

The Impact of Transport Infrastructure and Pollutant Emissions in Sustainable Tourism for Mongolia

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Tourism has a positive impact on economic growth, and it is one of the rapidly growing sectors in Mongolia. The Mongolian government, focusing on the development of tourism and transportation since 1990, has made it possible for achieving continuously growing sustainable tourism. Sustainable tourism is a way of maintaining a high level of tourist satisfaction while reducing adverse impacts on the environment. As transportation has been an integral part of the tourism industry, the purpose of this study is to examine the impact of transportation infrastructure, CO₂ emission, and other classical demand factors on tourism flow in Mongolia by using a gravity model. Utilizing a panel data of tourists from 30 countries with the highest number of travel visits in Mongolia from 2002 to 2018, the study employs on panel co-integration analysis, aside from the conventional pooled ordinary least squares (OLS), fixed effects, and random effects estimators, to estimate the long-run relationship between Mongolian tourism flow and their respective determinants. According to the result of this study, the local transportation system and transportation investment have come out negative due to the underdeveloped transportation system. Moreover, the research indicates that carbon dioxide emission has a positive impact on tourism flow in the long-run.

Keywords: tourism flow, transport infrastructure, CO₂ emission, sustainable tourism, Mongolia

Introduction

The United Nations World Tourism Organization (UNWTO, 2004) identified sustainable tourism development is the maximization of tourist satisfaction while protecting the environment and natural resources, ensuring environmental sustainability, and resolving any conflicts between hosts and tourists. The UNWTO and the United Nations Environment Program (UNEP) have argued that sustainable tourism should promote social and cultural prosperity, environmental responsibility, and economic development (Hall, 2011).

Mongolia has a small but rapidly growing tourism sector. Tourism is a relatively new sector and the development of tourism started during the industrial period of 1954-1990. In 1999, "Tourism Master Plan" for National Tourism Development was first developed. Later, in 2000, the Law on Tourism was approved by the

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Mongolian Parliament and began creating a legal framework. The long-term development policy of Mongolia, titled “Vision-2050”, will improve the quality of infrastructure and services, develop eco-tourism, serve eco-friendly product and services, and increase the number of foreign tourists to 1.5 million annually.

According to the concept of global development, green development is the cornerstone of Mongolia’s long-term development policy and economic, infrastructure, and regional development based on environmental resources and geographical advantages. Mongolia has the world’s largest land area, with an area of 1,564,100 square kilometers, and the second largest landlocked country after Kazakhstan and located two superpowers of the world: Russia and China. Mongolia is a unique relatively unexplored travel destination that offers a great combination of scenic natural features, a wide variety of untouched landscapes, nomadic life style and culture are main attractions. Table 1 shows the top inbound tourists arrived in Mongolia between 2015 and 2019 by countries.

Table 1

The Top Inbound Tourists in Mongolia 2015 to 2019

	2015	2016	2017	2018	2019
China	215,500	185,824	201,912	216,379	208,449
Russia	73,489	87,655	110,353	133,402	146,783
Korea	48,979	59,514	76,637	86,013	103,379
Japan	19,837	20,568	23,093	21,621	25,163
USA	15,187	16,758	17,663	18,866	19,948

Source: National Statistical Office of Mongolia.

The number of tourists in 2019 reached 636,900. Table 1 shows the number of international tourist arrivals in Mongolia between 2015 and 2019. In 2019, travel and tourism sector accounts for 11% of Mongolia’s gross domestic product (GDP). International tourist arrivals totaled 636,960 in 2019, among which China accounted for 208,449 (32.5%), followed by Russia with 146,783 (22.9%). The other three countries are South Korea with 10% Japan and the United States with 3% each.

