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TOURISM EXPENDITURES AND ENVIRONMENT IN THAILAND[†]

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Abstract

Tourism activities affect the environment of different destinations, which is influenced by different tourists' consumption. The objective of this study is to examine the relationship between inbound tourist expenditures and three main environmental dimensions, which are carbon dioxide emission from transport, energy demand, and water usage, in Thailand. This paper employs Vector Autoregressive (VAR) models to determine the relationship of variables. Data from Ministry of Energy, Bank of Thailand, Metropolitan Electricity Authority, Provincial Waterworks Authority, National Statistical Office, Department of Tourism, and Tourism Authority of Thailand between 1988 and 2012 have been applied in the model. Note that, energy demand is represented by total electricity consumption of hotel and accommodation sector in Thailand, while water usage is represented by the total water consumption of tourists. This study found the relationships among tourists' expenditures, carbon dioxide emission from transport, energy demand, and water usage. Therefore, the policies recommendations may be essential to prepare the optimal schemes and budgets for encountering the environmental impacts from tourism business expansion.

Keywords: Tourist Expenditure, Environment, Thailand

1. Introduction

Many previous studies are examined in tourism and the economic effects (Kweka *et al.* 2001; Edward *et al.* 2003; Sinclair *et al.* 2005; Oula, 2006; Kantamaturapoj, 2007; Rabibhadama and Jatuworapruk, 2007; Zhang, 2007; Matarrita-Cascante, 2009). Tourism results in income generation, the distribution of income, the production, the demand of output of services and goods and so on. Tourism generated income for households, firms, and the government. villagers earned some of their income from tourism (Oula, 2006; Kantamaturapoj, 2007; Zhang, 2007; Matarrita-Cascante, 2009) by selling handicrafts and being guides (Edward, 2003; Rabibhadama and Jatuworapruk, 2007).The distribution of income was especially commercial and tourist area in Galapagos Island (Edward *et al.* 2003). Agricultural and non-agricultural sector received more revenue because of the increased production along with the growth of

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tourism (Edward *et al.* 2003). The demand for goods and service from domestic and foreign sources are increased certainly with the tourism expansion. Government also got benefits from imposing tax on tourism (Kweka *et al.* 2001; Sinclair *et al.* 2005).

In addition to economic effects, environment is also influenced both direct and indirect way from tourism. First, it is considered as a tourist attraction or tourism product. If there are overcrowded and overexploited on a destination because of increasing local and foreign tourist. Environment on the destination is decadent. Some tourists would choose other travel patterns because of the change of environment (Inskeep, 1987). Second, the expansion of tourism led to increase in water demand and wastewater discharges due to the increasingly agricultural production (Wattanakulijarus and Coxhead, 2008). Furthermore, local people might affect others such as noise pollution, river bank erosion, the congestion of people, cars etc (Juan and Piboonrungroj, 2007; Matarrita-Cascante, 2009). However, tourism activities affect the environment of different destinations. The environment is influenced by different tourists' consumption.

Transport sector is an initial component of tourism sector. Tourists travel a destination by air, road, train, and so on. In fact, transport share of international tourist expenditure accounts for eight percent of all expenditures in Thailand (Tourism Authority of Thailand, 2003). The interdependence of transport and tourism sector was between the tourism origin and the tourism destination (Papatheodorou and Zenelis 2013). Moreover, the sector can lead to emit pollution. Some carbon dioxide emission may result from travel of tourist as well.

Accommodation services has influenced on environment in a destination. The services consist of tourist facilities and activities such as hotels, restaurants, entertainment, golf, and so on. Use of water and electricity may result mainly from tourist accommodation services. Accommodation expenditure of inbound tourism in Thailand accounts for twenty six percent of all expenditures (Tourism Authority of Thailand, 2003).

Therefore, the objective of this study is to examine the relationship between inbound tourist expenditures and three main environmental dimensions, which are carbon dioxide emission from transport, energy demand, and water usage, in Thailand.

