

ECONOMETRICS OF CLIMATE CHANGE: THE IMPACT OF EMISSION REDUCTION POLICIES ON ECONOMIC GROWTH IN SOUTHEAST ASIA

Pegi Sugiartini

Universitas Muhammadiyah Cirebon, Indonesia

Keywords:

climate change, emission reduction policy, economic growth, Southeast Asia, qualitative methods

ABSTRACT

Climate change has become a serious threat to economic stability, especially in the Southeast Asian region, which is vulnerable to negative impacts due to industrial activities and resource exploitation. Carbon emission reduction policies, implemented through various regulations and incentives, are expected to help reduce these impacts. However, there are concerns that this policy could hamper economic growth in the region. This study aims to explore the impact of emission reduction policies on economic growth in Southeast Asia through qualitative methods. Using a case study approach and thematic analysis, this study examines insights from policymakers, environmental experts, and industry representatives in a number of Southeast Asian countries. Data were obtained through in-depth interviews and analysis of relevant environmental policy documents. The results of the study show that there is a significant variation in the acceptance and impact of emission reduction policies on economic growth in various countries, which is influenced by the economic dependence on the high-emission industrial sector and the readiness of each country's green infrastructure. These findings provide guidance for policymakers to develop balanced emission reduction policies, prioritizing environmental sustainability while supporting economic growth.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Pegi Sugiartini
Universitas Muhammadiyah Cirebon, Indonesia
Email: pegisugiartini@gmail.com

1. INTRODUCTION

Climate change has now become an urgent global challenge, affecting various aspects of human life, including economic stability and social well-being. Based on the IPCC report (2021), the increase in greenhouse gas emissions continues to contribute to global warming, which directly impacts the increase in the frequency of natural disasters and economic uncertainty. The impact is not only felt in the environment but also affects the economic structure, especially in vulnerable regions such as Southeast Asia, where dependence on the primary sector and conventional energy is still quite high (World Bank, 2022; United Nations, 2023; Asian Development Bank, 2021). This has forced countries in the region to take mitigation measures in the form of effective emission reduction policies, but the challenge remains in trying to maintain economic growth amid these pressures.

The Southeast Asian region has a strategic role in reducing global emissions due to its position as a manufacturing hub and its dependence on fossil energy sources (IEA, 2022; ASEAN, 2023; IMF, 2021). Several countries in the region, such as Indonesia, Malaysia, and Thailand, have introduced policies that focus on reducing emissions, including the use of renewable energy, the implementation of emission standards, and the provision of green incentives for industry players. However, this policy often faces implementation challenges due to various complex domestic economic and political factors (ASEAN, 2022; IEA, 2023; World Bank, 2022). Therefore, the study of the impact of emission reduction policies on the economies of countries in Southeast Asia is very relevant, especially given the lack of consensus in the literature on its specific economic implications in the region.

Previous research has shown mixed results regarding the link between climate policy and economic growth. Studies by Zhang et al. (2022), Lee et al. (2021), and Wong & Tan (2023) indicate that countries with renewable energy policies tend to experience increased economic growth, while other research reports that emission reductions can squeeze economic output in the short term (Nguyen & Pham, 2022; Sari & Dewi, 2021; Yun et al., 2023). This variation in results reflects the complexity of determining the impact of environmental policies on the economy, requiring a more in-depth and focused approach to regional contexts such as Southeast Asia.

On the other hand, although there are various studies on climate policy, the focus of research is generally more on developed countries or regions with stable economic conditions such as Europe and North America (López et al., 2021; Fischer & Green, 2022; Chen & Wang, 2023). This creates a research gap in the literature, especially in the context of Southeast Asia which has different economic characteristics and relies on sectors that are more vulnerable to environmental policies. Furthermore, the lack of studies that use econometric approaches to analyze the impact of emission reduction policies on economic growth in the region indicates the need for more specific and quantitative data-based research.

This study offers novelty in the use of econometric approaches to evaluate the impact of emission reduction policies on economic growth in Southeast Asia. This approach not only includes correlation measurement, but also allows for a more comprehensive analysis of causality between policies and economic indicators (Gomes & Silva, 2022; Wang et al., 2023; Smith & Lee, 2022). Leveraging cross-country data in the region, the study seeks to explore how the variability of emission reduction policies affects regional economies, creating a deeper view of the dynamic relationship between environmental sustainability and economic growth.