The infrastructure of any country serves as the foundation for development. Good infrastructure and especially good accessibility to the road network are the key drivers of development of all sectors of the economy. One key issue for tourism development in Mongolia is improving the transport infrastructure. Mongolia has a limited amount of paved roads and the only rail crossings to connect Russia through Ulan-Bator to China (Undrakh, 2009). Archibald, LaCorbinière, and Moore (2008) used a dynamic tourism gravity model to measure the competitiveness of the Caribbean tourism market. Khadaroo and Seetanah (2008) applied gravity models to investigate the role of transportation infrastructure in attracting tourists. Their result is the importance of the state of transport infrastructure on tourism inflows into a destination. The study finds a positive relationship between the state of road and the number of tourists flowing into a country. Chasapopoulos, Butter, and Mihaylov (2014) examined the impact of the socio-economic and geographical determinants of foreign tourist arrivals and a panel dataset of 31 countries is used over the period 2001-2010. Study analysis employs the transport investment, data availability focus on transport infrastructure, which is arguably the most important type of infrastructure for tourists. The investment of transport infrastructure does not appear to have a beneficial impact on tourism arrival which is the impact of infrastructure on tourism is captured to some extent by the country-specific effects. With increasing global awareness of the environmental problems, the researchers are more interested in CO₂ emissions. Relevant literature has shown that there is a

relationship between CO₂ emissions and economic growth, population, transportation, trade, energy consumption, and financial development (Li & Lin, 2015; Park, Meng, & Baloch, 2018). Solarin (2014) focused primarily on how CO₂ emissions react to tourism developments. Empirical results indicate that tourism arrivals have an increasing effect on CO₂ emissions.

First, this paper utilized a gravity model with panel data to estimate the importance of transport infrastructure, CO₂ emission, and other classical variables influencing international tourism flow to Mongolia. All variables included GDP, population, tourism price, exchange rate, international trade, CO₂ emissions, internal transport infrastructure, transport investment, and inbound tourism flow to Mongolia. Second, this study to examine Mongolia's tourism flows with origin countries using pooled OLS, fixed effects and random effects estimators, panel unit roots and co-integration tests, and the estimation of long-run relationships were discussed.

The remaining paper is organized as follows: Section 2 presents the literature review. Section 3 describes the model specification and data issues. Section 4 examines the estimation result based on the empirical model. The paper finally provides discusses the results and concluding remarks.

Literature Review

The tourism sector has become increasingly popular and an important source of income for the country. This has attracted economists from different countries to study the factors behind this growing industry. In this section, the paper shows the literature review on the international tourist arrival with particular emphasis on the gravity model of tourism. Prior to the 1970's, tourism demand did not go unnoticed by many researchers. Williams and Zelinsky (1970) were surprised to find out how many geographic researchers, demographers, and other social scientists paid attention to tourist circulation among nations. According to the cumulative body of empirical research, this situation has changed now. Tourism is not exist in quantifiable form it is a good complement to standard products, such as transportation, accommodation, restaurant meals, and many other personal services. Although integrated tourism products may not be precisely defined, their market characteristics may be more precisely defined (Bond & Ladman, 1972).

Empirical analysis in this study used the gravity model. The fundamental work on gravity was written by the English physicist and mathematician Sir Isaac Newton. He was one of the most influential scientists of all time, the founder of classical mechanics and the inventor of an infinite number of calculations. The earliest definition of the universal gravitational equation was defined by Newton's the Mathematical Principles of Natural Philosophy as one of the most important works in the history of science (Gucciardini, 2003). The gravity model of international trade was first formulated by Dutch economist, Jan Tinbergen, in 1962 and, since then, a large body of work regarding the theoretical and practical considerations has been written by Shepherd, (2013). The gravity model drew on analogy with Newton's law of gravity, which stated that the gravitational force between two objects is directly proportional to each of their masses, and inversely proportional to the square of the distance between them. The gravity model is expressed as follows:

$$F_{ij} = GM_iM_jD_{ij}^{-1}\eta_{ij} \quad (1)$$

Where: F is the gravitational force between two objects i and j ; G is the gravitational constant; M_i is the mass of object i and M_j is the mass of object j ; D is the distance between the objects; η is an error term 0 or 1 equal uncorrelated with the explanatory variables. The equation takes the natural logarithm of both sides.

$$\ln(F_{ij}) = \beta_0 + \beta_1 \ln(M_i) + \beta_2 \ln(M_j) + \beta_3 \ln(D_{ij}) + \ln(\eta_{ij}) \quad (2)$$

It is expected that the signs of coefficients β_1 and β_2 will be positive, as the economy will grow and trade will be large. Distance is negatively correlated with F because many dimensions to distance that have been shown important, the sign of coefficient β_3 should be negative. The distance is correlated with transportation costs that variable can represent transportation costs.

