

Impact of growth in international tourism industry contributed to
CO2 emission in Cambodia, Philippines and Thailand

Miss Juthamard Laohawattanajinda



An Independent Study Submitted in Partial Fulfillment of the
Requirements
for the Degree of Master of Arts in International Economics and Finance
Field of Study of International Economics
FACULTY OF ECONOMICS
Chulalongkorn University
Academic Year 2019
Copyright of Chulalongkorn University

ผลกระทบบจากการเติบโตของอุตสาหกรรมการท่องเที่ยวระหว่างประเทศต่อการปล่อยก๊าซ
คาร์บอนไดออกไซด์ในประเทศกัมพูชา ฟิลิปปินส์ และไทย



สารนิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
สาขาวิชาเศรษฐศาสตร์และการเงินระหว่างประเทศ สาขาวิชาเศรษฐศาสตร์ระหว่างประเทศ

คณะเศรษฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2562

ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

Independent Study Title	Impact of growth in international tourism industry contributed to CO2 emission in Cambodia, Philippines and Thailand
By	Miss Juthamard Laohawattanajinda
Field of Study	International Economics and Finance
Thesis Advisor	Assistant Professor SAN SAMPATTAVANIJA

Accepted by the FACULTY OF ECONOMICS,
Chulalongkorn University in Partial Fulfillment of the
Requirement for the Master of Arts

INDEPENDENT STUDY COMMITTEE

..... Chairman
(Assistant Professor PANUTAT
SATCHACHAI)

..... Advisor
(Assistant Professor SAN
SAMPATTAVANIJA)

..... Examiner
(Associate Professor FREDERIC JEAN-
MARIE TOURNEMAINE)

CHULALONGKORN UNIVERSITY

จุฑามาศ เลหาวัฒนจินดา : ผลกระทบจากการเติบโตของอุตสาหกรรมการท่องเที่ยว
ระหว่างประเทศต่อการปล่อยก๊าซคาร์บอนไดออกไซด์ในประเทศกัมพูชา ฟิลิปปินส์
และไทย. (Impact of growth in international tourism
industry contributed to CO2 emission in Cambodia,
Philippines and Thailand) อ.ที่ปรึกษาหลัก : ผศ. ดร.สันต์ สัมปิตตะว
นิช

การท่องเที่ยวโดยทั่วไปถือว่าเป็นอุตสาหกรรมที่สะอาด เหตุผลหนึ่งคือการท่องเที่ยว
นั้นเพิ่มการลงทุนในสิ่งอำนวยความสะดวก แทนการลงทุนในโรงงาน นอกจากนี้การพัฒนาการ
ท่องเที่ยวที่เพิ่มขึ้นนั้นต้องอาศัยการปกป้องสิ่งแวดล้อมทางธรรมชาติและนิเวศวิทยา อย่างไรก็ตาม
ตามการพัฒนาการท่องเที่ยวเช่นเดียวกับการพัฒนาอุตสาหกรรมอื่นๆ เพิ่มความต้องการใช้
พลังงานที่สูงขึ้นและหากขาดการจัดการที่ดีในอุตสาหกรรมการท่องเที่ยว ก็จะส่งผลให้เกิดความ
เสี่ อ ม โ ท ร ม ข อ ง สິ ง แว ด ลี อ ม

รายงานฉบับนี้ศึกษาผลกระทบของความเสื่อมโทรมของสิ่งแวดล้อมทั้งในแง่ของปัจจัยจาก
จุดหมายในการท่องเที่ยว และปัจจัยจากนักท่องเที่ยว บนสมมติฐานอีเคซี โดยรวมการเปิดกว้าง
ทางการค้าและการปล่อยก๊าซคาร์บอนไดออกไซด์เข้ามาด้วย โดยศึกษาในประเทศ กัมพูชา
ฟิลิปปินส์และไทย ซึ่งเป็นประเทศที่ติดอันดับสามอันดับแรกของเอเชียตะวันออกเฉียงใต้ที่มี
สัดส่วนรายได้สูงสุดจากการท่องเที่ยวต่อเศรษฐกิจโดยรวม

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

สาขาวิชา เศรษฐศาสตร์และการเงิน
ระหว่างประเทศ

ปีการศึกษา 2562

ลายมือชื่อนิสิต

.....

ลายมือชื่อ อ.ที่ปรึกษาหลัก

.....

6284014229 : MAJOR INTERNATIONAL ECONOMICS AND FINANCE

KEYWORD environmental degradation, tourism development,

RD: EKC hypothesis

Juthamard Laohawattanajinda : Impact of growth in international tourism industry contributed to CO2 emission in Cambodia, Philippines and Thailand.

Advisor: Asst. Prof. SAN SAMPATTAVANIJA

Tourism is generally considered a clean industry, one of the reasons is tourism increasing investment in traveling facilities, instead of investment in factories. Furthermore, increasing tourism development relies on the protection of the natural environment and ecology. However, tourism development, like all industrial development, also comes with the higher demand in energy consumption and lack of management in the tourism industry resulting in environmental degradation

The paper investigated the effect of environmental degradation in both aspects of destination factors and tourist factors based on the EKC hypothesis by incorporating trade openness and CO2 emission in Cambodia, Philippines, and Thailand which are the top three countries in South East Asia with the highest proportion of income from tourism to the entire economy.

