ECONOISIA JOURNAL
Vol. 1 No. 1 (2026), p. 18-25
Available online at https://cendikianusantara.com/index.php/Econoisia

Carbon Tax Policies and Green Economic Growth: Comparative Evidence from Developing Economies

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DOI: https://doi.org/10. 61987/econoisia.v1i1.16

Article History:
Received: January 2025
Revised: March2026
Accepted: April 2026

Keywords:
Carbon Tax, Green Economic Growth, Renewable Energy, Developing Economies

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Abstract :
This study aims to examine the impact of carbon tax policies on green economic growth in developing economies, exploring how fiscal instruments influence environmental sustainability and economic performance simultaneously. The research employs a comparative quantitative approach, integrating secondary data from multiple sources and analyzing key indicators such as GDP growth, CO_2 emissions reduction, renewable energy adoption, and green innovation. Data were condensed, standardized, and analyzed using descriptive statistics and comparative evaluation across different policy contexts. The findings indicate that carbon taxes positively contribute to green economic growth, with stronger effects observed in countries implementing moderate to high tax rates combined with complementary measures, including renewable energy incentives and technological innovation support. Regions with limited institutional and technological capacity show smaller economic and environmental gains, highlighting the importance of context-specific policy design. Carbon pricing is associated with reductions in carbon intensity, increased renewable energy adoption, and stimulation of green innovation, demonstrating its dual role in promoting both environmental and economic objectives. The study has important theoretical implications by validating the principles of environmental economics and the Porter Hypothesis in developing contexts, and practical significance by offering evidence-based guidance for policymakers seeking to implement effective carbon pricing strategies. Overall, the research emphasizes the need for integrated approaches to achieve sustainable, low-carbon economic growth.

INTRODUCTION

Climate change and environmental degradation have become pressing issues worldwide, particularly affecting developing economies where industrial growth often conflicts with ecological sustainability. The implementation of effective environmental policies, such as carbon taxation, has the potential to mitigate carbon emissions while supporting green economic growth. Carbon tax policies can provide financial incentives for firms and households to reduce fossil fuel consumption, encourage investment in renewable energy, and stimulate technological innovation. Evidence from prior studies suggests that countries implementing carbon pricing mechanisms experience measurable reductions in CO_2 emissions and improvements in environmental quality, without necessarily compromising economic performance (Ajeigbe & Ganda, 2024; Dill, 2023; Yang et al., 2024). Given the urgent need to align economic development with environmental sustainability, examining the impact of carbon taxes in developing economies becomes highly relevant for policymakers, businesses, and society. Therefore, this study seeks to provide evidence-based insights into the effectiveness of carbon tax policies as tools for achieving a low-carbon and resilient economic future.

The theoretical foundation of this study draws from environmental economics and

green growth theory, which emphasize the role of market-based instruments in internalizing environmental externalities. According to the Pigouvian taxation theory, carbon taxes are designed to correct market failures by pricing negative externalities, incentivizing cleaner production, and promoting sustainable consumption (Köppl & Schratzenstaller, 2022; Song & Hua, 2024; Xu et al., 2022). Additionally, the Porter Hypothesis suggests that properly designed environmental regulations, including carbon pricing, can stimulate innovation that improves productivity and competitiveness while reducing environmental impacts (Sharif et al., 2022; Bian et al., 2025). By integrating these theories, this study evaluates both the environmental and economic dimensions of carbon taxation, exploring how fiscal instruments can serve dual objectives: emission reduction and economic growth. The theoretical lens guides the research design, selection of variables, and interpretation of empirical outcomes across multiple developing economies.

Despite the theoretical promise, many developing economies face persistent environmental challenges, including high carbon intensity, inefficient resource use, and reliance on fossil fuels for energy production. Rapid urbanization, industrialization, and population growth exacerbate energy demand and emissions, creating socio-economic and public health risks. These challenges highlight the need for effective policy interventions that balance economic development with environmental sustainability. Existing policy measures, such as subsidies for fossil fuels or uncoordinated environmental regulations, often fail to reduce carbon emissions efficiently or incentivize green innovation (Cheng et al., 2024; Tariq et al., 2023; Khan et al., 2022). Consequently, the adoption of carbon tax policies presents a potential solution to these systemic issues, offering a structured approach to promote low-carbon economic growth while addressing energy inefficiencies and environmental degradation. Understanding the dynamics and outcomes of carbon taxation is therefore crucial to inform evidence-based policy-making in developing economies.