The first textbook for gravity model appeared in 2004 (Feenstra & Kee, 2004) after successfully linking gravity to economic theory. The advantage of model explains with relationship between the countries in international economic theory provisions that contradict the international economic theory which is concentrated in two cases of countries; sometimes it is expanded in the case of three countries with special features. Tracking of gravity in many countries through modulation, the spatial distribution of goods or factors is determined by gravity, depending on the size of the economic activity in each location.

Most of researchers decide to study tourism flows by choosing the gravity model approach. Crouch (1994) analyzed a significant number of quantitative works related to international tourism demand, concluding that there are a large number of explanatory variables to take into consideration, depending on the origin and destination countries, the selected data frequency and sample, etc. Taplin and Qiu (1997) took the size of the population to measure the economical mass instead of the region's GDP. Researchers who apply tourism flows on gravity models have similar critiques, like Anderson and Wincoop (2003), for the intuitive model of Tinbergen due to a missing theoretical founding.

The relationship between tourism flows and GDP has been studied by many economists and has become an important factor. Over time, researchers have demonstrated in many ways that there is a relationship between tourism flows and GDP. According to Garin-Munoz and Amaral (2000), they showed on economic theory assuming the better a country's income, the more people able to travel, and the country's economy is well-government with budgets for building tourism destinations and facilities. Therefore, tourism flow is assumed to be direct positive related to income.

The researchers, Habibi and Abbasianejad (2011), identify and measure the impact of the main determinants of the international tourist arrivals to the Malaysia, on panel data 19 European countries period 1998-2007. Dependent variable is number of tourist arrivals in Malaysia, and independent variables are GDP, tourism price, substitute price, hotel room, and political stability. Estimate shows income variable is positive sign and tourists highly sensitive to the tourism price which means suppliers must be careful with their product price.

The study of Santana, Ledesma, and Pérez (2011) evaluated between international tourism and trade to analyze both long- and short-run relationships for Organisation for Economic Co-operation and Development (OECD) countries, over the period year 1980-2006. The study found that business travel can increase international trade and consumers could be attracted by the imported product and wish to visit the country to explore more products also the local governments need to make efforts to improve the country's infrastructure to support international trade and tourist will be attracted by the higher living standard.

According to Nepal, Irsyad, and Nepal (2019) examined the causality relationships between tourist arrivals and CO₂ emissions. A unidirectional long-run causality when tourist arrivals increases, CO₂ emissions increase. Tourist arrivals have negatively significant effects on CO₂ emission levels both in the long- and short-term periods (Katircioglu, 2014).

Gołembski and Majewska (2018), in their paper, investigated transport the relationship between export and international tourist arrivals, a panel data of bilateral tourism flows in the period 2008-2016 from 33 trading countries with Poland. The result shows that between exports variable and the number of tourist arrivals in Poland had a strong correlation. The road infrastructure was statistically significant variable with inbound tourism in Poland, with increments in the number of kilometers of motorways and expressways constituting a particularly important factor.

Finally, Malaj and Kapiki (2016) identified the main demand and supply determinants of international tourism flows to Greece; dataset includes tourist arrivals from 19 countries over the period 2005-2015. The results indicate that international tourism flows to Greece are positively affected investments in transport infrastructure.

Research Methods

This paper aims to investigate the international tourist arrivals in Mongolia using gravity model. To answer the question, an empirical study is pursued by using a panel data set of annual observations on a cross-section of 30 countries with the highest number of travel visits in Mongolia, over a period of 17 years between 2002 and 2018 collated from different secondary sources. A total of 510 data points of selected origin country refers to push force tourist and pull forces attracting tourist to a destination country. The data have been collected from National Statistic Commission of Mongolia and World Bank in yearly basis, between 2002 and 2018. In order to achieve the purpose of this research, test used Software for Statistics and Data Science (STATA 15) and Eviews 9 employed to help us analyze data.

