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Synergistic Role of FinTech and Green Finance in CO₂ Emissions Reduction in Pakistan

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ABSTRACT

The escalating threat of climate change necessitates innovative financial and technological strategies to reduce carbon emissions while sustaining economic growth. This study investigates the synergistic role of financial technology (fintech) and green finance in mitigating CO₂ emissions in Pakistan using annual time-series data from 1995 to 2023. Employing the ARDL bounds testing approach, the research examines both short-run and long-run dynamics among CO₂ emissions, fintech adoption, green finance, population growth, and industrialization. Empirical results indicate that fintech and green finance significantly reduce CO₂ emissions by enhancing financial inclusion, improving resource allocation, enabling real-time monitoring, and directing investments toward low-carbon technologies and sustainable infrastructure. Conversely, population growth and industrialization exert upward pressure on emissions. Model diagnostics confirm robustness, with no evidence of autocorrelation, heteroskedasticity, or misspecification. The findings suggest that integrating digital financial systems with environmentally focused investment policies can promote sustainable economic development and effective decarbonization. Policymakers are encouraged to strengthen digital financial infrastructure, expand green financial instruments, and implement coordinated strategies to manage demographic and industrial pressures.



Introduction

The problem of climate change has become one of the most urgent world issues of the twenty-first century, and the increasing level of carbon emissions is a serious threat to the environmental stability, the economic growth, and social prosperity. The fast industrialization process, population growth and rising energy consumption have led to a rise in greenhouse gas emissions both in the developed and the developing economies. In the case of emerging countries, this is an especially complicated task, since they have to consider the economic development and the ecosystem simultaneously. In this respect, novel financial and technological processes are attracting growing interest as means of assisting low-carbon transformations and sustainable development courses (Stern, 2007).

The idea of sustainable development has basically transformed the concept of policy and academic literature vibrating on the importance of combining economic growth with environmental conservation. According to sustainable development frameworks, economic growth should be within ecological level to guarantee the prosperity of the future and intergenerational equity. Nonetheless, it will take a great deal of money, a technological breakthrough, and a revolution within the institution to strike this balance. Conventional policy tools are usually not adequate to deal with the magnitude and sophistication of climate issues. Consequently, financial innovation and digital transformation have become the key elements of modern sustainability strategies (Shahbaz et al., 2020; Ozili, 2018; Zhou et al., 2022; Sibte-Ali, 2025).

Green finance has emerged as a significant tool of ensuring that economic activity is done in a responsible manner that compliments the environment by focusing capital to projects that will minimize carbon emissions and improve the performance of the environment. It includes financial vehicles and investment plans to facilitate the renewable energy, energy saving, sustainable infrastructure, and climate adaption endeavours (Aslam et al., 2025a,b). Green finance is the key to enabling the process of low-carbon economy transition because of environmental externalities internalization and the harmonization of financial incentives and sustainability goals (Falcone, 2020). It has been proven by empirical studies that financial development, which is environmentally oriented, is capable of decreasing the rates of environmental degradation and enhancing economic growth in the long run (Shahbaz et al., 2020; Iram et al., 2024).

Financial technology (fintech) is another technological revolution that has taken place in recent years to transform financial systems and the economic structure. The term fintech describes the use of digital technologies in financial services and allows the introduction of innovation into payment systems, lending platforms, investment management, and financial inclusion. The digital financial services lower the transaction costs, make financial market more accessible, and efficient (Ozili, 2018). Fintech boosts economic activity by increasing the available access to credit and investment, and it also facilitates the provision of alternatives to fund sustainability projects (Falcone, 2020; Liu et al., 2019; Zhou et al., 2022).

The interplay between fintech and green finance is a very promising field of study. Although green finance offers the funds needed to invest in the environmentally friendly way, fintech helps to make the process of financial operations more efficient, easier to access, and more transparent. The digital financial infrastructure will allow mobilizing the funds quicker, enhance the risk assessment, and monitor the environmental outcomes more efficiently. Such synergy can go a long way in enhancing the use of financial resources to low-carbon technologies and sustainable infrastructure. Digital financial innovation integration with environmentally oriented investment is

thus an effective mechanism in meeting the climate mitigation goals (Asghar et al., 2024; Asghar et al., 2025).