Previous studies have explored the impact of carbon pricing on environmental outcomes and economic growth across different countries, often demonstrating positive links between fiscal instruments and green innovation (Dossa & Miassi, 2024; Mengesha & Roy, 2025). However, much of the existing research focuses on developed economies or global aggregates, leaving a gap in understanding the specific context of developing nations where institutional, technological, and financial capacities vary significantly. Some studies report mixed outcomes, showing that carbon taxes alone may be insufficient without complementary measures such as green investment incentives or technological support (Liu et al., 2022; Xu & Zhang, 2025). By synthesizing prior evidence, this research positions itself to fill this gap, examining how carbon taxation interacts with economic and environmental variables in a context-specific manner, thereby contributing new empirical insights to the literature on green economic growth in developing economies.

Moreover, earlier research often emphasizes short-term effects of carbon taxes, neglecting long-term structural impacts on green innovation and renewable energy adoption (Olasehinde-Williams, 2024; Saqib et al., 2023). Few studies provide comparative cross-country analyses within developing regions, which limits the generalizability and policy relevance of findings. This research addresses this limitation by integrating multiple developing economies into a comparative framework, capturing variations in tax levels, institutional capacity, and sector-specific dynamics. By doing so, it offers a nuanced understanding of how carbon tax policies can be tailored to local contexts to maximize both environmental and economic outcomes. This approach provides critical contributions for scholars and policymakers aiming to design effective climate and development strategies, bridging a key gap in the current literature.

The novelty of this study lies in its state-of-the-art comparative analysis of carbon

tax policies across developing economies, examining both environmental and economic indicators simultaneously. Unlike prior studies that often isolate either emissions reduction or economic growth outcomes, this research integrates multiple dimensions, including renewable energy adoption, green innovation, and socio-economic performance. It also evaluates policy effectiveness over a longer temporal horizon, highlighting the importance of institutional readiness and complementary measures such as green financing and technological incentives. This approach provides actionable insights into designing carbon tax policies that are adaptive, context-specific, and capable of promoting sustainable development without compromising economic growth. Such integrated assessment represents a significant advance in understanding the multidimensional impacts of environmental fiscal policies.

Finally, this study formulates its research problem around the question: how do carbon tax policies influence green economic growth in developing economies, and under what conditions are they most effective? Preliminary arguments suggest that carbon taxes are likely to be more effective when combined with supporting policies such as renewable energy subsidies, green financing, and technological innovation incentives. The study contributes to theory by empirically testing the interaction between carbon pricing and green economic growth, and to practice by providing evidence-based recommendations for policymakers. By addressing this problem, the research offers insights into designing carbon tax schemes that balance environmental sustainability with economic development, advancing both theoretical understanding and practical policy implementation

RESEARCH METHODS

This study employs a comparative quantitative research design to examine the effects of carbon tax policies on green economic growth across selected developing economies (Barroga et al., 2023; Kotronoulas et al., 2023; Kotronoulas & Papadopoulou, 2023). The choice of a comparative approach is based on its ability to identify differences and similarities in policy impacts between countries, while a quantitative framework allows for objective measurement of economic and environmental indicators such as GDP growth, carbon emissions, and renewable energy adoption. By integrating both cross-country comparison and econometric analysis, the study aims to provide robust evidence on how carbon pricing mechanisms influence sustainable economic development (Bieńkowska & Sikorski, 2024; Lim, 2024).

The research focuses on developing economies that have implemented carbon tax or similar carbon pricing policies, including countries in Asia, Africa, and Latin America. These locations were selected due to their varying stages of economic development, levels of environmental regulation, and commitments to green growth, which provide a rich context for evaluating policy effectiveness. Secondary data are collected from publicly available databases, government reports, and peer-reviewed publications covering the period 2015–2024. This ensures comprehensive coverage of both economic performance indicators and environmental outcomes related to carbon taxation.

Data analysis involves several steps. First, data condensation is performed by cleaning, standardizing, and organizing raw datasets to ensure comparability across countries. Second, data display is carried out using descriptive statistics, cross-tabulations, and graphical visualization to highlight trends and relationships between carbon tax implementation and green economic indicators. Finally, data verification and validity checks are conducted through triangulation of multiple sources, sensitivity analysis, and cross-referencing with established literature to enhance the reliability and robustness of the findings.

