The Effect of CO_2 Emission on Tourism in Iran; an Ecotourism Approach in Zagros Area

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Abstract: Sustainable tourism has been a key concept for tourism researchers and tourist industry alike since the early 1990s. The aim of this paper is considering the impact of CO_2 emissions on International tourism in Iran at 1960-2009 period. Estimation results indicate that CO_2 emission has a negative effect on international tourism in Iran. Also, Dummy variable for political instability has a negative effect on international tourism in Iran at 1980-2009 period. Also, in this paper, the Zagros Area has considered as an ecotourism location in Iran.
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1. Introduction

Iran is a unique country in terms of its tourist attractions and abundant resources. The most important characteristics of the country are its diverse natural and ecotourism attractions, religious, ethical and cultural diversity, its national and Islamic architectural style, diverse climatic conditions and above all its people's hospitality. Iran is not only a nation with reach historical and cultural sites but, it has unique environment and nature in which four season of the year could be observed. There are 17 kinds of climates in the world that 12 kinds of them can be seen in Iran. The numbers of registered historic buildings are 11000 and many historical works and buildings of Iran have been registered in the list of world cultural heritage. According to many foreign, Iran's archeology, cultural heritage, traditions and diversity of nature are the main factors which attract foreigners to Iran.

Sustainable tourism has been a key concept for tourism researchers and tourist industry alike since the early 1990s. [4] used a simulation model of international tourist flows for estimation the impact of a carbon tax on aviation fuel. He concluded that: The effect of the tax on travel behaviour is small: A global tax of $1000/t C would change travel behaviour and reduce carbon dioxide emissions from international aviation by 0.8%. A carbon tax on aviation fuel would particularly affect long-haul flights, because of high emissions, and short-haul flights, because of the emission during take-off and landing. Medium distance flights would be affected least. This implies that tourist destinations that rely heavily on short-haul flights or on intercontinental flights will see a decline in international tourism numbers, while other destinations may see international arrivals rise. If the tax is only applied to the European Union, tourists would stay closer to home and European tourism would grow at the expense of other destinations. Sensitivity analyses reveal that the qualitative insights are robust.

[3] in his study focuses on five national parks in Taiwan, namely Kenting National Park, Yushan National Park, Yangmingshan National Park, Taroko National Park and Sheipa National Park, and applies a bottom-up approach to determine the amount of CO_2 emissions from domestic tourism transport in 1999–2006. The CO_2 emission factor of private car derived in this study reveals a higher value than that of previous study due to its lower load factors. Moreover, CO_2 emissions per person are different in each national park, influenced by the attributes of travel distance and transport mode. The scenario analysis indicates that CO_2 emission can be reduced by increasing load factors of transport, tourist switching from private cars to public transport and going to destinations close to their points of departure, which can be achieved by authorities through activity management, regulation control and price adjustment. This is also an adequate solution for Taiwan Government owing to the increases in transport volume and the limited tourism budget.

[2] used a model of international and domestic tourist numbers and flows to project tourist numbers and emissions from international tourism out to 2100. They find that between 2005 and 2100 international tourism grows substantially. Not only do people take more trips but these also increase in length. They find that the growth in tourism is mainly fuelled by an increase in trips from Asian countries. Emissions follow this growth pattern until the middle of the century when emissions start to fall due to improvements in fuel efficiency. Projected emissions are also presented for the four SRES scenarios and maintain the same growth pattern but the levels of emissions differ substantially. They find that the projections are sensitive to the period to which the model is calibrated, the assumed rate of improvement

in fuel efficiency and the imposed climate policy scenario.

[1] explore tourists' awareness of the impacts of travel on climate change, examines the extent to which climate change features in holiday travel decisions and identifies some of the barriers to the adoption of less carbon-intensive tourism practices. Their findings suggest that many tourists do not consider climate change when planning their holidays. The failure of tourists to engage with the climate change impact of holidays, combined with significant barriers to behavioural change, presents a considerable challenge in moving the tourism industry onto a sustainable emissions path. The findings are discussed in relation to theoretical perspectives from psychology and sociology.

