THE IMPACT OF TOURISM ON ENVIRONMENTAL POLLUTION IN SOUTHWEST CHINA

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Abstract - The present study explores the impact of tourism on environmental pollution in southwest China using the panel data from 1995 to 2017, taking the annual tourist arrivals and carbon emission as the main variables, based on immense tourism market and severe environmental problems in China. Southwest region is less developed but important part of China, and holds rich tourism resources. Panel ARDL technique is applied in this study. The results show that there is a positive impact of tourism on the environment in southwest provinces. The coefficient of tourism is negative, indicating that tourism sector assists in reducing the level of carbon emission and improve the environmental quality. Similarly, trade openness tends to induce the carbon emission and benefit for the environment. Conversely, the coefficients of energy consumption and GDP show that both of the variables have a negative impact on environment.

Keywords - Tourism, Carbon Emissions, Pollution, Energy Consumption, Panel ARDL, Southwest China

I. INTRODUCTION

In the macro background of severe environmental problems, controlling greenhouse gas emissions and sustainable development have become a hot and focus issue that has attracted worldwide attention. The tourism industry is the largest industry in the world. Over the decades, tourism has experienced continued growth and deepening diversification to become one of the fastest growing economic sectors. Modern tourism is closely linked to development and encompasses a growing number of new destinations. These dynamics have turned tourism into a key driver for socio-economic progress. China's tourism industry has achieved remarkable growth. China received a total of 60.74 million international overnight visitors in 2017, ranking fourth in the world, after France, Spain and the United States. The dramatically increased tourist arrivals and tourism revenue indicate that China has grown into an important tourist host country. According to the prediction of the World Tourism Organization, China will become the world's largest tourist destination and fourth largest tourist source country in 2020. Tourism has driven the growth of China's national economy, stimulated consumption, and solved social employment problems.

In recent years, global warming has caused various extreme climates, and natural disasters such as heat waves, floods and droughts have occurred frequently. Climate change will have a serious impact on our lives. Concomitant with the rapid development of the tourism industry are increasing energy consumption and carbon emissions, environmental problems in many tourism destinations are increasingly emerging and posing enormous challenges and threats to sustainable tourism development. According to the World Tourism Organization (UNWTO), tourism sector is responsible for 4.6% of global warming; in addition, 5 per cent of carbon emissions are due to tourism, only 2% of the world population actively takes part in aviation, 80% of all flights for holiday reasons. The results of the 'business-as-usual' scenario (which takes into account the UNWTO's Tourism 2020 Vision forecast of an average 4% annual growth of international tourist arrivals up to 2020) it was estimated that CO2 emissions in the global tourism sector may experience a growth of 161% by 2035 (UNWTO-UNEP-WMO,2008).

China currently accounts for more than a quarter of the world's total carbon dioxide emissions and is the largest emitter of greenhouse gases in the world. According to world bank statistics, global carbon dioxide emissions were 36.14 billion tons in 2014, while China's carbon dioxide emissions reached 10.29 billion tons. Based on the pressure of low carbon emission reduction, China is committed to developing a low carbon economy. And low carbon economy and sustainable development have become an emerging topic in tourism. At present, the tourism led growth is an open secret, but the energy consumption and tourist related activities are linked with the environmental degradation. The tourism has a significant impact on environment as it directly and indirectly promotes carbon emission. The available literatures focus on the overall level of the country and developed region, and study less at the regional level. To the best of our knowledge, the impact of tourism on environmental pollution has not been studied in southwest China. The southwest part of China is considered to be underdeveloped region, while it has rich tourism resources and good conditions for opening up to South and Southeast Asia due to "Belt and Road Initiative" and Trans-Asian Railway (TAR), as a part of the target provinces of Development of the West Regions strategy in China.