Many empirical studies have reported that the equation basic gravity model fits data well and gives robust results. This study estimates an augmented version of the basic gravity model specified. This is done by incorporating other factors that facilitate or inhibit tourism flows between pairs of countries. The augmented gravity equation employed in this study is expressed as follows:

$$\begin{aligned} \ln(Inbound_{ijt}) = & \delta + \varphi_{ij} + \gamma_t + \beta_1 \ln(GDP_{it}) + \beta_2 \ln(GDP_{jt}) + \beta_3 \ln(Dist_{ij}) \\ & + \beta_4 \ln(Pop_{it}) + \beta_5 \ln(Pop_{jt}) + \beta_6 \ln(Tp_{it}) + \beta_7(Exr_{ijt}) + \beta_8 \ln(Trade_{ijt}) \\ & + \beta_9 \ln(CO2_{jt}) + \beta_{10} \ln(Transport_{it}) + \beta_{11} \ln(Ti_{it}) + \beta_{12}(Bord_{ij}) + \beta_{13}(Land_{ij}) \\ & + \varepsilon_{ijt} \end{aligned} \quad (3)$$

Where: $\ln$ is the natural logarithm, $Inbound_{ijt}$ is the value of inbound tourism between origin country i and destination country j at time t , $\beta_1, \beta_2, \dots, \beta_{13}$, are coefficients to be estimated, δ is the gravitational constant, ε_{ij} represents the white-noise error term, φ_{ij} accounts for country-specific effects, and γ_t accounts time-specific effects.

Table 2

Summary and Definition of Variables Used in the Model

Variables	Description	Source
$Inbound_{ijt}$	The number of tourist arrivals from origin country (i) to Mongolia at time (t)	National Statistic Commission of Mongolia
$GDP_{it(jt)}$	GDP in country i (j) at time (t), current USD	World Bank Taiwan data https://knoema.com/
$Dist_{ij}$	Distance in kilometers between the capital cities of the origin and destination country (Mongolia)	http://www.distancefromto.net

$Pop_{it(jt)}$	Size of population country i (j) at time (t)	World Bank Taiwan data https://knoema.com/
Table 2 to be continued		
Tp_{ijt}	Tourism price. CPI destination country divided by CPI in origin country	World Bank Taiwan data https://knoema.com/
Exr_{ijt}	Nominal exchange rate between the origin country (j), and destination country (i) at time (t)	http://www.oanda.com
$Trade_{ijt}$	Value imports and exports of goods from origin country to Mongolia at time (t)	National Statistic Commission of Mongolia
CO_{2it}	Million tones of CO_2 emissions origin country (i) at time (t)	https://knoema.com/
$Transport_{jt}$	Kilometers of paved roads in the destination country	National Statistic Commission of Mongolia
Ti_{jt}	Transport investment destination country at time (t)	National Statistic Commission of Mongolia
$Bord_{ij}$	The dummy variable borders assumes the value of 1 if countries share same border and value of 0 otherwise	http://www.cepii.fr/
$Land_{ij}$	The dummy variable borders assumes the value of 1 if countries share same border and value of 0 otherwise	http://www.cepii.fr/

Source: Authors own elaboration.

