ASSESSING THE INBOUND TOURISM EFFICIENCY OF EUROPEAN COUNTRIES IN CHINA: 2006-2019

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Abstract

Assessing inbound tourism efficiency helps to understand the potential levels and constraints of inbound tourism flows. In this study, 35 European countries and China were selected as samples and influencing factors of tourism efficiency were constructed within the gravity model (GM) and stochastic frontier analysis (SFA). Taking into account individual heterogeneity, a true fixed-effects stochastic frontier gravity model (TFE-SFA-GM) was developed and empirically analysed using data from 2006 to 2019. The results show that (1) the inbound tourism efficiency of European countries in China is jointly affected by many core factors, such as economic scale, geographic distance, and population size on both sides; (2) the inefficiency factors that affect the inbound tourism efficiency of European countries in China are diversified;(3) the inbound tourism efficiency of European countries in China generally shows an upward trend during the sample period, but there are significant differences in the gap between the frontier level of inbound tourism flow in China and the actual inbound tourism flow. These findings imply that to better attract European tourists, China must continue to maintain and strengthen economic and trade relations with European countries, create a favourable security environment for tourism, highlight the integration of international tourism resources with Chinese culture, and continue to promote them in Europe.

Keywords: stochastic frontier analysis, gravity model, true fixed effects stochastic frontier analysis gravity model, inbound tourism efficiency.

JEL Classification: A10, C23, L83, Z31

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Introduction

International tourism activities have become a significant alternative for vacation and leisure time for people, according to the acceleration of global integration and higher income levels (Chen et al., 2021). China is an important tourist destination, and Europe is the second largest source of tourists in China's inbound tourism market after Asia. Evaluating the inbound tourism efficiency of European countries in China and analysing its influencing factors can provide a decision-making basis for China to further optimise the allocation of tourism resources and formulate more targeted industrial policies.

When measuring tourism-related efficiency, the literature generally constructs the relationship between the input and output of the production factor to examine the performance achieved by the input factor. However, there are three difficulties in applying this method when the efficiency of inbound tourism is discussed at the national or regional level. First, the input factors for inbound tourism are difficult to specify. Second, behavioural decision-making regarding transnational tourism is affected by multiple factors that cannot be clearly distinguished as the inbound tourism industry's input or output. Third, there are non-random elements that impact inbound tourism efficiency that are challenging to account for in evaluating efficiency. Taking into account these issues, measuring the efficiency of inbound tourism solely by the ‘input-output’ connection is inaccurate.

Leibenstein (1996) defined efficiency as the ratio of the actual output to the maximum possible output. Consequently, we consider the measurement of inbound tourism efficiency from the output perspective. The flow of inbound tourists can be regarded as a comprehensive output of inbound tourism. Based on these, this study defines the inbound tourism efficiency as the ratio of the actual flow of inbound tourism to the maximum achievable flow. At the same time, we view inbound tourism as a special type of international service trade. The gravity model framework is used to create a system of factors for tourism destination countries to attract foreign tourists, and the SFA is used to create a measure of the efficiency of inbound tourism.

Although there is considerable cultural and economic homogeneity between European countries, there are also clear regional variations in tourist flows to China. Taking 2019 as an example, Russia is the country with the largest number of tourists (2.25 million) to China among them, while there are only 2,400 tourists from Malta. The heterogeneity of the tourist flow from European countries to China and the heterogeneity of the hindering factors of inbound tourism efficiency among countries must be considered. Therefore, TFE-SFA-GM is used to measure the efficiency of the inbound tourism of European countries in China.

This study makes the following contributions. (1) TFE-SFA-GM is introduced in the domain of assessing inbound tourist efficiency. In contrast to similar studies, the model used here isolates the heterogeneity of the sample countries, while also measuring the relationship between efficiency and its influencing factors. It also addresses the issue of non-monotonicity of exogenous variables on the inefficiency term. (2) Taking China and Europe as samples, the inbound tourism inefficiency factors are discussed, and the inbound tourism efficiency of each European source country is measured in China from 2006 to 2019. To our knowledge, there has been no discussion on tourism efficiency between China and European countries.

The remainder of this paper is structured as follows: Section 1 contains a literature review, Section 2 describes theoretical hypotheses, and Section 3 introduces the research technique. Section 4 describes the setup of the model and the selection of variables. Section 5 consists of empirical results and a study of influence elements. Section 6 examines the efficiency characteristics of inbound tourism in China from European source countries and the distance from the frontier levels. Finally, we present the conclusion.

1. Literature review

1.1. Factors affecting inbound tourism

In this study, the ratio of actual flow to potential flow of inbound tourism was used as a measure of inbound tourism efficiency. Therefore, factors that affect inbound tourism flow are also regarded as those affecting inbound tourism efficiency. A considerable body of work has examined the factors influencing inbound tourism flows, which can be broadly classified into five categories in addition to population and economic size. The first category comprises the tourism resources of a country. It comprises world heritage sites, five-star hotels, historical and cultural resources, and other tourism resources. The second category is the social environment of the destination country, which includes crime, the rule of law, social stability, corruption, and political stability. Crisis events such as infectious diseases, natural catastrophes, terrorist attacks, and wars comprise the third category. The living environment of an individual, such as quality of life, environmental contamination, and transportation infrastructure, constitutes the fourth category. The fifth category is the trading environment between the source and destination countries, which includes exchange rates, relative prices, and levels of openness and trade.

