Environmental Tax – Economic Growth Nexus in ASEAN-4 Countries

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Abstract. In the modern world, energy consumption, carbon emissions, and economic growth are concerns for all nations that want to continue expanding by striking a balance between energy and carbon emissions. One reason for this is that these fuels will cause global warming due to climate change. Environmental taxes are increasingly seen as a crucial component of economic policy, where a well-constructed tax can encourage innovation and economic incentives. The nexus of the economic growth and environment is now becoming one of the essential relations for policymakers. Nevertheless, most of the previous studies are limited to European countries. Thus, this research investigates the cointegration of Environmental Tax (ET) towards Economic Growth (EG) with Interest Rate (IR) as a control variable for the case of selected ASEAN countries, namely Malaysia, Philippines, Thailand, and Vietnam. The yearly data set covering the period from 2014 to 2021 was utilized as the sample period for the panel autoregressive distributed lag model (ARDL) approaches. Results revealed that both the Environmental Tax and Interest Rate have a long-run negative effect on Economic growth but have a positive influence in the short run. From this finding, the implication of environmental tax toward economic growth also may depend on the economic conditions of an economy.

1 Introduction

Achieving the Sustainable Development Goals (SDGs) depends on environmental protection. The SDGs are a comprehensive framework for solving global concerns. By conserving natural resources, mitigating pollution, and addressing climate change, environmental protection ensures the long-term viability of ecosystems and supports human well-being. Incorporating environmental considerations into economic decision-making helps promote sustainable practices and ensures the well-being of future generations. Environmental concerns often require policy interventions and regulations to ensure sustainable and equitable outcomes. These policies influence economic behavior, investment decisions, and market dynamics.

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The nations of the Association of Southeast Asian Nations (ASEAN) are aware of how important environmental preservation and sustainable development are. Several ASEAN member states have implemented various forms of environmental taxes or levies to address environmental challenges and promote green practices. Additionally, a carbon tax on large carbon emitters aims to incentivize companies to reduce greenhouse gas emissions. There is growing recognition that environmental protection and sustainable development can yield economic benefits. By investing in renewable energy, eco-friendly industries, and sustainable agriculture, economies can create jobs, drive innovation, and promote long-term economic growth while minimizing environmental impacts.

Economic growth is an important driver of development, poverty reduction, and improved living standards. However, the traditional focus on economic growth without adequate consideration of environmental sustainability can lead to negative consequences, such as resource depletion, pollution, and environmental degradation. Unsustainable economic activities can undermine the very foundations of long-term growth and well-being. Therefore, integrating environmental considerations into economic growth strategies is vital for sustainable development. Figure 1 shows the increasing trend of Gross Domestic Product for Malaysia, the Philippines, Thailand, and Vietnam from 1998 to 2022.

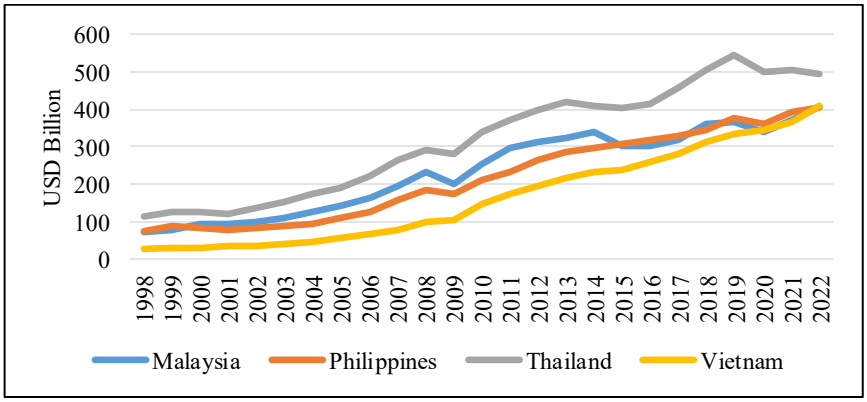

Fig. 1. Gross Domestic Product (current US$) ASEAN-4, 1998-2022
Source: World Bank

A significant amount of study looks at the relationship involving taxation on the environment and certain pollutant emissions, like carbon dioxide and sulphur dioxide emissions, and how those emissions affect air quality [1, 2, 3, 4]. In this regard, a need for more studies comprehensively analyzes a globally comparable indicator, particularly in investigating the interconnectedness between environmental taxes and economic progress on a broader scale. Hence, our research objective is to examine whether environmental taxes contribute to economic development, a crucial aspect in formulating feasible policy recommendations for the ASEAN group. Despite the limited research, environmental taxes are regarded as a direct policy instrument for mitigating environmental harm. However, there needs to be more studies that establish a connection between this policy measure and economic growth.