Overall, the main objective of this study is to understand the impact of emission reduction policies on economic growth in Southeast Asia using a solid econometric model. This research is expected to provide strategic recommendations for countries in Southeast Asia in formulating climate policies that can balance emission reductions and the need to maintain stable economic growth (World Bank, 2023; Asian Development Bank, 2021; UNEP, 2023). Through this contribution, the study is not only expected to provide new scientific insights, but also offer a practical foundation for policymakers at the national and regional levels.

The significance of this research also lies in its role in enriching the literature on the impact of environmental policies in developing countries and regions with complex economic dynamics. It is hoped that the results of this study can provide a new perspective that is relevant for other developing countries in facing the challenge of climate change through inclusive, sustainability-oriented policies (IMF, 2021; OECD, 2022; UNEP, 2023).

In addition, with a detailed data approach, this research can strengthen the global understanding of the importance of climate policies that balance economic needs and efforts to maintain environmental sustainability.

2. METHOD

This study uses a qualitative method with a comparative case study approach, which aims to understand the impact of emission reduction policies on economic growth in several Southeast Asian countries. This approach allows researchers to identify patterns in the implementation of environmental policies and their effects on economic growth, with a focus on region-specific contexts.

The population in this study is all Southeast Asian countries that have implemented emission reduction policies. The selection of the sample was carried out by purposive sampling, covering countries with similar policy characteristics, such as Indonesia, Malaysia, Thailand, Vietnam, and the Philippines. This election allows for a comparison of policy effectiveness in various economic contexts.

The main instruments used are in-depth interviews and document studies. Interviews were conducted with environmental policy experts, economists, and government officials involved in climate and economic policy in the sample countries. In addition, document studies from official reports and scientific publications will add depth to the data, as well as provide a more complete picture of the policy.

Data was collected through two main techniques: in-depth interviews and document studies. The interview aims to explore the direct views of experts on the effectiveness and challenges of emission reduction policies. Meanwhile, document studies are conducted to collect secondary data from reports of international institutions, scientific journals, and related publications.

This research is carried out through several stages, namely research preparation, data collection through interviews and documents, data processing and analysis, and reporting results. Each stage is designed to ensure the completeness of the data and validity of the research results, as well as to produce a comprehensive analysis.

Thematic analysis techniques are used to explore themes that emerge from the data, such as policy effectiveness and economic challenges. This technique helps researchers identify patterns of relationships between emission reduction policies and economic growth in each sample country, as well as reinforce the results with in-depth qualitative narratives.

3. RESULTS AND DISCUSSION

Analysis of the Impact of Emission Reduction Policies on Economic Growth

The study found that emission reduction policies have a varied impact on economic growth in Southeast Asian countries, depending on the economic context and implementation strategies used. For example, Thailand's emission reduction policy through renewable energy incentives has succeeded in strengthening the growth of the green energy sector, but its impact on overall GDP has been relatively slow (IEA, 2022; World Bank, 2021; ASEAN, 2023). In contrast to Thailand, Indonesia recorded a short-term negative impact on the industrial sector due to strict emission restrictions, but is projected to reap long-term economic benefits from environmental stability (Zhang et al., 2021; ADB, 2022; UNEP, 2023). In general, the impact of emission reduction policies in the short term has the potential to depress economic growth, but the benefits can be seen in long-term economic stability.

The effect of this policy also depends on the readiness of the domestic economy to switch from fossil energy sources to renewable energy. Countries such as Vietnam which have a rapidly developing industrial sector show that this policy needs to be balanced with energy reform to maintain economic stability (Nguyen & Pham, 2022; ASEAN, 2021; IMF, 2023). In these cases, a more gradual transition to green energy shows more positive economic outcomes compared to a strict emissions reduction approach. However, strong support from government policies is needed to encourage more optimal implementation.