2. Data

Sources of data are obtained from Ministry of Energy, Bank of Thailand, Metropolitan Electricity Authority, Provincial Waterworks Authority, National Statistical Office, Department of Tourism, and Tourism Authority of Thailand between 1988 and 2012, collecting monthly.

Inbound tourism expenditures, Carbon dioxide emission, Energy demand, and water usage are defined to accord with tourism sector. Inbound tourism expenditures (TE) are represented by inbound tourism expenditures in Thailand. Lenzen (1998) and Lenzen and Murray (2001) suggested that consumer expenditure is effort rather than income in case of environment pressure in Australia. Carbon dioxide emission (COT) from transport is represented by overall transport in tourism (unit: metric ton million). Energy demand (ETC) is represented by total electricity consumption of hotel and accommodation sector in Thailand (unit: Kilowatt-hours million), while water usage (WU) is represented by the total water consumption of tourists (unit: million liters). These variables in the model are the logarithm form.

3. Methodology

In the analysis of time series, the Vector Autoregressive (VAR) model is widely conducted. The relation among variables cannot be indicated clearly in the model. In the construction and estimation of the models, this method is not necessary under implicit theoretical framework (Sims, 1980). This paper employs VAR model to determine the relationship of variables. The VAR model is specified as follow:

$$y_t = A_0 + BT + A_1 y_{t-1} + \ldots + A_p y_{t-p} + \varepsilon_t \quad (1)$$

where y_t is vector of variables in VAR model which are inbound tourism expenditures (TE), Carbon dioxide emission (COT), and water usage (WU), y_{t-1} is vector of lag variable,ε_t is error term, t is the time period, and $\mathrm{A_p}$ is parameters of lag variable. Furthermore, the model can be added other exogenous variables such as trend (T), constant ($\mathrm{A_0}$).

The procedure of the VAR model consists of Test Stationary, Optimal Lag Selection, Granger Causality, Test Impulse Response analysis, and Variance Decomposition (Gujarati, 2004). The augmented Dickey-Fuller (ADF) test is conducted to a test of stationary in each variable. Characteristics of data are stationary to the effective result.

Null Hypothesis: Ho: $\mathrm{A_1} = 0$ (the time series is nonstationary)
Alternative Hypothesis: H1: $\mathrm{A_1} < 0$ (the time series is stationary)

Akaike's Information Criteria (AIC) is used for selecting the optimal lag length. It is effective in the large sample size (Boonserm, 2007). Granger Causality Test is employed to test causality among the variables. The integration of the variables is in the same order and the variables are cointergrated. The VAR with lag order include the maximum order and the VAR optimal lag length:

$$\mathrm{X_t} = \mathrm{b} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \mathrm{w_{i1}X_{t-i}} + \sum_{\mathrm{i=1}}^{\mathrm{dmax}} \mathrm{w_{2i}X_{t-i}} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \mathrm{w_{3i}X_{t-i}} + \sum_{\mathrm{i=1}}^{\mathrm{dmax}} \mathrm{w_{4i}X_{t-i}} + \varepsilon_{2t} \quad (2)$$

$$\mathrm{Z_t} = \mathrm{c} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \theta_{\mathrm{i1}}\mathrm{Z_{t-i}} + \sum_{\mathrm{i=1}}^{\mathrm{dmax}} \theta_{\mathrm{2i}}\mathrm{Z_{t-i}} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \theta_{\mathrm{3i}}\mathrm{Z_{t-i}} + \sum_{\mathrm{i=1}}^{\mathrm{dmax}} \theta_{\mathrm{4i}}\mathrm{Z_{t-i}} + \varepsilon_{3t} \quad (3)$$

where dmax is the maximum order, k is the VAR optimal lag length. The impulse response function (IRF) considers that the response of a variable result from the impulse of the endogenous variables. Standard deviation impulse is added on random errors in the model. The result of impulse response function is indicated by variance decomposition in each variable.