Additionally, the purpose of our research is to clarify the effectiveness of environmental taxes in ASEAN nations, potentially inspiring similar measures in other nations to alleviate environmental harm and foster economic growth. The rest of the content of this study is divided into the following sections: The technique is presented in section three after a

thorough evaluation of the pertinent literature is presented in section two. Section four of the study discusses the findings, and section five summarises the findings and their implications.

2 Literature Review

There has been a notable shift in public and political sentiment in recent years towards adopting low-carbon economies [5]. This changing perspective has called for substantial modifications in environmental policies to safeguard the planet's ecosystem against the detrimental effects of greenhouse gas (GHG) emissions and climate change. The research by [6] examines environmental taxes, encompassing energy, pollution, transport, and resource taxes. The study uses a systematic approach to reviewing the literature with a focus on bibliometric analysis. The analysis takes into account droughts, excessive moisture, rising sea levels and adverse weather. In line with Intergovernmental Panel on Climate Change (IPCC) recommendations, it is crucial to implement environmental reforms that aim to limit the global temperature increase to less than two (2) °C compared to pre-industrial levels [7]. In this context, the introduction of environmental taxes serves multiple purposes. Firstly, these taxes promote energy efficiency, improving fuel efficiency and reducing per capita fossil fuel consumption [8] [9]. Secondly, they stimulate growth in the renewable energy sector, enabling energy-exporting countries to increase their foreign exchange reserves. By reducing domestic fuel consumption, these countries can redirect their surplus energy towards developing economies, thus boosting their export potential [10].

Numerous studies have examined the effectiveness of environmental taxes concerning trade competitiveness [11][12] and environmental degradation [13][14][15]. These studies consistently demonstrate a negative and significant impact of environmental taxes on pollutant emissions reduction and improvements in energy efficiency. From an economic standpoint, [16] argues that environmental taxes play a crucial role in fostering economic growth and facilitating economic transformation. They promote sustainable economic development and create employment opportunities, particularly in the renewable energy sector. Contrasting views on the effectiveness of environmental taxes have emerged from recent studies. For European economies, a study by [13] and specifically for Romania, conducted by [17], present contradictory opinions on the impact of environmental taxes. These studies argue that environmental taxes primarily succeed in reducing pollutant emissions. However, scholar such as Carraro [18] express scepticism, asserting that environmental taxes are a policy instrument primarily aimed at controlling greenhouse gas emissions.

Most of previous empirical literature studies the relationship that linked economic growth and interest rates have found a negative correlation between the two. Numerous techniques were used by authors to investigate how interest rates affect economic growth, including Hatmanu et al. [20], Inam and Etim [21], and Ighodalo et al. [22]. According to Hatmanu's study, the interest rate has a short-term negative impact on economic growth in Romania. This study looked at how the interest rate for monetary policy in the Eurozone affected that country's economic growth. When Ighodalo et al. used the Johansen Cointegration test and the system Generalised Method of Moments (sysGMM) to investigate the relationship between foreign debt and economic growth in 43 African nations from 2001 to 2018, they found that there was a negative and significance correlation between interest rates and economic production.

3 Methodology

The study follows the below econometric model to examine the cointegration of Environmental tax towards Economic growth while the Interest rate operates as a control variable.

$$EG_{it} = \beta_0 + \beta_1 ET_{it} + \beta_2 IR_{it} + \varepsilon_t \quad (1)$$

Where; EG represents Economic Growth proxied by GDP per capita growth (annual%). ET and IR designate the Environmental Tax (Environmental Taxes (% of GDP)) and Interest Rate (%), respectively, while ε shows the error term. Since the study followed the panel data analysis with unrestricted specification, 'i' shows the cross-section and 't' indicate the time-variant. The respective coefficients are presented with β to illustrate the magnitude of the effect from ET and IR to EG. This study gathered annual data spanning from 2014 to 2021 for four selected ASEAN countries, i.e. Malaysia; Philippines; Thailand, and Vietnam.

