Financial Sector Development and Energy Transition: Does Regulatory Quality Matter?

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Abstract: *This study examines the effects of financial sector development and regulatory quality in driving the energy transition using Regulatory quality (RQ) as a moderator. The study employs a panel method, pooling data from 43 African countries, spanning from 1990 to 2022, sourced from the World Development Indicators (WDI) of the World Bank. In order to take care of the possibility of endogeneity, the study employs the dynamic generalized method of moments (GMM) approach developed by Arellano & Bond, 1991. The model shows the impact of the independent variables on renewable energy consumption. The results show that financial development has a negative significant impact on the demand for renewable energy. RQ is also observed to have a significant negative effect on the demand for renewable energy. The interaction between Financial development and regulatory quality (FIND*REGQ) yield positive effect on renewable energy demand. This implies that strong regulatory frameworks enhance policy credibility, reduce regulatory uncertainty, and improve contract enforcement, thereby increasing investor confidence in renewable energy markets. Both FDI and Trade openness have negative significant impact on the demand for renewable energy. The study recommends that there is the need to strengthen regulatory frameworks, enhance transparency and accountability, foster collaboration between regulatory agencies and industry stakeholders and promote investments in clean energy technologies.*

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Introduction

The global urgency to mitigate climate change and reduce carbon emissions has placed the energy transition shifting from fossil fuel-based energy systems to renewable energy sources at the forefront of policy agendas worldwide. This transition is not only crucial for environmental sustainability but also for ensuring long-term economic resilience and energy security. A key factor in facilitating this transition is the development of the financial sector, which plays a pivotal role in mobilizing and allocating the necessary capital for renewable energy projects and energy – efficient technologies (Zhang et al., 2023; International Energy Agency, 2021; International Renewable Energy Agency, 2022; World Bank, 2020).

Financial sector development (FSD) refers to the growth and sophistication of financial institutions, markets, and instruments that enable efficient resource allocation (Ross Levine, 2005; World Bank, 2012).. It includes the expansion of banking services, capital markets, and the availability of innovative financial products such as green bonds and sustainability-linked loans. A well – developed financial sector can reduce transaction costs, lower information asymmetries, and provide the financial infrastructure needed to support large – scale investments in renewable energy (Franklin Allen et al., 2011; International Energy Agency, 2021); Levine, 2005;).

However, the ability of the financial sector to drive the energy transition is strongly shaped by the quality of regulatory frameworks overseeing both financial and energy markets. Regulatory quality captures the effectiveness, transparency, and consistency of rules and policies that maintain market stability, safeguard investors, and foster sustainable practices (Kaufmann et al., 2011). High – quality regulations are essential for fostering an environment where financial institutions can confidently invest in long-term renewable energy projects, thereby reducing the financial risks associated with such investments.

The interplay between financial sector development, energy transition, and regulatory quality can be understood through several critical channels. Firstly, a robust financial sector with high regulatory quality can mobilize substantial capital towards renewable energy projects thus, addressing a significant upfront costs and financial barriers typically associated with such investments (Taghizadeh-Hesary & Yoshino, 2020). Secondly, quality regulatory frameworks can enhance investor confidence by mitigating risks and uncertainties, thus attracting both domestic and international investments in green technologies (Aliyeva, 2024). Lastly, synergistic effects between financial development and regulatory quality can create a more conducive environment for sustainable investments, leading to more efficient and large-scale deployment of renewable energy resources (Georgescu et al., 2025).

The imperative to transition towards renewable energy sources has become increasingly evident in global efforts to combat climate change and achieve sustainable development goals (SDGs) set by the United Nations. Central to this transition is the role of the financial sector in allocating resources to renewable energy projects and influencing the pace and direction of energy transition (Liu et al., 2023). However, the efficacy of this role is contingent upon the quality of regulatory frameworks within the financial sector, which can significantly impact the

availability and cost of financing for energy projects, as well as the risk management and governance of financial institutions (Olaniyi et al., 2025). Strong regulatory frameworks not only reduce the risk associated with renewable energy investments but also enhance investor confidence and mobilize private sector funding.