Zagros Mountain

The Zagros Mountains are the largest mountain range in Iran and Iraq. With a total length of 1,500 km (932 mi), from northwestern Iran, and roughly correlating with Iran's western border, the Zagros range spans the whole length of the western and southwestern Iranian plateau and ends at the Strait of Hormuz. The highest points in the Zagros Mountains are Zard Kuh (4,548 m, 14,921 ft) and Mt. Dena (4,359 m, 14,301 ft). The Hazaran massif in the Kerman province of Iran forms an eastern outlier of the range, the Jebal Barez reaching into Sistan.

The mountains are divided into many parallel sub-ranges (up to 10, or 250 km wide), and have the same age as the Alps. Iran's main oilfields lie in the western central foothills of the Zagros mountain range. The southern ranges of the Fars Province have somewhat lower summits, reaching 4000 metres. They contain some limestone rocks showing abundant marine fossils.

During early ancient times, the Zagros was the home of peoples such as the Kassites, Guti, Assyrians, Elamites and Mitanni, who periodically invaded the Sumerian and/or Akkadian cities of Mesopotamia. The mountains create a geographic barrier between the flatlands of Mesopotamia, which is in Iraq, and the Iranian plateau. A small archive of clay tablets detailing the complex interactions of these groups in the early second millennium BC has been found at Tell Shemshara along the Little Zab. Tell Bazmusian, near Shemshara, was occupied between the sixth millennium BCE and the ninth century CE, although not continuously.

The Zagros Mountains contain several ecosystems. Prominent among them are the forest and steppe forest areas (PA0446), which have a semi-arid temperate climate. The annual precipitation there ranges from 400 mm to 800 mm, and falls mostly in the winter and spring. The winters are severe, with winter low temperatures often below −25 degrees C. The summer and autumn are very dry. This area has a potential location for ecotourism location.

The aim of this paper is considering the impact of CO2 emissions on International tourism in Iran at 1960-2009 period.

This paper is organized by four sections. The next section is devoted to research method. Section 3 is shown empirical results and final section is devoted to conclusion.

2. Material and Methods

This paper has used the following model for considering the effect of CO2 emissions on International tourism in Iran:

$$International\ Tourism_t = \alpha + \beta\, CO2\ emissions_t + \gamma\, GDP_t + \varepsilon_t \quad (1)$$

Unit Root Tests

Of particular interest to us is the Augmented Dickey-Fuller (ADF) test that has been developed to test univariate time series for the presence of unit roots or non-stationarity. The extended maintained regression used in the ADF test can be expressed in its most general form as:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \quad (2)$$

Where μ is the drift term, t denotes the time trend, and p is the largest lag length used. In order to analyze the deterministic trends, we used modified versions of the likelihood ratio tests suggested by Dickey and Fuller (1981). We followed the testing sequence suggested by Patterson (2000), which suggests the following maintained regressions, test statistics, and hypotheses:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \quad (3)$$

$\hat{\tau}_\beta, H_0: \gamma = 0, H_a: \gamma < 0; \phi_3, H_0: \gamma = 0, \beta = 0, H_a: \gamma \neq 0,$ and/or $\beta \neq 0$

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \omega_t \quad (4)$$

$\hat{\tau}_\mu, H_0: \gamma = 0, H_a: \gamma < 0; \phi_1, H_0: \mu = 0, \gamma = 0, \beta = 0, H_a: \mu \neq 0,$ and/or $\gamma \neq 0$

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \quad (5)$$

$\tau, H_0: \gamma = 0, H_a: \gamma < 0$

Johansen's Procedure

Intuitively, the Johansen test is a multivariate version of the univariate DF test. Consider a *reduced form* VAR of order p:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + u_t \quad (6)$$

where y_t is a *k*-vector of I(1) variables, x_t is a n-vector of deterministic trends, and u_t is a vector of shocks. We can rewrite this VAR as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + u_t \quad (7)$$