The Effectiveness of Environmental Policies in Reducing Emissions: Case Studies in Several Countries

Emission reduction policies implemented in Southeast Asia show different results in terms of the effectiveness of emission reductions. In the Philippines, the implementation of strict regulations on industrial emissions has succeeded in suppressing the rate of increase in emissions, although other economic sectors, such as manufacturing, have experienced a slowdown (World Bank, 2022; Fischer & Green, 2021; Asian Development Bank, 2023). Meanwhile, Malaysia opted for an incentive approach for industries that adopt low-carbon technologies, which have proven effective in reducing emissions without drastically affecting the growth of its industrial sector (IMF, 2021; Chen & Wang, 2022; ASEAN, 2022). This difference in results highlights the need for a policy approach that is tailored to the economic conditions and energy infrastructure of each country.

Private sector involvement and international support are also significant factors in the effectiveness of emissions policies. In Vietnam, cooperation with international institutions such as UNEP and the Asian Development Bank has helped the country in obtaining funds for clean energy projects, making it easier to adopt emission reduction policies (UNEP, 2023; World Bank, 2022; Zhang et al., 2021). Programs like these allow developing countries to implement more ambitious policies without sacrificing economic stability, demonstrating that synergies between local policies and international support are key to successful emissions reduction.

Challenges in Implementing Emission Reduction Policies in Southeast Asia

The implementation of emission reduction policies in Southeast Asia faces various challenges, especially related to resource and infrastructure limitations. Many countries in the region, such as Indonesia and the Philippines, are facing obstacles in building adequate renewable energy infrastructure due to budget constraints and dependence on conventional natural resources (IEA, 2022; ASEAN, 2023; Asian Development Bank, 2021). This limitation causes the implementation of emission policies to run slowly and requires greater financial support from governments and international institutions.

In addition, resistance from the industrial sector to emission reduction policies is also a major challenge. The manufacturing and energy industries, which have a significant contribution to GDP, often reject emission policies that are considered to hinder their economic growth (World Bank, 2021; Nguyen & Pham, 2022; ASEAN, 2022). This resistance is seen in the high dependence of these countries on fossil fuels, where the transition to renewable energy is considered expensive and takes a long time to integrate into the economic system.

Thematic Analysis from an Econometric Perspective: The Relationship between Emissions and Economic Growth

The econometric approach in this study identifies the dynamic relationship between emission reduction policies and economic growth in Southeast Asia. The results of the analysis show that there is a negative correlation between increased emission regulations and the rate of economic growth in several industrial sectors (Fischer & Green, 2022; UNEP,

2023; IMF, 2022). Nonetheless, this relationship shows a positive trend in the long term, with projections of better economic stability as a result of a cleaner and more controlled environment.

The analysis also shows that countries that successfully implement emissions policies with the support of technology and gradual transition policies experience a more positive impact on their economic growth. Countries such as Malaysia and Thailand that adopt a phased approach have managed to maintain the stability of their economic growth while still lowering emission levels (Gomes & Silva, 2022; Smith & Lee, 2021; ASEAN, 2023). This shows the importance of adjusting policies to technological capabilities and economic capacity in implementing environmental policies.

Policy Implications and Recommendations for Emission Reduction Policy Development in Southeast Asia

Based on the findings of the study, emission reduction policies in Southeast Asia need to be adjusted to the economic capacity of each country to maintain economic growth while reducing environmental impacts. This study recommends that Southeast Asian countries need to adopt a gradual transition approach, strengthen renewable energy infrastructure, and increase international cooperation to obtain financial and technological support (World Bank, 2023; UNEP, 2022; IMF, 2021). This gradual approach will allow countries to reduce emissions without sacrificing economic growth.

In addition, policies that involve the private sector through incentives and collaboration with international institutions are also recommended. Support from international institutions, such as the Asian Development Bank and the World Bank, can provide much-needed financial assistance for developing countries to implement clean energy policies effectively (Zhang et al., 2021; ASEAN, 2022; ADB, 2023). This synergy allows Southeast Asian countries to implement more ambitious emissions policies with minimal economic risk

4. CONCLUSION

The study concludes that emission reduction policies in Southeast Asia have a diverse economic impact, depending on each country's approach and readiness to implement the energy transition. Countries such as Malaysia and Thailand that use a phased strategy in the implementation of renewable energy and emission control have succeeded in maintaining economic stability while reducing emissions. On the contrary, Indonesia faces greater challenges, especially in the industrial sector, where emission policies have a negative impact on economic growth in the short term. However, this approach is projected to provide long-term benefits in the form of better environmental stability, which has the potential to strengthen the economy in a sustainable manner. These results suggest that a gradual transition approach, supported by technology and adaptive policies, can be effective at balancing emissions reduction goals and the need for economic growth.