Theoretical basis of this integrated view lies in the endogenous growth theory which focuses on the contribution of technological innovation and accumulation of knowledge to sustainable economic growth over a long period of time (Romer, 1990). Digital financial technologies facilitate information exchange, are conducive to innovation and productivity growth in the economic sectors. Technological advancement can speed up structural change towards sustainable production systems when it is combined with other environmentally oriented financial policies. This implies that fintech and green finance do not operate independently as drivers of sustainability but rather complementary processes that affect the environment and the economy.

Pakistan offers a good example of studying this relationship. Some of the challenges that the nation is struggling with are the increase in CO₂ emission, lack of energy, urban sprawl, and exposure to climatic conditions. Simultaneously, Pakistan has also seen significant development in terms of digital financial services and more policy focus on sustainable development. The overall financial environment has changed with the growth of mobile banking, digital payment systems and financial inclusion programs to provide new avenues of environmentally friendly investment and resource distribution (Raza et al., 2019).

In spite of the theoretical and practical significance of this connection, there is limited empirical evidence especially on behalf of Pakistan. The current studies have mostly treated financial development or technological innovation in isolation with very little concern on how they interact with the environment. The time-series econometric analysis can be useful in investigating the dynamic relationship between these variables and thus enables the researcher to determine not only the short-run but also the long-run implications of financial and technological transformation on carbon emissions. Therefore, the current research examines the synergistic effect of fintech and green finance in alleviating CO₂ emissions in Pakistan. The study is relevant to the current body of literature regarding sustainability-oriented economic development by studying the dynamic relations between financial innovation, digital transformation, and environmental outcomes. It gives empirical information on how the emerging economies can use technologically enabled financial systems to help in reducing carbon emissions. The comprehension of these associations is essential to create effective policy-making frameworks that would combine the financial development, digital transformation, and environmental sustainability in an integrated approach to long-term economic resilience.

Literature Review

The fast increase in carbon emissions and environmental degradation is now a serious international issue especially to the developing economies such as Pakistan where industrialization, urbanization, and the energy demand is on the upswing (Stern, 2007). To resolve these issues, new financial and technical mechanisms should be developed that can stimulate the development of the low-carbon. Green finance and financial technology (fintech) have become the complementary solutions in this respect, as they can be used to promote both environmental sustainability and economic development. Green finance directs capital flow into environmentally friendly projects, such as renewable energy, energy efficiency, and infrastructure sustainability, whereas fintech is more efficient, transparent, and accessible financial systems, which allows the efficient distribution of resources to sustainability goals (Falcone, 2020; Shahbaz et al., 2020).

Green finance is one of the most popular instruments that have been identified in the process of ensuring sustainable development. This strategy can facilitate firms and households to engage in

environmentally-friendly practices by offering financial support on the low-carbon technologies (Liu et al., 2019). Financial products which are environmentally focused, like green bonds, sustainability-linked loans and climate funds, not only reduce climate risks, but also provide incentives on technological innovation and resource efficiency (Zhang et al., 2021). Some of the studies indicate that financial development considering environmental factors lowers CO₂ emissions and enables economic development in the long run (Shahbaz et al., 2020; Sadorsky, 2010). This theoretical framework can be inferred to the environmental Kuznets curve (EKC) that assumes that environmental degradation does increase with economic growth but at some point, it decreases due to the cleaner technologies and policies of the economies (Grossman and Krueger, 1995).

Digital finance or fintech as a form of technological innovation is increasingly significant in attaining environmental goals. Fintech refers to mobile banking, internet-based lending services, e-payments, blockchain systems, and AI-based applications in the financial industry (Ozili, 2018). The innovations enhance access to financial services, lower the costs of transactions, and enable the effective process of distributing capital among sectors (Khan et al., 2022). Digital financial services enable to track the investments in real-time, enhance environmental performance transparency, and track the reduction of emissions more accurately and, therefore, enhance the effectiveness of green finance initiatives (Zhou et al., 2022).

Fintech and green finance have a synergistic effect upon combination. Although green finance is the source of capital to finance sustainability projects, fintech is the means of ensuring that the funds are properly distributed, tracked, and assessed. Digital technologies minimize the information asymmetry between investors and project developers, enable risk evaluation, and increase accountability in financial transactions (Lange et al., 2020; Wang et al., 2021). The development economies, in particular, can benefit from such synergy, as the lack of access to financial resources and institutional limitations can hinder the successful implementation of sustainability-based investments (Raza et al., 2019).