Therefore, the present study adds to the literature by investigating the southwest China taking the annual tourist arrivals and carbon emission as the main variables and explores the impact of tourism on environmental pollution using the panel data from 1995 to 2017, based on immense tourism market and

severe environmental problems in China. This is a unique contribution as none of the previous studies investigated this association for the southwest provinces and the findings to promote the sustainable eco-friendly development with the help of tourism. The Panel Autoregressive Distributed Lag (ARDL) technique will be opted to explore the impact of tourism on environmental pollution (CO2 emission) in Southwest region. Southwest China, the analysis of this region as China's main tourism region, which helps the government to manage tourism industry more effectively, promote the sustainable development of tourism and the environment, and achieve a low-carbon economy.

II. LITERATURE REVIEW

In recent years, the relationship between tourism and its influence on socio-economic factors has aroused wide concern in academic circles. Meanwhile, with the increasing global warming, more and more scholars begin to pay attention to climate change, and carry out in-depth research and learning. However, the relationship between tourism and climate change remains an academic field to be studied.

Lee and Brahmasrene (2013) examine the effect of tourism on economic growth and CO2 emissions for a panel of the EU countries for the period 1988–2009 by using the IPS and the LLC panel unit root tests, the Johansen co-integration test and the OLS estimator. Empirical results reveal that while tourism and CO2 emissions have statistically significant and positive effect on real GDP, tourism has a negative impact on CO2 emissions. Dogan and Aslan (2017) explore the relationship among CO2 emissions, real GDP, energy consumption and tourism in the EU and candidate countries, using panel models robust to heterogeneity and cross-sectional dependence. There is one-way causality running from tourism to carbon emissions, from economic growth to energy consumption, and from growth to tourism, and two-way causality between CO2 emissions and energy consumption, and between real income and CO2 emissions.

Jayanthakumaran, Verma and Liu (2012) compare CO2 emissions, energy consumption, trade and income between China and India. The CO2 emissions in China were influenced by per capita income, structural changes and energy consumption. A similar causal connection cannot be established for India with regard to structural changes and CO2 emissions, because India’s informal economy is much larger than China’s. Dogan and Bulbul (2015) investigated the impacts of energy consumption, real GDP, tourism and trade on CO2 emissions by accounting for cross-sectional dependence. The dynamic ordinary least squares (DOLS) estimation technique indicates that energy consumption and tourism contribute to the levels of gas emissions, while increases in trade lead to environmental improvements. The EKC hypothesis cannot be supported as the sign of coefficients on GDP and GDP2 is negative and positive, respectively. Moreover, the Dumitrescu–Hurlin causality tests exploit a variety of causal relationship between the analyzed variables.

Katircioglu (2014) analyzes international tourism, energy consumption, and environmental pollution in Turkey for the period 1960–2010, the impulse response and variance decompositions reveal that the reaction of energy consumption, and therefore CO2 emissions, to changes in tourism development is positive and gains strength in the longer periods. Azam, Alam and Hafeez (2018) analyze effect of tourism on environmental pollution in Malaysia, Singapore and Thailand. Tourism has a significant positive effect on environmental pollution in Malaysia. However, an inverse relationship between tourism and environmental pollution is observed in Thailand and Singapore.

Sharif, Afshan and Nisha (2017) applied three approaches of co-integration (autoregressive distributed lag bounds test, Johansen and Juselius and Gregory and Hansen structural break test) to confirm the valid long-run positive interaction between CO2 emission and tourist arrivals. The results of variance decomposition method exhibit the un-directional causality between CO2 emission and tourist arrivals running from tourist arrival to CO2 emission. Balli, Sigeze, Manga, Birdir and Birdir (2019) explores the impact of tourism on economic growth considering CO2 emissions utilizing panel data techniques for a sample of Mediterranean countries. The cointegration tests reveal that there is a positive long-run equilibrium between tourism, CO2 emissions and economic growth. This positive long-run relationship may suggest that tourism increases the level of CO2 emissions and has a statistically significant impact on economic growth in Mediterranean countries.

Danish and Wang (2018) analyze dynamic relationship between tourism, economic growth, and environmental quality in BRICS countries. Investment in tourism enhances economic growth and mitigates the level of CO2 emissions. The tourism sector stimulates economic growth but impairs environmental quality. The presence of the EKC is confirmed in the significance of investment in tourism. Bi-directional causality is detected between tourism receipts and CO2 emissions. Tourism and economic growth Granger cause each other. Finally, tourism receipts and investment in tourism Granger cause each other.