Field of Study:	International Economics and Finance	Student's Signature
Academic Year:	2019	Advisor's Signature

ACKNOWLEDGEMENTS

I would like to thank Asst. Prof. Dr. San Sampattavanija for his expert advice, my family, and my partner for their encouragement throughout this difficult moment.

Juthamard Laohawattanajinda



TABLE OF CONTENTS

	Page
ABSTRACT (THAI)	iii
ABSTRACT (ENGLISH).....	iv
ACKNOWLEDGEMENTS.....	v
TABLE OF CONTENTS.....	vi
LIST OF FIGURES	1
LIST OF TABLES.....	2
INTRODUCTION	3
Objective.....	4
Scope.....	4
LITERATURE REVIEW	5
The EKC hypothesis	5
Sources of environmental degradation	8
Trade openness and environmental degradation.....	9
Tourism development and environmental degradation	10
DATA AND METHODOLOGY.....	13
RESULT	18
CONCLUSION.....	24
REFERENCES	25
VITA.....	28

LIST OF FIGURES

Figure 1. Different effects of income on pollution. 7



LIST OF TABLES

Table 1 Expected relationship of variables to a dependent variable.....	14
Table 2 Data source and measurement.	16
Table 3 Result from the OLS test, Cambodia.....	21
Table 4 Result from the OLS test, Philippines	22
Table 5 Result from the OLS test, Thailand	23



INTRODUCTION

The growth in economic from all around the world leads to more human activities, both from the household sector and the business sector. When people exhaust natural resources or release harmful chemicals into the air causing environmental degradation. The more growth in economic demand, more resources usage is affecting ecology.

The obvious phenomenon from environmental degradation is global warming which one of the factors is Greenhouse gases. The Greenhouse gases soak up and emit some of the thermal energy which radiated from the earth's surface, causing that thermal energy to be retained in the lower part of the atmosphere which slowly increases in the average temperature of the earth's atmosphere. The increase in average temperature changes the great patterns of wind which leads to climate change that causing erratic weather phenomena, monsoons and rain, and snow around the world. Around 71 percent of earth's surface is covered by water which heats up and produces more water vapor into the layer of clouds, where weather phenomena such as typhoons and hurricanes are forming resulting in more dense and intensive typhoons and hurricanes. The heated atmosphere also makes glaciers and mountain snowpack's, the polar-ice cap, and Antarctica ice sheet melt rising sea levels.

One hypothesis explains the relationship between income and environment is the Environmental Kuznets Curve (EKC) hypothesis which explained that environmental degradation and economic growth have an inverted U-shape relationship.

The tourist industry is one of engine for economic growth. As the country becomes globalization, international tourist is attracted by the country. The higher number of visitors leads to a higher number of country's income. Especially in small countries, for example, Seychelles, Maldives and St. Kitts and Nevis, the economy of countries relies on tourism more than 60% from all of countries activities, which is a huge number.

Tourism development has a lot of economic advantages, people find more employment opportunities, stimulates trade, and investment of the country especially in the service sector. The infrastructure of the country is improved. Moreover, the government also gets benefits from

tax revenue. Even, tourism development brings a lot of income to the country, but the environmental issue is ambiguous.

Therefore, this study will focus on Cambodia, Thailand, and the Philippines which are the top three countries in South East Asia with the highest proportion of income from tourism to the entire economy. As the higher income that countries depend on will bring obvious effects from environmental issues.

The ratios, collected from World Travel & Tourism Council in 2018, are 31.61, 22.05, and 21.18 respectively.

This study is divided into 5 sections. Section I, Introduction that we have introduced the background and rationale of the problems and objectives of our study. Section II, literature reviews, in this section we will summarize a broad existing literature. Section III, we will focus on the model and methodology of the study. Next, we will show results from the empirical evidence of this study in Section IV. Finally, the conclusion of this study in section V.

Objective

1. Prove the EKC hypothesis in 3 countries in SEA.
2. Does the growth in tourist industries affect the CO₂ emission?
3. Does the effect of CO₂ emission from tourist industry in different income countries perform in the same direction?

Scope

In this paper, the main focusing is the impact of tourism to environmental degradation from countries in South East Asia, Thailand Cambodia and Philippines from three tourism proxy, the share of income from tourism to total income, tourist receipt and a number of international tourist arrival, followed the Environmental Kuznets Curve and extend with trade openness and electricity consumption of the country. The study period is between 1995 and 2014.

LITERATURE REVIEW

The EKC hypothesis

Islam et al. (1999) studied Income-Environment Relationship (IER). The study using pollution intensity as a proxy of environment and GDP as a proxy of income. He explained that the outcome from the pollution intensity of GDP, the proportion of pollution intensity over GDP relies on two factors. The first one is a forcing that generated pollution and another one is a forcing that tried to reduce the pollution, abatement forced. The combined of both forced to raise the hypothesis of the Environmental Kuznets Curve (EKC).