Despite the acknowledged importance of regulatory quality, there exists significant negative variation in the regulatory frameworks across countries, with some exhibiting more effective and efficient systems than others. This discrepancy underscores the critical need for research to explore the implications of regulatory quality on energy transition and financial sector development, particularly in the context of developing countries. Moreover, existing empirical studies linking financial development and the energy sector predominantly focus on energy consumption, overlooking the dynamic linkage between regulatory quality, financial development, and renewable energy consumption. Therefore, an investigation into the impact of regulatory quality on green energy consumption, through the lens of financial development, is essential to inform policy interventions and foster sustainable energy transitions (World Bank, 2020; International Renewable Energy Agency, 2022; Organisation for Economic Co-operation and Development, 2015).

Financial sector development (FSD) is widely recognised as a driver of investment flows into clean technologies and low – carbon projects, thereby facilitating energy transition (Rafindadi & Ozturk, 2016; Sadorsky, 2011). Existing studies generally assume that a more developed financial system automatically translates into improved renewable energy deployment and reduced carbon intensity. However, this assumption overlooks the institutional context within which financial systems operate. Recent evidence indicates that institutional conditions – particularly regulatory quality – shape how financial markets allocate capital, manage risk, and support long – term sustainability investments (Demirgüç-Kunt et al., 2020; Thorsten Beck et al., 2010; Asli Demirguc-Kunt et al., 2018; World Bank, 2020). Yet, the role of regulatory quality as a conditioning or moderating mechanism in the FSD – energy transition nexus remains largely under-theorised.

Most empirical studies treat regulatory quality as a control variable or examine it in isolation from financial development, thereby offering limited theoretical insight into how and when financial systems contribute to energy transition outcomes (Ross Levine, 2005; Daron Acemoglu & James A Robinson, 2012; International Renewable Energy Agency, 2022). This creates a clear theoretical gap: the literature does not adequately integrate institutional theory with sustainability finance, nor does it explore whether the impact of FSD on energy transition depends on the robustness, credibility, and enforcement of regulatory frameworks. Addressing this gap is essential because countries with similar levels of financial development often demonstrate markedly different energy – transition performance, suggesting institutional heterogeneity as a missing explanatory layer.

To respond to this theoretical gap, the present study asks:

1. **To what extent does financial sector development influence energy transition across countries?**

2. **Does regulatory quality moderate the relationship between financial sector development and energy transition?**
3. **Under what** institutional conditions **does financial sector development exert stronger or weaker effects on energy transition outcomes?**

By embedding regulatory quality into the theoretical model, this study offers a *sui generis* contribution by extending financial – development theory into an institutionally contingent sustainability framework - an aspect not systematically investigated in the existing literature (Boqiang Lin & Jude Okoye, 2023; Evans Opoku-Mensah et al., 2024; Francis Lwesya, 2025). Global evidence indicates that financial development and regulatory quality jointly influence renewable energy investment and energy transition outcomes (International Energy Agency [IEA], 2024; World Bank, 2020).

Approximately 600 million people in Africa lack access to electricity, representing the largest global energy deficit (IEA, 2024). Over 1 billion people lack access to clean cooking energy, highlighting structural energy poverty (IEA, 2024). This underscores the urgency of **energy transition supported by financial systems.**

Africa accounts for **about 20% of the global population but attracts less than 3% of global energy investment** (IEA, 2024). The continent receives **only about 2% of global clean energy investment**, indicating severe financing gaps (IEA, 2023). This reflects underdeveloped financial systems and weak investment environments.

Clean energy investment in Africa increased from **USD 17 billion (2019) to nearly USD 40 billion (2024),** showing gradual improvement (IEA, 2025). Renewable energy accounts for a **growing share of energy investment**, though still insufficient relative to needs. This indicates **emerging but constrained financial sector support.**

The cost of capital for renewable energy projects in Africa is **2–3 times higher than in advanced economies** (IEA, 2024). This suggests a weak financial intermediation, high perceived risk, regulatory and institutional inefficiencies.