Zhang and Gao (2016) explore the effects of international tourism on China's economic growth, energy consumption and environmental pollution, they thought tourism causally affects economic growth and CO2 emissions in all three regions and the feedback effect exists between economic growth and CO2 emissions. It also reveals that the tourism-induced EKC hypothesis does not exist in China. Sun, Zhang and Xu (2017) investigate pollution haven hypothesis (PHH) for China, the

results of bounds test indicates that PHH does exist in China. Chen, Thapa and Yan (2018) analyze the relationship between tourism, carbon dioxide emissions, and economic growth in the Yangtze River Delta China. The result is industry size and expenditure size effect were the principal factors to promote carbon emissions growth, where as energy intensity, spatial structure, and sectorial structure had negative effects.

Ahmad, Draz, and Su (2018) examine the impact of tourism on the environmental pollution of five provinces located in the heart of OBOR over the period of 1991–2016. The results confirm a negative impact of tourism on environment for Ningxia, Qinghai, Gansu, and Shanxi. However, tourism improves the environmental quality of Xinjiang. The negative impact of energy consumption and GDP growth is significant than tourism.

Wang, Shao, Zhou and Deng (2018) based on EKC Theory and related literatures, developed the EKC Theoretical Model by introducing tourism development variables and exploring the effects of tourism development on regional carbon emissions on the basis of the provincial panel data of China during 1995-2015. They examined the effects of economic growth, trade openness, unemployment rate, education level and urbanization level on carbon emissions. Results show that the development of tourism has a significant impact on per capita CO2 emissions.

The above practical studies show that "tourism" and "environment" play key roles in the development of any economy, the researchers investigated the influence of tourism on economic growth and CO2 emissions through panel methods or time series data. However, previous studies have found mixed results on the impact of tourism on carbon dioxide emissions and environmental pollution. Existing studies have also shown a lack of inclusive research on tourism and environmental pollution in the context of southwest China. Therefore, the main purpose of this study is to explore the impact of tourism on environmental pollution in five provinces in southwest China, so as to reduce the background and knowledge gap, and further improve the understanding of the relationship between tourism and environmental pollution.

III. THEORETICAL SETTING

The starting point of the theoretical setting in the present study is that tourist arrivals might be a determinant of climate change. Dogan and Aslan (2017) uses international tourist arrivals and CO2 emissions to explore the relationship between tourism and environmental degradation. In addition to energy consumption, many studies have identified gross domestic product as a major contributor to climate change, and trade openness is also considered in this study. Thus, the model to investigate the impact of tourism on environmental pollution is derived by using the following function:

$$CO2_{it} = f(GDP_{it}, TA_{it}, TRADE_{it}, E_{it}) \quad (1)$$

The function in Eq. (1) can be transformed into an econometric model in the economic long-term period:

$$CO2_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 TA_{it} + \beta_3 TRADE_{it} + \beta_4 E_{it} + \varepsilon_{it} \quad (2)$$

While t refers to the time period, i refers to the cross-section (i=Guangxi, Chongqing, Sichuan, Guizhou, Yunnan); ε_{it} isthe residual term. $CO2_{it}$ is a proxy for environmental pollution; TA_{it} is the number of tourist arrivals in the host province. GDP_{it} represents the real region gross domestic product per capita (constant 2000); $TRADE_{it}$ is trade openness (the proportion of import and export trade to total GDP); E_{it} is energy consumption. The Coefficients β_1 and β_4 are expected to be positive, while the β_2 and β_3 on carbon emission are expected to be negative.

IV. DATA AND METHODOLOGY

The panel data used in this paper are annual figures covering the period 1995–2017 due to available data, the concerned variable is tourist arrivals (TA), and each province in China has a different way of collecting domestic tourism data, tourist arrivals represents international overnight visitors. And CO2 emissions standing for climate change, other variables are real GDP per capita (constant 2000), energy consumption (E) and trade openness (TRADE). Following the literature, we employed CO2 emission as a proxy variable for environmental pollution (climate change). Since the provincial CO2 emissions data is not available, based on Inter-governmental panel on climate change (IPCC), we estimate CO2 emissions by using the amount of fuel burned and the default emission factor.