The EKC hypothesis was developed from Kuznets (1995), Kuznets studied the relationship between economic growth and income inequality in developing countries and resulting in an invert U-shape relationship.

With the same idea of relationship Environmental Kuznets curve (EKC) hypothesis, was also explain invert U-shape relationship, indifferent parameters, between economic development and environmental degradation. As increasing in economic development, the higher number of environmental degradations. The relationship is positive until average income reaches a certain point, turning point, and then increasing in economic development is reducing the relationship is negative. Furthermore, the different stage of relationship supposes a change from industrial structural that related to economic growth

Considering deeply in outcome from invert U-shape relationship, the EKC hypothesis was impacted differently in pollution intensity of GDP from three effects: scale effect, composition effect, and abatement or technical effect.

The scale effect states that economic activity interacts with the environment and is generally depleted resource and generated pollution. Thereby, the higher the level of economic activity resulted in a higher level of pollution. This implies a regularly increasing relationship between income and pollution, as shown in figure 1. The variable represented the level effect is the income per capita and pollution.

Jaunky (2011) extended that the country with initial stages of industrialization or developing country, the scale effect tends to overcome net effect due to the setting up of the primary industry.

The next one, a composition effect or known as a structural effect. The effect is named structural effect due to it happen to the economy that experiences the technology of the countries and the structure of the economy changed.

When composition effect happened, this is probably that the most economic revolution, the industry shifted from the initial stage, an agricultural-based economy or pre-industrial phase, towards an energy-intensive phase and finally into a technology-intensive service economy, post-industrial phase. The country that experiences the structural effect is the developing country, Jaunky (2011). So, the variables that force the change in structural effect are technological features of the sectors, sectoral shares in GDP, and others.

The relationship between economic growth and environmental degradation in the initial stage is positive as the industrial phase. After that economic integration with higher technology, contributing to protecting the environment and purpose to the sustainability of resources, so the relationship is negative. In overall, the relationship obtained an inverted-U shaped pattern as shown in figure 1.

The last one is the abetment effect that results from two sides: demand side and supply side.

From the demand side, in a low-income economy, people give priority to their income. They concern more about their urgent needs and less awareness of the environment. However, if the economy turns to a higher level of income economy, people unfettered from limited in their needs and turn to appreciate more in the value of the environment.

The variables that represent the abetment effect from the demand side are per capita income, political rights, level of awareness and education, inequality of income distribution, and others.

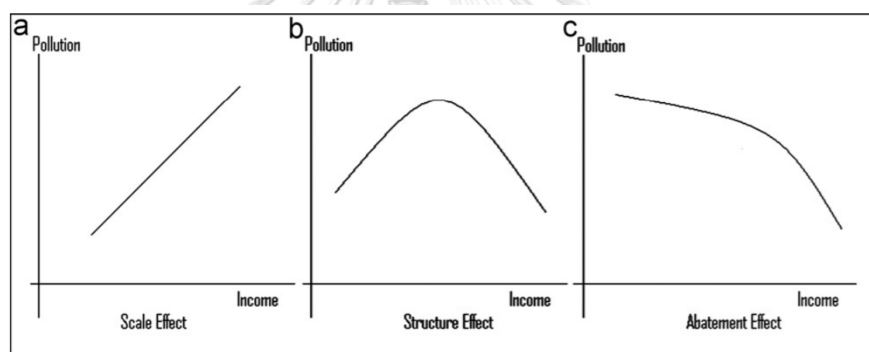
The supply side, in the low-income economy, even the societies are concerned about the environment, but they faced the limitation from the income side, hence, they have less ability to allocate resources in order to environmental improvement. On the contrary, the high level of income makes this possible. The economy increases awareness of the importance of environmental preservation. They can allocate their resources on instruments that can reduce the pollution, such as importing the

innovative technologies or on developing their own by financing in tax reduced for clean industries, research and development activities, or the other. Even from the government policy can issue the more restrict environmental policy to business sectors. Economic activities result in monotonic decreasing pollution in terms of an increase in income.

The variables that drive abatement effect from the supply side are a level of research and development expenditure, degree of openness of the economy, and others.

Hence, the integrated supply side and demand side, the relationship between income and pollution goes to an inverted-J shape, as shown in figure 1.

Integrated three kinds of effects resulted in inverse-U shape as the EKC hypothesis



Source: Islam et al. (1999)

Figure 1. Different effects of income on pollution.

Source: Islam et al. (1999).

Ang (2007) examined "the dynamic causal relationships between pollutant emissions, energy consumption and output" in other word EKC hypothesis, in France between 1960 and 2000. The result shows a causal relationship between output energy and output pollution. Moreover, in the long-run relationship, the growth in output causes energy consumption and CO₂ emissions while in the short run growth of energy use to output growth is observed.

Islam et al. (1999) studied the income environment relationship in 23 countries including Canada, China, and the USA between 1977 and 1988, but some of the results are not as expected. For example, the abatement effect curve, an invert-J curve is replaced by backward-J curve or implementation. The next one is the structural effect shows a declining

segment for the lower range of the share of industry in GDP. Therefore, the relationship is not always followed the theory.