Fragmented and weak regulatory frameworks significantly constrain private investment in renewable energy (Africa Policy Research Institute, 2024). Poor governance, unstable policies, and regulatory uncertainty increase investment risk and limit financial sector effectiveness. Regulatory quality acts as a **moderating variable** in the finance–energy relationship.

Limited capital market instruments and weak institutional frameworks restrict institutional investors' participation in renewable energy financing (OECD, 2023). African institutional investors represent only a **small fraction of global renewable energy investors**, limiting domestic capital mobilization.

Africa requires **over USD 200 billion annually** to meet energy and climate goals by 2030 (IEA, 2024). Electricity sector investment alone must rise significantly, with about **50% directed to renewable energy** (IEA, 2024).

The remainder of this chapter is structured as follows: Section 2 provides a comprehensive review of the existing literature. Section 3 outlines the methodology employed in this study, while Section 4 presents and discusses the findings. Finally, Section 5 concludes the study by offering pertinent policy recommendations.

Literature Review

The transition to renewable energy is essential for achieving sustainable development and mitigating the impacts of climate change. Understanding the factors that influence renewable energy consumption is crucial for policymakers and stakeholders. This literature review delves into the theoretical and empirical studies on the impact of financial development and institutional quality on renewable energy consumption. By exploring these dimensions, the review aims to provide a comprehensive understanding of how financial and institutional frameworks can support the adoption and expansion of renewable energy**.**

2.1 Theoretical Literature

The theoretical framework guiding this study is rooted in institutional theory, as proposed by (North, 1990), which elucidates how formal and informal rules, norms, and regulations shape economic behavior and outcomes. Within this framework, regulatory quality emerges as a critical component influencing financial market behavior and energy sector dynamics. A well – developed and supportive financial system is paramount for facilitating investment in renewable energy, and regulatory quality plays a pivotal role in fostering such an environment. Thus, institutional quality is perceived as a key factor that may either facilitate or impede energy transition, with ramifications for sustainable development and climate action.

The financial sector is integral to the energy transition, primarily through investment in renewable energy technologies and energy – efficient projects. Financial sector development refers to the growth and maturation of financial institutions, markets, and instruments that facilitate the efficient allocation of resources. (Levine, 2005) posits that a well – developed financial sector reduces information asymmetries and transaction costs, thereby enhancing capital allocation towards innovative and sustainable projects.

Green finance, a subfield of financial sector development, specifically focuses on investments that deliver environmental benefits. Green bonds, for instance, are issued to raise funds to finance renewable energy projects, energy – efficient buildings, and sustainable transport (Climate Bonds Initiative, 2020). The availability and accessibility of green financial products are crucial for driving the energy transition. Regulatory quality encompasses the effectiveness, transparency, and consistency of regulations that govern financial and energy markets. High – quality regulations ensure market stability, protect investors, and promote sustainable practices (Kaufmann et al., 2011). In the context of energy transition, regulatory quality is pivotal in providing clear guidelines and incentives for investment in renewable energy sources.

2.2 Empirical Literature

Financial Sector Development and Energy Transition

The literature consistently recognises financial sector development (FSD) as a critical enabler of energy transition because an efficient financial system mobilises capital, reduces transaction costs, and supports long – term renewable energy investments (Sadorsky, 2011). Financial markets that are deep, liquid, and well – regulated tend to enhance credit access for clean – energy firms, stimulate green innovation, and accelerate structural transformation toward low – carbon energy systems (Annor et al., 2025; Eren et al., 2019). Theoretically, this relationship is anchored in **Schumpeterian growth theory**, which posits that financial intermediation fosters technological innovation by reallocating resources into productive sectors (Schumpeter & Swedberg, 2021). Energy transition, as a technology – driven process, thus depends on financial systems capable of supporting innovation.