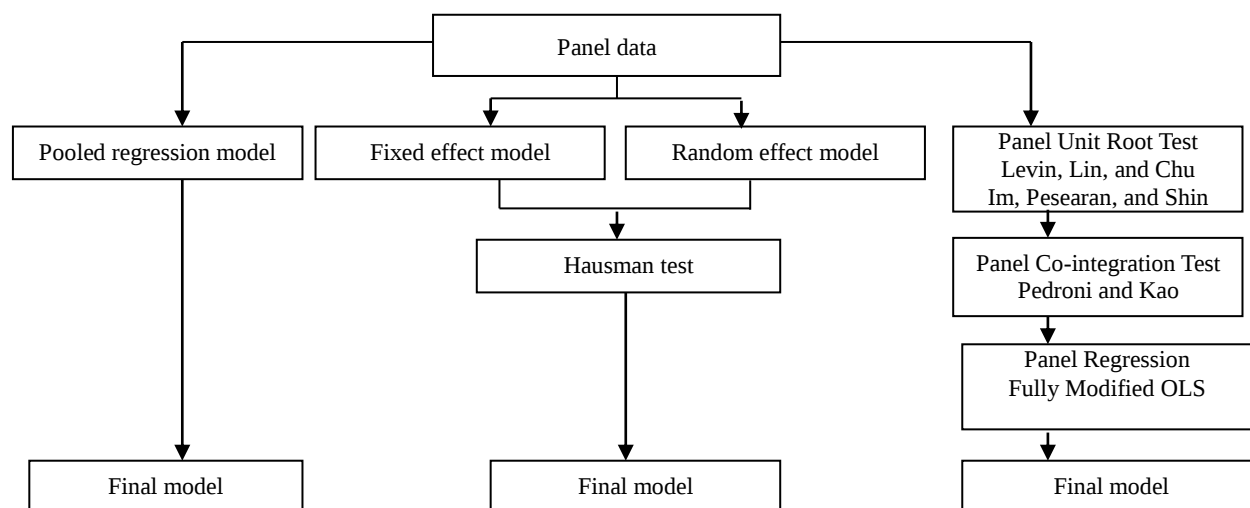


Figure 1. The methodology of panel analysis.

The data set includes 30 countries (China, Russia, Korea, Japan, United State, Germany, United Kingdom, France, Kazakhstan, Australia, Netherland, Canada, Italy, India, Ukraine, Switzerland, Poland, Singapore, Belgium, Austria, New Zealand, Taiwan, Czech, Finland, Israel, Turkey, Malaysia, Ireland, Vietnam, and Hungary), all of them coming in as origin countries being trade partner for Mongolia, and the period under study is between 2002 and 2018. Table 2 shows the definition of the dependent and other main independent variables that were used in this study.

As reviewed early empirical studies employed cross-section data to estimate gravity models. However, most contemporary researchers use panel data (which pools together cross-sectional observations over several time periods) to estimate gravity models. Figure 1 shows the steps to be followed to the method of panel analysis in the based model.

Research Result

As a prerequisite for panel co-integration tests, we ascertain the stationary or integration properties of the time-variant variables that enter the gravity model, namely, inbound tourism, incomes, population, tourism

price, exchange rate, international trade, CO₂ emissions, internal transport infrastructure, and transport investment. This is achieved by employing Levin, Lin, and Chu (LLC) and Im, Pesaran, and Shin (IPS) panel unit root tests on the variables over 2002-2018. Individual intercepts and individual intercepts plus deterministic time trends were included in all the test specifications.

Table 3

Results of Panel Unit Root Tests-Level

Variables	Levin, Lin, and Chu (LLC, 2002) t^* statistics Null: unit root (assumes common unit process)		Im, Pesaran, and Shin (IPS, 2003) W-statistics Null: unit root (assumes individual unit root process)	
	Level		Level	
	Constant	Constant + trend	Constant	Constant + trend
Inbound _{ijt}	-12.7295***	-12.8708***	-6.71699***	-7.61211***
GDP _{it}	-9.52356***	2.50784	-2.71157***	7.97794
GDP _{jt}	-10.0681***	-6.83706***	-8.02091***	-0.68528
Pop _{it}	-29.7270***	-32.1430***	-14.9779***	-18.1766***
Pop _{jt}	-6.74955***	-12.1548***	0.64650	-5.88536***
Tp _{ijt}	-3.59710***	-3.39980	3.29404	4.14407
Exr _{ijt}	0.02160	-5.07934***	4.65381	-1.51339*
Trade _{ijt}	-6.34408***	-6.17632***	-2.60052***	-1.86152**
CO _{2jt}	-7.19952***	-4.16430***	-0.31915	-2.67715***
Transport _{jt}	3.87930	-2.45121***	10.2565	-0.81817
Ti _{ijt}	-6.91424***	-9.72455***	-0.16516	-1.65512**

Notes. *, **, *** reject null hypothesis significance at 1%, 5%, and 10% levels respectively. Results were obtained with the aid of Eviews 9.

Table 4

Results of Panel Unit Root Tests-First Difference

Variables	Levin, Lin and Chu (LLC, 2002) t^* statistics Null: unit root (assumes common unit process)		Im, Pesaran, and Shin (IPS, 2003) W-statistics Null: unit root (assumes individual unit root process)	
	First difference		First difference	
	Constant	Constant + trend	Constant	Constant + trend
Inbound _{ijt}	-27.4100***	-31.1744***	-27.4100***	-31.1744***
GDP _{it}	-13.1105***	-14.4517***	-13.1105***	-14.4517***
GDP _{jt}	-13.7089***	-12.5532***	-13.7089***	-12.5532***
Pop _{it}	-19.0527***	-8.53720***	-19.0527***	-8.53720***
Pop _{jt}	-5.07746***	-9.76000***	-5.07746***	-9.76000***
Tp _{ijt}	-16.1698***	-15.9962***	-16.1698***	-15.9962***
Exr _{ijt}	-17.3185***	-15.7813***	-17.3185***	-15.7813***
Trade _{ijt}	-16.5640***	-14.4030***	-16.5640***	-14.4030***
CO _{2jt}	-17.7369***	-17.2898***	-17.7369***	-17.2898***
Transport _{jt}	-22.1094***	-18.7015***	-22.1094***	-18.7015***
Ti _{ijt}	-28.3151***	-25.1532***	-28.3151***	-25.1532***