According to the literature, for different research samples or under different research themes, scholars have a different understanding of the factors that influence tourism flows, and the associated empirical analysis is inconsistent with the direction of the effect of the influencing variables. We believe that, as a form of service trade, the influencing factors of inbound tourism flow not only have the common characteristics of general international trade but also must reflect the destination country's attractiveness to source country tourists. Based on the explanations mentioned above, we can divide these influencing factors into three perspectives: core, inefficiency, and random factors. Among these, inefficiency factors can play a role in hindering or promoting inbound tourism.

1.2. Efficiency measurement methods in tourism-related fields

The most common efficiency measures are DEA and SFA. The former uses linear programming, whereas the latter employs econometric methods (Assaf and Tsionas, 2019). Owing to its benefits, such as the simplicity of handling numerous input and output problems and the absence of the need to specify the model's specific form, DEA has been widely utilised in the literature on efficiency measurement. However, DEA also has many disadvantages, such as that it disregards random variables (Assaf and Tsionas, 2019) and easy to overestimate the efficiency (Anderson et al., 1999). Although SFA requires the establishment of a model form in advance and is typically applied to single-output situations (multiple outputs can be combined into a single output). This method decomposes the deviation between the actual level and the frontier surface into a composite error term containing a non-negative inefficiency term and a random error term, which has the characteristic of being tolerant to data errors. SFA has been used in tourism-related industries to assess airport (Bergantino, Intini and Volta, 2021), hotel (Zhang et al., 2020), and destination efficiency (Tang, 2021). Two models, the time-invariant stochastic frontier gravitational model and the time-varying stochastic frontier gravitational model, are primarily used in the efficiency measurement of tourism-related fields; however, neither model can effectively address the problem of individual heterogeneity.

2. Hypothesis development

The gravity model has been widely used in areas such as trade and international tourism flows since Tinbergen (1962) introduced it to international trade mobility (Tang, 2021). Factors that influence inbound tourism flows into the gravity model include core variables, hindering factors, and random factors.

2.1. Core influencing factors

Economic growth: In the theory of tourism-led economic growth, numerous researchers have confirmed a mutually strengthening relationship between tourism development and regional economic growth (Tang, 2021). Therefore, the hypothesis is formulated:

Hypothesis no. 1: Economic growth in the source countries increases the flow of inbound tourism to the destination country.

Existing research differs in the relationship between economic growth and the volume of international tourism in destination countries. Some authors of literature believe that economic growth will increase the flow of tourism inbound (Petit and Seetaram, 2019). Another literature contends that unspoiled natural areas are destroyed as the economic size of destination countries grows. Meanwhile, because of the snob effect (Candela and Figini, 2012, p.110-112,187), tourists may be more inclined to choose less industrialised regions that are more relaxing for them as tourist destinations. Therefore, the following hypotheses are formulated:

Hypothesis no. 2a: The number of foreign tourists visiting the destination country will increase as its economy grows.

Hypothesis no. 2b: The number of foreign tourists visiting the destination country will decrease as its economy grows.

Population scale: The population scale has been a recognised factor affecting the trade potential. Generally, in countries with larger populations, the national demand for international tourism is relatively large. Consequently, we propose the following hypothesis:

Hypothesis no. 3: The growth of population in the source countries increases the level of inbound tourism in the destination countries.

Regarding the destination country, most scholars believe that an increase in population size means that there will be more tourism practitioners, thus improving the level of refined tourism services and attracting more tourists (Provenzano, 2020). However, some scholars argue that the larger the population size, the higher the likelihood of a crowding effect on inbound tourism (Tang, 2021). Therefore, we suggest the following hypotheses:

Hypothesis no. 4a: The growth of population in destination countries will increase the inbound tourism traffic.

Hypothesis no. 4b: The growth of population in destination countries will reduce the flow of incoming tourism.

Geographical distance: According to the first law of geography (Tobler, 1970, p.236), everything is more strongly associated with nearby objects. For tourism activities, the cost of crossing the distance between the source and destination is what tourism must pay. Consequently, this study proposes the following hypotheses:

Hypothesis no. 5: The geographical distance between two countries has an inhibitory effect on the flow of inbound tourists from the destination country.

2.2. Impact of inefficiency factors

Exchange rate fluctuation: Tourism consumption is accompanied by currency exchanges. When the destination country's currency depreciates, it will reduce the travel cost of inbound tourists. Consequently, the following hypothesis is formulated:

Hypothesis no. 6: The higher the exchange rate of the source country's currency versus the currency of the destination country, the more attractive the inbound tourism from the source country.

International public health events: Typically, public health crises, such as epidemics, are closely related to personal safety. And long-lasting public health incidents also change the destination country's inbound supervision policy. The uncertainty of the inbound supervision policy and the increase in inbound difficulty inhibit the flow of inbound tourism. Therefore, we propose the following hypothesis:

Hypothesis no. 7: Public health events have an inhibitory effect on the flow of inbound tourism to destination countries.

Security aspects of destination country: Terrorist attacks in public places will not only threaten the personal safety of tourists, but will also destroy the image of the destination. Tourists may have a negative memory effect and will seek safer tourist destinations (Song, Livat and Ye, 2019). Consequently, this study proposes the following hypotheses:

Hypothesis no. 8: Terrorist attacks on destination countries may hinder inbound tourism flows from source countries.

