

GREEN FINANCIAL DEVELOPMENT AND SUSTAINABLE ECONOMIC GROWTH IN PAKISTAN: A PATHWAY TO RESILIENCE AND PROSPERITY

Waqar Jalal¹, Dr. Mahboob Ullah²

¹PhD Scholar, Department of Management Sciences, Abasyn University Peshawar, Pakistan

²Associate Professor, Department of Management Sciences, Abasyn University Peshawar, Pakistan

¹waqar18713@abasyn.edu.pk, ¹waqar.jalal1@gmail.com, ²mahboob.ullah@abasyn.edu.pk

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Corresponding Author: *

Waqar Jalal

Abstract

This study investigates the dynamic relationship between Green Financial Development (GFD) and Sustainable Economic Growth (SEG) in Pakistan, an emerging economy facing severe environmental and economic challenges. Utilizing annual data from 2000 to 2022 and employing the Autoregressive Distributed Lag (ARDL) bounds testing approach, the research examines the short and long term effects of Green Credit, Green Insurance, Green Securities, Green Investment, and Foreign Direct Investment (FDI) on Sustainable Economic Growth. The study also incorporates Urban Population and Technology as control variables. Results of this study reveals that Green Credit And Green Securities significantly promote Sustainable Growth, while Green Investment And Technology show adverse effects. Also Green Insurance contributes positively in the short term but not in the long run. Granger causality analysis confirms a unidirectional causal relationship from Green Credit to Sustainable Growth. These findings underscore the pivotal role of Green Finance in shaping Pakistan's sustainable development trajectory and provide evidence-based recommendations for policymakers to optimize green financial instruments and enhance institutional frameworks. The study contributes to the growing literature on sustainable finance by offering insights from a developing country scenario.

INTRODUCTION

The mounting severity of climate change, environmental degradation, and natural resource depletion has intensified the global urgency for economies to transition toward sustainable development models. This shift necessitates the integration of environmental considerations into economic and financial policymaking, giving rise to the concept of Green Financial Development (GFD). GFD encompasses a range of financial instruments, practices, and policies that facilitate environmentally sustainable investments while supporting economic

growth objectives (Agrawal et al., 2024; W. Fu & M. Irfan, 2022). It represents a crucial intersection between environmental sustainability and financial systems, enabling the redirection of capital flows from carbon-intensive industries toward climate-resilient, low-emission, and resource-efficient sectors. The global financial landscape has responded to the climate agenda with an increasing emphasis on green finance, defined broadly as the allocation of capital to projects that deliver positive environmental externalities. Instruments such as green bonds, green

loans, green insurance, and sustainability-linked financing mechanisms have become integral to this transformation (Gupta & Kumar, 2024; Sadiq et al., 2022). Financial institutions are progressively incorporating Environmental, Social, and Governance (ESG) criteria into credit risk assessments and investment decisions, driven by regulatory pressure, investor demand, and reputational considerations. The strategic adoption of green finance has been further galvanized by international commitments, including the Paris Agreement and the United Nations Sustainable Development Goals (SDGs), particularly SDG 13 (Climate Action) and SDG 8 (Decent Work and Economic Growth) (Afzal et al., 2022).

Green finance is more than an environmental imperative it is increasingly recognized as a catalyst for long-term economic growth and structural transformation. Evidence from both developed and emerging economies suggests that green financial instruments can promote green technological innovation, enhance energy efficiency, and improve environmental quality, all while generating employment and boosting productivity (Abbasi et al., 2022; Feng et al., 2022). For instance, green credit schemes have been instrumental in financing energy-efficient industries and promoting renewable energy transitions, while green bonds have enabled large-scale investments in climate-resilient infrastructure (Lei et al., 2023). These developments underscore the dual role of green finance in achieving environmental sustainability and supporting sustainable economic growth. Despite its growing relevance, the deployment of GFD remains uneven across regions. Developed economies, supported by mature capital markets and robust institutions, have made significant strides in mainstreaming green finance. In contrast, many developing economies—including Pakistan—face critical structural and institutional barriers that impede the growth of green financial markets. These include limited regulatory capacity, a lack of standardized definitions and metrics, insufficient awareness among financial institutions, and fragmented data systems (Nawaz et al., 2021). Additionally, Pakistan's economy is highly vulnerable to climate change impacts such as floods, water scarcity, and temperature variability, making

the adoption of green finance not only desirable but essential for resilience and inclusive development.