4. Results

As stated above, the process of running the VAR model consists of Test Stationary, Optimal Lag Selection, Granger Causality, Test Impulse Response analysis, and Variance Decomposition. The results of each step can be seen respectively.

4.1. Test Stationary

This test for this study is estimated with constant and time trend form. All variables are first difference at the five percent significance level as Table 1. Each variable is stationary. Vector Autoregressive (VAR) model is used with the variables.

Table 1. ADF test

	ADF	Probability
LTE	-15.881	0.000
LCOT	-15.724	0.000
LETC	-12.743	0.000
LWU	-16.116	0.000

Source: Author's calculation

4.2. VAR Optimal Lag Selection

The precision of estimates in a VAR have to determine the lag length before. There is a problem that there is too long a lag to reduce degree of freedom (Gujarati, 2004). The optimal lag length is selected by Akaike's information criterion (AIC) for this study. Lag order 3 is chosen and optimal criteria in all criteria because the AIC value is lowest as shown in Table 2. A VAR with lag order 3 may be suitable to construct.

Table 2. VAR optimal lag selection

Lag	Log	LR	FPE	AIC	SC	HQ
0	561.1461	NA	2.72e-07	-3.764501	-3.714631	-3.744534
1	1971.303	2772.672	2.21e-11	-13.18448	-12.93513	-13.08464
2	2034.201	121.9729	1.61e-11	-13.50136	-13.05253*	-13.32166
3	2065.814	60.44844*	1.45e-11*	-13.60685*	-12.95855	-13.34728*

Source: Author's calculation

4.3. Granger Causality Test

Granger Causality is done to test causality among the variables with the lag order 4 for this study as Table 3. Based on Granger Causality test, the effect of carbon dioxide from transport (LCOT) on inbound expenditure (LTE) is only at the five percent significance level. The relationship between LCOT and LTE is unidirectional. It is indicated that carbon dioxide emission from transport may affect inbound tourism expenditure. The effect of inbound expenditure (LTE) on energy consumption (LETC) is only at the 5 percent significance level. The relationship between LTE and LETC is unidirectional. Inbound tourism expenditure seem to increase energy consumption. The effect of water usage (LWU) on energy consumption (LETC) is only at the 5 percent significance level. The relationship between LWU and LETC is unidirectional. It appears that water usage may affect energy consumption. It is probable that the tourists travel more. There is an increase of carbon dioxide emission from transport. Inbound tourism expenditure may influence on energy demand, while water usage may influence on energy demand as well. Furthermore, interrelationship of LCOT and LETC is reversely each other at the five percent significance level. The relationship between LCOT and LETC is bidirectional. It is revealed that carbon dioxide from transport could result in demanding energy. Perhaps energy demand could cause carbon dioxide from transport. Therefore, it is possible that inbound tourism expenditure might be led to change environment through tourist activities.

Table 3. Granger Causality test

Independent variable	Dependent Variables			
	LTE	LCOT	LETC	LWU
LTE	-	9.908*	4.097	4.400
LCOT	0.742	-	32.243*	1.084
LETC	47.381*	14.998*	-	48.361*
LWU	5.201	8.990	8.467	-

Source: Author's calculation

4.4. Impulse Response Analysis

A shock in inbound tourism expenditure (LTE) brings about positive and negative direction on three variables as the Figure 1. The response lines are represented by the solid lines. The dotted lines are calculated by the analytical method. The lines are double the standard errors of confidence curve. Carbon dioxide from transport (LCOT), energy consumption (LETC), and water usage (LWU) have fluctuated between possibly two and eight month after reentering normal. The response of carbon dioxide from transport (LCOT) and energy consumption (LETC) has trended positively because of inbound tourism expenditure. Water usage has a negative trend. It appears that an increase of inbound tourism expenditure leads to an increase of carbon dioxide from transport and energy consumption.