Trade between the destination and the source countries: Tatoglu and Gul (2019) suggest that the tourists' discovery and consumption of home country products in the destination country improves their sense of belonging, thereby boosting the destination country's tourism attraction. Similarly, tourists' domestic use of imported goods from the destination country strengthens their view of it, thereby facilitating their decision to travel there. Consequently, this study assumes the following hypothesis:

Hypothesis no. 9: Trade between the two countries has a favourable impact on inbound tourism from the source country to the destination country.

Endowment of tourism resources in the destination country: The main sources of utility for most tourists are experiencing the distinctive customs of the destination country and observing their distinctive natural landscapes. Attractions are the main draw for tourists, and tourism does not exist without them. Therefore, we suggest the following hypothesis:

Hypothesis no. 10: The abundance of tourism resources in a destination country positively influences inbound tourism flows.

Cultural distance: Qiang, Shen and Xie (2019) stated that certain tourists prefer places with cultures similar to their home countries. Other research confirms that cultural distance has a favourable impact on the selection of tourist destinations (Bi and Gu, 2019). Consequently, we formulate the following hypotheses:

Hypothesis no. 11a: The cultural distance attracts European visitors to China.

Hypothesis no. 11b: Cultural differences prevent European visitors from visiting China.

Wealth distribution: Scholars agree that income distribution influences the marginal propensity to consume (Trivin, 2021). For relatively high-cost cross-border tourism, there is no relevant literature that confirms whether the equalisation of wealth distribution in the source country will lead to an increase in inbound tourism flow in the destination country. In general, it is assumed that a more equitable distribution of social wealth in the source country will result in an increase in overall wealth, thus stimulating the outbound tourism demand of residents and contributing to an increase in their inbound tourism flows in the destination country. However, other researchers contend that the income elasticity of international tourism demand tends to be greater than 1, with consumption characteristics of luxury products (Massidda and Etzo, 2012; Muñoz, Álvarez and Baños, 2021). According to Dalgin, Trindade and Mitra (2008), luxury goods imports are proportional to the wealth distribution imbalance in the importing country. Because relevant studies have not reached a consistent conclusion and considering that outbound tourism is a special form of service trade import in the source country, we assume the following hypotheses:

Hypothesis no. 12a: The equalisation of wealth distribution in source countries will increase inbound tourism flows from source countries to destination countries.

Hypothesis no. 12b: The equalisation of wealth distribution in source countries will decrease inbound tourism flows from source countries to destination countries.

3. Methodology

3.1. Model for heterogeneous stochastic frontier gravity

In order to solve the limitation of ignoring individual heterogeneity in the traditional stochastic frontier gravity model, Greene (2005) propose a true fixed-effects stochastic frontier analysis model.

$$\ln T_{ij} = \alpha_i + \ln f\left(x_{ij}, \boldsymbol{\beta}\right) + v_{ij} - u_{ij}, u_{ij} \geq 0 \tag{1}$$

In Eq. (1), $f\left(x_{ij}, \boldsymbol{\beta}\right)$ indicates a core combination of variables (including population, economic scale, and geographic distance) that influences T_{ij}, $\boldsymbol{\beta}$ is the vector of parameters to be estimated, and the intercept term is α_i to reflect the heterogeneity of individuals. The stochastic disturbance terms $v_{it} \sim iidN(0, \sigma_v^2)$, v_{ij}, and u_{ij} are independent.

This study also cites Wang (2002) for the setting of the inefficiency term, who contends that the inefficiency term's mean and variance exhibit individual differences because of the exogenous variables in the model that affect the inefficiency term differently for different individuals. Furthermore, given that the half-normal distribution is a special case of the truncated normal distribution, the inefficiency term is set as follows:

$$\begin{aligned} &u_{ij} \sim iid\ N^{+}(\mu_{ij}, \sigma_{u_{ij}}^{2}) \\ &\mu_{ij} = \mu_0 + z_{ij}\boldsymbol{\omega} \\ &\sigma_{u_{ij}}^{2} = \exp(\sigma_0 + z_{ij}\boldsymbol{\gamma}) \end{aligned} \tag{2}$$

where μ_{ij} and $\sigma_{u_{ij}}^{2}$ are the mean and variance of the truncated normal distribution obeyed by the inefficiency term, u_{ij}, respectively. μ_0 and σ_0 are constant terms, and z_{ij} is a set of exogenous variables constituting the inefficiency term, $\boldsymbol{\omega}$ and $\boldsymbol{\gamma}$ are both vectors to be estimated. Eq. (2) not only incorporates the effects of exogenous variables on the mean and variance of the inefficiency term into the model, but also allows for the existence of nonlinear effects of the exogenous variables on the inefficiency term, which better reflects the economic trade reality between the two countries. The parameter estimation approach is consistent with Wang (2002), and interested readers may refer to their study.

3.2. Efficiency measurement of inbound tourism

T_{ij} attains the frontier level T_{ij}^{*} if there is no inefficiency term in Eq. (1). According to the definition of efficiency given by Battese and Coelli (1992), it is determined that

$$TE_{ij} = \frac{T_{ij}}{T_{ij}^{*}} = \frac{\exp\left[\alpha_i + \ln f\left(x_{ij}, \boldsymbol{\beta}\right) + v_{it} - u_{it}\right]}{\exp\left[\alpha_i + \ln f\left(x_{ij}, \boldsymbol{\beta}\right) + v_{it}\right]} = \exp(-u_{it}) \tag{3}$$

where the efficiency value TE_{it} can take values between 0 and 1, and the higher the value, the greater the efficiency.