Data of variables for carbon emission calculation were selected from China Energy Statistics Yearbook. Economic data and tourism development data were obtained from National Bureau of Statistics of China, energy consumption and trade openness data were collected from China and Provincial Statistics Yearbook.

Pesaran et al. (1999) have introduced the pooled mean group (PMG) approach in the panel ARDL framework. They offer two important new techniques to estimate nonstationary dynamic panels in which the parameters are heterogeneous across groups: the mean-group (MG) and pooled mean-group (PMG) estimators. Blackburne and Frank (2007) introduce a new Stata command, xtpmg, for estimating nonstationary heterogeneous panels. Asongu et al. (2016) test the relationships between energy consumption, CO2 emissions, and economic growth in 24 African countries by using a panel ARDL approach.

V. EMPIRICAL RESULTS

To test the stationarity of the data, we used LLC (Levin, Lin and Chu ,2002) panel unit root tests. Statistical P-value could determine the data is stationary or not, and P-value must be less than 5% significant level, otherwise it will fail to reject H_0 of having a unit root. In panel ARDL approach, all the variables in the model can be either I (0) or I(1), without confirming which are I(0) or I(1).

Variables	Level	LLC	Result
CO2	I(0)	-0.87779 (0.1900)	Non-Stationary
	I(1)	-3.74156***(0.0001)	Stationary
GDP	I(0)	-3.86325***(0.0001)	Stationary
	I(1)	-2.69486***(0.0035)	Stationary
TA	I(0)	0.72874 (0.7669)	Non-Stationary
	I(1)	-6.51407***(0.0000)	Stationary
TRADE	I(0)	-0.51104 (0.3047)	Non-Stationary
	I(1)	-5.53704***(0.0000)	Stationary
E	I(0)	-2.39152***(0.0084)	Stationary
	I(1)	-3.64363***(0.0001)	Stationary

Note: *, **, *** denote 10%, 5%, and 1% significant level respectively

Table 1. Panel Unit Root Test Results

Table 1 reports that the null hypothesis of no unit root cannot be rejected at level for carbon emission (CO2), tourist arrivals (TA) and trade openness (TRADE), they are non-stationary at level. GDP per capita (GDP) and Energy consumption (E) are stationary at level. All the variables are discovered to be stationary in their first differences. The variables in level are now suitable for the panel ARDL analysis.

In order to estimate the panel data set, Mean Group (MG) estimation and Pool Mean Group (PMG) estimation will be applied for the analysis, and Hausman Test is used to choose the best estimator. MG estimation results are shown in the table 2, in the long run, all variables are not significant, it reveals that there is no long run relationship. In the short run, the trade openness is significant at 10% significant level, there is a negative relationship between trade openness and carbon emissions; the speed of adjustment of error correction has negative sign and is significant at 1%. However, for other variables, there are no any long run or short run relationship, therefore, MG estimation is not a good estimator in this study.

D.CO2	Coefficient	Standard error	P value
Long Run			
GDP	0.0571	0.0630	0.365
TA	-0.9112	0.8585	0.289
TRADE	-3.2300	122.1061	0.213
E	-132.9165	0.0734	0.474
Short run			
ΔGDP,D1	0.0471	0.0346	0.173
ΔTA,D1	-0.0794	0.2723	0.771
ΔTRADE,D1	-94.0024*	53.8937	0.081
ΔE,D1	-0.0002	0.0070	0.978
EC	-0.6375***	0.1908	0.001
Constant	2.0497	12.4677	0.869

Table 2. MG Estimation Results

Note: *, **, * denote 10%, 5%, and 1% significant level respectively**

We can deduce from Table 3 that there is great evidence that the long run relationships are existed between carbon emissions and Southwest provinces' GDP per capita, tourist arrivals and energy consumption, and trade openness is significant at 10% significant level, P value is 0.068. For the short run estimation, the speed of adjustment of error correction has negative sign and is significant at 1%. The short-term relationship between variables is not significant.