Pakistan has taken initial steps toward fostering green financial practices. The State Bank of Pakistan (SBP) introduced green banking guidelines and encouraged financial institutions to develop ESG-aligned lending portfolios. Moreover, the Securities and Exchange Commission of Pakistan (SECP) has begun exploring frameworks for green bonds and sustainable investment disclosures. However, these efforts are often isolated and lack a coherent national strategy or strong institutional coordination (Sadiq et al., 2022). The country's green finance landscape remains underdeveloped in comparison to its regional peers, underscoring the need for empirical research and policy frameworks to guide its evolution. From a theoretical perspective, the nexus between financial development and economic growth has long been established in economic literature (Beck et al., 2000; King & Levine, 1993). However, GFD introduces a sustainability dimension by internalizing ecological risks and addressing market failures associated with environmental externalities (Jabeen & Khan, 2022; Sohag et al., 2019).

In light of these considerations, this study seeks to contribute to the growing body of literature on green finance by examining the impact of five core dimensions of Green Financial Development—green credit, green securities, green insurance, green investment, and environmentally aligned foreign direct investment (FDI)—on sustainable economic growth in Pakistan. Furthermore, this research incorporates urbanization and technological advancement as control variables, recognizing their significant influence on economic and environmental dynamics. Given the paucity of comprehensive empirical studies in the Pakistani context, this investigation offers timely insights for policymakers, investors, and development practitioners interested in leveraging green finance as a tool for climate resilience and sustainable development.

Literature Review

The discourse surrounding Green Financial Development (GFD) has gained unprecedented relevance as global economies struggle with the dual

imperatives of economic advancement and environmental preservation. Green finance, as a critical subset of sustainable finance, is designed to support economic activities and projects that deliver positive environmental outcomes while fostering long-term economic growth. In recent years, the conceptual and empirical linkages between green financial instruments and economic growth have increasingly garnered scholarly attention, particularly in the context of emerging and developing economies (Nawaz et al., 2021). Central to GFD is the deployment of financial instruments and mechanisms that internalize environmental externalities and incentivize environmentally responsible behaviors across sectors. Green credit, for example, has emerged as a pivotal tool in aligning financial intermediation with environmental objectives. (Li et al., 2022) empirically demonstrated that Green Credit enhances Sustainable Economic Growth by channeling funds into low-carbon technologies and energy-efficient enterprises. Similarly, (Li et al., 2020) provided quasi-natural experimental evidence from China confirming that Green Credit policies significantly improve environmental, social, and governance (ESG) performance of firms. In Addition, Green bonds and other Green Securities serve as capital mobilization vehicles for financing renewable energy, green infrastructure, and sustainable urban development. (Tang & Zhang, 2020) argue that green bonds not only reduce financing costs for issuers but also offer reputational gains through enhanced corporate social responsibility (CSR) signaling. These bonds are particularly effective in promoting high-quality economic development when supported by well-functioning regulatory and certification systems (Li et al., 2020; Tolliver & Keeley, 2020). The rapid expansion of the green bond market has been partially driven by commitments under the Paris Agreement and Nationally Determined Contributions (NDCs), highlighting the interplay between international policy and financial innovation (Sadiq et al., 2022). Green Insurance, although a relatively less explored component of GFD, plays an instrumental role in mitigating environmental risks and enhancing the resilience of eco-friendly investments. As highlighted by (Klapkiv & Ülgen, 2023), insurance mechanisms designed to

underwrite environmental liabilities can lower the financial risks associated with green technology ventures and infrastructure development. These instruments contribute to financial stability while safeguarding ecological integrity in vulnerable sectors.

