

Are all nations addicted to CO_2 emission? Evidence from ASEAN countries

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Introduction

- The increasing threat of global warming and climate change has focused attention on the relationship study between economic growth and Carbon emission
- In order to save the cleaner environment, is it true that a nation has to sacrifice on their economic expansion?
- Historic studies investigated that the higher the economic expansion of a nation, the greater the intensity of Carbon emission
- Research is showing us now that there is a method to control climate change without giving up on value of all goods and services produced in a country in a year, (Gross Domestic Product)



Historic Studies

2 parallel literatures on the relationship between economic growth and environmental pollution

EKC

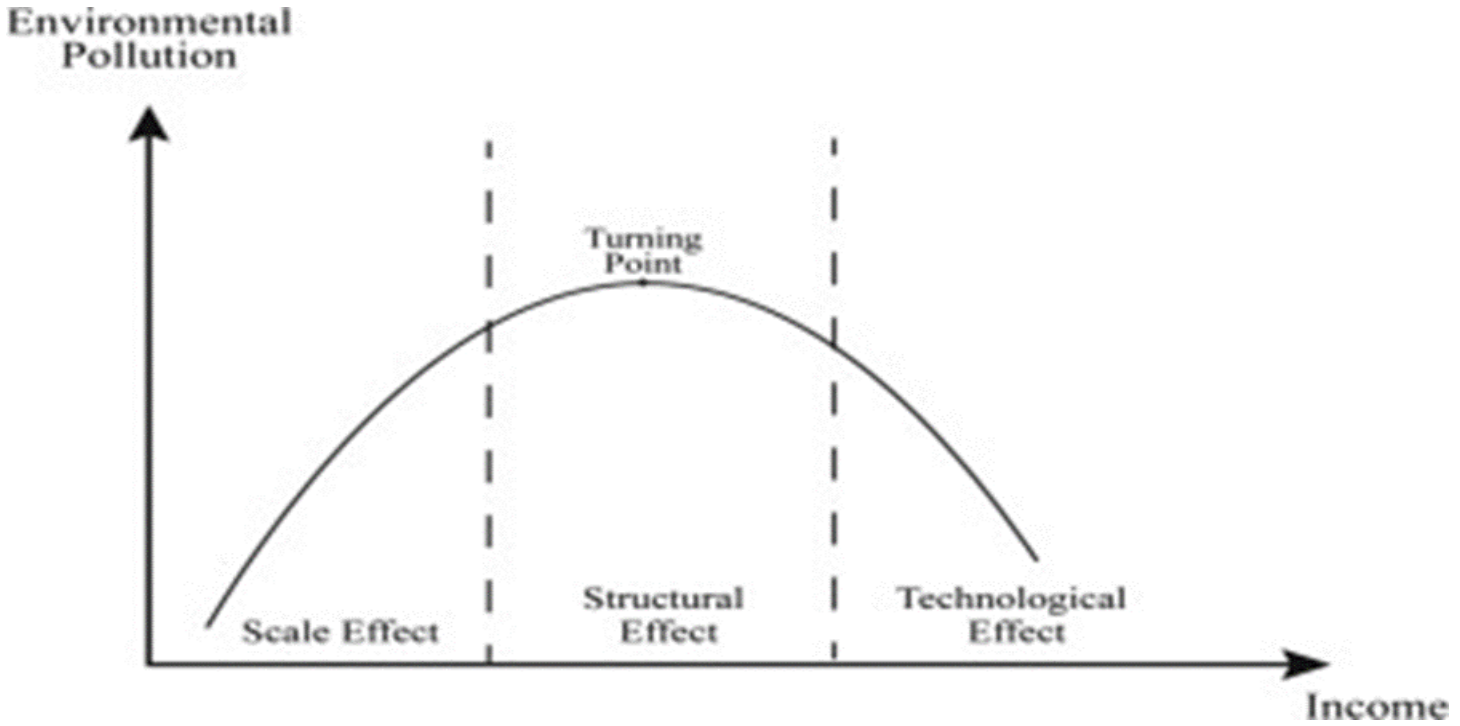
Grossman and Krueger's (1991) Environmental Kuznets Curve

IPAT

I = Impact
A = Affluence
P = Population
T = Technology



Environmental Kuznets Curve



Environmental degradation increases as the economy expands and environmental pollution decreases when the economy develops further enough to exceed a critical threshold



Research Questions:

- To what extent is the ASEAN region as well as each country dependent on CO_2 emission?
- Does the dependence on CO_2 emission decreases over time?

