Analysis of the Ecological Impact of Tourism Development under Environmental Kuznets Curve:
Based on the Panel Data of RCEP Members from 1995 to 2017

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ABSTRACT

This paper mainly studies the intrinsic linkages between inbound tourism development and ecological environment among RCEP members. We first construct an economic model for the EKC to represent the relationship between tourism development and environmental impacts, taking the panel data (1995 ~ 2017) of RCEP members as foundation. Then we adopt Fixed Effects (FE) and Generalized Method of Moments (GMM) to continue further analysis. The results show that, in the past 30 years, the relationship between the overall development of inbound tourism and the ecological footprint follows an inverted N-shape. The changes of ecological footprint are mainly affected by transportation, urbanization, economic development and the degree of trade openness. Due to the differences in economic development, indigenous natural resources and transportation location among members of RCEP, there are various relationship curves, such as U-shape, inverted U-shape, N-shape and linear, etc., between inbound tourism development and ecological footprint. In the long run, the development of inbound tourism will help slow down the increase in total ecological footprint consumption, thereby protecting the ecological environment and achieving sustainable development of regional economy.

Keywords: *RCEP, Environmental Kuznets Curve (EKC), Inbound tourism, Ecological footprint.*

1. INTRODUCTION

Tourism is an industry greatly basing on environment and resource consumption, which determines that the relationship between tourism and ecological environment is both antilogous and unified. How to strike a balance between economic and ecological benefits of tourism to achieve sustainable development is of both theoretical and practical significance. In this regard, scholars at home and abroad have conducted a lot of research in this field. In the 1990s, Farrel pioneered a study on the relationship between regional environmental capacity and tourism development [1]. Prokopiou assessed the carrying capacity of tourism development in the Cyclades by developing the Prokopiou-Tselentis model that measures the degree of environmental impacts [2]. Saveriades studied the importance of tourism carrying capacity for tourism planning and economic development management, taking Cyprus as an example [3]. Zaman constructed an index for tourism development based on environmental Kuznets curve (EKC) theory through principal component analysis and found a causal relationship between tourism development and the increase in carbon emissions [4]. Katircioglu conducted an empirical study on Singapore based on the EKC, which confirmed the causal relationship between tourism development and carbon emissions [5]. Ozturk applied an empirical study based on the EKC quadratic term model using GMM for panel data from Egypt, Madagascar, Brazil, South Africa, and Singapore. He discovered that tourism development and ecology in these countries can be explained based on the EKC theory [6]. Muhammad Usman constructed an EKC-based log-quadratic model to study the panel data of ecological footprint from 20 largest economies and found that tourism economic development also improves environmental quality. In China, Fengjun Cui constructed a tourism carrying capacity index and an arithmetic model, and concluded that tourist density, tourism land intensity and revenue intensity index are important bases for judging whether tourism is sustainable or not [7]. Guihua Yang et al. studied the measurement function of tourism ecological footprint on sustainable tourism development and explored the theoretical significance of tourism ecological footprint [8,9]. Honghong Zhao measured the environmental capacity of urban tourism, taking Suzhou as an example [10]. You Changjiang, on the other hand, measured the environmental capacity of tropical maritime islands for tourism [11]. Through Granger causality test of tourism waste in Huangshan scenic area, Jinhe Zhang found a quantitative causal relationship between per capita tourism income and indicators such as solid waste and wastewater [12]. By studying cities including Xi'an and Shanghai, Wen Pang found a coupled and coordinated relationship between the tourism economy and ecological environment [13,14]. Taking Heilongjiang as an example, Zi Tang studied the coupled interaction between tourism economic development and ecological environment at the provincial level [15]. In summary, the EKC-theory has gradually become the most explanatory model for tourism sustainable development theory due to its ability to effectively explain the relationship between tourism industry and ecological environment with mutual influence of coupled development [16,17]. However, research on existing tourism-environmental Kuznets curve (TEKC) are mostly conducted from a meso- or microscopic perspective to study the causal relationship between tourism development and ecological environment at the provincial, municipal or scenic area scales, and the research methods are mainly time series analysis. In this regard, this paper analyzes the panel data from 1995 to 2017 of tourism and ecological footprints by constructing a TEKC model with 15 RCEP member countries as the research object, in order to expand the application of the EKC-theory in the field of tourism research and provide useful references for the sustainable development of tourism industry in RCEP members.