where $\Pi = \sum_{i=1}^{p} A_i - 1, \Gamma_i = -\sum_{j=t+1}^{p} A_j$

The error correction model (ECM), due to Engel and Granger (1987). The Π matrix represents the adjustment to disequilibrium following an exogenous *shock*. If Π has reduced rank $r < k$ where *r* and *k* denote the rank of Π and the number of variables constituting the long-run relationship, respectively, then there exist two $k \times r$ matrices α and β, each with rank *r,* such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is stationary. *r* is called the *cointegration rank* and each column of β is a cointegrating vector (representing a long-run relationship). The elements of the α matrix represent the *adjustment* or *loading* coefficients, and indicate the speeds of adjustment of the endogenous variables in response to disequilibrating shocks, while the elements of the Γ matrices capture the short-run dynamic adjustments. Johansen's method estimates the Π matrix from an unrestricted VAR and tests whether we can reject the restrictions implied by the reduced rank of Π. This procedure relies on relationships between the rank of a matrix and its characteristic roots (or eigenvalues). The rank of Π equals the number of its characteristic roots that differ from zero, which in turn corresponds to the number of cointegrating vectors. The asymptotic distribution of the Likelihood Ratio (Trace) test statistic for cointegration does not have the usual χ^2 distribution and depends on the assumptions made regarding the deterministic trends.

Data Source

This paper has used World Development Indicator 2010 (WDI 2010) for the variables at 1980-2009 period.

4. Discussions

The First, variables are tested by unit root test as following (Table 1):

Table 1. Unit Root Test

Null Hypothesis: D(CO2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.339276	0.0000
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(TOURISM,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic based on SIC, MAXLAG=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.957177	0.0001
Test critical values:	1% level	-4.467895	
	5% level	-3.644963	
	10% level	-3.261452	

*MacKinnon (1996) one-sided p-values.

Results from unit root test indicate that co_2 has a unit root and tourism has two unit roots. So, in next section, this research has tested cointegration test as following:

Table 2. Cointegration Test

Date: 12/07/11 Time: 23:19
Sample (adjusted): 1983 2007
Included observations: 25 after adjustments
Trend assumption: No deterministic trend (restricted constant)
Series: TOURISM CO2
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.401346	19.65339	20.26184	0.0605
At most 1	0.238957	6.826620	9.164546	0.1359

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Cointegration test indicates that there is a long run relationship between Co_2 emission and international tourism. Therefore, the model is estimated by ordinary least square method as following:

Table 3. Estimation Results

Method: Least Squares
Date: 12/07/11 Time: 23:22
Sample (adjusted): 1980 2007
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5119136.	819931.3	6.243373	0.0000
CO2	-5050264.	1032657.	-4.890556	0.0000
D1	-714071.3	177819.7	-4.015705	0.0005

R-squared	0.708710	Mean dependent var	776857.1
Adjusted R-squared	0.685407	S.D. dependent var	754506.3
S.E. of regression	423192.2	Akaike info criterion	28.85000
Sum squared resid	4.48E+12	Schwarz criterion	28.99273
Log likelihood	-400.9000	Hannan-Quinn criter.	28.89363
F-statistic	30.41254	Durbin-Watson stat	1.006146
Prob(F-statistic)	0.000000		

Estimation results indicate that CO_2 emission has a negative effect on international tourism in Iran. Also, Dummy variable for political instability has a negative effect on international tourism in Iran at 1980-2009 period.

Also, the correlation coefficient for CO_2 emission and international tourism is -0.72. This means that there is a negative relationship between CO_2 emission and international tourism.

The relationship between economic development and environmental quality has been extensively explored in recent years. The shape of this relationship has implications for the definition of an appropriate joint economic and environmental policy: depending on whether there is a negative or a positive influence of economic development on environmental quality, policy recommendations will differ. Sustainable tourism has been a key concept for tourism researchers and tourist industry alike since the early 1990s. The aim of this paper is considering the impact of CO_2 emissions on International tourism in Iran at 1960-2009 period. Estimation results indicate that CO_2 emission has a negative effect on international tourism in Iran. Also, Dummy variable for political instability has a negative effect on international tourism in Iran at 1980-2009 period. Also, the correlation coefficient for CO_2 emission and international tourism is -0.72. This means that there is a negative relationship between CO_2 emission and international tourism.

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