4. Model setting and variable selection

4.1. Model Setup

This study examines the efficiency of European inbound tourism in China and the factors influencing it. Based on data availability, we selected a sample of 35 European countries and used annual data from 2006 to 2019 to provide empirical support. Table no.2 lists the sample countries. According to Eq. (1), Eq. (2), and Eq. (3), TFE-SFA-GM can be synthesised as follows:

$$\begin{aligned} &\ln T_{it} = \alpha_i + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln POP_{it} + \beta_4 \ln POP_{jt} + \beta_5 \ln DIST_i + v_{it} - u_{it} \\ &u_{it} \sim N^{+}(\mu_{it}, \sigma_{u_{it}}^{2}), \\ &\mu_{it} = \mu_0 + z_{it}\omega, \\ &\sigma_{u_{it}}^{2} = \exp(\sigma_0 + z_{it}\gamma), \\ &z_{it} = (EXCH_{it}, PUBL_t, TERR_{jt}, TRAD_{it}, ENDO_{jt}, CULT_{it}, WEAL_{it}) \end{aligned} \tag{4}$$

The explanatory variable T_{it} denotes the number of overnight visits to China from the European country i in year t . Specific data was collected from the Euromonitor (Passport) database. China is a fixed destination country; therefore, the subscripts j for some variables are omitted.

4.2. Variable selection

We use GDP to measure the size of an economy, and the dollar figures for GDP were converted from domestic currencies using the official exchange rates of 2010. For the population scale, the mid-year estimates of the population size of each country published by the World Bank are used. As for geographical distance, we refer to Deng, Hu and Yang (2019) employing a population-weighted geographic distance between major cities as a proxy for the geographic distance between countries.

The World Bank provides official exchange rates (in US dollars to local currency) for each country, which are annual averages determined from monthly averages. Based on this assumption, we calculate the exchange rate from the China-to-Tourist source country in year t using the following formula:

$$EXCH_{it} = \frac{rate'_{jt}}{rate'_{it}} \tag{5}$$

where $rate'_{jt}$ and $rate'_{it}$ represent the exchange rates of China's RMB and the source country's currencies relative to the US dollar, respectively.

To reflect the impact of public health events, a dummy variable was created with a value of 1 if the WHO identified a public health emergency of international concern during the year and 0 otherwise. Table no.1 summarises the results throughout the study period.

Table no. 1. International health emergency of public health during 2009 to 2019

Name	Starting time	Ending time
H1N1	April 25, 2009	August 10, 2010
Poliovirus	May 5, 2014	Remains a public health emergency of international concern
Ebola (West Africa)	August 8, 2014	March 29, 2016
Zika	February 1, 2016	November 18, 2016
Ebola (DRC)	July 17, 2019	June 26, 2020

With reference to Puczkó and Smith (2012), this article uses the number of terrorist attacks in China (including Hong Kong). In reference to Tatoglu and Gul (2019), we use China's exports of goods to European countries to measure the proximity of trade exchanges. The number of Chinese sites included in the World Heritage List was chosen to represent China's tourism resource endowment here with reference to Yang, Liu and Li (2019).

According to the six dimensions of the Hofstede index, we employ the KSI composite index method (Kogut and Singh, 1988) to measure the cultural distance between China and European countries, as other scholars.

$$CULT_{ijt} = \frac{1}{6}\sum_{k=1}^{6}\frac{\left[\left(I_{ik} - I_{jk}\right)^2\right]}{V_k} \quad (6)$$

where I_{ik} and I_{jk} represent the scores of countries i and j on the k-th cultural dimension and V_k represents the variance in the k-th dimension. For missing data, the Blomkvist and Drogendijk (2013) imputation method was used for data imputation.

Although the Gini coefficient and the quantile of income are frequently used to reflect fairness of distribution, they are not employed here as measures of wealth distribution. The primary reasons are that, on the one hand, the absence of these indicators is more severe and does not match the empirical proof requirements of the model, and, on the other hand, wealth and income are statistically distinct. Combining many data sources, such as national accounts, survey data, fiscal data, and wealth rankings, the World Inequality Database has done productive work on wealth distribution metrics. Using the generalised Pareto interpolation approach, the indicator of the proportion of wealth owned by those whose personal wealth is below the national median (wealth disparity: bottom 50% share) is created and used to measure wealth distribution inequality in 174 countries worldwide. Given the availability of data, this indicator was used to describe the level of wealth distribution in European countries.

Table no. 2. Variables, data sources, and expected effects

	Variables	Data Sources	Expected effects
Explained variables	T_{it}	Euromonitor (Passport) database	\
Core explanatory variables	GDP_{jt}	World Bank	\
	GDP_{it}	World Bank	+
	POP_{jt}	World Bank	\
	POP_{it}	World Bank	+
	$DIST_i$	CEPII	-
Inefficiency terms	$EXCH_{it}$	World Bank	-
	$PUBL_t$	WHO	+
	$TERR_{jt}$	Global Terrorism Database	+
	$TRAD_{it}$	China Statistical Yearbook	-
	$ENDO_{jt}$	World Heritage Database	-
	$CULT_{it}$	GEERT HOFSTEDE website	\
	$WEAL_{it}$	World inequality database	\
Note: 35 sample countries are Albania, Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Turkey, Ukraine and the United Kingdom.			