2. RESEARCH METHODS AND DATA SOURCES

2.1. Measurement for Ecological Impacts

The ecological impacts of tourism is measured, early on, often using polluting indicators such as carbon dioxide, sulfur dioxide, solid waste [12,17,18] highlighting the detection of impacts on specific areas of the ecological environment. In the 1990s, Willian E. Rees proposed a more comprehensive method for measuring ecological impacts, the ecological footprint, which uses four biological resource account indicators for cropland, grazing land, forest, and water, and two energy account indicators for fossil energy and building lands. The four biological resource account indicators of cropland, grasslands, forest lands and water, and two energy account indicators of fossil energy and building lands are used to characterize the biologically productive geographical space that provides resources or absorbs waste [19], as shown in Equation (1). In view of its perfect system and authoritative data, more and more studies have chosen the ecological footprint as a characterization indicator of the ecological impact of tourism development.

$$EF_C = EF_P + (EF_I - EF_E) \tag{1}$$

Among them, EF_C represents the total ecological footprint consumption of a country's residents; EF_P represents the total regional space with biological productivity consumed by the country's food, housing, transportation and various services; EF_I and EF_E represent the regional space with biological productivity consumed by the import and export in international trade respectively, and the difference between the two is the net ecological footprint consumption in trade.

2.2. Construction and Variable Selection for TEF-EKC-based Tourism Ecological Model

The EKC hypothesis is a concept proposed by Grossman in 1991 based on Kuznets' inverted "U"-shape hypothesis on the relationship between income distribution and economic growth [20]. He considered that there is an inverted U-shaped relationship between the degree of environmental pollution and the growth of per capita income, that is, the degree of environmental pollution first deepens with the increase of per capita income, and then decreases with the increase of per capita income after an inflection point, which is commonly known as "pollution first, then treatment" [21]. Balaguer was first introduced in tourism development studies in 2002, finding a positive effect of tourism on economic growth [22], which was then gradually applied to verify the relationship between different pollutant emissions and tourism economic growth [14, 18]. Based on ecological footprint, this paper constructs a three-dimensional EKC regression equation to reflect the relationship between tourism development and ecological environment, as shown in Equation (2).

$$efptotal = b_0 + b_1 intrcpt + b_2 intrcpt^2 + b_3 intrcpt^3 + b_X + u \tag{2}$$

Among them, *efptotal* is the dependent variable, representing the total ecological footprint consumption, which is the environmental indicator selected in this paper; *intrcpt* is the independent variable, representing the total international tourism revenue, which is the economic indicator selected in this paper. b_0 represents the constant term; $b_1 \sim b_X$ are the coefficients; x represents the cases of control variables affecting the total ecological footprint consumption, which are total energy consumption (*eguse*), total urban population (*urbtotalt*), total GDP per capita (*gdppcap*) and the share of foreign trade in GDP (*trdgnfs*), etc.; *u* represents the random error term.

To mitigate the effects of heteroskedasticity, autocorrelation or multicollinearity on the model estimation, the absolute values are logarithmic and denoted as *ln*. External trade as a share of GDP (*trdgnfs*) uses relative values in percentages and is not subject to logarithmic treatment. Considering the relationship between ecological environment and inbound tourism development in RCEP member countries, Equation (2) was optimized to obtain Equation (3):

$$lnefptotal_{at} = b_0 + b_1 lnintrcpt_{at} + b_2 lnintrcpt_{at}^{\ 2} + b_3 lnintrcpt_{at}^{\ 3} + b_4 lneguse_{at} + b_5 lnlnurbtotal_{at} + b_6 lngdppcap_{at} + b_7 trdgnfs_{at} + u_{at} \quad (3)$$

where, $lnefptotal_{at}$ represents the logarithm of total ecological footprint consumption in country *a* in year *t*; $lnintrcpt_{at}$, $lneguse_{at}$, $lnurbtotal_{at}$ and $lngdppcap_{at}$ represent the logarithm of total international tourism revenue, the logarithm of total energy consumption, the logarithm of total urban population, and the logarithm of total GDP per capita in country *a* in year *t*, respectively; $trdgnfs_{at}$ represents the share of foreign trade in GDP in country *a* in year *t*; b_0 represents the constant term; $b_1 \sim b_7$ all represent the coefficients corresponding to each variable in the equation; and u_{at} represents the random error term in country *a* in year *t* under this model.