To assess the short-run and long-run co-integration, the study used Macro Panel data models, namely Pooled Mean Group (PMG), Mean Group (MG), and Dynamic Fixed Effect (DFE). The study chose the Panel ARDL model since the number of cross-sectional countries is less than the number of time intervals in the sample, and there is a cross-sectional dependency among the countries. Hence, in a situation with a cross-sectional dependency and the data set follows the long panel characteristics, the best fitting model to examine the co-integration is the panel ARDL model. Pooled Mean Group estimation assumes that panel estimators are consistent and efficient. Further, PMG estimation can measure the dynamic long-run and short-run coefficients event when the error variance is heterogeneous. However, the Mean Group can be used to estimate the long-run relationship but is weak in homogeneity estimation. Further, the Dynamic Fixed Effect limits the co-integration vector coefficients to keep the consistency for long-run panels. Further, in the short run, it limits the time adjustment coefficient. Moreover, DFE limits the coefficients of integration vectors.

In order to determine the cross-sectional dependency of the data set, four cross-sectional dependency tests—the Breush-Pagan (1980) LM test, the scaled LM test developed by Pesaran (2004), the bias-corrected scaled LM test developed by Baltagi, Feng, and Kao (2012), and the LM test developed by Pesaran (2004)—were utilised. First- or second-generation tests can be used to estimate the panel unit root. The second generation of the panel unit root test accounts for cross-sectional dependency and is more suitable than the first generation when the data set exhibits cross-sectional dependency [19]. The Hausman test was occupied with selecting the best-fitting model among PMG, MG and DFE. The Hausman test confirms the slope homogeneity and finalizes the best-fitted model among PMG, MG, and DFE.

4. Results

4.1 Descriptive Statistics

Table 1 presents the key attributes of the overall data series. Statistics in Table 2 confirm that EG and IR present negative skewness with leptokurtic distribution while ET has positive skewness with platykurtic shape.

Table 1. Descriptive Statistics – Pooled Data set

Variables	Obs	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
EG	32	3.885	4.967	7.465	-9.518	4.044	-1.974	6.418
ET	32	1.104	0.893	2.590	0.200	0.795	0.855	2.296
IR	32	3.740	3.798	8.988	-2.147	2.015	-0.250	4.562

Table 2 presents the key attributes of the overall data series. Statistics in Table 2 confirm that EG and IR present negative skewness with leptokurtic distribution while ET has positive skewness with platykurtic shape.

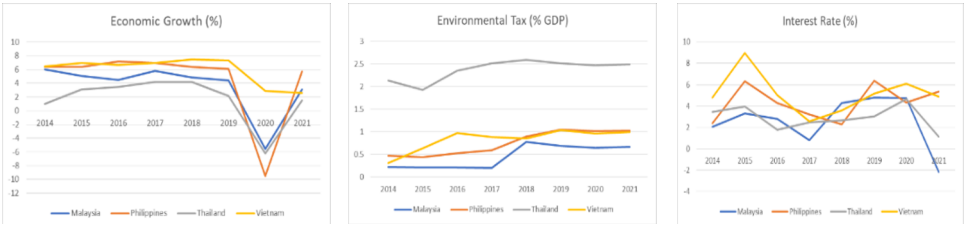

Fig 2. Behaviour of Economic Growth, Environmental Tax payment and Interest Rate

Further, Figure 2 presents the changes in the economic growth rate, environmental tax payment and interest rate of selected ASEAN countries during the seven years from 2014 to 221. According to the diagram, despite the economic growth of all the selected countries having dropped in 2020 and 2021, they recovered the negative growth rate. They moved forward with a drastic economic bounce back. While Malaysia, Thailand and Vietnam reduced their interest rates in 2021, only the Philippines has increased the interest rate. All the countries show a flatter rate of environmental tax payment as a percentage of GDP from 2018.

4.2 Panel Regression with Generalized Least Square

Table 2 presents the pooled regression, which shows that environmental tax significantly affects the economic growth of ASEAN countries.