5. Empirical results

5.1. Parameter estimation results

To guarantee the robustness of the calculated models, ordinary least squares, fixed effects, random effects, and likelihood method were estimated using STATA 16.0, Table no.3. presents the result. Second, to compare the performance of the models, we gradually relax the assumptions of Eq. (4) (denoted as model VIII) to obtain models V, VI, and VII. The parameters were estimated in the same manner as in Wang (2002), and the calculations were performed using STATA16.0. Table no.4 presents the results of the model estimations.

The results indicate that the coefficient signs of Models I, II, III, and IV are generally consistent with theoretical expectations. And according to the Hausman test, a fixed-effects model should be employed. Meanwhile, the generalised likelihood ratio test indicated that the LR statistic was significant at the 1% level for Models I, IV, and VIII, rejecting the null hypothesis of 'no inefficiency term'.

The results are in Table no. 4 indicate that, in Model V, $\ln POP_{it}$ is not statistically significant, but the remaining variables are significant at the 1% level, and the sign is the theoretical expectation. In Model VI, $\ln POP_{it}$ has the anticipated opposite sign and is not significant. Furthermore, in terms of inefficiency, $EXCH_{it}$, $TERR_{jt}$, and $TRAD_{it}$ are not significant.

The generalised likelihood ratio test indicated that the LR statistic was significant at the 1% level for Models V, VI, and VIII, and it may be assumed that the exogenous variables simultaneously influenced the mean and variance of the inefficiency term. Therefore, the TFE-SFA-GM presented in this study is preferable. The following section analyses the explanatory variables and the inefficiency term based on Model VIII.

Table no. 3. Estimation results of the baseline models

	(I)	(II)	(III)	(IV)
	OLS	FE	RE	MLE
$\ln GDP_{jt}$	-0.726 (0.469)	-0.708*** (0.148)	-0.708*** (0.166)	-0.718*** (0.160)
$\ln GDP_{it}$	0.777*** (0.028)	0.826*** (0.098)	0.889*** (0.079)	0.822*** (0.106)
$\ln POP_{jt}$	16.052** (7.284)	17.110*** (2.351)	15.570*** (2.597)	15.886*** (2.540)
$\ln POP_{it}$	0.264*** (0.031)	-2.378*** (0.233)	0.008 (0.096)	0.105 (0.066)
$\ln DIST_{i}$	-2.234*** (0.203)	(omit)	-2.847*** (0.792)	-3.971*** (0.143)
$\_cons$	-310.151** (139.466)	-311.873*** (44.755)	-293.838*** (50.496)	-289.604*** (48.531)
LOG	-345.786			179.028
LR	1306.678***			257.05***
Hausman			127.17***	

Note: 1. *, **, *** signify rejection of the original hypothesis at the 10%, 5%, and 1% significance levels, with standard errors in parenthesis. 2. "omit" indicates that the variable was eliminated as a result of multicollinearity. 3. The likelihood ratio (LR) is the chi-square value of the likelihood ratio test of the other model vs Model VIII.

Table no. 4. TFE-SFA-GM under different assumptions

	(V)	(VI)	(VII)	(VIII)
	$\omega = 0, \gamma = 0$	$\omega \neq 0, \gamma = 0$	$\omega = 0, \gamma \neq 0$	$\omega \neq 0, \gamma \neq 0$
$\ln GDP_{jt}$	-0.718*** (0.160)	-0.894*** (0.148)	0.872*** (0.084)	-0.671*** (0.139)
$\ln GDP_{it}$	0.820*** (0.106)	0.756*** (0.094)	0.383*** (0.046)	0.786*** (0.080)
$\ln POP_{jt}$	15.901*** (2.540)	20.980*** (2.373)	-6.635*** (0.101)	7.960*** (2.104)
$\ln POP_{it}$	0.106 (0.066)	-0.012 (0.068)	2.015*** (0.045)	0.444*** (0.064)
$\ln DIST_{i}$	-3.969*** (0.143)	-4.162*** (0.140)	7.558	-3.900*** (0.129)
$\_cons$	-289.867*** (48.535)	-385.849*** (45.519)	15.659	-129.281*** (40.278)
The parameters of the mean of the term for inefficiency μ_{it}				
$EXCH_{it}$		0.004 (0.006)		0.004* (0.002)
$PUBL_{t}$		0.189*** (0.045)		0.059*** (0.015)
$TERR_{jt}$		0.001 (0.001)		0.004*** (0.0007)
$TRAD_{it}$		-0.001 (0.001)		-0.007*** (0.002)
$ENDO_{jt}$		0.016*** (0.003)		-0.024*** (0.003)
$CULT_{it}$		0.284*** (0.048)		-0.397*** (0.047)
$WEAL_{it}$		0.023*** (0.006)		0.006 (0.006)
$\_cons$	-10.155 (96.422)	-2.044*** (0.293)	-6.278	2.829*** (0.291)
The parameters of the variance of the term for inefficiency $\sigma^2_{u_{it}}$				
$EXCH_{it}$			0.151*** (0.058)	-0.222*** (0.042)
$PUBL_{t}$			0.205 (0.151)	1.121*** (0.346)
$TERR_{jt}$			0.017** (0.007)	-0.022* (0.012)
$TRAD_{it}$			0.037** (0.148)	-0.0006 (0.010)
$ENDO_{jt}$			-0.009 (0.027)	0.113*** (0.030)
$CULT_{it}$			-0.626	-0.241** (0.118)
$WEAL_{it}$			0.285*** (0.069)	0.172*** (0.053)
$\_cons$	-2.612 (11.711)	-7.069*** (0.900)	-0.207 (0.752)	-9.030*** (1.477)
LOG	179.022	244.783	-268.677	307.553
LR	257.062***	125.54***		