2.3. Data Sources

This paper analyzes panel data on tourism economy and ecology of 15 RCEP members from 1995-2017. Among them, the ecological footprint data were obtained from the Global Footprint Network database National Ecological Footprint and Biological Carrying Capacity Accounts(NFAs); the data of total international tourism revenue, total urban population, total GDP per capita and foreign trade as a share of GDP were obtained from the World Bank and the United Nations World Development Database; the energy consumption data were obtained from the total energy consumption table of the database form Energy Information Administration, USA.

Table1. Selection for Variables

Variables	Description	Unit
efptotal	Total Ecological Footprint Consumption	Global Hectares (GHA)
intrcpt	Total international tourism revenue	Current Price USD (Current USD)
eguse	Total energy consumption	British Thermal Unit (btu)
urbtotalt	Total city population	Number of People
gdppcap	Total GDP per capita	Current Price USD (Current USD)
trdgnfs	Foreign trade as a share of GDP	Percentage (%)

3. ANALYSIS OF RESULTS

3.1. Data Stationarity Test and Co-integration Test

Considering that the period of the study data is as long as 23 years, the stationarity and cointegration relationship of each panel series must be considered, and a stationarity test, i.e., panel unit root test, is required for the panel data. In this paper, the panel data were successively subjected to LLC [23], Breitung [24], IPS [25], ADF-Fisher, and PP- Fisher [26] five panel unit root tests (**Table 2**). The results show that the horizontal series of the main variables are smooth; some of the variables are first order single integer. Based on the voting principle, it was determined that the selected variables were all homogeneous single-order and passed the test, and the panel data were smooth and did not cause pseudo-regression problems.

The Kao, Pedroni and Westerlun cointegration tests were conducted on the panel data (**Table 3**), and the results of the tests were compared and analyzed by the voting method, which allowed us to determine the existence of cointegration relationships among the variables, that is, the existence of long-term stable equilibrium relationships, which can be directly regressed and used to verify the long-term causal relationships among the variables.

3.2. Total Sample Analysis

3.2.1. General Trends in Inbound Tourism and Ecosystem Development in RCEP Members

Since 1997, along with the accelerated globalization process and rapid economic development, the inbound tourism revenue has shown a rapid growth trend, with the total international tourism revenue increasing from USD 63.101 billion in 1995 to USD 2.5 billion in 2017.

The growth rate was approximately 450.14%, up from USD 284,040 million in 2009 (see **Figure 1**). The RCEP launched by ASEAN in 2012 and the "One Belt and One Road" initiative launched by China in 2013 both had a positive impact on international tourism revenue in the region; the 1997 Asian financial crisis and the 2008 global financial crisis had some impact on international tourism revenue in the region during this period, but the region was resilient as a whole, and international tourism quickly resumed growth after a brief one-year adjustment.

During the same period, the overall regional ecological footprint index increased from 4.069 billion hectares to 7.716 billion hectares, an increase of 1.9 times, which is in a steady increase, and the degree of reliance on and use of the ecological environment for regional economic development has been increasing. Based on the trend of homogeneous growth between inbound tourism and ecological footprint in RCEP countries, this paper proposes the hypothesis that there is a coupled and interactive coordinated development relationship between inbound tourism and ecological environment in RCEP countries during the period of 1997-2017.

Table 2. Panel Unit Root Test

	LLC Inspection	Breitung test	IPS test	ADF-Fisher test	PP-Fisher test
lnefptotal	-0.1540	0.3990	-3.3136***	3.4904***	1.9681**
Δlnefptotal	5.7842***	-4.4576***	-12.4596***	4.0450***	45.3063***
lnintrcpt	-	-	-2.0322**	0.9239	1.9199**
Δlnintrcpt	-	-	-10.8693***	3.4121***	33.6438***
lneguse	-	-	-10.7837***	3.4189***	-1.9412
Δlneguse	-	-	-13.4393***	10.9458***	26.9909***
lnurbtotal	-4.4430***	0.0093	-3.0057**	2.1677**	8.4618***
Δlnurbtotal	-5.1053***	-3.7979***	-15.5523***	3.7556***	71.2930***
lngdppcap	-2.1961***	0.3648	-0.7900	6.1204***	-0.6417
Δlngdppcap	-3.9509***	-1.7047**	-10.7782***	2.5689***	20.9570***
trdgnfs	-	-	-1.4720*	1.1369	0.3278
Δtrdgnfs	-	-	-14.0238***	2.4389***	32.7876***

Note: Δ indicates the first-order difference of variables; *, ** and *** indicate variables significant at the 10%, 5%, and 1% levels, respectively.