D.CO2	Coefficient	Standard error	P value
Long run			
GDP	0.0062***	0.0022	0.004
TA	-0.3104***	0.0690	0.000
TRADE	-101.9616*	55.8837	0.068
E	0.0200***	0.0026	0.000
Short run			
ΔGDP,D1	0.0179	0.0111	0.106
ΔTA,D1	0.1200	0.1066	0.260
ΔTRADE,D1	-4.7931	34.9606	0.891
ΔE,D1	0.0028	0.0046	0.545
EC	-0.5425***	0.1334	0.000
Constant	1.005	5.7437	0.861

Table 3. PMG Estimation Results

Note: *, **, * denote 10%, 5%, and 1% significant level respectively**

Blackburne and Frank (2007) introduce that the test of difference in MG and PMG models is performed with the

familiar Hausman test. The calculated Hausman statistic is 0.61, here we conclude that the PMG estimator, the efficient estimator under the null hypothesis, is preferred.

	(b) mg	(B) pmg	(b-B) Difference	Sqrt(diag(V_b-V_B)
GDP	0.0572	0.0062	0.0509	0.1112
TA	-0.9112	-0.3104	-0.6008	1.5147
TRADE	-152.1522	-101.9616	-50.1906	208.2819
E	-0.0525	0.0200	-0.7256	0.1296

Table 4. Hausman Test Results between PMG and MG
Test: Ho: difference in coefficients not systematic
Chi2(3) = (b-B)' [(V_b-V_B) ^ (-1)] (b-B)
= 0.61
Prob>chi2 = 0.8944

According to the empirical results, the resulting estimate of the level relationship under the panel ARDL specification presented in Eq. (2) is given as follows:

$$CO2_{it} = 1.005 + 0.0062GDP_{it} + (-0.3104)TA_{it} + (-101.9616)TRADE_{it} + 0.02E_{it} + \varepsilon_{it} \quad (3)$$

The coefficients of GDP and E are positive and statistically significant, which implies that economic growth and energy consumption will increase carbon emissions. The coefficient of TA is negative and statistically significant which implies that in the long-term period, a 1 percent change in tourist arrivals to southwest region will lead to a 0.3104 percent change in CO2 emissions in the opposite direction. Consequently, tourism sector is not a concern for environmental pollution in the sample provinces (Southwest China)

VI. CONCLUSION AND POLICY IMPLICATIONS

Present paper investigates the impact of tourism on environmental pollution in southwest provinces of China employing panel data techniques for the period of 1995 to 2017, taking the annual tourist arrivals and carbon emission as the main variables. The panel ARDL model is utilized in this study to determine the impact of tourism on CO2 emission for southwest China. The results show that there is a positive impact oftourism on the environment in southwest provinces in China. The coefficient of tourism is negative, indicating that tourism sector assists in reducing the level of carbon emission and improve the environmental quality. Similarly, trade openness tends to induce the CO2 emission and benefit for the environment. Conversely, the coefficients of energy consumption and GDP show that both of the variables have a negative impact on environment; the impact of energy consumption is more significant than GDP.

In combination, the empirical results demonstrate several major policy implications. First of all, the existence of long-run relationship between tourism and CO2 emissions, thus, Southwest provinces can improve its economic performance and environmental quality by further developing the tourism sector. Moreover, energy consumption leads to environmental degradation, the provincial government in southwest region needs to accelerate industrialization, reduce energy consumption (mainly coal, oil and natural gas), and develop a low-carbon and environment-friendly economy. In addition, trade level has a positive impact on carbon emission, southwest region has good conditions for opening up to South and Southeast Asia. Consequently, for the rich tourism resources in the southwest, this is a good opportunity to develop tourism, improve the economic level and relieve the environmental pressure caused by industrial development. In summary, given the growing influence of tourism, understanding the impact of tourism on the economy and the environment is crucial for Chinese provincial governments, so that appropriate actions can be taken in a timely manner to help the tourism industry Sustainable development.

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