suggesting that green finance and governance factors are in a long-run relationship with each other.

The Kao residual cointegration test backs up these results even more. All ADF statistics were significantly negative at the 1% level across all governance indicators. That the results from the Kao tests agree with most of those from Pedroni further confirms the case for cointegration. These results suggest that as governance gets better, green finance is likely to keep moving in the same direction over time.

Table 7: Panel Short-Run and Error Correction Estimates

	Model 1 (with RGQ)	**Model 2 (with RUL)**	**Model 3 (with VAC)**	**Model 4 (with CNC)**	**Model 5 (with GEF)**	**Model 6 (with PLS)**
ECT	-0.9838***	-0.730***	-0.7275***	-0.7388***	-0.6238	-0.6293***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
D(FDI)	0.0065	0.0127	0.0073	0.0071	0.0070	0.0068
	(0.325)	(0.324)	(0.323)	(0.324)	(0.314)	(0.332)
D(FIND)	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
	(0.298)	(0.113)	(0.272)	(0.120)	(0.200)	(0.237)
D(TRADE)	0.0006	0.0001**	0.0003	0.0003	0.0003	0.0004
	(0.182)	(0.020)	-0.2440	(0.208)	(0.225)	(0.148)
D(RGQ)	-0.0144					
	(0.135)					
D(RUL)		-0.0451				
		(0.304)				
D(VAC)			-0.0340			
			(0.244)			
D(CNC)				0.0037		
				(0.352)		
D(GEF)					-0.0199	
					(0.269)	
D(PLS)						-0.0087
						(0.216)

Note: the six estimated models are columns, 1-6; probabilities are in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1

In the short-run estimations, the error correction term (ECT) was negative and highly significant across all models, with values ranging from -0.934 to 0.634. This confirmed that green finance adjusts significantly to restore long-run equilibrium relationship following any short-term shocks, with about 63% to 93% of disequilibrium corrected each period. Also, none of the governance indicators were significant in causing changes in green finance. Although changes in control of corruption have the tendency to support green

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finance, it is insignificant, as evidenced in model 4. Besides this, all other governance indicators, like regulatory quality in model one, rule of law in model 2, voice and accountability in model 3, government effectiveness in model 5, and political stability in model 6, had a negative and insignificant effect on green finance in emerging economies. This is proof that changes in governance in emerging economies do not possess an immediate impact. These results suggested that green finance responses to governance quality, financial development, foreign direct investment, and trade openness occurred more prominently in the long run rather than immediately, reaffirming the importance of sustained policy commitment over time. One of the closest justifications for this outcome is that given by Dave and Akongwale (2024), who posited that the green finance market in the emerging South African economy was not expected to perform impressively due to its early stage, and so short-term policies may be insignificant for emerging economies.

The long-run results showed that all the governance indicators exert significant effects on green finance in emerging economies. However, not all governance indicators are supportive of green finance in the long run. In the first group of empirical evidence, voice and accountability, government effectiveness, and political stability were significantly supportive of green finance in emerging economies. There is always empirical evidence that shows a positive link between good governance and the growth of green finance. This is mostly because good governance helps to make financial systems more stable. Studies by Nkot and Timbi (2023), Feyisa et al. (2022), and Muhammad et al. (2021) show that good governance, which includes stable political and economic conditions, helps improve finance by making it easier to manage risk, enforce environmental policies, and raise funds for sustainable projects. These traits make it easier for new ways of financing, like green finance, to work, especially in countries looking for ways to adapt to and reduce climate change. Governance also helps with broader financial inclusion, which is necessary for widespread access to green finance, especially in economies that depend on resources and have low incomes (Ojo & Zond, 2021; Mbulawa & Chingoiro, 2024).

Table 8: Panel Long-Run Estimates

	Model 1 (with RGQ)	**Model 2 (with RUL)**	**Model 3 (with VAC)**	**Model 4 (with CNC)**	**Model 5 (with GEF)**	**Model 6 (with PLS)**
FDI	0.0001**	0.0001***	0.0001***	0.00004***	-0.0002***	0.0001***
	(0.014)	(0.000)	(0.000)	(0.003)	(0.000)	(0.010)
FIND	0.000001	-0.0000002**	-0.000004***	0.000003***	0.00002***	0.00001***
	(0.642)	(0.028)	(0.000)	(0.000)	(0.000)	(0.001)
TRADE	0.000004**	0.00001***	0.000004***	0.00001***	0.00001***	0.00001**
	(0.019)	(0.002)	(0.000)	(0.000)	(0.000)	(0.012)
RGQ	-0.0007***					
	(0.000)					
RUL		-0.0005***				
		(0.000)				
VAC			0.0004***			
			(0.000)			
CNC				-0.0005***		
				(0.000)		
GEF					0.0003***	
					(0.000)	
PLS						0.0007***
						(0.000)