Table 3. Panel Co-integration Test

Testing	Reference values	lnintrcpt	lneguse	lnurbtotal	lngdppcap	trdgnfs
Kao	Modified DF t	-0.9162	1.9239**	1.8474**	1.6739**	2.2025**
	Dickey-Fuller t	-1.3191*	1.8386**	1.6373 *	1.5914*	2.6255***
	Augmented DF t	-2.5102***	2.2799**	2.1402**	2.5772***	3.4838***
Pedroni	Modified PP t	1.9161 **	-0.9168	1.331*	1.2992*	1.8755**
	Phillips-Perron t	-1.3301*	-4.2519***	-4.0458***	-4.0130***	-3.0511***
	Augmented DF t	-2.5005***	-5.0504***	-4.1001***	-4.0925***	-3.1714***
Westerlund	Variance ratio	-1.6791**	-2.2782**	-2.1204**	-2.7080***	-1.2796*

Note: *, ** and *** indicate variables significant at 10%, 5% and 1% levels, respectively

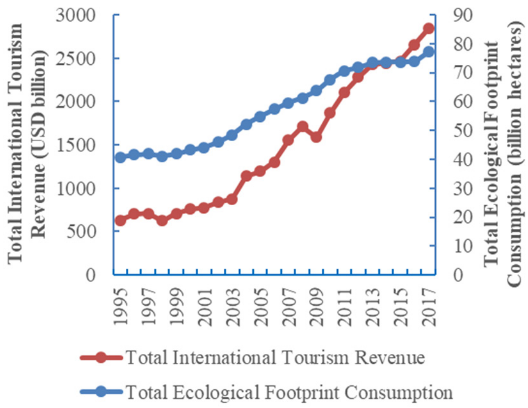

Figure 1 Comparison of International Tourism Revenue and Ecological Footprint of RCEP Members

3.2.2. Overall Sample Regression Estimation

This paper uses Stata 15.1 statistical analysis software to conduct regression analysis on the overall sample using the econometric model (2) constructed in this paper, and the analysis process:

(1) F-test was firstly conducted. Mixed estimation model ordinary least squares (OLS) and FE regressions were performed to estimate the variable parameters, respectively. The OLS regression results show that except for total energy consumption and the share of foreign trade in GDP, all other variables fail the significance test and the fit is only 0.762. Under FE test, all variables are significant at the 1% level except for total energy consumption which is significant at the 5% level, and the goodness of fit is 0.848. Comparing the results, mixed regression should not be used, and obviously fixed effects model (FE) is more suitable for this paper.

(2) In Hausman test, FE and RE were tested separately, and all variables were not significantly different in terms of significance. Therefore, further Hausman's test is needed for a more accurate determination. Besides, Sigmamore variance was added for estimation. The test result p-value was 0.0081, so the original hypothesis of the random effects model (RE) was strongly rejected, and the fixed effects model (RE) should be used instead. And the value of *rho* (0.998 5) is very close to 1 under FE test, indicating that the individual effects vary strongly and the ecological impacts vary significantly among countries with different stages of inbound tourism development. The specific tests are shown in **Table 4**:

Table 4. Overall Regression Analysis Results of Inbound Tourism and Ecological Environment

Variables	OLS	FE	RE
lnintrcpt	-7.121 -27.88	-6.938*** -1.816	-5.948*** -1.831
lnintrcpt^2	0.336 -1.329	0.325*** -0.0852	0.279*** -0.0861
lnintrcpt^3	-0.00475 -0.021	-0.00507*** -0.00133	-0.00436*** -0.00134
lneguse	0.165*** -0.0517	0.0105** -0.00531	0.0109** -0.00549
lnurbtotal	0.0519 -0.0647	0.271*** -0.076	0.194*** -0.0585
lngdppcap	-0.399* -0.208	0.545*** -0.0463	0.554*** -0.0437
trdgnfs	-0.0053** -0.00205	0.00094*** -0.000278	0.00086*** -0.000286
_cons	62.2 -193.8	58.44*** -12.46	52.45*** -12.68
Observations	260	260	260
R-squared	0.762	0.848	

Note:*, ** and *** indicate variables significant at the 10%, 5%, and 1% levels, respectively.

3.3. Sub-sample Analysis

In order to find the best model for the EKC problem of inbound tourism development in RCEP members, this paper uses Stata15.1 statistical analysis software to conduct a GMM regression analysis with ecological footprint as the dependent variable, international tourism income as the independent variable, and control variables such as transportation level, urbanization level, economic development level, and trade openness. The specific tests are shown in **Table 5**.