Jaunky (2011) studied the relationship between economic growth and environmental quality in 36 high-income countries between 1980 and 2005. He found that the relationship is negative, which implies that the high-income countries are faced in the final period of the EKC hypothesis, abatement effect.

Sources of environmental degradation

To measure environmental degradation, Ang (2007), Islam et al. (1999), and Jaunky (2011) used CO₂ emission as a proxy of environmental degradation. EPA studies the sources of carbon dioxide emission the most of them derive from human activities where the top 3 activities are transportation, electricity generation and industrial activity, contributed the greenhouse gas as 80 percent from all human activities.

The data from World Bank shows that the most of CO₂ emissions in Thailand and Philippines came from electricity generation as a portion of 46.6 and 50.16 respectively to total fuel combustion in 2014. Hence, electric power consumption is added to the model to correct the trend of CO₂ emission.

Allali et al. (2015) studied the EKC hypothesis by incorporating electricity consumption per capita with the value of import and export in Algeria during 1970-2010. The study revealed that the relationship between electricity consumption per capita and energy consumption to CO₂ emission, their coefficient is positive and significant. In other words, CO₂ emission increasing along with electricity consumption per capita and energy consumption. While the EKC hypothesis revealed that Algeria's income and CO₂ emission met a certain turning point at 252% GDP per capita higher than today. Furthermore, Algeria will face a long history of environmental degradation

Finally, the results from export coefficients and import coefficients are different, there are statistically significant with a negative number and positive number respectively. Which means that increase in export cause

environmental improvement while import cause environmental degradation.

Trade openness and environmental degradation

According to the Heckscher–Ohlin theory, the factor endowment of each country is different which leads to comparative advantage in different product producing. The countries get benefit from export the competence product and then import the incompetence product which leads to higher utilities and income of their countries; therefore, the world becomes globalization.

A free trade agreement and improved infrastructure have reduced costs of cross-border trade, allowing transactions to take place wherever cost is lower. The globalization comes with free movement of the industries, therefore the heavy industries from developed countries where have more strictly about environmental problems tried to escape from the costly and complicated law by moving their business to the developing countries, where the degree of regulation is loosened than their home countries. At the same time, the movement of industrial brings technological innovation which can improve the ability of production resulting in less energy consumption, less industrial waste, and environmental improvement.

Kohler (2013) studied "CO₂ emissions, energy consumption, income and foreign trade in South Africa" over the period between 1960 and 2009. The interesting point is that the openness ratio was added to the EKC hypothesis with the reason that South Africa is considered a trade-induced economy, environmental degradation increasing demand in energy correlate with the export of the country. The finding from his work is more interesting. The study showed the relationship between environmental quality and levels of per capita energy use with foreign trade is significant in the long run. Energy usage per capita has a significant raising of the country's CO₂ emission levels, however, higher levels of trade reduce CO₂ emissions.

The study also explains the result that CO₂ emission is reduced as increasing in the degree of trade openness by technological innovations. The increase in trade openness induced an increase in energy R&D

spending which results in energy efficiencies, reduced energy usages, and then fewer pollutants emission to the environment.

Kohler also explained that trade openness affects CO₂ emission in a different stage of economic differently. Technological progress, law and regulation, and direction of openness, import or export, are significant factors to CO₂ emission.

Hooi and Muhammad. (2012) also found the same impact from trade openness and CO₂ emission in Pakistan during 1971 and 2009 in both short run and long run. Moreover, Pakistan as a developing country found the relationship between CO₂ emission and income as the EKC hypothesis.

Saboori et al. (2012) investigated the relationship between CO₂ emissions and economic growth based on the EKC hypothesis in Indonesia between 1971 and 2007 extended with energy consumption and trade openness. They found that CO₂ emissions are declines at the initial stage of economic growth and then reach a certain point and increases with the higher level of economic growth, in the U-shape relationship instead of invert U-shape relationship. Therefore, their results oppose the EKC hypothesis.

While the CO₂ emissions within order to energy consumption is increasing with a significant number. Trade openness of the country is significantly increasing CO₂ emission in a long period but there is no effect in a short period.

Tourism development and environmental degradation

Tourism is generally considered a clean industry, one of the reasons is that increases in tourism increase investment in traveling facilities, instead of investment in factories. Furthermore, increasing tourism development relies on the protection of the natural environment and ecology. However, tourism development, like all industrial development, also comes with a higher demand for energy consumption.

Kreng (2001) studied the impact of tourism in many dimensions; economic impacts, social and cultural impacts, and environmental impacts.

The researcher generally divided sources of tourism impact to environment into two sections: first tourist factors and next destination factors.

Tourist factors are those that tourist contributes to the place their visit, destination. Tourist factors that Kreng had studied include a bunch of elements for example; demographic characteristics, economic characteristics, numbers of visitors, and many others. While destination factors are on the other side. Destination factors affect the environment as the destination itself, the example of destination factors is travel linkage and circulation, diversification of the economy, local acceptance of tourism, and others.