Note: 1. *, **, *** signify rejection of the original hypothesis at the 10%, 5%, and 1% significance levels, with standard errors in parenthesis. 2. The likelihood ratio (LR) is the chi-square value of the likelihood ratio test of the other model vs Model VIII, whose LR statistic could not be obtained because Model VII did not converge.

5.2. Analysis of core explanatory variables

The results for Model VIII in Table no.4 indicate that $\ln GDP_{it}$ is significantly positive at the 1% level. The number of visitors to China will increase by 0.786% for each 1% increase in the GDP of the source country. This finding supports hypothesis no.1. $\ln GDP_{jt}$ is significantly negative at the 1% level. This conclusion verifies hypothesis no. 2b and is consistent with Candela and Figini (2012). It can be explained in two ways. On the one hand, the ecological environment and natural scenery were harmed to some extent by rapid economic expansion. However, as economic development accelerates, the level of consumer prices in the destination country will increase, resulting in an increase in tourism costs and a decrease in tourists. The number of European tourists in China will fall by an average of 0.671% for every 1% growth in China's GDP. $\ln POP_{jt}$ and $\ln POP_{it}$ are significant at the 1% level. For European countries, for every 1% increase in population, the average number of tourists in China will grow by 0.444%. This supports hypothesis no.3. In line with the growth of China's population, the number of people employed in tourism and leisure-related service businesses will increase dramatically, indicating a greater capacity to provide more sophisticated services to attract tourists; For every 1% growth in China's population, the inbound tourists increase by 7.960% on average. This supports hypothesis no.4a. $\ln DIST_i$ is negative at the 1% significance level. Inbound tourists to China will decrease by 3.9% for every 1% increase in distance. This result verifies Hypothesis no.5.

5.3. The impact of inefficiency factors

According to Wang (2002), we calculate the average marginal effects of the exogenous variables on the inefficiency terms of the mean and variance. Table no.5 presents the results.

Table no. 5. The average marginal effect on the mean and variance

Variable Name	The average marginal effect on the mean $E(u_{it})$	The average marginal effect on the variance $V(u_{it})$
$EXCH_{it}$	-0.00006	-0.00487
$PUBL_t$	0.06681	0.02548
$TERR_{jt}$	0.00314	-0.00043
$TRAD_{it}$	-0.00595	-0.00010
$ENDO_{jt}$	-0.01864	0.00222
$CULT_{it}$	-0.33588	-0.01003
$WEAL_{it}$	0.00794	0.00387

According to Table no. 5, the average marginal effect of cultural distance on the mean of the term of inefficiency is -0.33588, indicating that the efficiency of inbound tourism in China from the source country will increase. This result verifies Hypothesis no.11a and is consistent with Bi and Gu (2019). The average marginal effects of trade relations and tourism resource endowment on $E(\mu_{it})$ are -0.00595 and -0.01861, respectively. This means that when China's exports grow and the endowment of tourism resources increases, the inhibiting influence of the term inefficiency diminishes, and efficiency improves. This finding confirms Hypotheses no.9 and 10. The average marginal effect of the exchange rate on $E(\mu_{it})$ was negative. This shows that when the local currency units relative to the RMB increase, tourists will be more likely to participate in tourism, and the efficiency value will increase. This result verifies hypothesis no.6. The average marginal effects of international public health events and security aspects in China on $E(\mu_{it})$ were 0.0668 and 0.00314, respectively. This shows that when there are international public health events and terrorist attacks in China, the willingness of tourists to travel abroad weakens, hindering the flow of European tourists to China. And the conclusion confirms hypotheses no. 7 and 8. The average marginal effect of wealth distribution on $E(\mu_{it})$ is 0.00794, indicating that the greater the proportion of wealth possessed by low wealth groups from source countries, the lower the inbound tourism efficiency of the source country in China will be. This result verifies hypothesis no. 12b. One possible explanation is that the marginal propensity to consume international tourism varies among groups with different wealth holdings. The high-wealth group is not sensitive to the marginal propensity to consume international travel, even after a decrease in personal wealth; however, when the least wealthy group's wealth increases, they may prefer to improve their essential quality of life rather than to engage in relatively costly international travel. Thus, when the wealth distribution gap is large, narrowing it may result in a decrease rather than an increase in tourism demand.