(1) The TEKC curves of inbound tourism and ecological footprint of each RCEP member have various expressions such as inverted U-shaped, U-shaped, N-shaped, and primary curves. Indonesia, Philippines, Singapore, Vietnam, Australia and New Zealand have an inverted U-shaped TEKC; Thailand, Brunei, Cambodia and Korea have a U-shaped curve; Laos and Myanmar have an N-shaped curve; Malaysia and China have a linear upward curve, and Japan has a linear downward curve.

(2) RCEP members are at different stages of development of coupling inbound tourism and ecological environment. ①The TEKC has an inflection point and the ecological environment has improved in the following countries: the Philippines (2013, 22.45), Vietnam, Singapore (2007, 22.93), currently in the right half of the inverted U-shape, where inbound tourism development has a negative effect on the ecological footprint, i.e., it is conducive to the improvement of the ecological environment; Myanmar (2011, 19.3539), where inbound tourism development has a restoration of the ecological environment In Myanmar (2011, 19.3539), inbound tourism development has a positive effect on ecological restoration and is about to achieve positive

environmental improvement. ②The TEKC curve shows an inflection point and the ecological depletion increases. Cambodia (2004, 20.322 79), New Zealand (2002, 21.886 42) and South Korea (2011, 23.556 48) have reached the inflection point and are in the right half of the U-shape, and the total ecological footprint has increased in parallel with the development of inbound tourism, i.e., the development of inbound tourism has increased the pressure on the ecological environment. ③The TEKC curve has not yet reached the inflection point, and the ecological and environmental pressure is gradually increasing. Indonesia (25.059 9) and Australia (25.701 3) have not yet reached the inflection point and are in the left half of the inverted U-shape, in the stage of rising environmental pressure, and the development of inbound tourism depends on the increase of ecological footprint; both China and Malaysia have no inflection point and are in the stage of linear rise, with further increase of ecological and environmental pressure. ④The TEKC curve did not show an inflection point and the ecological environment improved. Thailand (25.163 3) and Brunei (18.330 7) have not yet reached the inflection point and are in the left half of the U-shape, where the development of inbound tourism has not aggravated the increase of ecological footprint; Laos has no inflection point and is in the middle of the N-shape, which also belongs to the stage of environmental pressure improvement; Japan has no inflection point and is in the stage of linear decline, where the ecological environment is gradually improving.

(3) Indirect factors of ecological impact of inbound tourism development vary among RCEP members. In Indonesia, Thailand, Myanmar, and China, the ecological

Table 5. Results of Regression Analysis of Differences in The Relationship Between Inbound Tourism and Ecological Environment in RCEP Members

