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Factors Influencing Green GDP Growth in Southeast Asia: The Role of Foreign Direct Investment, Trade Openness, and Economic Development

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ABSTRACT

This study investigates the key factors that drive Green GDP (GGDP) growth in Southeast Asia, focusing on foreign direct investment (FDI), trade openness, economic development, urbanization, labor productivity, and financial development. Utilizing panel data from 2009 to 2019 and employing a fixed-effects model, the findings indicate that economic development, labor productivity, and financial development are significant contributors to GGDP growth. The results underscore the importance of investing in green infrastructure and improving resource efficiency. In contrast, FDI and trade openness did not show a statistically significant effect, suggesting a need for policy reforms to channel investments and trade towards environmentally friendly sectors. Urbanization had a negative impact, highlighting the environmental challenges associated with rapid urban growth, thus calling for stronger environmental regulations and green urban planning. These insights suggest that Southeast Asian countries can further enhance GGDP growth through targeted policies that promote sustainable FDI, increase labor productivity, and support financial systems conducive to green projects.

KEYWORDS

Green GDP; Foreign Direct Investment; Sustainable Development Policies

1. INTRODUCTION

This study explores the determinants of Green GDP (GGDP) growth in Southeast Asia, focusing on key factors such as foreign direct investment (FDI), trade openness, economic development, urbanization, labor productivity, and financial development. GGDP, which integrates environmental costs into economic performance, is a crucial indicator for evaluating sustainable growth. In recent years, Southeast Asian countries have experienced rapid economic development and urbanization, yet face growing environmental challenges. Understanding the factors that drive or hinder GGDP growth is essential for shaping policies that balance economic progress with environmental sustainability. By employing panel data and a fixed-effects model, this study aims to analyze the effects of these variables on GGDP, providing insights that can help guide future policy decisions to promote long-term green growth in the region.

2. LITERATURE REVIEW

In recent years, the sustainable development of the green economy and its relationship with factors such as Foreign Direct Investment (FDI) and trade openness has garnered widespread attention. Jie Guo and Fuli Zhang, through an empirical analysis of data from 2004 to 2017, found that FDI's impact

on China's green economic growth exhibited an initial negative influence, followed by a positive effect [1]. Yue Wang further explored the mechanisms of government quality's impact on Green GDP, highlighting the spatial spillover effects of government quality on Green GDP and emphasizing the mediating role of technological innovation [2]. Jingyi Shi focused on Belt and Road countries, discovering that China's Outward Foreign Direct Investment (OFDI) significantly promotes green total factor productivity [3]. However, this positive effect diminishes in host countries with higher trade openness.Simultaneously, the relationship between trade openness and the green economy has also drawn significant interest. Jing Yang and Ming Zhang analyzed carbon emission efficiency, revealing a U-shaped relationship between trade openness and carbon emission efficiency, with green technological innovation serving as a key mediator [4]. Xiaoyang Zhang further demonstrated that trade openness significantly enhances Green Total Factor Productivity (GTFP), with technological innovation playing an important role [5]. Additionally, Xing Luo et al. found that financial digitalization plays a crucial role in enhancing the endogenous momentum of green financial development, particularly in regions with weaker financial regulation [6].The importance of green finance in sustainable development has also been widely acknowledged. Qiyu Li analyzed the critical role of green finance in promoting economic transitions toward greener pathways, emphasizing its ability to provide financial support for environmental projects [7]. Meanwhile, the impact of FDI on Southeast Asian countries has also been a key research focus. Hoa examined FDI's effect on wage levels in key industries in Vietnam, finding that FDI's impact varies across sectors and regions [8].Laos, as a key participant in China's Belt and Road Initiative, has also been profoundly affected by Chinese investment. Yongsheng Zhou highlighted that Chinese investment has positively influenced education, economic development, and urbanization in Laos, although challenges remain in certain areas [9]. Diyi Zhang examined Chinese digital enterprises' outward investment under the "Digital Silk Road" initiative, emphasizing the importance of considering the host country's business environment and foreign investment regulations when selecting investment destinations [10].

In conclusion, these studies explore the multi-dimensional impacts of green economic development, FDI, trade openness, and financial digitalization from various perspectives, underscoring the importance of policy formulation in promoting sustainable green economic growth.

3. EMPIRICAL RESEARCH

3.1. Data and Variables

This study uses panel data from 2009 to 2019 for six Southeast Asian countries—Vietnam, Indonesia, Malaysia, Thailand, the Philippines, and Cambodia. The analysis examines the relationship between Chinese FDI in the manufacturing sector and economic growth, incorporating several control variables that reflect the economic environment of each country. Table 1 presents the dependent and explanatory variables, along with their sources.