Research Hypotheses:

1: The reduction of CO_2 emission will have negative effect on GDP in the ASEAN region. ASEAN region as a whole is addicted to CO_2 emission.

2: The effect of CO_2 emission varies across countries in the ASEAN region

3: The effect of CO_2 emission on GDP decreases over time



Research Objectives

- To determine the impact of CO_2 emission on economic growth across ASEAN countries
- To examine how technology plays a role in reducing $C0_2$ emission in the ASEAN region
- To identify if any of the ASEAN countries are not addicted to CO_2
- To examine if effect of CO_2 emission on GDP decreases over time



Relevance of Research

- Novel research - limited empirical studies to date on the dependence of GDP growth on CO_2 emission for ASEAN countries
- Studies on EKC and other related research examined the impact of GDP growth on the growth of CO_2 emission → this study looks into the issue on a different perspective
- Study attempts to provide some insights on the debate about the issue on global warming
- Platform to educate policy makers



Research Methodology

- **IPAT model:**
- $$CO2 = Population\ X \frac{GDP}{Population} X \frac{E}{GDP}\ X \frac{CO2}{E}$$
- **My research model :**
- $$\underset{X}{\frac{CO2}{Population}} = \underset{Y_1}{\frac{GDP}{Population}} X \underset{Y_2}{\frac{E}{GDP}}\ X \underset{Y_3}{\frac{CO2}{E}}$$



Panel Study

- Cross sectional study
- Time series: 1971-2014

Unit of Analysis

- 9 countries in ASEAN
- Malaysia, Singapore, Thailand, Myanmar, Cambodia, Vietnam, Brunei, Indonesia, Philippines

Statistical Method

- Data Analysis
- Regression model



Data Source

- **Secondary data**
- *Data from World Bank :*

❖ Total national population

❖ CO_2 Emission (kilo ton/year)

❖ Energy use (kg of oil equivalent per capita)

- *Data from Penn table :*

❖ GDP (in million US$)



Results & Discussion

Table 1: Results of Panel regression with interaction term

Dependent/Independent variable	Estimated coefficient	Standard error	z	P value	R^2
Equation 1					
Dependent variable: growth of GDP per capita					
Independent variable: growth of CO_2 per capita	0.3903647	0.027398	14.25	0.000	0.8142
Interaction: d*growth of CO_2 per capita	- 0.0630824	0.0057846	-10.91	0.000	
Constant	-2.648082	0.2569937	-10.30	0.000	
Equation 2					
Dependent variable: growth of energy-GDP ratio					
Independent variable: growth of CO_2 per capita	- 0.2650836	0.0384553	-6.89	0.000	0.1576
Interaction: d*growth of CO_2 per capita	0.0757871	0.0064873	11.68	0.000	
Constant	-6.526029	0.5129196	-12.72	0.000	
Equation 3					
Dependent variable: growth of C02-energy ratio					
Independent variable: growth of CO_2 per capita	0.681005	0.0284503	23.94	0.000	0.2090
Interaction: d*growth of CO_2 per capita	- 0.0180034	0.0047819	-3.76	0.000	
Constant	7.924801	0.5247888	15.10	0.000	



Table 2: Effect of the growth of CO_2 emission per capita on the growth of GDP per capita by country in the ASEAN region

Country	Coefficient of per capita CO_2	Interaction term	Constant
Brunei	0.3108591*** (0.1033446)	0.015363 (0.0293022)	-1.402348*** (0.3989827)
Cambodia	0.0676139* (0.0357025)	-0.0677004*** (0.0110767)	-6.18656*** (0.3586552)
Indonesia	1.155597*** (0.0620949)	0.0280349** (0.0107534)	2.376597*** (0.0107534)
Malaysia	0.7568036*** (0.0439368)	-0.0281788** (0.0106968)	-0.4161763 (0.2605746)
Myanmar	0.7563379*** (0.2285572)	-0.076112*** (0.0164032)	-0.3378376 (2.009592)
Philippines	0.6796245*** (0.1825764)	-0.0385893*** (0.0089075)	-0.8327976 (1.316612)
Singapore	0.4728989*** (0.1300172)	-0.1210712*** (0.016077)	-0.7058788 (0.5686263)
Thailand	0.7404481*** (0.0303479)	-0.0082957 (0.0084735)	-0.4706824** (0.2061783)
Vietnam	0.6286338*** (0.1387804)	-0.0471436* (0.0270356)	-1.800426 (1.095541)