Sources of impact provide both positive and negative impacts on social & cultural impacts, economic impacts, and environmental impacts. Kreng also explains the relationship of some variables to the environment that this paper interested in; a number of tourist arrivals, income, and degree of tourism involvement.

First, a number of tourist arrivals, at the beginning stage, small numbers of visitors are often inconspicuous to the environment. However, increasing visitors increase pollution and waste generation in various forms for example air pollution, wastewaters, solid waste, pollution from noise, and visual. Moreover, a big tourist number also affects landscape in both losing in natural and agricultural lands, degradation of the historic site, and disrupted wildlife behavior.

A result of the number of tourists is not different from income, higher tourist spending to destinations may give tourists easier and greater access to the environment that have higher environmental degradation. However, high income often makes it possible to preserve the environment for the sustainability of tourism business such as improvements in the scenery through repairs or cleanup in the area which benefit both visitors and residents visual.

The last one is diversification of the economy, a country with a high diversity of economic reduce the influence of negative impacts from specific industry to the overall economy. For example, if tourism decline in a year, other economic activities may compensate for the negative

impact, nevertheless, if other industry declines in a year that tourism income increase, tourism compensate overall impact too.

Hence, government officials must supervise and regulate the concentrated industry in their country. For the country that concentrated in tourism, government officials should plan for sustainability in the tourism industry, especially in environmental issues.

However, a country without readiness in environmental management will be faced with a rapid increase in environmental degradation.

Therefore, the effect from concentrated in the tourist industry of the country to the environment is ambiguous.

Katircioglu (2009) studied the relationship between international tourist arrivals in Singapore extending in the tourist developing, the real effect from the exchange rate, and the growth of real income in Malta between 1960–2006. Results of the bounds test for co-integration is confirmed the long-run bidirectional causality relationship between economic growth and international tourism in the study.

Katircioglu et al. (2018) studied "the role of tourism development in the environmental quality for the major tourist destination countries" with the data from the World Tourism Organization of United Nations, including Thailand. The paper investigates the relationship with the EKC hypothesis and extends with 3 tourist proxies: tourism receipts, tourist arrivals, and tourism expenditures that extended from Katircioglu's work in 2009. With the panel estimation, Environmental Kuznets Curve hypothesis has been confirmed as an inverted U-shape. While tourism development in the countries improving on the levels of environmental quality, negative effect on CO₂ emission.

Amuquandoh (2010) studied the tourism development and ecology in Lake Bosomtwe Basin, Ghana, and found the negative relationship from environmental pollution: air, water, soil and noise, traffic congestion, impact on sanitary: garbage. At the same time, there is a positive relationship on environmental awareness of people is increasing and environmental and natural resource protected.

So, there is both positive and negative impact from tourism development that sources of impacts may be contributed from tourist factors or destination factors that the different degree of sources result differently.

DATA AND METHODOLOGY

This paper will study the relationship between CO₂ emissions and tourism development with energy consumption, economic growth, trade openness, and electricity consumption. The relationship can be specified as the equation below.

$$CO_{2t} = \beta_0 + \beta_1 ENE_t + \beta_2 GDP_t + \beta_3 GDP_t^2 + \beta_4 TO_t + \beta_5 ELC_t + \beta_6 TP_t + \varepsilon_t$$

where,

CO₂ is CO₂ emission (kt)

ENE is energy consumption (kg of oil equivalent per capita)

GDP is Gross Domestic Product (USD base on 2010)

TO is trade openness (%)

ELC is electricity consumption (kWh per capita)

TP is tourist proxies that this paper will measure in three parameters:

1. Share of travel and tourism to GDP (St) is the ratio of the country's income from tourism industry.
2. Tourism receipts (TR_t) are expenditures by international inbound visitors which is different followed by the living expense of each country.
3. Number of international tourist arrivals (NUM_t)

Table 1 Expected relationship of variables to a dependent variable

Variables	Expected relationship	An explanation for the sign
ENE	+	Energy is a source of economic activity, a developing economy demanding more energy where the generation process stimulates CO ₂ emissions to an environment.
GDP	+	From the Kuznets curve hypothesis (1955), an inverted U-shape relationship between carbon dioxide emission and economic had confirmed for significant positive value in a per capita GDP, while the square of per capita GDP has a significant negative value.
GDP ²	-	
TO	+/-	Trade openness can be either positive or negative depending on the level of income and stage of economic development of a country. A country with technological progress, strong law, and regulation in the environment and import the heavy share of pollution products rather than export seems to be negative.
ELC	+	The electricity generation in developing countries mostly comes from fossil fuel which emits CO ₂ . The higher level of electricity consumption should result in higher CO ₂ emissions.
S	+/-	Share of travel and tourism to GDP could be negative or positive, depend on the public policy and awareness of people.

Table 1: Expected relationship of variables to dependent variables
(continued)

Variables	Expected relationship	An explanation for the sign
TR	+/-	Tourism receipt supposed to be positive, as higher-income stimulates higher tourism activity and higher environmental degradation. However, high income often makes it possible to preserve the environment.
NUM	+	A number of tourist arrival is supposed to be positive, as higher visitors generate waste and pollution that affect the environment.