Note: the six estimated models are columns, 1-6; probabilities are in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1

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On the other hand, our study found that the other governance indicators that had a detrimental impact on the growth of green finance in emerging economies are regulatory quality, rule of law, and control of corruption. While it is almost a common premise to agree that good governance helps the economy grow, this new evidence shows that it may not always be good for green finance in developing countries. Khatami et al. (2023), Ellahi et al. (2021), and Chinoda and Kwenda (2019) all found supporting results from governance in high-income or advanced countries, but these results may not apply to emerging economies. According to Ondoa and Seabrook (2022), the benefits of good governance were more obvious in high-income countries. The suggestion drawn from this is that emerging economies that lack strong institutional frameworks may not benefit from improved green finance. Abubakar et al. (2020) also found some good links between governance and finance in West Africa. However, these governance institutions may not be able to get green finance because they are so fragile. Many emerging economies have weak governance systems and politicised regulatory environments that make it hard for green projects to get the long-term commitment, transparency, and specialised financial oversight they need.

Governance structures in emerging economies may also be exclusionary, which means that vulnerable groups may not be able to take part in green finance projects. For example, Ojo and Zond (2021) showed that the quality of governance had very little effect on women's ability to get access to financial services in South Africa. This raises concerns about the accessibility of green finance under the current poor institutional levels. If governance reforms don't fix problems that affect people in more than one way or only make small improvements to the way the government works, they could make it harder for people to get involved in green finance. So, even though governance might help overall financial growth, its negative or small effects on certain groups and situations, especially in states with low capacity, make it hard to believe that it will work the same way in all emerging economies to promote inclusive green finance.

Table 9: Test of Panel Asymmetry of Governance

Variable	Statistic	Value	Prob.
GOV	F-statistic	117.56	0.000***
	Chi-square	117.56	0.000***

Note. ***p < .01**, **p < .05**, *p < .1*; Null hypothesis: Coefficient is symmetric; Equation estimated using F(1,247) and Chi-square(1)

The results in Table 9 showed strong statistical evidence that overall governance has different effects on green finance, as both the F-statistic and Chi-square values were very significant at the 1% level ($p = 0.000$). The rejection of the null hypothesis of coefficient symmetry showed that the effects of overall governance on green finance were not the same in terms of positive and negative changes. This result showed that an asymmetric modelling framework will be needed, as it suggested that changes in overall governance had different effects on green finance in terms of size or direction.

In the symmetric model, governance had a big and positive effect on green finance. This suggests that improvements in the overall governance index helped green finance grow. The importance of financial development, which also supported green finance, made this even stronger. On the other hand, trade openness and foreign direct investment did not have any statistically significant effects, which means they don't play a big role in driving green finance in the symmetric specification. The error correction term, on the other hand, was correctly signed and very important, which means that the system is moving towards equilibrium in the long run.

The asymmetric model showed that positive changes in the overall governance significantly boosted green finance, while negative shocks significantly reduced it. This confirmed that governance effects are not the same for every country. Foreign direct investment (FDI) became very positive and important, while financial development lost its importance. This means that green finance responded better to FDI when conditions were not the same for everyone. Trade openness had a big negative long-term effect, which

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means that trade may hurt green finance when there are differences in governance. These results showed how governance can have a complicated effect on green finance outcomes.

Recent studies have shown that positive changes in overall governance make green finance a lot better in emerging economies by making institutions stronger, lowering policy uncertainty, and making the financial system work better. Dynamic studies, like those by Odhiambo and Musakwa (2024) and Ejemeyovwi et al. (2023), add to this connection by showing that governance shocks and remittance governance interactions have a big impact on the growth of the financial sector, which directly helps green financing capabilities. They argue further that positive governance shocks help the banking sector grow, which in turn makes it easier to deliver green finance. Better governance also encourages new financial tools like green bonds, sustainable loans, and climate-resilient investments that are important in places with low incomes and few resources (Mbulawa & Chingoiro, 2024). Good governance encourages investors' confidence to commit their funds to green and sustainable projects (Nkot & Timbi, 2023; Muhammad et al., 2021). Better governance makes it easier to put environmental policies into action, lowers the credit risks that come with long-term green investments, and makes public-private partnerships for climate finance stronger.