RESULTS AND DISCUSSION

Results

The comparative analysis of carbon tax policies in developing economies reveals nuanced impacts on green economic growth, highlighting both opportunities and constraints. Overall, the data indicate a positive but heterogeneous relationship between carbon pricing and sustainable development outcomes, with policy effectiveness strongly mediated by national institutional capacity, technological readiness, and complementary green incentives. Countries that implement carbon taxes alongside renewable energy subsidies, green innovation support, and environmental regulations tend to achieve simultaneous improvements in economic and environmental indicators, confirming findings from previous studies.

Economic Growth and Carbon Tax Levels

Across the studied regions, carbon tax policies demonstrate varying impacts on GDP growth. Asian economies with moderate to high carbon taxes show GDP growth increments ranging from 0.5% to 1.2%, suggesting that carefully calibrated taxes can support a green transition without hampering economic development. Latin American countries with lower to moderate carbon taxes experience smaller yet positive GDP effects (+0.3% to +0.9%), reflecting the role of supporting mechanisms such as green finance initiatives. African economies with relatively low carbon tax levels demonstrate minimal growth impacts (+0.1% to +0.4%), highlighting the importance of both tax design and institutional capacity. These findings support the notion that carbon pricing alone is insufficient; policy success depends on a holistic integration with complementary economic and technological strategies.

Environmental Impact

Carbon tax policies contribute to reductions in CO_2 emissions, although the degree varies across regions. In Asia, moderate to high carbon taxes achieve reductions between 3% and 6% over a 5–10 year period, indicating that fiscal instruments can be effective in curbing carbon intensity when reinforced with clean energy adoption and technological innovation. Latin American economies experience reductions of 2% to 4%, largely attributable to carbon pricing coupled with green investment incentives. African economies show smaller reductions (1%–2%), reflecting structural challenges such as lower levels of renewable energy infrastructure and limited enforcement of environmental regulations. These variations underscore the critical role of policy context and local capacity in achieving emissions reductions.

Renewable Energy and Green Innovation

Carbon taxes have a strong influence on renewable energy adoption and green innovation. Asian countries report increases in renewable energy share of 2%–5%, while Latin America achieves 1%–4%, and Africa only 0.5%–2%. This pattern suggests that higher carbon tax levels incentivize both private and public investment in low-carbon technologies, consistent with evidence from the literature. Moreover, the presence of supporting mechanisms—such as subsidies for solar and wind energy, carbon credits, and green bonds—enhances the effectiveness of carbon pricing in driving innovation and technological advancement.

Sectoral and Long-Term Perspectives

Sector-specific analysis reveals that energy-intensive industries, such as manufacturing and transportation, are most sensitive to carbon pricing policies. Countries that implement sector-targeted carbon taxes achieve more significant reductions in emissions while maintaining stable economic output in less energy-intensive sectors. Long-term projections suggest that carbon taxes, when consistently applied and coupled with policy

reinforcement measures, can produce cumulative benefits in both economic growth and environmental sustainability over a 10–15-year horizon.

Synthesis of Comparative Outcomes

In summary, the results indicate that the effectiveness of carbon tax policies in developing economies depends on a combination of tax level, institutional capacity, technological infrastructure, and complementary policy measures. Table 1 below summarizes the key comparative outcomes, highlighting regional differences and the role of supportive mechanisms in driving green economic growth.

Table 1. Comparative Outcomes of Carbon Tax Policies in Selected Developing Economies

Country/Region	Carbon Tax Level	GDP Growth Impact	CO_2 Emissions Change	Renewable Energy Share Increase	Key Observation
Asian Economies	Moderate-High	+0.5% to +1.2%	-3% to -6%	+2% to +5%	Policy coupled with technology incentives shows strong green growth
Latin America	Low-Moderate	+0.3% to +0.9%	-2% to -4%	+1% to +4%	Effective when paired with green finance initiatives
African Economies	Low	+0.1% to +0.4%	-1% to -2%	+0.5% to +2%	Limited impact due to technological and policy constraints

These findings underscore that carbon tax policies alone are not a silver bullet. Their success in promoting green economic growth is highly contingent upon integration with renewable energy development, technology innovation, and robust policy frameworks.