Table 2 Data source and measurement.

Variables	Measurement of Variables	Data sources
CO ₂	Carbon dioxide emissions are including all activities that produce carbon dioxide in all states of matter. (Unit: kt)	Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States.
ENE	Usage of primary fuels before the transition to other line-use fuels, which equal to primary production plus imports and shifts in stocks, minus exports and fuels supplied to ships and aircraft engaged in foreign transportation. (Unit: kg of oil equivalent per capita)	IEA Statistics
GDP	Gross Domestic Product (GDP) is the summation of gross value added by all domestic producers in the economy plus any product taxes and minus any product subsidies. Data are in constant 2010 U.S. dollars and converted from domestic currencies using 2010 official exchange rates. (Unit: million USD)	World Bank national accounts data
TO	The summation of exports and imports of goods and services measured as a share of GDP. (Unit: %)	World Bank national accounts data
ELC	Electric power consumption monitors the generation from thermal power plants, combined power plants, and other kinds of power plants with fewer losses in transmission, distribution, and processing. The consumption is also including and internal electricity consumption in power plants. (Unit: kWh per capita)	World Bank national accounts data

Table 2: Data source and measurement. (Continued)

Variables	Measurement of Variables	Data sources
S	Total travel and tourism contributed to the economy in the percentage of GDP (Unit: %)	World Travel & Tourism Council
TR	The costs of overseas inbound travelers include fees for air travel to national airlines and all other prepayments rendered provided in the destination country. The expenditure can also contain receipts from tourists on the same day. (Unit: million USD)	World Tourism Organization
NUM	The number of visitors traveling to another country for a while with the primary purpose of visiting is other than a business purpose. (Unit: number of arrivals)	World Tourism Organization

RESULT

The result from the OLS regression, show a different aspect of income of a country to the CO₂ emission in Cambodia Philippines and Thailand, as shown in table 3, table 4, and table 5 respectively.

First, the result from the EKC hypothesis, energy consumption contributed to the significantly positive relationship to CO₂ emission in all countries with the reason that energy consumption is a significant source of CO₂ emission.

The result of the coefficient of GDP and GDP square in Thailand, are positive and negative respectively which means that the relationship between GDP and CO₂ emission is an invert U-shape. As CO₂ emission is still growing with GDP trend, however with GDP square, an accelerated parameter, represents a declining trend in the next period. Thailand is a new industrial country that shifts itself from an agricultural economy to industrial and services economies. Followed to IER theory from Islam et al. (1999), the Thai economy is facing the structural effect or composition effect from economic restructuring. Another reason to explain the relationship is an abatement force, try to reduce the pollution that conquers the force that generated pollution from increasing in the income of the country, shift Thailand to an upper-middle-income economy.

However, the total forces in Cambodia and Philippines, a lower-middle-income economy, result differently as the force that generates pollution outcome the abatement forces. As the sign of GDP and GDP square are positive. It means that the growth of income increases pollution in those countries with an accelerated rate, an upward trend.

Trade openness illustrates different results among a group. Thailand and Cambodia show a negative relationship while Philippines show a positive relationship. The deeper analysis for the contrast result explains that the trade openness combined the effect of import and export. Thailand and Cambodia have a trade deficit in goods and services while Philippines has a trade surplus to the global economy. So, the result confirms the study by Allali et al. (2015) is true. The study explains that an increase in export cause environmental degradation while an increase in import cause environmental improvement.

An increase in export tends to increase the domestic production of the country, which increases in usage of natural resources and generates pollution. However, if the country increases the technology of production to gain more energy efficiency, the country can reduce energy usage and reduced CO₂ emission in the long term.

While the result in import is contrary, instead of domestic production, the goods that concentrated in pollution generate in the producing process can shift to origin countries that produce goods.

Electricity consumption coefficients in Philippines and Thailand are positive as source electricity generation is the first ranked activity that contributed CO₂ in these countries. Whereas the first ranked activity that contributed to CO₂ in Cambodia is transportation, so the result in Cambodia is an insignificant number.

A coefficient of share of travel and tourism to GDP in Thailand is negative while Cambodia and Philippines are positive and significant numbers from Cambodia.

Higher economic dependence of tourism should decrease the CO₂ emission if considered tourism as a clean industrial, however, the country with leakage in law and regulation may have less potential in environmental supervision.

As the share of travel and tourism to GDP is destination factor which means that the difference in result comes from differences in environmental management in each country, which income of a country is a source of power in management. Thailand which considering as higher income than the two, performs well in environmental management. However, Cambodia and Philippines have insufficient environmental management for tourists, especially for Cambodia.

Tourist receipt and a number of tourist arrivals are tourist factors which come from the outside of a destination.

The tourist receipt coefficient illustrated a negative number in all countries, which implies that the increase in income from tourism, the environment quality has been improved. With the higher income from the tourist industry, instead of easier damage to the environment, income is spent on environmental improvement for sustainable tourist business that was promoted from business owners or stakeholders.