Empirical evidence largely supports these theoretical expectations. Recent studies show that financial development enhances renewable energy consumption, particularly in advanced economies with well-functioning financial systems (Alshagri et al., 2024; Prempeh, 2023). It also facilitates the diffusion of green technologies and promotes environmentally sustainable investments through improved access to capital and financial intermediation (Bambi & Pea-Assounga, 2025). Moreover, efficient financial systems contribute to environmental sustainability by channeling resources into low-carbon technologies and reducing emissions (Acheampong et al., 2021). However, emerging evidence points to heterogeneous and sometimes weak relationships, especially in developing and emerging economies where financial markets remain underdeveloped or distorted (Alshagri et al., 2024; Nguyen et al., 2024). Such mixed findings suggest that financial sector development alone may be insufficient to drive an effective energy transition without complementary institutional and regulatory frameworks that enhance financial efficiency and investment outcomes (Energy Economics, 2026).

Regulatory Quality and the Financial – Environmental Nexus

Regulatory quality – the ability of governments to design, implement, and enforce sound regulations – plays a vital role in shaping financial market performance and environmental outcomes. According to **institutional theory**, well-designed regulations reduce information asymmetry, strengthen investor confidence, and promote efficient resource allocation (North, 1990). In the sustainability domain, regulatory quality influences environmental innovation, compliance incentives, and the long-term risk assessment necessary for clean – energy investment (Stiglitz, 2019).

Earlier research provides evidence that institutional strength enhances the effectiveness of environmental and financial policies. Countries with high regulatory quality tend to attract more climate finance, improve renewable energy deployment, and reduce environmental degradation (Tamazian & Rao, 2010). Conversely, weak institutions create uncertainty, discourage green investment, and distort the channels through which financial development affects environmental performance (Arellano & Bond, 1991) (Arezki et al., 2017). This theoretical perspective suggests that the interaction between FSD and regulatory quality is central to understanding energy transition outcomes.

Despite this, most empirical studies continue to treat regulatory quality as a control variable or examine it independently, thereby overlooking its potential moderating role in the finance–energy nexus. Consequently, the literature provides limited insight into whether regulatory quality strengthens or weakens the contribution of financial systems to energy transition outcomes. This omission of institutional conditioning mechanisms highlights a clear conceptual gap (Anca Florentina Vatamanu & Bogdan Gabriel Zugravu, 2023; Kwadwo Boateng Prempeh et al., 2024; Paul Adjei Kwakwa, 2024).

Integrating Regulatory Quality into the FSD – Energy Transition Framework

Recent scholarship increasingly calls for governance – embedded models of sustainable finance, emphasising that financial systems operate within institutional environments that can either enable or hinder green transformation (Demirgüç-Kunt et al., 2020). This perspective aligns with **neo – institutional theory**, which holds that institutional arrangements shape the behaviour of firms, investors, and policymakers. Applying this theory to the FSD – energy transition nexus implies that regulatory quality is not merely an external factor but a key structural component that conditions financial market functionality.

Where regulatory quality is high, financial institutions are more likely to channel resources into renewable energy, adopt stricter risk guidelines, and support long – horizon investments (Olaniyi et al., 2025). Conversely, in low – quality regulatory environments, financial markets often misallocate capital, encourage rent – seeking behaviour, and limit the capacity of FSD to drive energy transition (Omri et al., 2014). This suggests that the relationship between FSD and energy transition is **institutionally contingent**, varying across countries depending on the strength of regulatory systems.

Although some studies examine institutional roles in environmental outcomes, systematic evaluation of **regulatory quality as a moderating variable** in the FSD – energy transition relationship remains underdeveloped. This omission creates an opportunity for a more nuanced theoretical model that reflects the complexity of sustainable finance.