Table 2. Panel Regression with Generalized Least Square Method

R-squared	Within				0.1284	
	Between				0.4775	
	Overall				0.1267	
Number of Observations					32	
Number of groups					4	
Observation per group	Min				8	
	Avg				8	
	Max				8	
F (5, 607)					8.000	
Prob> F					0.000	
	Coefficient	SE	z	P> |t|	[95% conf.	Interval]
ET	-1.826	0.892	-2.05	0.041	-3.575	-0.078
IR	-0.622	0.352	-0.18	0.860	-0.752	0.627
Cons	6.135	1.883	3.26	0.001	2.443	9.828
Sigma_u	0					
Sigma_e	3.780					
rho	0					

4.3 Multi Collinearity Test

Table 3 presents and confirms that no multicollinearity exists among the variables since the Variance Inflation Factor (VIF) values are lower than five and the tolerance ratio is higher than 0.2.

Table 3. Multicollinearity Test

Variable	VIF	1/VIF
ET	1.02	0.9797
IR	1.02	0.9797
Mean VIF	1.02	

4.4 Panel Unit Root

Table 4 presents that there is a cross-section dependency on the data series. Hence, the study used the Bai and Ng unit root test to measure the stationarity of the data series. The results are presented in Table 4. According to the table statistics, Economic Growth (EG) and Interest Rate (IR) show stationarity, while Environmental Tax (ET) presents a unit root.

Table 4. Cross-sectional dependency

Variable	t statistic	P-value
EG	-1.756	0.079
ET	-0.867	0.386
IR	4.498	0.000

***, ** and * show significance at the 1%, 5% and 10% levels, respectively

4.5 Panel data estimation

The long-run and short-run effect of environmental tax and the interest rate on the economic growth of ASEAN countries was measured with PMG, MG and DFE methods, and the selection of the best fitting model was done by assessing the results of the Hausman test. The PMG, MG and DFE test statics are presented in Table 5, while Hausman test values are in Table 6. According to the Chi Square values and probabilities values in Table 6, PMG was selected as the most appropriate model to showcase the long-run and short-run influence of ET and IR to EG.

Table 5. Panel Co-integration

DV (Economic Growth)	Mean Group (MG)	Pooled Mean Group (PMG)	Dynamic Fixed Effect (DFE)
		LONG-RUN	
ET	-7.816	-14.013***	-7.267**
	(11.118)	(1.387)	(2.741)
IR	-7.484	-2.874***	-1.352 **
	(3.843)	(0.213)	(0.569)
		SHORT-RUN	
Speed of adjustment	-0.751**	-0.715***	-1.196***
	(0.288)	(0.222)	(0.191)
ET	7.936	8.127**	8.515**
	(15.440)	(3.228)	(4.015)
IR	1.691	0.690	1.089**
	(0.910)	(0.682)	(0.467)
Number of groups	4	4	4
Number of observations	28	28	28

Notes: Standard error is shown in brackets, while ***, **, and * denote significance at levels of 1%, 5%, and 10%, respectively.

The Pooled Mean Group (PMG) confirms that ET and IR have a significant negative influence over the EG of ASEAN countries in the long run, while there is a positive effect of ET on the EG in the short run. These results highlight that even though imposing ET reduces

the EG by 14.01 per cent in the long run, it contributes to improving the EG by 8.127 per cent in the short run. Hence, it is clear that the economy can generate additional income for investment by implementing the environmental tax (ET) rule. However, when it comes to the long run, ET clearly generates negative economic growth consequences. Further, IR does not significantly influence the economic condition in the short run but reduces economic growth by 2.874 per cent in the long run. Here the speed of adjustment indicates that the economy takes at least sixteen (16) months to recover the influence made by ET and IR on the EG of ASEAN countries.

Table 6. Hausman Test

Test	χ^2 Value	P-Value	Decision
MG vs PMG	0.16	0.9217	PMG is appropriate
PMG vs DFE	146.7	0.0000	PMG is appropriate

5.0 Conclusion and Implications of the Study

Environmental protection is essential for sustainable development, and achieving the SDGs requires addressing environmental challenges. Integrating environmental considerations into economic growth strategies can lead to green and sustainable economic development. Our study findings and policy recommendations are consistent with pursuing specific Sustainable Development Goals (SDGs). Countries, for example, must prioritize climate action (SDG-13) alongside economic growth (SDG-9) to proceed to a more sustainable stage of development. Recognizing the interdependence of environmental protection, the SDGs, and economic growth allows societies to work together to create a more sustainable and prosperous future.

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