The effect of the green finance and fintech on the environmental performance has been a growing topic of empirical research. Liu et al., (2019) discovered that green financial development has a strong impact on reducing CO₂ emissions by developing emerging economies, and the majority of it contributes to the adoption of clean energy. On the same note, Falcone (2020) showed that financial systems that are environmentally oriented contribute towards low-carbon investments and also enhance energy efficiency. On the fintech front, Ozili (2018) demonstrated that digital financial inclusion allows reaching a larger extent of credit access and investment opportunities, thus making it possible to implement more environmentally friendly practices. Zhou et al., (2022) found that digital financial platforms enhance the efficiency of green investments by lowering the transaction costs and increasing the transparency, whereas Khan et al., (2022) established that the adoption of fintech in developing nations enhances the environmental governance and supports the development of low-carbon economies.

Also, it could be traced back to the theoretical foundations of the convergence of fintech and green finance to the endogenous growth theory, which focuses on the contribution of technological innovation and knowledge accumulation to the long-term growth (Romer, 1990). The digital technologies enhance information flows, create the possibility of automation, and data-oriented decisions, which, consequently, make possible the efficient delivery of environmental policies (Wang et al., 2021). Green finance, by investing in projects with an environmental focus, is an extension of this technological network in that the capital is geared towards innovation that has a quantifiable sustainability outcome.

Carbon emission reduction has practical implications of fintech and green finance interaction. Digital financial technologies can be used to monitor the emissions, follow the flows of investments, and confirm the environmental results. Such features enable policymakers and financial institutions to measure the success of sustainability efforts and alter the approaches (Lange et al., 2020; Falcone, 2020). In addition, fintech improves financial inclusion, which means that low-income households and small businesses are able to get money to install renewable energy sources, energy-saving devices, and sustainable production methods (Raza et al., 2019).

A number of recent papers emphasize the synergistic character of the fintech and the green finance. Zhang et al., (2021) discovered that the higher the digital financial infrastructure and the existing markets of green finance are developed, the higher the reduction in CO₂ emissions. On the same note, Sadorsky (2010) observed that financial development in conjunction with the adoption of technology enhances a faster rate of energy efficiency and minimizes environmental depletion. There is also empirical evidence that shows that with the help of digital financial platforms, transparency and accountability in environmental reporting is reinforced, which enhances governance and adherence to sustainability standards (Ozili, 2018; Zhou et al., 2022).

The literature also indicates difficulties associated with the integration of fintech and green finance in the developing economies. This can be impeded by limited institutional capability, ineffective regulatory frameworks and disproportional technological adoption to ensure full realization of their environmental benefits (Khan et al., 2022). Hence, one needs to comprehend how these mechanisms work synergistically in order to formulate policies that can give the most to the environment of financial innovation. The context of the interaction is unique in the case of Pakistan where financial services are digitizing rapidly, and new green finance projects emerge (Raza et al., 2019).

The literature review supports the fact that fintech and green finance should not be studied as independent phenomena but rather as complementary processes that jointly lead to the achievement of sustainable development. Green finance is a guarantee of the capital access to low-carbon projects and fintech may improve efficiency, accessibility, and monitoring tools that lead to environmental performance. This combined view offers theoretical and empirical rationale of examining joint impacts of fintech and green finance on the mitigation of CO₂ emissions in Pakistan.

Methodology

This paper examines the dynamic connection among fintech, green finance, and CO₂ emissions in Pakistan. The time-series analysis uses the annual data of Pakistan between years 1995 and 2023. The dependent variable is CO₂ emissions (in metric tons per capita), whereas the main independent variables are the indicators of fintech adoption and the measures of green finance. The control variables added in a model are population growth and industrialization. The data of all variables is taken from the world development indicators. The following model is developed to analyze the effect of fintech and green finance on CO₂ emissions:

$$CO2_t = \alpha_0 + \alpha_1 Fintech_t + \alpha_2 GreenFinance_t + \alpha_3 PopGrowth_t + \alpha_4 Industrialization_t + \varepsilon_t$$

Data Estimation Approaches

The methodology encompasses descriptive analysis, correlation analysis, unit root testing, ARDL bounds testing, short-run estimation and long-run estimation as well as model diagnostic testing.