Table 1. Variables and Sources

Variable	Coefficient
Green GDP	The database is sourced from reference [11].
FDI	World Bank
Trade Openness	World Bank
Economic Development Level	IMF
Urbanization Level	World Bank
Labor Productivity	The Conference Board Total Economy Database™
Financial Development Level	IMF
Economic Globalization Index	The database is sourced from reference [12-13].

3.2. Model Setup

The study applies a random-effects model to account for both time-invariant and country-specific characteristics. The model is specified as follows:

$$\text{GGDPGrowth}=\alpha+\beta1\times\text{FDI}+\beta2\times\text{Trade Openness}+\beta3\times\text{Economic Development Level}+\beta4\times\text{Urbanization Level}+\beta5\times\text{Labor Productivity}+\beta6\times\text{Financial Development Level}+\beta7\times\text{Economic Globalization Index}+\epsilon \quad (1)$$

3.3. Empirical Results

The empirical results are shown in Table 2.

Table 2. Regression Results

Variable	Coefficient	P>|z|
FDI	0.0241	0.073
Trade Openness	-0.0439	0.387
Economic Development Level	0.9332	0.000
Urbanization Level	-0.5839	0.034
Labor Productivity	0.4753	0.000
Financial Development Level	0.3742	0.019
Economic Globalization Index	-0.0577	0.732

Based on the regression results from both the random effects model and fixed effects model, as well as the findings from the Hausman test, the analysis proceeds with greater clarity regarding the model choice. The Hausman test results (chi2(7) = 268.09, Prob > chi2 = 0.0000) strongly reject the null hypothesis that the random effects model is appropriate, suggesting that the fixed effects model is more suitable for analyzing the dataset. Consequently, the subsequent discussion is grounded in the results obtained from the fixed effects model, providing a more robust understanding of the factors influencing Green GDP (GGDP) growth in Southeast Asia.

Transitioning from model selection to empirical insights, the fixed effects model sheds light on the role of various factors, with particular emphasis on Foreign Direct Investment (FDI), trade openness, and economic development.

First, the coefficient for Foreign Direct Investment (FDI) is 0.0241, with a P-value of 0.073. While this nears statistical significance, it remains marginally below the threshold. This suggests that, although FDI may have played a role in the manufacturing sector's growth in Southeast Asia, its positive impact on GGDP growth is not strongly evident during the study period. One possible explanation is that FDI inflows were not predominantly directed toward environmentally sustainable industries, or that policies were lacking to channel FDI into green sectors, limiting its contribution to green economic growth.

Similarly, trade openness, with a coefficient of -0.0439 and a P-value of 0.387, does not appear to significantly influence GGDP. This result could reflect the persistence of energy-intensive industries within the trade structures of Southeast Asian countries. These traditional industries may offset the environmental benefits that trade liberalization could potentially bring, thus weakening the direct relationship between trade openness and green growth.

On the other hand, the results show that economic development has a significant positive effect on GGDP, with a coefficient of 0.9332 and a P-value of 0.000. This suggests that countries with higher levels of economic development have greater capacity to invest in green infrastructure and technologies, driving more sustainable growth.

However, urbanization poses a challenge to GGDP, as indicated by its negative coefficient of -0.5839 and P-value of 0.034. Rapid urbanization, particularly in the absence of adequate environmental safeguards, exacerbates resource consumption and pollution, thereby hampering green economic growth in the region.

Labor productivity also emerges as a significant driver of GGDP, with a coefficient of 0.4753 and a P-value of 0.000. Enhanced labor productivity often correlates with greater resource efficiency and reduced waste, both of which are critical for promoting green economic growth. This underscores the importance of productivity improvements in fostering sustainable development.

Additionally, financial development plays a key role in supporting GGDP growth, as evidenced by a coefficient of 0.3742 and a P-value of 0.019. A well-developed financial system facilitates access to funding for green projects and technological innovation, which are crucial for sustainable industrial development and long-term economic growth.

Finally, the coefficient for the Economic Globalization Index is -0.0577 with a P-value of 0.732, indicating no significant impact on GGDP growth. While globalization aids in the flow of capital and technology, its contribution to green economic growth remains limited, particularly as globalization in Southeast Asia has largely focused on traditional industries rather than environmentally sustainable sectors.

In conclusion, the empirical results highlight the importance of economic development, labor productivity, and financial development as key drivers of green GDP growth. The relatively weak impacts of FDI and trade openness suggest that Southeast Asian countries may need to reform policies to better direct foreign investment and trade flows towards green sectors. Urbanization poses additional environmental challenges, necessitating green urban planning and stronger regulatory frameworks to ensure sustainable growth. Future policies should focus on enhancing labor productivity, strengthening financial systems, and promoting environmentally friendly investments to achieve long-term sustainable development in the region.