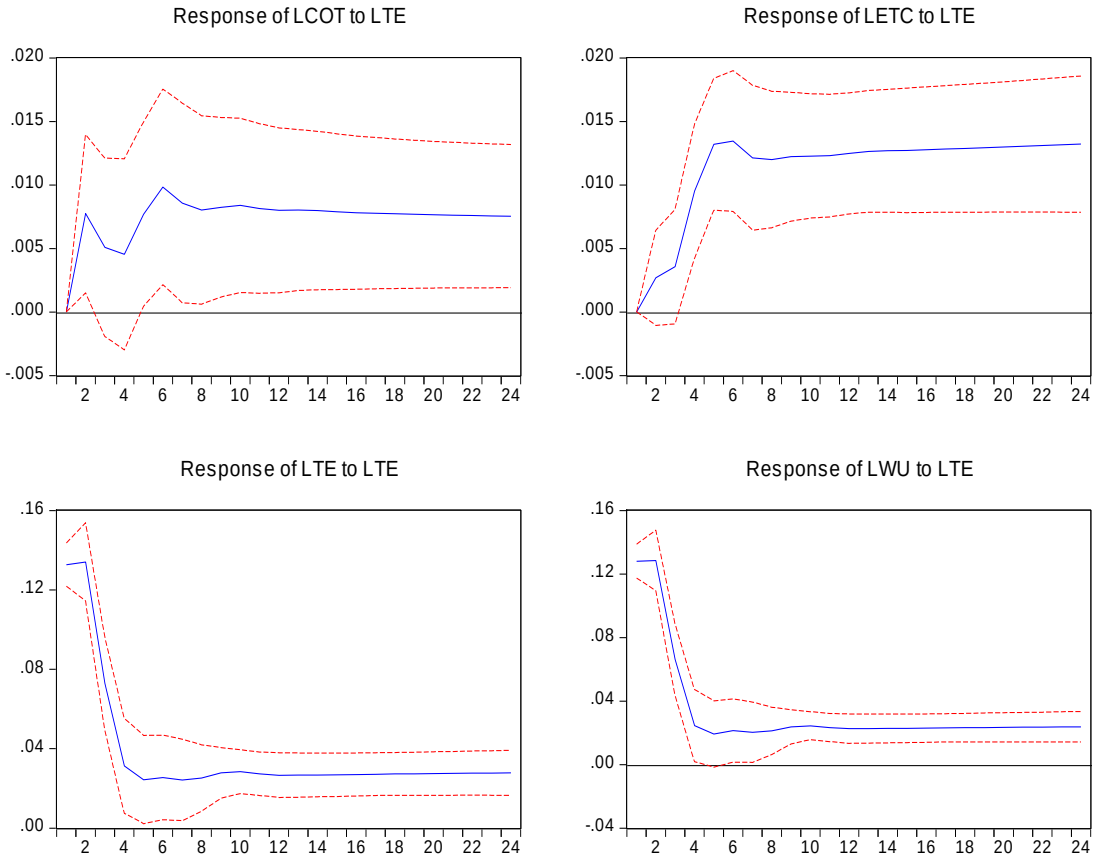

Figure 1. Response to non-factorized one standard deviation innovations plus or minus two standard errors

4.5. Variance Decomposition

Inbound tourism expenditure (LTE), water usage (LWU), carbon dioxide from transport (LCOT) and energy demand (LETC) are differently affected by a shock to inbound tourism expenditure (LTE) in two years as Table 4. Inbound tourism expenditure has the largest impact from itself in two years. The impact of inbound tourism expenditure is between approximately ninety three percent in first month and seventy one percent in twenty fourth moth. The impact of water usage on inbound tourism expenditure is similar to that of inbound tourism expenditure. Water usage has a decreased impact within two years. In first month, the effect is around ninety two percent. It decreases gradually at seventy four percent in twenty fourth month. The effect of carbon dioxide from transport and energy demand are less than that of inbound tourism expenditure and water usage. The results show that the impacts of carbon dioxide from transport and energy demand are increased slowly. The impact of carbon dioxide from transport due to inbound tourism expenditure is between zero percent and ten percent during twenty four month. Carbon dioxide from transport has the least effect in the period. The impact of energy demand is from zero percent to about thirty seven percent in the two years. It is likely that the inbound tourism expenditure may lead to increase the environment impact in long term.