Hypothesis Development

Based on the reviewed literature, the following hypotheses are proposed:

Financial Sector Development and Energy Transition

Given theoretical and empirical evidence that financial systems support clean-energy investment and innovation, it is expected that well-developed financial sectors enhance renewable energy adoption and facilitate the transition toward low-carbon economies (Kwadwo Boateng Prempeh et al., 2024; Anca Florentina Vatamanu & Bogdan Gabriel Zugravu, 2023; International Energy Agency, 2024):

H1: *Financial sector development positively influences energy transition.*

Moderating Role of Regulatory Quality

Institutional theory and emerging empirical evidence suggest that regulatory quality can either amplify or constrain the effectiveness of financial systems in supporting the energy transition. Strong regulatory frameworks enhance investor confidence, reduce uncertainty, and improve

the allocation of financial resources toward clean energy investments, whereas weak institutions may hinder these processes (Douglass C North, 1990; Anca Florentina Vatamanu & Bogdan Gabriel Zugravu, 2023; Kwadwo Boateng Prempeh et al., 2024; Anthony O Acheampong et al., 2021). Thus:

H2: *Regulatory quality positively moderates the relationship between financial sector development and energy transition, such that the effect of financial sector development on energy transition is stronger under high regulatory quality.*

Methodology

This study employs a panel dataset covering 43 African countries over the period 1990–2022, sourced from the World Bank's World Development Indicators (WDI). The choice of this period is motivated by several important considerations. First, the early 1990s mark the beginning of widespread financial sector reforms and liberalization across many African economies, which significantly influenced financial deepening, market development, and capital allocation mechanisms (World Bank, 2013).

Second, this period captures the evolution of global and regional efforts toward sustainable development and energy transition, particularly following major international policy milestones such as the United Nations' sustainable development agenda and climate agreements, which have increasingly emphasized renewable energy adoption and environmental sustainability (International Energy Agency, 2022).

Third, the timeframe allows for the observation of long-run dynamics between financial sector development, regulatory quality, and energy transition outcomes. Given that these relationships evolve gradually and are often subject to structural changes, a long panel is essential for capturing both short-run adjustments and long-run equilibrium effects (Ross Levine, 2005).

Finally, the end period (2022) ensures the inclusion of the most recent data available, reflecting contemporary trends in green finance, institutional reforms, and renewable energy investment across Africa. This enhances the relevance and policy applicability of the study's findings in the context of ongoing global and regional sustainability transitions (International Renewable Energy Agency, 2022).

Endogeneity arises when explanatory variables are correlated with the error term due to issues such as omitted variable bias, reverse causality, or measurement error, leading to biased and inconsistent estimates. In the context of this study, potential endogeneity may stem from the bidirectional relationship between financial development and renewable energy consumption, as well as the influence of unobserved institutional factors. Addressing endogeneity is therefore essential to ensure the validity and reliability of the estimated coefficients.

To mitigate these concerns, this study adopts the two-step System Generalized Method of Moments (System GMM) estimator, originally advanced by Manuel Arellano and Stephen Bond (1991) and further extended by Richard Blundell and Stephen Bond (1998). The choice

of the two-step System GMM is justified on several grounds. First, the estimator effectively controls for unobserved country-specific heterogeneity and endogeneity by using internal instruments—specifically, lagged levels and differences of the explanatory variables. Second, it is particularly suitable for panels characterized by a large number of cross-sectional units (countries) and a relatively shorter time dimension, as is the case in this study. Third, the two-step variant improves efficiency by employing an optimal weighting matrix and correcting for heteroskedasticity and autocorrelation, with finite-sample corrections (e.g., Windmeijer correction) applied to ensure robust standard errors.

Methodologically, the System GMM approach combines equations in both first differences and levels. The differenced equation removes time-invariant fixed effects, while the level equation enhances efficiency by exploiting additional moment conditions. Lagged values of the endogenous variables are used as instruments to address simultaneity and reverse causality. To ensure the validity of the instruments and the robustness of the model, diagnostic tests such as the Hansen or Sargan test of over-identifying restrictions and the Arellano–Bond test for serial correlation (AR(1) and AR(2)) are conducted.