Moreover, Foreign direct investment (FDI) aligned with environmental sustainability represents another important dimension of GFD. Empirical studies have shown that Green FDI contributes to technological diffusion, capacity building, and institutional strengthening in host countries (Weiwei Fu & Muhammad Irfan, 2022; Qenaat et al., 2025; Xu et al., 2023). Moreover, FDI directed toward renewable energy, clean manufacturing, and sustainable services offers substantial economic benefits while reducing the ecological footprint (Wang et al., 2021). (Yi et al., 2023) revealing a U-shaped relationship that underscores the heterogeneous effects of FDI across different levels of innovation intensity. However, as noted by (Kamal et al., 2021), the environmental impact of FDI is contingent on institutional quality, environmental regulation, and host-country absorptive capacity. The significance of Green Investment extends beyond direct financial returns, as it supports innovation, decarbonization, and job creation in emerging green sectors. (Xinxin & Ping, 2019) contend that institutional investors are increasingly constructing green portfolios to align profitability with sustainability, thereby contributing to both financial market stability and environmental goals. Similarly, (Zhai et al., 2024) emphasize that green financial tools such as sustainability-linked loans and ESG tied securities are crucial for transitioning to zero-carbon economies. In the South Asian context, particularly Pakistan, GFD remains underexplored despite the region's acute vulnerability to climate change and environmental degradation. (Nawaz et al., 2021) noted that green finance in Pakistan is fragmented and lacks a coherent regulatory framework. Their study indicates that although isolated initiatives exist, their impact is limited by poor inter-agency coordination, lack of awareness among financial institutions, and data paucity. (Sadiq et al., 2022) further argue that the effective deployment of green financial instruments in South Asia requires not only fiscal and monetary support but also technological

innovation and policy alignment. The theoretical foundation of GFD lies in the broader discourse on financial development and its relationship with economic growth, enhanced by an environmental sustainability lens. The Environmental Kuznets Curve (EKC) hypothesis posits that as income increases, environmental degradation initially rises and then falls, assuming the adoption of cleaner technologies and stricter regulations (Zeng et al., 2023). Green finance can accelerate the turning point of the EKC by facilitating investments in green innovation, promoting resource efficiency, and reducing carbon intensity (Liu et al., 2023).

Nonetheless, the development of Green Finance in low and middle income countries faces significant barriers. These include weak institutional frameworks, absence of standardized definitions and metrics, and limited capacity of financial markets to absorb and manage green risks (Mudretsov & Prudnikova; Sun et al., 2022). Furthermore, the lack of reliable data on green finance flows and environmental impacts impedes evidence-based policymaking and investor confidence (Nawaz et al., 2020). To address these challenges and strengthen the nexus between GFD and sustainable economic growth in Pakistan, recent empirical models have begun to incorporate control variables such as urbanization, digital infrastructure, and technological advancement. These factors are essential in shaping the diffusion of green finance and moderating its effects on environmental and economic outcomes (Li & Hu, 2021; Tan et al., 2024). Additionally, the mediating role of institutional quality and governance effectiveness has been highlighted as a determinant of the success of green financial strategies (Jahanger et al., 2022; Sun et al., 2025). In conclusion, the literature strongly supports the hypothesis that GFD can drive SEG, especially when it is well-integrated into national development strategies, supported by robust institutions, and complemented by sound environmental policies. The Pakistani context, while lagging behind, presents an opportunity for strategic interventions aimed at building a resilient, low-carbon, and inclusive economy. Future research must focus on the quantification of GFD impacts, the development of composite indices, and the design of

context-specific policy tools to harness the transformative potential of green finance.