Country	lnintrcpt Coeff. & t-stat	lnintrcpt2 Coeff. & t-stat	lnintrcpt3 Coeff. & t-stat	lneguse Coeff. & t-stat	lnurbtotal Coeff. & t-stat	lngdppcap Coeff. & t-stat	trdgnfs Coeff. & t-stat	Intercept Coeff. & t-stat	R^2	Shape	Inflection Point	lnintrcpt in 2017
Indonesia	0.837*** -0.0592	-0.0167*** -0.0016	–	-0.00425 -0.0855	0.339*** -0.102	0.379*** -0.0756	0.00103*** -0.000328	–	0.983	Inverted U	25.0599	23.4313
Malaysia	0.182*** -0.0612	–	–	-0.131 -0.409	-0.0678 -0.438	1.006*** -0.321	0.00275** -0.00107	8.770*** -2.529	0.927	Linear	–	23.719
Philippine	2.210* -1.231	-0.0517* -0.0286	–	–	–	0.971*** -0.176	0.00458*** -0.00115	-12.86 -13.55	0.87	Inverted U	21.3733	22.8395
Thailand	-2.466** -1.255	0.0490* -0.0264	–	–	-0.403*** -0.142	1.391*** -0.17	0.00273*** -0.000625	44.54*** -14.83	0.948	U	25.1633	24.7663
Singapore	9.369*** -2.966	-0.206*** -0.065	–	–	1.052*** -0.285	0.238 -0.234	–	-107.8*** -34.49	0.806	Inverted U	22.7403	23.719
Brunei Darussalam	-9.422** -4.573	0.257** -0.121	–	–	2.886*** -0.53	3.509*** -0.974	–	27.93 -49.77	0.753	U	18.3307	19.0085
Cambodia	-4.480** -1.878	0.112** -0.0452	–	-1.065 -0.684	0.779* -0.401	-0.000754 -0.00119	-0.00183 -0.00609	72.03*** -27.07	0.989	U	20	22.1096
Lao P.D.R.	3.405*** -0.404	-0.272*** -0.0493	0.00646*** -0.00141	–	0.228 -0.309	0.281 -0.488	-0.0028 -0.00192	–	0.948	N	–	20.3078
Myanmar	1.044*** -0.0123	-0.101*** -0.00256	0.00255*** -0.0000816	–	-0.279** -0.121	0.415*** -0.0218	-0.00229*** -0.000313	19.11*** -1.958	0.99	N	7.0513 19.3539	21.4164
Vietnam	0.932*** -0.0351	-0.0248*** -0.00131	–	–	0.6 -1.292	1.079 -0.659	0.00322*** -0.00102	–	0.985	Inverted U	18.7903	22.9093
China	0.0952*** -0.0292	–	–	0.104 -0.151	-1.954*** -0.64	1.092** -0.472	0.00379*** -0.000782	47.75*** -12.14	0.995	Linear	–	24.3868
Japan	-0.0831** -0.0366	–	–	-0.249*** -0.084	0.0319 -0.261	0.673 -0.579	0.000416 -0.00237	20.23*** -6.684	0.854	Linear	–	24.3342
South Korea	-7.433** -3.056	0.158** -0.066	–	–	-0.442 -1.401	0.687* -0.409	0.000943** -0.000397	107.9*** -33.65	0.91	U	23.5222	23.5565
Australia	2.822*** -0.505	-0.0549*** -0.0089	–	-0.324 -0.369	-1.574*** -0.483	1.548*** -0.282	-0.00447 -0.00364	–	0.698	Inverted U	25.7013	24.5075
New Zealand	8.938*** -2.583	-0.206*** -0.0584	–	–	–	–	1.136** -0.561	-91.49*** -29.65	0.313	Inverted U	21.6942	23.1212
15 RECP Members	-6.938*** -1.816	0.325*** -0.0852	-0.00507*** -0.00133	0.0105** -0.00531	0.271*** -0.076	0.545*** -0.0463	0.000943*** -0.000278	58.44*** -12.46	0.848	Inverted N	–	–

Note: *, ** and *** indicate variables significant at the 10%, 5%, and 1% levels, respectively.

environment is significantly affected by the indicators of urban population, GDP per capita, and foreign trade as a share of GDP, in addition to international tourism income; Brunei and Australia are significantly affected by the indicators of urban population and GDP per capita; Malaysia, the Philippines, and Korea are significantly affected by the indicators of GDP per capita and foreign trade as a share of GDP; Singapore, Cambodia, and Japan are significantly affected by the indicators of urban population only; Vietnam and New Zealand are significantly affected by the indicators of foreign trade as a share of GDP.

4. CONCLUSIONS

This paper validates that the EKC theory can be used in tourism field research by empirically studying the panel data of RCEP members from 1997-2017. The relationship between inbound tourism and ecological footprint exists in various forms. In the long run, the increase of international tourism income in RCEP region helps to slow down the increase of total ecological footprint consumption, and the inbound tourism industry has a certain protective and improvement effect on ecological environment when realizing economic benefits, which helps to promote the sustainable development of tourism industry in the region. Members of RCEP can make the certification and assessment system based on the concept of sustainable development to manage the tourism development and ecological environment improvement of the member countries in an integrated manner and promote the healthy and coordinated development of the two. In response to the increase in ecological footprint caused by the development of inbound tourism, the following proactive measures can be taken. (1) Increase investment in environmental protection; improve energy utilization and increase the development and use of clean energy; develop public transportation construction and encourage the use of public transportation. (2) According to the characteristics of the country's resources, adjust the development of tourism, and develop low-carbon tourism, such as trying slow tourism, forest tourism and other new business models that are less damaging to the ecological environment. (3) More reasonable planning for the city; increase the publicity on ecological and environmental protection, advocate a green lifestyle and raise awareness of energy conservation and environmental protection, so that people's consumption awareness is gradually changed. (4) The government should give policy assistance to develop and implement stricter ecological environmental protection.

Since some data such as the national economic development index, the share of tourism in the tertiary sector, and the investment in pollution control are difficult to obtain, the influence of these factors on the ecological footprint is not considered for the time being. In the future, we will strengthen the collection and accumulation of this part of data, and continue to expand the scope and depth of research on TEKC to provide useful theoretical and practical guidance for the sustainable development of tourism in more countries and regions.

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