Notes. *, **, *** reject null hypothesis significance at 1%, 5%, and 10% levels respectively. Results were obtained with the aid of Eviews 9.

The test results are presented in Tables 3 and 4, LLC and IPS tests for unit root first differencing the data series, whilst allowing for individual effects (constant) and individual effects plus a deterministic time trend.

The overall conclusion drawn from the results of the LLC and IPS panel unit root tests is that there is mixed evidence of non-stationary in all the variables that are time-variant. Whereas some of them are stationary

at the level with constant plus time trend, all of them achieved stationary after first differencing with a constant plus time trend.

In view of the nature of the dataset employed in this study, it is imperative that we select an appropriate estimation method that accounts for the heterogeneity in the gravity models resulting from the presence of individual and time effects in the panel data. In so doing, we first estimate the pooled OLS model, fixed effects (FE), and random effects (RE) models, with international tourist arrival in Mongolia. The panel data were found strongly balanced for period of 2002-2018.

The main shortcoming of the OLS (POLS) shortcoming with pools is that ignores the panel structure (time and space dimensions) of the pooled data and estimates the usual OLS regression. In other words, the POLS regression treats all the observations for all time periods as a single sample, without regard for unobservable individual or country-specific effects. This disregard for the effects of unobserved heterogeneity on tourism flows induces autocorrelation in the errors and substantially distorts the inferences one draws from the estimates. Serlenga and Shin (2004) and Cheng and Wall (2005) showed that ignoring heterogeneity leads to biased estimates of trade relations. To ascertain whether or not these observed differences between the coefficients of the FE and RE estimators are statistically significant, we perform the Hausman test specification test to compare the FE and RE estimates of coefficients. The Hausman test strongly rejects the null hypothesis, the fixed effect estimator is appropriate for the estimation of the inbound model.

The preliminary result of model is presented in Table 5. It is not difficult to notice that, the overall test model corresponding p -values are statistically significant at 1%. Broadly speaking, $R^2 = 0.8795$ that the model explain a satisfactorily high 87% of variation inbound tourism in Mongolia on OLS regression.

Table 5

Results of Pooled OLS, FE, and RE Estimates of the Augmented Gravity Model With Number of Tourist Arrivals as Dependent Variable, 2002-2018

Estimated method	Pooled OLS lnbound _{ijt}			Fixed effects lnbound _{ijt}			Random effects lnbound _{ijt}		
Variables	Coefficient	Std. err	Significance	Coefficient	Std. err	Significance	Coefficient	Std. err	Significance
GDP _{it}	-0.004	0.111	0.969	0.525***	0.065	0.000	0.399***	0.064	0.000
GDP _{jt}	0.3859***	0.039	0.000	-0.116	0.077	0.132	0.075	0.070	0.288
Dist _{ij}	-0.71302***	0.074	0.000				-0.4292	0.289	0.137
Pop _{it}	1.31983	2.517	0.600	3.9385***	1.167	0.001	4.1139***	1.229	0.001
Pop _{jt}	-0.7676***	0.050	0.000	1.87703***	0.399	0.000	-0.1419	0.125	0.257
Tp _{ijt}	0.4801***	0.128	0.000	-0.4745***	0.107	0.000	-0.2135**	0.092	0.021
Exr _{ijt}	0.0203	0.014	0.136	-0.1588**	0.079	0.047	-0.0439	0.046	0.340
Trade _{ijt}	0.1123***	0.011	0.000	0.0174**	0.009	0.046	0.0218**	0.009	0.017
CO _{2jt}	0.7898***	0.065	0.000	0.4398***	0.119	0.000	0.5956***	0.114	0.000
Transport _{jt}	-0.21102	0.358	0.555	-0.5019***	0.164	0.002	-0.4633***	0.174	0.008
Ti _{jt}	-0.02284	0.036	0.532	-0.0488***	0.017	0.004	-0.0407**	0.018	0.021
Bord _{ij}	1.7935***	0.139	0.000				2.2759***	0.517	0.000
Land _{ij}	-0.1365*	0.077	0.079				-0.1944	0.315	0.538
_cons	-5.2943	31.916	0.868	-86.8013***	15.553	0.000	-54.1723***	15.993	0.001
R ²	0.8795			0.6703			0.6486		
No. of obs.	510			510			510		
Root MSE	0.5688								
Prob. > F	0.0000								
Hausman	-			-			102.45		