6. Further discussion: tourism efficiency and distance from frontier levels

6.1. Inbound tourism efficiency of source countries in China

We estimate the inbound tourist efficiency values in China for each European source country during the sampled period, and figure no.1 shows the trends. The performances of various source countries vary significantly. Denmark, Ireland, and the United Kingdom have stable high levels of inbound tourist efficiency in China. However, certain countries, such as Turkey and Russia, did not fare well during this period. From the perspective of trend, eight countries experienced efficiency increases of more than 0.4 during the sample period, representing approximately 22.86 % of the sample. The inbound tourism efficiency values of these countries were relatively low in 2006, with an average inbound efficiency of 0.357, indicating that during the observation period, the inbound tourism efficiency of the initially inefficient source countries improved to a greater degree. 14 countries experienced increases of between 0.2 and 0.4, representing approximately 40 % of the sample. The average value of inbound tourist efficiency to China for this group of countries rose from 0.436 in 2006 to 0.732 in 2019. 10 countries had efficiency increases of less than 0.2 during the sample period and the efficiency of inbound tourism for these countries in 2019 was not very low (the average value was 0.512). Denmark, Iceland, and Turkey experienced a decline in tourism efficiency during the sampled period. Despite this reduction, Denmark and Iceland consistently rank among the top countries in the sample, as their baseline efficiency values have already reached a high level and there is less chance of future efficiency increase. On the contrary, Turkey's inbound tourism efficiency decreased from 0.347 in 2006 to 0.309 in 2019, mainly due to the significant depreciation of the Turkish lira, which has increased the cost of outbound travel for its residents.

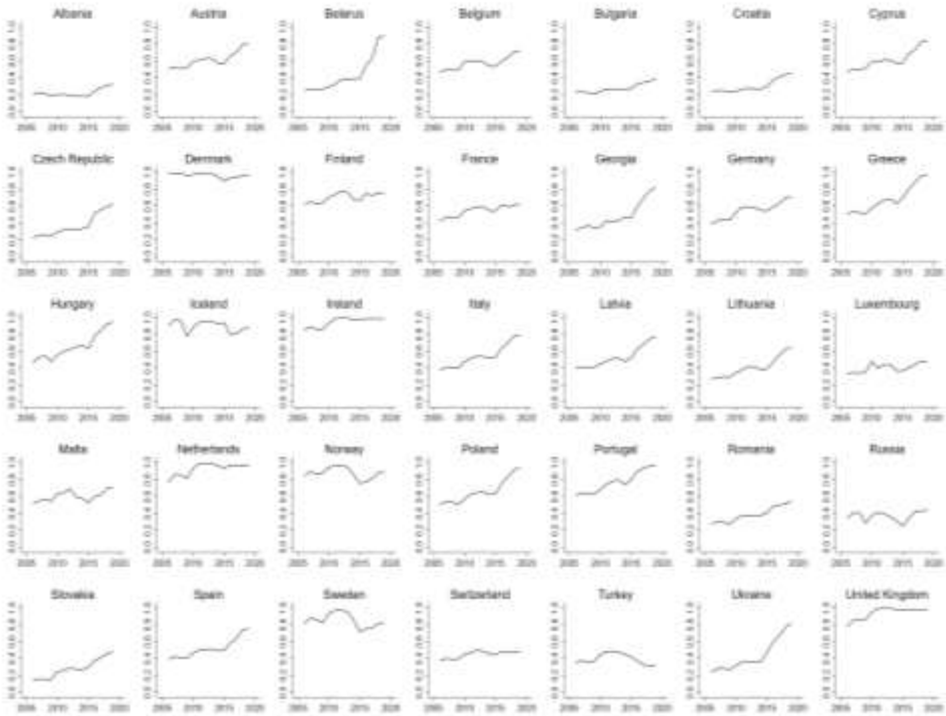

Figure no. 1. Efficiency of European source countries' inbound tourism

6.2. The gap between actual flows and frontier levels

Eq. (3) indicates that both the frontier level and actual inbound tourism flows might have an impact on inbound tourism efficiency. To further analyse, we calculated the frontier level of the number of tourists arriving in China from the sample countries from 2006 to 2019 and combined it with the actual flow of tourists arriving in China from the sample countries to plot figure no.2. The red and black lines depict the frontier level and the actual flow level, respectively. According to the dynamics of the actual flow and the frontier level shown in Figure no.2, the sample countries can be divided into three categories: gap convergence, diffusion, and stabilisation.

Group gap convergence. Austria, Belarus, Belgium, Croatia, Cyprus, the Czech Republic, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, Spain, Ukraine, and the United Kingdom, which represent 65.71 % of the sample countries, exhibit such characteristics in terms of frontier levels and actual flows. Except for Ireland, Finland, and Norway, in the low-increase group, all countries have a high or medium growth rate. In Belarus, Greece, Hungary, Poland, Portugal, and Ukraine, the gap between actual flows and frontier levels narrowed more drastically than in other countries.

Group gap diffusion. Denmark, Iceland, Turkey, and Sweden exhibit this trait. In terms of inbound tourism efficiency, the first three countries were classified into decreased groups. Figure no.2 reveals that while the distance of these countries' inbound tourism flows in China from the frontier level is growing, Denmark and Iceland have a smaller gap on this item, but the gap between Turkey and Sweden is growing.

Group gap stabilisation. Eight countries (Albania, Bulgaria, Luxembourg, Malta, Romania, Russia, Slovakia, and Switzerland) exhibit this trait. Except for Romania and Slovakia, in the medium-increase group, the other countries are in the low-increase group. The difference between frontier levels and actual flows tends to be reduced in Bulgaria, Romania, and Slovakia, although not dramatically. Therefore, we included them in this group.