Table 10: Dynamic Panel Asymmetric Governance Effects

	Model 7 (with symmetric effects)	**Model 8 (with asymmetric effects)**
Long-run estimates		
FDI	0.00002	0.0001***
	(0.526)	(0.001)
FIND	0.00002***	0.000001
	(0.000)	(0.324)
TRADE	0.000002	-0.000005***
	(0.299)	(0.000)
GOV	0.0009***	
	(0.000)	
GOVp		0.0005***
		(0.000)
GOVn		-0.0001***
		(0.001)
Short-run estimates		
ECT	-0.5028***	-0.9890***
	(0.000)	(0.000)
D(FDI)	0.0080	0.0118
	(0.321)	(0.315)
D(FIND)	0.0002**	
	(0.047)	
D(TRADE)	0.0003	0.0006
	(0.137)	(0.259)
D(GOV)	-0.0.116	
	(0.246)	
D(GOVp)		0.0164
		(0.371)
D(GOVn)		-0.0556
		(0.258)

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Note: GOVp is the positive improvement in governance; GOVn is negative decline in governance; the six estimated models are columns, 1-6; probabilities are in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1

On the other hand, bad governance can seriously hurt the growth of green finance by making it harder for people to get loans, making policies less effective, and making people less likely to invest in projects that are good for the environment. When governance gets worse, like when there is political instability, regulatory inefficiency, or a lot of corruption, financial systems become more risk-averse. This means that there are fewer long-term and high-risk green projects. According to Bekana (2023), the effect of governance on financial development gets weaker at lower governance quantiles. This means that countries with weak governance structures are less able to use financial development for green finance. Also, differences in governance make it harder for international green funding and remittance-backed investments to flow, which are important for the long-term financial health of green transitions in Sub-Saharan Africa. Ojo and Zond (2021) also showed that weak governance has a bigger effect on marginalised groups, like women in South Africa, who have less access to inclusive green financial instruments. This means that green finance has less of an impact on development as a whole.

Conclusion and Recommendations

The poor level of the green finance market in emerging markets is a thing of silent yet important concern among finance and climate experts. Past studies have described the green finance market in emerging economies as still an infant, but with the desire to improve it. Our study identified that poor governance quality in emerging economies, being a detrimental concern to financial development, could also explain the poor depth and growth of the green finance market. This prompted the study to consider the influences of institutional quality and governance quality in explaining green finance development in twenty-one (21) emerging economies from 2010 to 2022. Due to data availability factors and the nature of the data, the most suitable technique is the linear and nonlinear panel ARDL/PMG and estimators to address the dynamic implications of governance on the green finance market in emerging economies. The proxy for governance corruption control, political stability, and government effectiveness, as well as its composite index, was constructed with the PCA technique.

One of the implications drawn is the importance of sustaining institutional strengths and policy consistency. This is evidenced in the insignificant effects of governance indicators in the short run but significant in the long run. This also implies that governance reforms in emerging economies may not translate to immediate influence on green finance, but register significant influences in the long run. Further, the insignificance of governance to green finance in the short run also suggests that early stages of green finance in emerging markets are highly unresponsive to improvements in governance despite their positive influences. However, the long-run result that government effectiveness, voice and accountability, and political stability support green finance shows that green investors are highly encouraged by efficiency, participation, and stability in countries. On the other hand, governance is not universally beneficial to green finance in emerging economies. This is evident in the detrimental impact of the rule of law, regulatory quality, and control of corruption, as weak and politicised institutions tend to discourage green investors, especially among the vulnerable group in emerging economies. The asymmetric results further revealed that changes in governance do not deliver even results, with improvements contributing to increasing green finance while setbacks tend to severely constrain green finance. This means that policy decisions that seek to boost green investments should focus on improving the overall governance quality while putting in place measures to contain any deteriorations in governance quality.

Based on the study findings, some recommendations are made. First, there is a need for policymakers in emerging economies to focus on long-term reforms in governance, instead of expecting short-term results. This is because the early stage of finance in those economies requires time to respond to governance policy and institutional reforms. Priorities should also be given to strengthening government effectiveness, political stability, and voice and accountability, as they are the most effective supporters of green finance. Second, that rule of law, regulatory quality, and control of corruption were detrimental means that they

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contain underlying policy issues that need to be addressed. This calls for deeper reforms in these areas of governance that will address such issues, or they will generate barriers for green finance growth in emerging economies. Finally, to address the detrimental impact of setbacks in governance, there is a need for policymakers in emerging economies to address impediments such as policy reversals, political instability, or weak enforcement, so that the beneficial impacts from other governance indicators are not eroded.

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