[χ^2]

Notes. *p*-values in parenthesis. *, **, *** represent the 1%, 5%, and 10% level of significance respectively. The test statistics were computed with the aid of STATA 15.

Table 6

Result of Panel Co-integration Test

Test name	Constant without trend	Constant and trend
Pedroni residual co-integration		
Panel v-statistic	-2.375273 (0.9912)	-4.510527 (1.0000)
Panel rho-statistic	2.659602 (0.9961)	4.092035 (1.0000)
Panel PP-statistic	-10.78945*** (0.0000)	-11.31834*** (0.0000)
Panel ADF-statistic	-10.41998*** (0.0000)	-10.67597*** (0.0000)
Group rho-statistic	5.279999 (1.0000)	6.131876 (1.0000)
Group PP-statistic	-20.75375*** (0.0000)	-22.39836*** (0.0000)
Group ADF-statistic	-12.85360*** (0.0000)	-14.34213*** (0.0000)
ADF t-Statistic		
Kao's <i>t</i> -test	-5.248500*** (0.0000)	

Notes. *p*-values in parenthesis. *, **, *** represent the 1%, 5%, and 10% level of significance respectively. The test statistics were computed with the aid of Eviews 9.

In Table 6, firstly we consider seven tests for null hypothesis of no co-integration in a panel data international tourism demand of Mongolia, as developed by Pedroni (2000; 2004) and Kao (1999). These tests are divided into two categories: panel statistics, which consist of the first four tests, and group panel statistics, which consist of the last three statistics. A panel Philips-Perron (PP) and augmented Dickey-Fuller (ADF)-statistics out of the four-panel statistics, strongly rejected the null hypothesis of no co-integration among the variables at 1% significance level, considering the logarithms of tourist arrival of Mongolia as dependent variable. Also, Kao's *t*-test statistics, which are found to be highly statistically significant at 1% level (*p*-value = 0.00). Finally, the coefficients of Mongolia international tourist arrivals will be estimated to find long-run relationship.

In estimating the long-run parameters of the gravity models of Mongolia's inbound tourism, we applied the panel fully modified OLS (FMOLS) due to Kao and Liu (2000). Table 7 is the results of long-run coefficients from the panel fully modified OLS (FMOLS) estimator. From the long-run results, all the coefficients of the baseline gravity variables are robustly found to be consistent with the predictions of the gravity model of tourism flow.

R squared, which is called coefficient of determination, is used to measure how close the data are to the fitted on the regression line. It calculates the proportion of the dependent variable being explained by independent variables. In the FMOLS result, $R^2 = 0.97182$ means that 97.1% of the variation in the number of tourism arrivals and other variables.

According to both the FMOLS estimates, the coefficients of income in gravity specification found to be positive and significant long-run estimates. When the income concerned increased by 1%, the number of tourist arrival to Mongolia increased by 3%. However, the variables tourism price and exchange rate both have

significant negative coefficient, tourist highly sensitive to the tourism price in Mongolia. Mongolia's exchange rate is found to significantly negative coefficient, indicating that increase in the relative price of tourism in Mongolia would decrease the volume of tourism flows. From the results, 1 percent depreciation in the Mongolia MNT against the foreign currency of origin countries, the number of international tourist arrivals reduce to 1 percent reduce in tourism flow. For the case of estimates CO₂ and tourist arrivals also have significant positive influences on tourist arrivals. When increasing CO₂ emissions by a 1% increases in tourist arrival by 6 percent. There is a general agreement that tourism expands more when there are better transportation systems. The result of this study, the coefficient of internal transport infrastructure and transportation investment found to highly statistically significant in the gravity model. This outcome points to the negative impact of poor tourism-related infrastructural development in Mongolia tourism flows.