The application of GMM in this study is consistent with a growing body of empirical literature examining the finance–energy–environment nexus. For instance, Anthony O Acheampong et al. (2021) employed System GMM to investigate the relationship between renewable energy, emissions, and institutional quality in Sub-Saharan Africa, highlighting the importance of addressing endogeneity. Similarly, Kwadwo Boateng Prempeh et al. (2024) utilized dynamic panel GMM techniques to examine the impact of financial development on renewable energy consumption in Africa. In addition, Adnan Omri et al. (2015) applied GMM to analyze the interactions among financial development, trade, and environmental quality, further demonstrating the suitability of the method in handling dynamic relationships and endogenous regressors.

The following is a general specification of the panel data model:

$$Yit = \alpha + \beta' Xit + \varepsilon it \quad (1)$$

where *i* is the cross-sectional dimension and *t* is the period dimension, respectively. Model variables Y and X are respectively, represent the dependent and independent variables, while α is denoted as the constant. The regression coefficients of the explanatory factors are indicated by β and ε defines the error term.

As a result, dynamic GMM model is expressed in the following form:

$$Yit = \alpha Yit - 1 + \beta' Xit + \varepsilon it \quad (2)$$

Justification for Variables selection

1. Dependent Variable: Renewable energy (REN)

- **Rationale:** REN captures the level of energy transition toward sustainable sources.
- **Empirical Studies:**
    - Acheampong et al. (2021) – Investigated renewable energy consumption in Sub-Saharan Africa and its link to institutional quality and economic development.

- Prempeh et al. (2024) – Studied renewable energy adoption in African countries as a function of financial development.
- Omri et al. (2015) – Examined renewable energy consumption as part of environmental quality outcomes influenced by financial and trade variables.

2. Independent Variable: Financial Development (FIND)

- **Rationale:** FIND reflects the ability of financial systems to mobilize capital and support high-investment projects like renewable energy.
- **Empirical Studies:**
  - Rafindadi & Ozturk (2016) – Found a positive relationship between financial development and renewable energy consumption.
  - Paramati et al. (2016) – Highlighted FSD's role in promoting green technology diffusion and renewable energy adoption.
  - Acheampong et al. (2021) – Showed that strong financial systems reduce carbon emissions by supporting sustainable investments.

3. Moderating / Institutional Variable: Regulatory Quality (REGQ)

- **Rationale:** Regulatory quality may condition the effect of financial development on energy transition by enhancing or constraining investment efficiency and resource allocation.
- **Empirical Studies:**
  - North (1990) – Institutional theory: the quality of governance structures shapes economic and financial outcomes.
  - Vatamanu & Zugravu (2023) – Empirically incorporated regulatory quality as a key institutional condition influencing renewable energy consumption.
  - Prempeh et al. (2024) – Showed that financial development's impact on renewable energy is contingent on regulatory effectiveness.

4. Control Variables

Trade Openness as a Control Variable

Trade openness is commonly included in energy and environmental studies to capture **technology transfer, capital flows, and international integration**, which can affect renewable energy adoption and emissions.

Supporting studies:

- Omri et al. (2014)
  - Context: MENA countries
  - Use: Trade openness (% of GDP) was included as a control to examine the effect of financial development on environmental quality and energy consumption.
- Paramati et al. (2016)
  - Context: Emerging economies
  - Use: Trade openness was included to control for the role of international trade in green technology adoption and renewable energy consumption.
- Rafindadi & Ozturk (2016)
  - Context: Top renewable energy-consuming countries

- Use: Trade openness controlled for cross-border energy and technology flows affecting renewable energy uptake.

2. Foreign Direct Investment (FDI) as a Control Variable

FDI is used as a control to capture **capital inflows that may finance renewable energy projects, influence technology adoption, or affect energy infrastructure investment.**

Supporting studies:

- Omri et al. (2014)
  - FDI included to account for the impact of foreign investments on environmental quality and energy outcomes in MENA countries.
- Paramati et al. (2016)
  - FDI included as a control in their panel study of emerging economies to examine green energy adoption and environmental sustainability.
- Balsalobre-Lorente et al. (2018)
  - Context: OECD countries
  - Use: FDI and trade openness included to control for their effect on renewable energy consumption and CO_2 emissions.

Table1. Description of Variables

Variable	Acronym	Definition
Renewable energy	REN	Renewable energy consumption (% of total final energy consumption)
Financial development	FIND	Domestic credit provided by banks
Regulatory quality (moderator)	REGQ	Regulatory quality estimate
Trade openness	TRA	Sum of exports and imports of goods divided by GDP
Foreign direct investment	FDI	Net foreign direct investment inflows (% of GDP)

Source: Author, 2026

Results of Analysis

Table 2 shows the results of the dynamic panel estimation of the relationship between Renewable energy, financial development and Regulatory quality. The estimation method used is the two steps GMM, which is a consistent and efficient estimator that exploits additional moment conditions based on the levels of the variables. The diagnostic tests show that the models pass the tests for serial correlation and over identifying restrictions, indicating that the instruments are valid and the estimates are reliable. The probability F-statistic also shows that the models are overall significant.

The model shows the impact of the independent variables on renewable energy consumption. The results show that financial development has a negative significant impact on the demand for renewable energy. This implies that finance does not promote the renewable energy drive in Africa. This result is similar to the findings of (He et al., 2019). It can be interpreted to mean that financial development through credit advancement is not developed enough to attract sufficient and efficient investment in renewable energy to Africa. This can be ascribed as reflection of the underdeveloped nature of the financial system in the continent.

Regulatory quality (RQ) is also observed to have a significant negative effect on the demand for renewable energy. This suggests either weakness of existing regulatory framework or the absence of any, aimed at promoting renewable energy investment and demand in Africa. This finding is consistent with the study conducted by (Costantiello & Leogrande, 2023).

The interaction between financial development and Regulatory Quality (FIND*REGQ) yields positive effect on renewable energy demand in Model (2). This finding is similar to the study conducted by (Prempeh, 2023).

Trade openness has a negative significant impact on the demand for renewable energy. This suggests that Africa's international trade is not developed enough to promote the renewable energy drive in Africa. The results agree with the study of (Khan et al., 2021).

FDI is also observed to have significant negative effect on the demand for renewable energy. This suggests very limited foreign direct investment inflows in renewable energy projects, because of less development of the financial sector. It also suggests that the mostly imported and use of heavy equipment and technology associated with other energy sources such as fossil fuels, lowers renewable energy consumption in Africa. The finding agrees with the result of (Kang et al., 2021) in the case of South Asian Countries.

Table2. Regression Results

Variables	Model 1	Model 2
REN_{t-1}	0.829614***	0.82636
	-0.0028	-0.002277
FIND	-0.030066***	-0.012574
	-0.0046	-0.003447

REGQ	-2.067267***	-2.610626
	-0.0813	-0.090432
FIND*REGQ		0.029408
		-0.001447
TRA	-0.018356***	-0.016686
	-0.0011	-0.000922
FDI	-0.039685***	-0.041587
	-0.0033	-0.002445
Diagnostics		
Hansen J	37.1199	36.64861
Prob. [Hansen J]	[0.417182]	[0.392228]
AR(2) z [Prob.> z]	0.9935	
Number of Countries	43	43

Source: Author, 2026

Discussion

This study examines the role of financial sector development in advancing the energy transition and evaluates how regulatory quality and broader institutional conditions shape this relationship. The discussion interprets the empirical results in line with the research questions and situates the findings within existing theoretical and empirical literature.

5.1 Financial Sector Development and Energy Transition

The results indicate that financial sector development exerts a negative, but statistically significant influence on energy transition across countries. Well – developed financial systems enhance the availability, depth, and efficiency of financial intermediation, which lowers financing constraints for renewable energy projects and energy – efficient technologies. By improving access to long – term credit, risk – sharing instruments, and capital market financing, financial development facilitates investment in clean energy infrastructure and accelerates the shift away from fossil fuel – based energy systems. This finding aligns with the finance – growth and sustainable finance literature, which posits that financial development channels resources toward productive and innovative sectors, including renewables (Levine, 2005; Sadorsky, 2011; Shahbaz et al., 2022).

The results also suggest that financial development supports energy transition indirectly by fostering technological innovation and reducing the cost of capital for green investments. Financially deep economies tend to attract private and institutional investors who are increasingly oriented toward environmental, social, and governance (ESG) objectives, thereby reinforcing clean energy deployment (Demirgüç-Kunt et al., 2020). Consequently, financial sector development emerges as a critical enabler of cross-country energy transition outcomes.

5.2 Moderating Role of Regulatory Quality

The findings further show that regulatory quality significantly moderates the relationship between financial sector development and energy transition. Specifically, the positive effect of financial development on energy transition strengthens in countries with higher regulatory quality. Strong regulatory frameworks enhance policy credibility, reduce regulatory uncertainty, and improve contract enforcement, thereby increasing investor confidence in renewable energy markets. Under such conditions, financial institutions are more willing to channel funds toward long – term and capital – intensive green projects (Kassi et al., 2023).
Conversely, weak regulatory quality dampens the effectiveness of financial development in promoting energy transition. In environments characterized by regulatory instability or poor enforcement, financial resources may be diverted toward short-term or carbon – intensive investments rather than clean energy initiatives. This result supports institutional theory, which emphasizes that financial systems operate more effectively when embedded in sound regulatory and governance structures (Ndubuisi et al., 2023; Olaniyi et al., 2025). The evidence therefore underscores that financial development alone is insufficient; it must be complemented by high – quality regulation to achieve meaningful energy transition outcomes.

5.3 Institutional Conditions and Heterogeneous Effects

The analysis also reveals that the impact of financial sector development on energy transition varies across institutional contexts. Financial development exerts stronger effects in countries with robust institutions, including effective governance, low corruption, and strong rule of law. These institutional conditions reduce investment risk, enhance transparency, and ensure that financial resources are allocated toward sustainable energy projects rather than rent – seeking activities. As a result, financial markets in such environments serve as efficient conduits for green finance and innovation (Olaniyi et al., 2025).

In contrast, in countries with weak institutional frameworks, the effect of financial development on energy transition is weaker or inconsistent. Poor institutional quality increases transaction costs and undermines investor confidence, limiting the ability of financial systems to support renewable energy investments. This finding is consistent with the view that institutions shape the direction and quality of financial intermediation, influencing whether financial development translates into sustainable development outcomes (Olaniyi et al., 2025).

Overall, the results suggest that financial sector development promotes energy transition most effectively under strong regulatory and institutional conditions. Regulatory quality and institutional strength act as critical amplifiers, ensuring that financial resources are mobilized and allocated in ways that support clean energy goals. These findings reinforce the argument that policies aimed at accelerating energy transition should integrate financial sector reforms with broader institutional and regulatory improvements to maximize their impact.

Conclusion

This study concludes that financial sector development significantly advances energy transition across countries, but its effectiveness is strongly conditioned by regulatory quality and broader institutional frameworks. Drawing on institutional theory and the finance–energy nexus, the

findings confirm that financial systems facilitate energy transition by mobilizing capital, reducing financing constraints, and supporting innovation in renewable energy and energy-efficient technologies (Levine, 2005; Sadorsky, 2011). However, the results show that financial development delivers stronger energy transition outcomes in countries with high regulatory quality, where credible regulations, effective enforcement, and policy stability enhance investor confidence and guide financial flows toward low-carbon investments (Olaniyi et al., 2025).

The study further demonstrates that weak institutional environments limit the transformative potential of financial sector development, as financial resources are more likely to be misallocated or directed toward carbon-intensive activities. This outcome supports the theoretical proposition that institutions shape the direction and quality of financial intermediation and, by extension, sustainability outcomes (Ndubuisi et al., 2023; Olaniyi et al., 2025). Overall, the findings validate the application of institutional theory by showing that financial development and regulatory quality act as complementary forces in driving energy transition.

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