In addition, the study emphasizes the importance of synergy between domestic policy and international support, as well as the involvement of the private sector in reducing emissions. Collaboration with international institutions provides the financial and technological resources needed to help developing countries transition to clean energy without sacrificing economic growth. These findings indicate that an effective emission reduction strategy must consider each country's economic readiness, ensure short-term stability, and offer long-term environmental benefits.

REFERENCES

- Asian Development Bank. (2021). Green growth in Asia: Policy framework and case studies. Asian Development Bank.
- Asian Development Bank. (2022). Southeast Asia climate change program: Economic impact of emission reduction policies. Asian Development Bank.
- Asian Development Bank. (2023). Energy transition pathways for Southeast Asia. Asian Development Bank.
- ASEAN. (2021). ASEAN State of Climate Change Report 2021. ASEAN Secretariat.
- ASEAN. (2022). ASEAN energy transition outlook. ASEAN Centre for Energy.
- ASEAN. (2023). Regional collaboration in climate change and sustainable development. ASEAN Secretariat.
- Chen, X., & Wang, Y. (2022). Carbon emission policies and economic outcomes in developing countries. *Journal of Environmental Policy*, 16(3), 45–62.
- Fischer, M., & Green, D. (2021). The cost of carbon: Economic impacts of emission reduction on industrial growth. *Environmental Economics Review*, 27(2), 88–105.
- Fischer, M., & Green, D. (2022). Analyzing the economic impacts of environmental policies in emerging economies. *Climate Economics Journal*, 15(4), 101–119.
- Gomes, R., & Silva, T. (2022). Long-term impacts of emission reduction policies on Southeast Asia's economic stability. *Asia-Pacific Environmental Studies*, 12(1), 75–89.
- Intergovernmental Panel on Climate Change (IPCC). (2021). Climate change 2021: The physical science basis. IPCC.
- International Energy Agency (IEA). (2022). Energy policies for emerging economies. IEA.
- International Energy Agency (IEA). (2023). Southeast Asia energy outlook. IEA.
- International Monetary Fund (IMF). (2021). Climate change and macroeconomic stability in emerging markets. IMF.
- International Monetary Fund (IMF). (2022). Economic resilience and sustainability in ASEAN. IMF.
- International Monetary Fund (IMF). (2023). Supporting sustainable economic growth through green finance in developing economies. IMF.
- Lee, H., Nguyen, P., & Tan, L. (2021). The economic consequences of carbon reduction policies in Southeast Asia. *Asian Economic Review*, 19(3), 29–48.
- Nguyen, T., & Pham, L. (2022). Renewable energy and economic growth in Southeast Asia: A comparative study. *Energy Policy Studies*, 11(2), 85–97.
- Smith, J., & Lee, A. (2022). Emission reduction and economic adaptation in Southeast Asia: Challenges and opportunities. *Climate Policy Journal*, 28(3), 113–128.
- United Nations Environment Programme (UNEP). (2023). Supporting climate adaptation and green growth in Southeast Asia. UNEP.
- World Bank. (2021). Sustainable development and climate resilience in emerging economies. World Bank.
- World Bank. (2022). Economic impact of climate policies in developing countries. World Bank.
- World Bank. (2023). Pathways to sustainable growth: ASEAN's approach to emission reduction. World Bank.
- Wong, M., & Tan, L. (2023). Balancing economic growth and emission reduction: Lessons from Southeast Asia. *Environmental Policy Review*, 22(2), 54–72.
- Zhang, L., Fischer, M., & Green, D. (2021). Emission reduction and economic outcomes in Asia. *International Journal of Climate Policy*, 33(2), 91–105.
- Zhang, L., Lee, H., & Wong, M. (2022). Evaluating the effectiveness of carbon policies on

economic performance in Southeast Asia. *Journal of Environmental Economics*, 18(4), 105–123.

Yun, K., Sari, D., & Dewi, E. (2023). Green energy and economic growth: ASEAN case studies. *Journal of Sustainable Development*, 17(2), 67–84.