Water usage, carbon dioxide from transport and energy demand result in an increase effect of inbound tourism expenditure in the period as Table 4. The effect of inbound tourism expenditure due to water usage is increased by four percent in the two years. The effect of inbound tourism expenditure from a shock to carbon dioxide from transport has increased from around seven percent in first month to around nine percent in the twenty fourth month. The impact of inbound tourism expenditure is risen by sixteen percent within two years. It may be possible that an increase of environment problem may lead to rise the tourism expenditure.

Table 4. Variance decomposition

Independent variable	Period (month)	Dependent Variables			
		LTE	LCOT	LETC	LWU
LTE	1	93.10797	6.842508	0.049520	0.000000
	6	85.91537	6.060125	5.376809	2.647693
	12	77.87293	6.208668	10.82934	5.089063
	18	74.06394	7.416904	13.66506	4.854088
	24	71.24839	8.549392	15.85211	4.350108
LCOT	1	0.000000	100.0000	0.000000	0.000000
	6	4.82782	89.47075	3.226679	2.474747
	12	7.163866	82.11602	3.222013	7.498097
	18	8.614811	76.61418	2.723521	12.04749
	24	9.854059	72.81184	2.356616	14.97748
LETC	1	0.000000	2.325337	97.67466	0.000000
	6	16.00875	1.834338	79.62800	2.528904
	12	28.75399	2.148395	64.19908	4.898537
	18	33.90510	2.442849	58.42634	5.225715
	24	36.99407	2.789659	55.09275	5.123516
LWU	1	91.70301	6.694924	0.08685	1.515218
	6	87.59157	5.105313	6.076641	1.226477
	12	80.95807	4.734415	12.45354	1.853976
	18	77.33077	5.132694	15.89630	1.640237
	24	74.38872	5.67776	18.47486	1.458657

Source: Author's calculation

5. Conclusions

The objective of this study is to examine the relationship between inbound tourist expenditures and three main environmental dimensions, which are carbon dioxide emission from transport, energy demand, and water usage, in Thailand. Sources of data are obtained from Ministry of Energy, Bank of Thailand, Metropolitan Electricity Authority, Provincial Waterworks Authority, National Statistical Office, Department of Tourism, and Tourism Authority of Thailand between 1988 and 2012, collecting monthly. This paper employs VAR model to determine the relationship of variables.

From Granger Causality Test, the findings show that inbound tourism influences on energy demand. It is consistent with the study of Lee (2013). The study indicated that electricity demand impact on inbound visitors was positive because the facilities in hotel were required by electricity. It could be explained that a change in the consumption of inbound tourists may cause a change in energy demand. The relation between carbon dioxide emission from transport and energy consumption are bidirectional. It is possible that inbound tourism expenditure might be led to change environment through tourist activities. Hence, the development of tourism could be considered the management of energy demand, water usage, and CO2 emission in the tourism policies.

Inbound tourism expenditure, water usage, carbon dioxide from transport and energy demand are differently affected by a shock to inbound tourism expenditure in two years. Water usage, carbon dioxide from transport and energy demand result in an increase effect of inbound tourism expenditure in the period. It might be suggested that the other related policies may be determined along with the tourism policies.

Finally, the policies recommendations may be essential to prepare the optimal schemes and budgets for encountering the environmental impacts from tourism business expansion.

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