Methodology

Research Design and Objectives

This study employs ARDL approach to examine the effects of green financial development (GFD) on sustainable economic growth (SEG) in Pakistan. Specifically, the study aims to assess both the short-run and long-run relationships between key green finance indicators—Green Credit (GC), Green Securities (GSEC), Green Insurance (GINS), Green Investment (GINV), and Foreign Direct Investment (FDI)—and SEG. Two control variables—Urban Population (URBANPOP) and Technology (TECH)—are incorporated to account for structural and demographic factors influencing sustainability outcomes.

The research is guided by the following objectives:

To determine the impact of green financial instruments on Pakistan's sustainable economic growth.

To investigate the direction and nature of causal relationships among the variables using Granger causality tests.

To provide policy recommendations based on empirical findings.

Data Sources and Period

The study utilizes annual time-series data spanning the period from 2000 to 2022. The data were sourced from reliable sources i.e. World Development Indicators (WDI) and State Bank of Pakistan (SBP). All variables were transformed into logarithmic form where applicable to normalize distributions and minimize heteroscedasticity.

Model Specification

Based on the reviewed literature, the present research has formulated the following estimation equation:

$$SEG_t = \alpha_0 + \beta_1 GC_t + \beta_2 GSECT + \beta_3 GINSt + \beta_4 GINvt + \beta_5 FDI_t + \beta_6 URBANPOP_t + \beta_7 TECH_t + \epsilon_t \quad (1)$$

Where;

SEG = Sustainable Economic Growth

t = Time Period

GC = Green Credit

GSEC = Green Securities
 GINS = Green Insurance
 GINV = Green Investment
 FDI = Foreign Direct Investment

URBANPOP= Urban Population
 TECH= Technology
 e: Error term

Variable Construction						
1. Category	No.	Variable	Abbr.	Measurement	Reference	Source
<i>GFD</i>	1	Green Credit	GC	Green credit / Total loans	(Nawaz et al., 2021)	SBP
	2	Green Investment	GINV	Env. expenditure / Total fiscal expenditure	(Nawaz et al., 2021)	SBP
	3	Green Insurance	GINS	Agri. insurance / Total insurance	(Nawaz et al., 2021)	SBP
	4	Green Securities	GSEC	Env. company value / Total A-share value	(Nawaz et al., 2021)	WBD
	5	Foreign Direct Investment	FDI	FDI net inflows (% of GDP)	(Nawaz et al., 2021)	WBD
<i>SEG</i> <i>Control Variables</i>	6	Sustainable Econ. Growth	SEG	GDP + EE - NRP - NFD - CO ₂ *	(Sohag et al., 2019)	WBD
	7	Technology	Tech	Mobile phone subscribers (per 100 people)	(Afzal et al., 2022)	WBD
	9	Urban Population	Urban	Urban population (% of total population)	(Afzal et al., 2022)	WBD

*Note: GDP = Growth (%); EE = Edu. exp. (% of GDP); NRP = Fossil fuel use (%); NFD = Forest depletion (% of GNI); CO₂ = Emission damage (% of GNI)
 SBP = State Bank of Pakistan; WBD = World Bank Database

Econometric Techniques

To ensure the validity and reliability of the empirical results, a comprehensive suite of econometric techniques was employed. The initial step involved testing the stationarity properties of the time series data to avoid spurious regressions. For this purpose, the Augmented Dickey-Fuller (ADF) unit root test was applied to each variable, allowing the determination of their order of integration, whether stationary at level (I(0)) or first difference (I(1)). This foundational step was crucial in selecting an appropriate modeling strategy. Since the variables exhibited a mixed order of integration, the study employed the Autoregressive Distributed Lag (ARDL) bounds testing approach, as proposed by (Pesaran et al., 2001). The ARDL framework is particularly suitable for small sample sizes and accommodates a combination of I(0) and I(1) variables without requiring pre-testing for unit roots

in a restrictive manner. Upon establishing the presence of a long-run co-integrating relationship among the variables, an Error Correction Model (ECM) was estimated to capture the short-run dynamics and the speed at which deviations from the long-run equilibrium are corrected. The coefficient of the lagged error correction term (ECMt-1) reflects the rate of adjustment toward equilibrium in each period. In addition to co-integration analysis, Pairwise Granger Causality tests based on the Vector Autoregressive (VAR) framework were conducted to investigate the direction of causality among the proxies of Green Financial Development (GFD) and Sustainable Economic Growth (SEG). This approach facilitates the understanding of temporal precedence between variables, providing deeper insights into potential lead-lag relationships. All econometric analyses, including stationarity testing, ARDL estimation, ECM modeling, and Granger causality

analysis, were implemented using EViews 12 software, ensuring rigorous statistical diagnostics and robust time-series modeling throughout the study

Results and Analysis

This section presents the empirical findings of the study. The analysis proceeds in stages: descriptive statistics, correlation analysis, unit root testing, ARDL bounds testing for co-integration, short- and long-run estimations, and Granger causality analysis.

Descriptive Statistics

Descriptive statistics provide insights into the distributional characteristics of the study variables. As shown in Table 1, the average value of Sustainable Economic Growth (SEG) is negative, suggesting persistent sustainability challenges in Pakistan during the study period.

Table 1
Descriptive Statistics of Variables (2000–2022)

Variable	Obs	Mean	Std. Dev	Min	Max
SEG	23	-35.46	30.17	-59.93	8.60
FDI	23	-0.07	0.29	-0.45	0.56
GC	23	-0.32	1.74	-8.26	0.63
GINS	23	0.20	0.77	-0.04	3.75
GSEC	23	3.12	4.18	-3.45	17.88
GINV	23	-4.19	1.07	-6.95	-2.94
URBANPOP	23	35.24	1.43	32.98	37.73
TECH	23	42.25	28.71	0.20	81.55

Correlation Matrix

The correlation matrix (Table 2) reveals no multicollinearity concerns, as all correlation coefficients are well below the 0.90 threshold. SEG is positively associated with most green finance indicators, particularly GC, GINS, GINV, and URBANPOP.

Table 2
Correlation Matrix

Variables	SEG	FDI	GC	GINS	GSEC	GINV	URBANPOP	TECH
SEG	1.000							
FDI	-0.376	1.000						
GC	0.149	0.100	1.000					
GINS	0.302	-0.080	0.054	1.000				
GSEC	0.080	-0.298	0.354	-0.166	1.000			
GINV	0.427	0.135	-0.086	0.242	-0.161	1.000		
URBANPOP	0.827	-0.327	-0.030	0.318	-0.044	0.698	1.000	

TECH	0.558	-0.136	-0.118	0.278	0.036	0.718	0.811	1.000
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Unit Root Test

The Augmented Dickey-Fuller (ADF) test results in Table 3 show that some variables are stationary at level [I(0)], while others are stationary at first difference [I(1)]. This mixed integration order justifies the use of the ARDL model.

Table 3

ADF Unit Root Test Results

Variable	Level	t-Statistic	p-Value	Order of Integration
SEG	I(1)	-0.6762	0.0030	Stationary at 1st Diff
FDI	I(1)	-3.7111	0.0118	Stationary at 1st Diff
GC	I(0)	-5.0227	0.0006	Stationary at Level
GINS	I(0)	-4.6692	0.0013	Stationary at Level
GSEC	I(0)	-4.7702	0.0011	Stationary at Level
GINV	I(1)	-4.7752	0.0012	Stationary at 1st Diff

ARDL Bounds Test for Co-Integration

The ARDL bounds test results (Table 4) indicate the presence of a long-run relationship among the

variables, as the F-statistic exceeds the upper bound at all significance levels.

Table 4

ARDL Bounds Test Results

Model	F-Statistic	Lag	1% Bound	5% Bound	10% Bound
SEG / (GC, GINS, GSEC, GINV, FDI, URBANPOP, TECH)	25.997	2	2.73	2.17	1.92

Short-Run ARDL Estimation

Table 5 displays the short-run coefficients. Green Credit (GC), Green Insurance (GINS), and Green Securities (GSEC) positively and significantly

influence SEG. However, Green Investment (GINV) and Urban Population have negative short-run effects.

Table 5

Short-Run ARDL Results

Variable	Coefficient	Std. Error	t-Statistic	p-Value
D(GC)	2.1129	0.2628	8.0399	0.0002
D(GINS)	7.7623	0.6438	12.0578	0.0000
D(GSEC)	0.7926	0.1092	7.2575	0.0003
D(GINV)	-8.8490	1.0547	-8.3901	0.0002
D(URBANPOP)	-1254.347	54.371	-23.0702	0.0000
CointEq(-1)	-1.3268	0.0568	-23.3653	0.0000

Long-Run ARDL Estimation

Table 6 presents long-run coefficients. GC, GSEC, FDI, and URBANPOP have positive long-run

impacts on SEG. Conversely, GINS, GINV, and TECH negatively affect SEG in the long run.

Table 6
Long-Run ARDL Results

Variable	Coefficient	Std. Error	t-Statistic	p-Value
GC	4.6180	0.1492	30.9583	0.0000
GSEC	1.0145	0.0792	12.8066	0.0000
FDI	35.4590	2.0203	17.5518	0.0000
URBANPOP	68.7415	1.0477	65.6133	0.0000
GINS	-7.9016	1.4313	-5.5206	0.0015
GINV	-13.4288	0.7840	-17.1282	0.0000
TECH	-1.3647	0.0567	-24.0568	0.0000

Granger Causality Analysis

Granger causality results (Table 7) indicate a unidirectional causality from Green Credit to SEG

and from SEG to Urban Population. No causal relationships were found for GINS, GSEC, GINV, TECH, or FDI.

Table 7
Granger Causality Test Results

Null Hypothesis	F-Statistic	p-Value	Causality
GC does not Granger Cause SEG	112.268	0.0000	Unidirectional
SEG does not Granger Cause GC	0.2963	0.7476	No
SEG does not Granger Cause URBANPOP	6.1910	0.0102	Unidirectional
All others	p > 0.05		No causality

Discussion

The empirical findings of this study provide strong evidence of the influence of Green Financial Development (GFD) on Sustainable Economic Growth (SEG) in Pakistan. Both short-run and long-run estimations demonstrate the multifaceted impacts of various green financial instruments. The causality analysis further substantiates the dynamic and directional interactions between green finance and environmental sustainability, offering actionable insights for green policy formulation. In the short run, Green Credit (GC), Green Insurance (GINS), and Green Securities (GSEC) exhibit statistically significant and positive effects on SEG. This finding aligns with the broader literature that emphasizes the catalytic role of green-oriented financial products in promoting low-carbon and inclusive growth. Specifically, GC emerges as a critical determinant of SEG, as it enables the reallocation of financial resources toward environmentally responsible sectors. (Lei et al., 2023) and (Chen et al., 2022)

underscore that policy-driven green credit programs improve resource allocation efficiency and stimulate eco-innovation, which enhances both industrial productivity and environmental performance. GINS plays a pivotal role in de-risking Green Investments and facilitating the adoption of sustainable practices among firms. (Klapkiv & Ülgen, 2023; Xu et al., 2023) contend that environmentally targeted insurance mechanisms reduce liability uncertainty and encourage risk-averse enterprises to undertake long-term green projects. These risk mitigation tools are particularly relevant in developing economies where ecological volatility and weak regulatory frameworks discourage investment in clean sectors. Additionally, GSEC, including climate bonds and ESG-linked equities, are found to contribute positively to SEG through capital mobilization for sustainable infrastructure, renewable energy, and climate-resilient agriculture (Jian, 2023; Tang & Zhang, 2020). The deepening of green capital

markets in Pakistan could thus serve as a strategic lever to bridge the sustainable investment gap.

On the contrary, GINV demonstrates a negative and statistically significant relationship with SEG in both the short and long run. This counterintuitive outcome suggests that inefficiencies may exist in the allocation or utilization of Green Finance resources in Pakistan. Potential explanations include delayed project implementation, inadequate environmental due diligence, and governance challenges such as bureaucratic inefficiencies and weak monitoring mechanisms. These findings corroborate the observations of (Nawaz et al., 2021), who argue that Pakistan's green fiscal and investment frameworks suffer from institutional fragmentation and lack strategic coherence. As such, improving the institutional architecture and strengthening project evaluation criteria are necessary steps for reversing the underperformance of Green Investments. Technology (TECH), surprisingly, exhibits a negative association with SEG in the long run. Although technological advancement is generally perceived as a driver of economic modernization and environmental efficiency, this finding points to a potential misalignment between technological adoption and sustainability goals. In Pakistan's context, much of the technological deployment may still be rooted in energy-intensive, pollution-prone industries rather than green innovations. (Jianing, 2022) emphasize that the sustainability impact of technology depends on its orientation whether it is directed toward clean energy, emissions reduction, and resource optimization, or merely productivity enhancement without environmental considerations. This result highlights the importance of channeling technological investments into green digital infrastructure, smart grids, and AI-based sustainability tools. The Granger causality analysis reveals a unidirectional causal relationship running from GC to SEG. This confirms the foundational role of green lending in shaping long-term sustainability outcomes and affirms its utility as a policy tool for driving eco-friendly economic transformation. The finding supports the conclusions of (Wang et al., 2020), who identify GC as a leading indicator of environmental and economic convergence, particularly in emerging economies with transitioning financial systems. This

directional causality indicates that targeted green lending programs can serve as a primary policy channel to promote sustainable development and low-carbon transition.

Moreover, the results indicate reverse causality from SEG to Urban Population, suggesting that economic growth leads to increased urbanization. While urbanization can enhance economic efficiency through agglomeration effects, unplanned or rapid urban expansion may exacerbate environmental degradation, strain infrastructure, and reduce quality of life. As highlighted by (Jabeen & Khan, 2022), urban growth often lacks sustainability planning, leading to increased pollution, land degradation, and pressure on natural resources. Therefore, sustainable urban planning must be integrated with Green Financial Development to manage the socio-ecological implications of demographic concentration. Collectively, these findings underscore the complex but critical role that GFD plays in shaping sustainable economic outcomes in Pakistan. While instruments such as Green Credit, Green Securities, and Green Insurance demonstrate clear potential, challenges persist in effectively leveraging Green Investment and aligning technological advancement with sustainability objectives. Strengthening institutional quality, enhancing inter-agency coordination, and embedding ESG frameworks across the financial sector will be crucial in maximizing the developmental dividends of GFD in the country.

Theoretical and Practical Implications

Theoretical Contribution

This study adds to the emerging body of knowledge in green finance by empirically validating the relationship between GFD and SEG in a lower-middle-income context. Prior research has mostly concentrated on developed nations or large emerging economies like China and India. By focusing on Pakistan, this study expands the theoretical boundaries of the Environmental Kuznets Curve (EKC) which suggest that financial systems, when aligned with environmental goals, can mitigate ecological degradation during economic expansion (Ali et al., 2017).

Practical Implications

From a policy and practice perspective, the results offer several implications for financial regulators, development planners, and institutional investors: Given the strong performance of green credit, the State Bank of Pakistan should expand its green banking guidelines, introduce refinancing facilities for green loans, and develop environmental risk assessment frameworks within the banking sector. The positive role of green securities suggests a need to incentivize green bond issuance and establish a dedicated green stock index. Investor education and tax benefits can accelerate this process. The inefficacy of green investment signals a need to reassess government spending mechanisms. Projects should be vetted based on environmental return-on-investment (eROI) criteria and transparency should be improved. Policies should prioritize FDI that brings clean technologies, such as renewable energy, green logistics, or circular economy solutions. Pakistan's Board of Investment could offer preferential terms for such ventures. Technology investment must be reoriented toward sustainable innovation, including clean energy, digital governance for climate monitoring, and sustainable urban systems.

Conclusion

This study provides compelling empirical evidence on the role of Green Financial Development (GFD) in fostering Sustainable Economic Growth (SEG) in Pakistan. Utilizing annual time-series data from 2000 to 2022, the research applied the ARDL bounds testing approach, error correction modeling, and Granger causality analysis to examine the impact of five key green finance indicators—green credit, green securities, green insurance, green investment, and foreign direct investment—on SEG, with urbanization and technology serving as control variables.

The results reveal that green credit, green securities, and foreign direct investment positively influence sustainable economic growth in both the short and long run. In contrast, green investment and technology demonstrate negative effects, pointing to potential inefficiencies in public expenditure and misaligned technological priorities. Green insurance

contributes positively in the short run but not in the long term. Granger causality testing confirms that green credit causes sustainable economic growth, emphasizing its strategic policy relevance. These findings highlight the multifaceted nature of GFD and its capacity to drive economic transformation. However, they also underscore critical structural and institutional weaknesses that must be addressed to maximize the effectiveness of green financial instruments in Pakistan.

Policy Recommendations

Based on the findings, these actionable policy strategies are proposed, First Scale up Green Credit Mechanisms by Introducing sector-specific green credit lines for renewable energy, green manufacturing, and sustainable agriculture. Implement regulatory mandates for environmental risk disclosures in credit underwriting. Second Strengthen Green Securities Infrastructure through establishing a national green bond framework in line with international taxonomies. Offer fiscal incentives for listing green firms and issuing sustainable bonds. Third Optimize Public Green Investment via Conducting cost-benefit and environmental impact analyses before project financing. Shift from input-based budgeting to performance-based green project funding. Fourth is Leverage Environmentally Aligned FDI by Screen incoming FDI based on ESG performance. Provide preferential tax treatment for green technology transfer and infrastructure. Fifth is Align Technology with Green Goals via creating incentives for R&D in clean tech and green digital innovation. Invest in smart grids, e-governance for emissions tracking, and AI for water/energy conservation last one is to Promote Integrated Green Finance Policies through an integrated approach that combines green credit, green securities, and responsible investment practices is essential to achieving long-term sustainable growth. Financial institutions, regulators, and governments must collaborate to develop comprehensive green finance policies that support sustainable economic transitions.

Limitations and Future Research Directions

While this study provides valuable insights into the relationship between green financial development

(GFD) and sustainable economic growth (SEG), certain limitations must be acknowledged. The reliance on secondary data for green financial indicators poses challenges, especially in developing economies like Pakistan, where data granularity, consistency, and availability are often limited. The focus on a single country further restricts the generalizability of the findings, as variations in financial systems, regulatory frameworks, and economic conditions across countries may lead to different outcomes. Also this study ignore the role of different moderating, mediating variables like institutional quality, policy coherence, environmental sustainability and governance etc. These limitations present opportunities for future research, including cross-country comparative analyses to capture diverse global perspectives on the relationship between GFD and SEG. Researchers could also employ advanced econometric methods to uncover complex interactions and explore sector-specific implications in industries such as renewable energy, agriculture, or transportation. Additionally, examining the moderating or mediating effect on the nexus between GFD on SEG would offer valuable insights into the sustainability of current policies and practices. By addressing these gaps, future research can contribute to a deeper understanding of GFD's role in driving sustainable economic growth and provide targeted policy recommendations for effective implementation.

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