The analysis shows that the characteristics of the three types of source country vary. The actual flow of inbound tourism to China from sources of Group gap convergence is gradually reaching its frontier level, which shows, on the one hand, that the potential for inbound tourism in China from these countries is rapidly diminishing. However, the advertising and marketing of tourism conducted by China in these countries have created positive results and effectively increased the volume of actual inbound tourism. Therefore, China's tourism policy must maintain the existing level of tourism flow from these source countries while continuing to increase the attractiveness of Chinese tourism. In the gap stabilisation and gap diffusion groups, the actual flow away from the frontier shows nearly constant and gradually expanding tendencies, respectively, showing that there is still potential for inbound tourism in China from these countries. Therefore, China should examine establishing a more attractive inbound tourism policy and the active recommendation of the China tourism market to turn the potential of inbound tourism into real traffic.

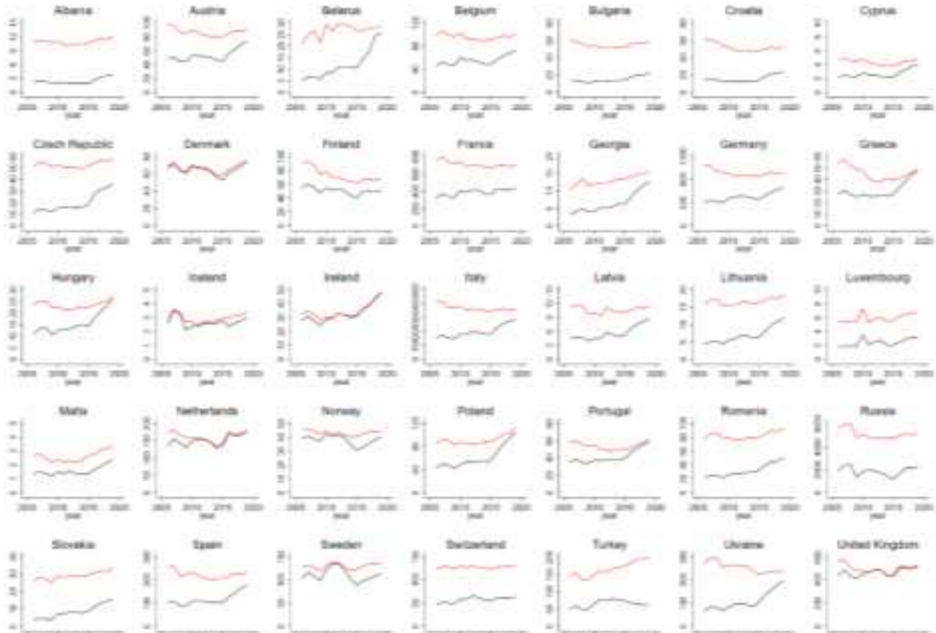

Figure no. 2. Frontier levels and actual inbound flows from source countries

Conclusions

This study examines the factors that affect the efficiency of inbound tourism in two major economies: China and Europe. TFE-SFA-GM was introduced to measure the efficiency of China's inbound tourism from 35 European sources from 2006 to 2019 based on individual heterogeneity and perform the corresponding analysis. The primary findings are as follows:

First, several factors influence the efficiency of China's inbound tourism from the source countries. (1) An increase in the size of China's economy may have a snob effect and therefore suppress inbound tourism demand in the source countries, whereas an increase in the size of the source country's economy will stimulate international tourism demand among its residents, resulting in an increase in the number of European tourists visiting China. (2) Population growth in the source countries will improve the efficiency of inbound tourism in China. In contrast, the expansion of China's population will lead to an increase in tourism-related employment, as well as a rise in the quality and specialisation of tourism services, which will boost the appeal of China's tourist sites weighted by the population distribution factor, and influences the desire of source country tourists to engage in inbound tourism via the cost of travel.

Second, an empirical examination of inefficiency reveals a variety of factors that influence the efficiency of inbound tourism from the source countries in China. (1) Creating a safe environment for international travel has a significant impact on inbound tourism in a country. (2) Good and stable international economic and trade relations improve the efficiency of inbound tourism from European source countries to China. The exchange rate of the source countries' currencies with the RMB can influence international tourists' travel decisions. (3) Unique tourism assets contribute to the growth of inbound tourism in China. The empirical findings show that the number of sites of world cultural heritage and the cultural distance can increase the efficiency of European tourism in China. This indicates that China should emphasise the protection and incorporation of its distinctive components, diverse lifestyles, and folk customs; encourage the recognition of more distinctive tourism resources; and add more tourism resources to the World Cultural Heritage List. Similarly, when advertising tourism in European countries, attention should be paid to the unique characteristics of Chinese culture and continuous promotions should be carried out to achieve success.

Third, the efficiency of travel to China from European countries has generally increased, although with varying characteristics. (1) During the sample period, the efficiency of inbound tourism in China increased in most countries, while it declined in only 3 countries. There are eight countries that exhibit a significant increase, 14 countries show a moderate increase, and 10 countries show a small increase. (2) Regarding the gap between the frontier level of inbound tourism flows to China and the actual flows from the source countries, 23 countries demonstrate a steady decline, 4 countries demonstrate an expansion, and 8 countries remain unchanged. Therefore, to improve the efficiency of inbound tourism in source countries, China should adopt a classified promotion policy. The tourist flows from these countries to China should be increased further for the source countries that already have a high efficiency of the inbound tourism. For source countries with low inbound tourism efficiency, more favourable policies should be adopted to stimulate and improve the attractiveness of the Chinese tourism market for tourists from these countries.

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