Note:*** - 1%; ** - 5%; * - 10% ; Value in parentheses show standard deviation



Table 3: Effect of growth of CO_2 emission per capita on growth of energy-GDP ratio by country in the ASEAN region

Country	Coefficient of per capita CO2	Interaction term	Constant
Brunei	- 0.534562***	0.0506214*	-3.117119***
	(0.096878)	(0.0274687)	(0.3740173)
Cambodia	-0.6021452***	0.0392291***	-9.156619***
	(0.1294849)	(0.0132109)	(1.136669)
Indonesia	-0.9247645***	-0.0348708***	-13.51884***
	(0.0738397)	(0.0738397)	(0.5349508)
Malaysia	-0.3264746***	0.0327889***	-6.673582***
	(0.0467075)	(0.0113713)	(0.2770066)
Myanmar	-0.4532947	0.1187297***	-8.781818***
	(0.2911997)	(0.020899)	(2.560377)
Philippines	-0.6723342**	0.1108993***	-10.79433***
	(0.3660053)	(0.0178565)	(2.639372)
Singapore	0.0285957	0.0587029***	-4.003959***
	(0.1618264)	(0.0200103)	(0.7077431)
Thailand	-0.2881051***	-0.0216999**	-7.831746***
	(0.0360274)	(0.0100593)	(0.2447635)
Vietnam	-0.2113336	0.0765006*	-7.197195***
	(0.2052441)	(0.0390204)	(1.620318)

Note:*** - 1%; ** - 5%; * - 10% ; Value in parentheses show standard deviation



Table 4: Effect of growth of C02 emission per capita on growth of C02-energy ratio by country in the ASEAN region

Country	Coefficient of per capita CO2	Interaction term	Constant
Brunei	1.223703***	- 0.06598438***	4.519467***
	(0.0741347)	(0.0210201)	(0.286212)
Cambodia	0.8041468***	-0.0209851**	8.889298***
	(0.0889369)	(0.0090739)	(0.7807223)
Indonesia	0.7691677***	0.0068359	11.14224***
	(0.0290502)	(0.0050308)	(0.210462)
Malaysia	0.569671***	-0.0046101	7.089758***
	(0.0266262)	(0.0064824)	(0.1579111)
Myanmar	0.6969568***	-0.0426178***	9.119656***
	(0.1173845)	(0.0084245)	(1.032105)
Philippines	0.9927097***	-0.07231***	11.62713***
	(0.1900527)	(0.0092722)	(1.370526)
Singapore	0.4985054**	0.0623683***	4.709838***
	(0.1838033)	(0.0227278)	(0.8038584)
Thailand	0.547657***	0.0299957***	8.302429***
	(0.0300409)	(0.0083878)	(0.2040926)
Vietnam	0.6193298***	-0.0255207*	9.287068***
	(0.0765855)	(0.0145602)	(0.604611)

Summary

CO_2 addicted Nations	vs	CO_2 non-addicted Nations
• GDP growth highly depends on $C0_2$ emission • Indonesia (high addiction) • Myanmar, Vietnam, Thailand, Philippines, Malaysia (moderate addiction)		• GDP growth not dependent on $C0_2$ emission • eg: Cambodia • Countries adopt right C reducing technology • e.g. Singapore, Brunei

Conclusion

- ASEAN region is nearly 40% dependent on $C0_2$ emission for its economic development.
- After year 1999, dependency on $C0_2$ reduced by 6% but the level of dependence varies across countries in the region from 7% to 116%.
- Growth of carbon dioxide emission was distributed into 33% of GDP growth and 67% of technological advancement after year 1999.
- Therefore, it shows that majority of ASEAN countries were performing better at managing their energy utilization and pollution index in response to Kyoto Protocol.



Limitations of this study and suggestion for further study

Endogeneity

- Shortcomings
- 2 way causality study

Heterogenity

- Differences among countries
- Institutional , cultural, political, regulations, environmental act

THANK YOU