Table 7

Results of Panel Co-integration Estimation of the Long-Run Coefficients Using the Panel Fully Modified OLS

Variable	Coefficient	Std. err	t-statistic	Significance
GDP _{it}	0.393976***	0.028233	13.95447	0.0000
GDP _{jt}	0.308918***	0.024180	12.77557	0.0000
Pop _{it}	3.990936***	0.004173	956.3874	0.0000
Pop _{jt}	1.896163***	0.001391	1363.253	0.0000
Tp _{ijt}	-0.316587***	0.004769	-66.38184	0.0000
Exr _{ijt}	-0.105343***	0.001914	-55.02986	0.0000
Trade _{ijt}	-0.054847***	0.001525	-35.97118	0.0000
CO _{2jt}	0.614549***	0.001833	335.2043	0.0000
Transport _{jt}	-0.482115***	0.001700	-283.5665	0.0000
Ti _{jt}	-0.025506***	0.002084	-12.23628	0.0000
R-squared	0.971821			

Notes. *p*-values in parenthesis. *, **, *** represent the 1%, 5%, and 10% level of significance respectively. The test statistics were computed with the aid of Eviews 9.

Conclusions

This study sets out to analyze the determinants of tourism arrivals in Mongolia within gravity model, using panel data covering a cross-section of 30 countries with the highest number of travel visits in Mongolia for the period 2002-2018. Following standard theoretical and empirical literature on sustainable tourism, the study estimates an augmented version of Tinbergen's (1962) and Pöyhönen's (1963) gravity model, with the aid of fixed effects and panel FMOLS estimation techniques.

The empirical results show that the gravity model is very successful in explaining the pattern of Mongolia's tourism flows. This is because the coefficients of the standard gravity variables (foreign incomes and distance) were found to be robustly consistent with the predictions of the gravity model. Specifically, international tourist arrival in Mongolia was found to significantly increase with improvements in foreign incomes and diminish significantly with distance.

Strong evidence of the existence of the absorption effect of the increasing population on Mongolia's tourism flows was found by the study, as Mongolia's population showed up to be positive and statistically significant. Growth in the population of origin country was found to significantly stimulate tourist arrival in Mongolia, due to the accompanying growth in foreign tourist as well as the size of international.

The effect of geographical distance was found to be negative and statistically significant in the model,

which is consistent with the theoretical expectation. Transportation cost is one of the critical factors that determine the performance of international tourist arrival in Mongolia.

Prices of Mongolia tourism and living cost in the Mongolia measured in terms of consumer price index negative and significant. Hence, policy-makers and suppliers should be closely monitor all tourism provider such as transportation companies also attention about prices of goods and services.

The exchange rate was found to be a robust negative and significant determinant of Mongolia's tourism flow in the long run. However, the elasticity's of tourist arrival with respect to exchange rates were found to be consistently small. In addition, the existence of the J-curve effect is suspected to be present in Mongolia, as real depreciation in the Mongolia MNT against the foreign currency was found to significantly reduce tourist arrival.

A unidirectional long-run causality between CO₂ emissions and tourism flow implies positive and statistically significant. As the tourism sector in Mongolia especially the capital city of Ulaanbaatar, the most important source of air pollution comes from coal burning stoves, and the low quality of mobility-related fuels leads to more CO₂ emissions. This finding must monitor the government to push for a green tourism agenda.

Internal transport infrastructure was found to be significantly deleterious to Mongolia's tourism flow. This finding is, nonetheless, inconsistent with priori expectation, suggesting that inadequacy of better quality transport infrastructure in Mongolia portends deteriorating trends in the volume of Mongolia's tourism flows, especially tourist arrival in the long run. The actual state of the road transport infrastructure should be improved, create competitive advantages, especially to reduce CO₂ emissions that road transport environmentally friendly and simulate sustainable tourism in Mongolia.

The transport investment was found to have robustly negative and significant impact on Mongolia's tourism flows. It was found a significant role in lowering Mongolia's road capacity and quality; it is reducing international tourist arrival in the long run.

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