The last one is a number of tourists, Thailand and the Philippines got a significant positive coefficient while Cambodia got a negative number with insignificant. In detail, the number of tourists is quite different. In 2014, a number of visitors in Thailand is around 25 million people, where Cambodia and Philippines get 4.5 million and 4.8 million respectively. So, with a huge gap between the data leads to the different sign between the results.

Results from Thailand shown the firmly environmental degradation form fluctuated in tourists in the country as the same evidence from Katircioglu (2009) that found the same positive relationship in Singapore, a country that also located in SEA. While Cambodia, tourism growth in the number of visitors had no significant does to deterioration in environmental quality.

Table 3 Result from the OLS test, Cambodia

Variable	Dependent Variable (CO2 emission in Cambodia)			
	MODEL_0	MODEL_1	MODEL_2	MODEL_3
C	1442.859** (751.0093)	-.1325635 (886.3384)	-.4165739 (544.8620)	-.3004849 (444.0258)
ENE_CAMBODIA	2.389604* (1.459283)	3.176108* (2.093396)	3.817981** (1.923083)	3.545598** (1.609676)
GDP_CAMBODIA	0.014265 (0.167922)	0.470244** (0.162674)	0.457500*** (0.117818)	0.394808*** (0.105648)
GDP2_CAMBODIA	4.94E-05*** (1.84E-05)	-7.74E-06 (1.67E-05)	-3.38E-06 (1.48E-05)	1.36E-05 (1.49E-05)
TO_CAMBODIA	-16.97671*** (3.974402)	-11.88730** (4.842274)	-10.52314*** (3.308077)	8.754662*** (2.964348)
ELEC_CAMBODIA	-.1447644 (6.937544)	5.322209 (9.761285)	7.208271 (8.899307)	5.127011 (7.582223)
S_CAMBODIA	72.11135*** (27.11243)	2.052743 (23.64067)		
TR_CAMBODIA	-0.686545** (0.444014)		-0.409332 (0.336351)	
NUM_CAMBODIA	-0.001004*** (0.000361)			-0.000825*** (0.000323)
Observations	20	20	20	20
R-squared	0.997442	0.993643	0.994290	0.995762

Table 4 Result from the OLS test, Philippines

Variable	Dependent Variable (CO2 emission in Philippines)			
	MODEL_0	MODEL_1	MODEL_2	MODEL_3
C	-60247.94* (37835.11)	-62756.77* (38134.26)	-63602.41** (34281.92)	-45000.19 (38953.88)
ENE_PHILIPPINES	164.0927*** (52.96092)	191.2303*** (50.26874)	175.2885*** (43.76942)	168.9071*** (52.09257)
GDP_PHILIPPINES	0.257422 (0.353210)	0.009664 (0.294958)	0.229445 (0.302595)	-0.078067 (0.325471)
GDP2_PHILIPPINES	2.02E-07 (7.03E-07)	3.42E-07 (7.03E-07)	2.14E-07 (6.53E-07)	5.23E-07 (7.47E-07)
TO_PHILIPPINES	29.28375 (132.3033)	-107.6072 (95.09965)	2.413302 (107.6802)	-143.4063* (99.17550)
ELEC_PHILIPPINES	24.70678 (68.15376)	99.81099*** (36.46532)	38.65293 (45.00444)	100.0149** (44.29575)
S_PHILIPPINES	262.8531 (714.4039)	-562.9617* (380.61360)		
TR_PHILIPPINES	-2.527856* (1.713631)		-1.916570** (0.865051)	
NUM_PHILIPPINES	0.000652 (0.002843)			-0.000757 (0.002877)
Observations	20	20	20	20
R-squared	0.984103	0.980843	0.983753	0.977737

Table 5 Result from the OLS test, Thailand

Variable	Dependent Variable (CO2 emission in Thailand)			
	MODEL_0	MODEL_1	MODEL_2	MODEL_3
C	-36009.39 (61315.99)	-81516.77*** (46336.88)	6050.782 (62218.04)	-91649.69* (67894.65)
ENE_THAILAND	92.21948** (46.90095)	114.8186*** (53.55714)	128.5288** (45.83723)	108.0023** (56.25027)
GDP_THAILAND	0.550490 (0.562652)	0.473135 (0.459256)	-0.109927 (0.497482)	0.576223 (0.668507)
GDP2_THAILAND	-4.03E-07 (1.19E-06)	-1.30E-06** (5.51E-07)	5.32E-07 (1.12E-06)	-1.43E-06 (1.17E-06)
TO_THAILAND	-191.9251 (183.1950)	-115.2025 (204.2575)	-29.07575 (170.2202)	-150.5546 (219.5164)
ELEC_THAILAND	27.16375 (48.51759)	75.49612 (50.43855)	31.70243 (50.20033)	75.08813* (51.37821)
S_THAILAND	-909.4710 (1382.664)	-310.3574 (1318.035)		
TR_THAILAND	-3.056767 (1.085818)		-1.6109317** (8.72672)	
NUM_THAILAND	0.004145** (0.002087)			0.000152 (0.001597)
Observations	20	20	20	20
R-squared	0.994444	0.990373	0.992336	0.990338

*, **, *** Indicate significant at 10%, 5%, 1% level of significance, respectively



CONCLUSION

This study has investigated the relationship of tourism development to environmental degradation in three countries in South East Asia, Cambodia, Philippines, and Thailand. The estimations have been done with the Environmental Kuznets Curve framework by incorporating tourism-induced factors both tourist factors and destination factors. Moreover, the model is adding trade openness and electricity consumption with the assumption to correct model accuracy.