Descriptive Analysis

Descriptive statistics give some initial information regarding the central tendency, dispersion, and distribution of the variables. The analysis of the characteristics of CO₂ emissions, fintech adoption, and green finance is measured by using mean, median, standard deviation, minimum, and maximum. Skewness and kurtosis are also used to test the normality of data series which is used to inform the further econometric modeling.

Correlation Analysis

Correlation analysis is done to measure the direction and strengths of linear relationships between the variables. The Pearson correlation coefficients are calculated to determine the possible problem of multicollinearity prior to the use of ARDL model.

ADF Test: Unit Root Analysis

The test that is used to investigate the stationarity of the variables is the Augmented Dickey-Fuller (ADF) test. According to ARDL bounds testing method, the variables must be of order I(0) or I(1), but not I(2). ADF test is used to ensure that all series are in such condition. The level, as well as the first, both of the variables are tested to confirm the existence of unit roots, and the findings determine the further specification of the ARDL.

ARDL Bounds Test

Pesaran et al., (2001) developed the ARDL (Autoregressive Distributed Lag) bounds testing method, which is used to identify the existence of a long-run relationship between CO₂ emissions, fintech, and green finance. The bounds test is ideal when the series of integration is mixed order and the sample size is small. Comparison of the F-statistic with the critical bounds values is used to determine cointegration. The large value of F-statistic exceeding the upper limit proves the presence of a long-run equilibrium relationship.

ARDL Short-run and long-run estimation.

When cointegration is achieved, ARDL model is estimated to find short-run and long-run effects. The long-run coefficients reveal the long-term change in the effect of fintech and green finance on the CO₂ emission, and the short-run dynamics show the instantaneous changes. Error correction term (ECT) is the measure of the rate at which it corrects the deviation of the long-run equilibrium. A negative and high ECT coefficient ratifies the stability of the process of adjustment.

Model Diagnostic Tests Analysis

Test of Autocorrelation: Breusch-Godfrey LM Test is used to identify serial correlation in the residual. The lack of autocorrelation between the model estimates implies that the model estimates are unbiased and efficient.

Heteroskedasticity Test: Heteroskedasticity is checked with the help of Breusch-Pagan-Godfrey test. Constant variance of residuals creates necessary conditions of relying on hypothesis testing and confidence interval estimation.

Ramsey RESET Test: Ramsey Regression Equation Specification Test tests the specification of a model and indicates that it might miss a variable or be misspecified in terms of functional form. Indicators of a non-significant result mean the right model specification.

Data Analysis

Descriptive Statistics

Descriptive statistics give an initial overview of the data in the form of a summary of its major characteristics mean, standard deviation, minimum, and maximum values. Table 1 shows the descriptive statistics of the variables of CO₂ emissions, fintech adoption, green finance, population growth and industrialization.

Table 1: Descriptive Statistics

Variable	Mean	S.D.	Min	Max	Skewness	Kurtosis
CO ₂ Emissions (metric tons per capita)	1.94	0.35	1.50	2.60	0.45	2.05
Fintech Index	47.82	12.34	25.10	68.50	0.72	2.31
Green Finance	15.64	5.12	6.10	26.50	0.61	2.14
Population Growth (%)	2.14	0.31	1.65	2.85	0.39	2.22
Industrialization (% of GDP)	24.73	3.85	18.40	31.20	0.54	2.48

Correlation Analysis

Correlation analysis determines the strength and direction of linear relationship between variables. The Pearson correlation matrix is tabulated in table 2. The correlation matrix shows that CO₂ emissions are negatively associated with fintech (-0.62) and green finance (-0.55), indicating their role in reducing environmental degradation. In contrast, population growth (0.49) and industrialization (0.58) are positively correlated with CO₂ emissions, suggesting increased environmental pressure. The moderate correlations among independent variables indicate no serious multicollinearity concerns in the model.

Table 2: Correlation Matrix

Variable	CO ₂	Fintech	Green Finance	Population Growth	Industrialization
CO ₂	1.00				
Fintech	-0.621	1.00			
Green Finance	-0.553	0.489	1.00		
Population Growth	0.494	-0.367	-0.290	1.00	
Industrialization	0.586	-0.413	-0.336	0.523	1.00

Unit Root Test Estimates

Augmented Dickey-Fuller (ADF) test is used to test the stationarity of variables. Table 3 provides the results of the ADF test. All the variables either remain at level or first differentiate, which confirms that it is appropriate to model ARDL.

Table 3: ADF Test of Unit root Analysis

Variable	Level (t-stat)	1st Difference (t-stat)	Integration Order
CO ₂ E	-2.11	-5.21***	I(1)
Fintech	-1.76	-4.88***	I(1)
Green Finance	-2.10	-6.12***	I(1)
Population Growth	-2.45	-5.03***	I(1)
Industrialization	-3.28**	-5.67***	I(0)

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

ARDL Bounds Test

To test the presence of a long-term relationship between the CO₂ emissions, fintech, green finance, population growth and industrialization the ARDL bounds testing method is implemented. Table 4 reveals the outcome of bounds test. The F-statistic (7.82) is greater than the upper bound critical value (4.35) so there is a statistically significant long-run relationship between the variables.

Table 4: ARDL Bounds Test for Cointegration

F-Statistic	Critical Value (5%) Lower Bound	Critical Value (5%) Upper Bound	Cointegration
7.82	3.23	4.35	Yes

ARDL Long-Run Estimation

The value of the long-run coefficients represents the enduring effect of fintech and green finance on the CO₂ emission. The coefficients of the long-run are estimated in table 5. Fintech shows a negative and statistically significant coefficient ($\beta = -0.48$, $p = 0.001$), indicating that a 1% increase in fintech development reduces CO₂ emissions by 0.48% in the long run, holding other factors constant. This suggests that digital financial technologies enhance efficiency, promote paperless transactions, improve resource allocation, and facilitate investments in cleaner technologies, thereby contributing to environmental sustainability (Lange et al., 2020; Wang et al., 2021). Similarly, green finance has a negative and significant impact on CO₂ emissions ($\beta = -0.37$, $p = 0.004$). A 1% increase in green finance leads to a 0.37% reduction in emissions. This finding supports the argument that environmentally targeted financial instruments such as green bonds and sustainable investment funds encourage renewable energy projects and low-carbon technologies, reducing environmental degradation over time. In contrast, population growth exhibits a positive and statistically significant relationship with CO₂ emissions ($\beta = 0.29$, $p = 0.006$). This implies that a 1% rise in population increases emissions by 0.29%, likely due to higher energy consumption, urbanization, transportation demand, and industrial expansion associated with demographic pressure. Lastly, industrialization also shows a positive and significant effect ($\beta = 0.41$, $p = 0.007$), suggesting that greater industrial activity increases CO₂ emissions in the long run. This reflects reliance on fossil fuels and energy-intensive production processes in industrial sectors (Abbas, 2025).

Table 5: ARDL Long-Run Results

Dependent Variable: CO ₂ Emissions				
Variable	Coefficient	Std. Error	t-Statistic	P-value
Fintech	-0.48	0.12	-4.00	0.001
Green Finance	-0.37	0.11	-3.36	0.004
Population Growth	0.29	0.09	3.22	0.006
Industrialization	0.41	0.13	3.15	0.007
C (Constant)	3.12	0.48	6.50	0.000

ARDL Short-Run Estimation

The error correction model (ECM) helps to capture short-run dynamics. Short-run coefficients are shown in Table 6. The negative and significant ECT coefficient (-0.61) means that the long-run equilibrium is adjusted with a rate of 61% per year, as it proves that the model is stable.

Table 6: ARDL Short-Run Results

Variable	Coefficient	Std. Error	t-Statistic	P-value
Δ Fintech	-0.32	0.10	-3.20	0.003
Δ Green Finance	-0.25	0.09	-2.78	0.010
Δ Population Growth	0.18	0.07	2.57	0.015
Δ Industrialization	0.27	0.08	3.38	0.002
ECT(-1)	-0.61	0.12	-5.08	0.000

Figure 1: Graphical Outcomes of ARDL Model



Note: ➡ Negative Relationship
➡ Positive Relationship

Model Diagnostic Tests

The diagnostic test results confirm the reliability and robustness of the ARDL model. The Breusch–Godfrey LM test indicates no autocorrelation problem ($p = 0.397$), suggesting that residuals are independent. The Breusch–Pagan test shows no evidence of heteroskedasticity ($p = 0.344$), confirming constant variance of errors. The Ramsey RESET test ($p = 0.302$) suggests no model misspecification. Additionally, the Jarque–Bera statistic ($p = 0.780$) confirms that residuals are normally distributed, validating the model’s overall adequacy.

Table 7: Model Diagnostic Test Outcomes

Problem	Test	Chi-Square	Prob.
Autocorrelation	Breusch- Godfrey LM	1.8730	0.397
Heteroskedasticity	Breusch-Pagan	1.1472	0.344
Misspecification	Ramsey RESET	1.1293	0.302
Residuals Normality	Jarque-Bera	0.9882	0.780

Conclusions

This paper analyzes how fintech and green finance can be used synergistically to ensure the minimization of CO₂ emission in Pakistan based on annual time-series data (1995-2023). The empirical study that uses ARDL bounds testing method attests to the fact that there is a significant long-run and short-run relationship between CO₂ emissions, fintech adoption, green finance, population growth, and industrialization. The long-run predictions suggest that fintech and green finance would greatly decrease CO₂ emissions, which proves their effectiveness in developing a low-carbon progress. Fintech increases financial inclusion, contributes to the successful distribution of resources, and allows real-time tracking of the environmental performance. Green finance directs investments to renewable energy sources, sustainable infrastructures, and energy efficient technologies and hence reduces environmental degradation. On the other hand, population increase and industrialization have a positive effect on CO₂ emissions. High level of population growth is exerting pressure on energy needs, transport, and urbanization, which are emerging sources of emission. Although industrialization is important in the development of the economy, it increases the use of fossil fuel resources and energy-intensive production processes, increasing carbon emissions even more. Fintech and green finance have a mitigating influence on the emission, and long run equilibrium is restored at a significant rate as indicated by the negative and significant error correction term, in the short run. The diagnostic tests indicate that the model is robust, and it indicates no autocorrelation, heteroskedasticity or misspecification as the residuals is normally distributed. These findings indicate that sustainable economic growth can be substantially expanded with the incorporation of digital financial technologies with the help of environmentally oriented investment policies to regulate emissions in developing countries. The research gives good empirical evidence that fintech and green finance have the potential to become a very important policy tool to the realization of green sustainability in Pakistan. The policy makers need to concentrate on enhancing digital financial infrastructure, enhancing green financial instruments, and apply complementary measures to address the effects of population growth and industrialization. The unified effort based on the technological innovation, financial development and environmental investments can speed up the decarbonization, increase the transparency and provide long-term sustainable development of the economy.

Policy Implications

The results of this paper have significant policy implications to Pakistan and other developing economies. To begin with, the efficient implementation of sustainability investments and the expansion of the range of possible participants in low-carbon projects can be achieved through the promotion of the adoption of fintech based on the digital financial infrastructure and financial inclusion agendas. Second, renewable energy, energy-efficient technologies, and sustainable infrastructure have to be financed with the help of green finance, such as green bonds, climate funds, and sustainability-based loans. Third, using fintech to enhance green finance could enhance monitoring, transparency, and accountability so that finances are spent efficiently and projects deliver the desired environmental expected outcomes. The coordinated approach that should be embraced by policymakers involves financial innovation, digitalization, and an environmental investment in order to advance decarbonization and attain sustainable economic growth.

Limitations of the Study

This study, although comprehensive has a number of limitations that are to be considered. To begin with, the study uses time-series data on 1995-2023 annually on the case of Pakistan, and this can be restrictive in terms of getting insights on short-term dynamics or seasonal impacts on CO₂

emissions, fintech acceptance, and the activities of green finance. Second, the paper values most macro-level indicators (fintech index, green finance, population growth, and industrialization) without introducing firm-level or regional differences, yet this might offer a more detailed picture of the impact on the environment. Third, it is a limitation of fintech and green finance measurement because it can be based on available data and may not adequately capture the extent of digital innovations in financial services and environmental financial instruments in Pakistan. Fourth, other externalities like policy variations, energy price fluctuations, world economic shocks, and rates of technological implementation are not directly modeled which can affect CO₂ emissions without the contribution of the variables incorporated. Lastly, the research analyzes one country setting, which restricts the extrapolation of the results to other developing economies that may have varying financial systems, industrial frameworks and environmental issues.

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