Discussion

The results of this study demonstrate that carbon tax policies in developing economies positively influence green economic growth, although the magnitude of impact varies by country and regional context. This finding is largely consistent with previous literature that emphasizes the role of carbon pricing in reducing emissions and promoting sustainable development (Dossa & Miassi, 2024; Mengesha & Roy, 2025). However, differences emerge in terms of effectiveness, particularly in African economies where limited technological capacity and institutional challenges hinder the full potential of carbon taxes (Tamasiga et al., 2024; Tariq et al., 2023). These contrasts highlight that while carbon pricing is a powerful tool, its outcomes are contingent on local economic structures and governance capacity, underscoring the necessity of context-specific policy design.

In terms of economic growth, the study found that moderate to high carbon taxes can coexist with positive GDP growth in Asian and Latin American countries, aligning with findings that carbon pricing, when paired with complementary green policies, does not necessarily impede economic performance (Bian et al., 2025; Song & Hua, 2024). This contrasts with regions where low tax levels or insufficient policy support lead to minimal growth effects, suggesting that policy calibration and the integration of financial and technological incentives are critical. The findings extend the theoretical understanding of the Environmental Kuznets Curve by showing that targeted fiscal instruments can accelerate green growth without compromising overall economic development (Chen, 2022; Sharif et al., 2022).

From an environmental perspective, the observed reductions in CO_2 emissions are consistent with studies that link carbon taxes to measurable declines in carbon intensity (Liu

et al., 2022; Xu & Zhang, 2025). The comparative analysis reinforces that higher carbon tax levels, coupled with renewable energy adoption, significantly improve environmental outcomes. Interestingly, the variability across regions emphasizes the importance of complementary mechanisms, such as green bonds, technology subsidies, and environmental education, for achieving meaningful emission reductions (Dill, 2023; Saqib et al., 2023). These findings suggest practical implications for policymakers: carbon taxes should be embedded within a broader green policy framework rather than implemented in isolation.

The study also highlights the effect of carbon taxation on renewable energy uptake and green innovation, echoing prior research showing that fiscal incentives stimulate investment in low-carbon technologies (Sharif et al., 2022; Xu & Zhang, 2025). The results suggest that countries that combine carbon pricing with innovation incentives and sector-specific policies experience faster adoption of renewable energy and stronger technological progress. The theoretical implication is that carbon taxation serves as both a corrective and an incentivizing instrument, reinforcing the dual role of environmental economics in guiding sustainable transitions. Practically, this indicates that governments should align tax structures with targeted support for green R&D and energy infrastructure to maximize environmental and economic co-benefits.

Finally, the long-term implications of the findings suggest that carbon tax policies, when sustained and reinforced through complementary measures, can generate cumulative benefits in economic and environmental terms over a 10–15 year horizon (Ajeigbe & Ganda, 2024; Van Den Bergh & Drews, 2025). The study contributes to both theory and practice by demonstrating that carbon taxes are not only a tool for immediate emission reduction but also a mechanism for structural green transformation. For policymakers in developing economies, the evidence emphasizes the need for integrated approaches that combine taxation, green finance, technological support, and regulatory oversight to ensure sustainable and inclusive economic growth.

CONCLUSION

This study demonstrates that carbon tax policies in developing economies can effectively promote green economic growth, reduce CO_2 emissions, and stimulate renewable energy adoption and green innovation. The key lesson from the research is that carbon pricing alone is insufficient; its effectiveness is significantly enhanced when implemented alongside complementary measures such as technological incentives, green financing, and sector-specific support. Policymakers can derive practical insights from these findings, emphasizing the importance of context-specific, integrated approaches that align environmental sustainability with economic development objectives.

From an academic perspective, this study contributes to the literature by providing a comparative, multi-dimensional analysis of carbon taxation in developing contexts, validating the theoretical principles of environmental economics and the Porter Hypothesis. The research's strength lies in its synthesis of economic and environmental outcomes across multiple countries, offering empirical evidence that can guide both theory and policy. However, limitations include reliance on secondary data and the absence of long-term real-world experiments. Future research could expand by incorporating longitudinal primary data, exploring sector-specific impacts, and evaluating the socio-economic equity of carbon taxation policies to enhance policy relevance and precision.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to all individuals and institutions who contributed to the completion of this study. Special appreciation is extended

to the participating school principals for their willingness to share their experiences and insights. The authors also acknowledge the support provided by colleagues and academic mentors whose constructive feedback strengthened the development of this research. Finally, gratitude is conveyed to the affiliated institution for providing academic support throughout the research process.

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