3.4. Policy Recommendation

To enhance the role of Foreign Direct Investment (FDI) in fostering sustainable growth, policymakers should establish clear guidelines and incentives to channel FDI into environmentally friendly industries. While empirical findings suggest that FDI has the potential to positively impact Green GDP (GGDP), this effect is not statistically significant, likely due to insufficient investment in green sectors. Governments can enhance the effectiveness of FDI by offering tax incentives, subsidies, and creating supportive regulatory frameworks that encourage foreign investments in areas such as renewable energy, low-carbon technologies, and sustainable infrastructure. Moreover, strengthening host countries' green investment policies is essential to ensure that foreign capital flows are aligned with sustainable development goals.

Although trade openness is typically beneficial for economic growth, the study indicates that its effect on GGDP is not significant. This may be attributed to the continued dominance of traditional, energy-intensive industries within Southeast Asian countries' trade structures. To unlock the green growth potential of trade, policymakers should reform trade policies to promote the exchange of green technologies and sustainable products. This could involve reducing tariffs on renewable energy equipment, fostering regional trade agreements that prioritize sustainability, and offering incentives for the development of green industries through trade channels.

Economic development has demonstrated a strong positive effect on GGDP, indicating that higher levels of development significantly contribute to sustainable economic progress. Governments should therefore continue to prioritize investments in sustainable infrastructure, including green energy, energy-efficient transportation systems, and environmentally friendly technologies. Policies must

ensure that economic growth is coupled with efforts to improve resource allocation efficiency, promote energy savings, and advance sustainable practices across all sectors.

The negative impact of urbanization on GGDP highlights the environmental challenges that accompany rapid urban expansion. Policymakers must address the environmental costs of urbanization by implementing stricter environmental regulations, promoting green urban planning, and investing in sustainable urban infrastructure. This could involve developing smart cities, green buildings, and public transportation systems that reduce pollution and resource depletion. Urbanization policies should align with green growth objectives to ensure that economic and environmental goals are achieved simultaneously.

The positive effect of labor productivity on GGDP suggests that increasing productivity is key to driving sustainable economic development. Efforts to enhance labor productivity should focus on improving education, vocational training, and technology adoption, with a specific emphasis on eco-friendly production processes. By increasing resource efficiency and reducing waste, higher labor productivity can support both economic growth and environmental sustainability, making it a crucial factor in promoting green development.

Financial development has been identified as a key driver of GGDP growth, underscoring the importance of a robust financial system in supporting green investments. Governments should strengthen financial markets to provide better access to capital for sustainable development projects. This can be achieved by promoting the issuance of green bonds, encouraging banks to finance environmentally sustainable projects, and fostering the growth of impact investing. A well-developed financial system is essential for funding the green economy, particularly as countries transition away from fossil fuels and toward renewable energy sources.

Although economic globalization does not have a significant impact on GGDP growth, it remains critical for policymakers to leverage globalization in ways that support sustainable development. This could include fostering international collaborations on green technologies, participating in global climate initiatives, and ensuring that globalization facilitates the expansion of environmentally friendly industries rather than traditional, high-pollution sectors. By aligning global economic integration with green growth strategies, Southeast Asian countries can ensure that the benefits of globalization contribute to long-term environmental sustainability.

By focusing on these key areas—redirecting FDI, reforming trade policies, promoting sustainable urbanization, enhancing labor productivity, advancing financial development, and strategically leveraging globalization—Southeast Asian nations can better position themselves for long-term green economic growth.

4. CONCLUSION

In conclusion, the empirical analysis identifies several key factors driving green GDP (GGDP) growth in Southeast Asia. Economic development, labor productivity, and financial development significantly contribute to GGDP, underscoring the importance of investing in green infrastructure and improving resource efficiency. Foreign direct investment (FDI), while showing potential, did not achieve statistical significance, indicating the need for policies to channel FDI into sustainable sectors such as renewable energy. Trade openness also had no significant impact on GGDP, suggesting the need to shift trade patterns towards environmentally friendly industries.

Urbanization was found to negatively impact GGDP, highlighting the environmental pressures of rapid urban growth, thus emphasizing the need for green urban planning and stricter environmental regulations. Labor productivity plays a crucial role in promoting green growth, indicating that investments in education, training, and eco-friendly technologies are essential for sustainable development.

While economic globalization did not significantly influence GGDP, aligning globalization with green growth strategies through international cooperation can help mitigate environmental impacts. The study concludes that policy measures focused on FDI, trade reforms, urban planning, labor productivity, and financial development are vital for achieving long-term sustainable economic growth in Southeast Asia.

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