The result in each country is different based on the real income in the country. Thailand as an upper-middle-income economy shows the sign of the EKC hypothesis while the other countries, as a lower-middle-income have no sign of an invert U-shape relationship.

The tourist induced proxies, for tourist receipts, increase the environmental quality overall while the share of travel and tourism contributed to the economy and number of tourists perform differently in both aspects of quantity and readiness of countries.

Therefore, to sustain a tourist industry in a developing country, government agents have an important role to lead the action to preserve an environment.

There are many policy suggestions for sustainable tourism such as provide the skills for people to rely on tourism activities, encouraging smart coastal planning and zoning of critically important areas, improved environmental practice and supporting regulatory frameworks, reduced a number of tourist in the sensitive area by limited a number of tourism or increase the entry fees and the most active policy implement of strict law.

However, there is a gap of the study both from a dependence variable and independence variables that can be amended to clarify the tourism effect in further studies. For a dependence variable, environmental degradation can be measured by other parameters such as water pollution, coastal environment, or decreasing in endangered species. While the independence variable, tourists can be measure in different tourist nationalities or the number of tourists can be adjusted to the same base value such as the number of tourists to citizens. As same as income from tourists that can be adjusted to the income of tourists to total GDP that may illustrate the different aspects of destination factor.

REFERENCES



จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

Allali, Malika & Mohammed, Tamali & Mostefa, Rahli. (2015). The Impact of CO₂ Emission on Output in Algeria. *Energy Procedia*. 74. 10.1016/j.egypro.2015.07.587.

Amuquandoh, F. E. Residents' perceptions of the environmental impacts of tourism in the Lake Bosomtwe Basin, Ghana. *Journal of Sustainable Tourism*, vol. 18, no. 2, pp.223–238, 2010

Ang, J. (2007). CO₂ emissions, energy consumption, and output in France. *Energy Policy*, 35 (10), 4772-4778.

<http://dx.doi.org/10.1016/j.enpol.2007.03.032>

Becken, S., Simmons, D.G., Frampton, C., 2003. Energy use associated with different travel choices. *Tour. Manag.* 24, 267–277.

Choudhary, Dr. Mahendra & Chauhan, Govind & Kushwah, Yogesh. (2015). *Environmental Degradation: Causes, Impacts and Mitigation*.

Dasgupta, S., Laplante, B., Wang, H., Wheeler, D., 2002. Confronting the Environmental Kuznets Curve. *Journal of Economic Perspectives* 16 (1), 147—168.

Francis Eric Amuquandoh (2010) Residents' perceptions of the environmental impacts of tourism in the Lake Bosomtwe Basin, Ghana, *Journal of Sustainable Tourism*, 18:2, 223-238, DOI: [10.1080/09669580903298531](https://doi.org/10.1080/09669580903298531)

Hung, Chiu-Hui & Wu, Meen-Tsai. (2017). The Influence of Tourism Dependency on Tourism Impact and Development Support Attitude. *Asian Journal of Business and Management*. 5. 10.24203/ajbm.v5i2.4594.

Islam, N., Vincent J., Panayotou, T., 1999. Unveiling the income–environment relationship: an exploration into the determinants of environmental quality. Harvard Institute for International Development, Development Discussion Paper No. 701, at:<http://www.cid.harvard.edu/hiid/701.pdf>

Jaunky, V. C. 2011. The CO₂ emissions-income nexus: Evidence from rich countries, *Energy Policy*, 39, 1228-1240.

Katircioglu S (2009) Testing the tourism-led growth hypothesis: the case of Malta. *Acta Oeconomica* 59(3):331–343

Kohler, Marcel. (2013). CO2 Emissions, Energy Consumptions, Income and Foreign Trade: A South-African Perspective. *Energy Policy*. 63. 1042-1050. 10.1016/j.enpol.2013.09.022.

Lean, Hooi Hooi & Shahbaz, Muhammad. (2012). Environmental Kuznets Curve Hypothesis in Pakistan: Cointegration and Granger Causality. *Renewable and Sustainable Energy Reviews*. 16. 10.1016/j.rser.2012.02.015.

Saboori, Behnaz & Sulaiman, Jamalludin & Mohd, Saidatulakmal. (2012). An Empirical Analysis of the Environmental Kuznets Curve for CO2 Emissions in Indonesia: The Role of Energy Consumption and Foreign Trade. *International Journal of Economics and Finance*



VITA

NAME Juthamard Laohawattanajinda

DATE OF BIRTH 18 February 1994

PLACE OF BIRTH Bangkok, Thailand



จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY