EXPLORING THE RELATIONSHIP BETWEEN TOURISM DEVELOPMENT INDICATORS AND CARBON EMISSIONS : A CASE STUDY OF TUNISIA

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Abstract

Tourism is viewed increasingly as an essential sector to local, regional and national reconstruction and development for economies at various scales. The objective of the study is to empirically investigate a two-way statistical relationship between tourism development indicators and carbon emissions in Pakistan over a period of 1991-2010. To recognize this relationship, a time series, co-integration and Granger Causality Tests have been employed. The study further evaluates four alternative but equally plausible hypotheses, each with different policy implications. These are: i) tourism indicators cause carbon emission (the conventional view), ii) carbon emission cause tourism indicators, iii) There is a bi-directional causality between the two variables and iv) both variables are causality independent (although highly correlated). The results reveal that tourism indicators significantly increase carbon emissions in Pakistan. The causality results, only moderately, support the conventional view that tourism indicators have significant long run casual effect on carbon emissions in Pakistan. The present study find evidence of unidirectional causality running between tourism indicators and carbon emissions while causal relationship running from carbon emissions to natural resource depletion and from carbon emissions to net forest depletion in the context of Tunisia.

Key words: Tourism, Carbon emissions, Natural resource depletion, Net forest depletion, Tunisia

Introduction

Over the past three decades, there have been many attempts in the literature of economy of energy in order to clarify the effects of energy consumption and emissions of CO 2 on economic growth. The CO 2 emissions used in literature as a proxy for the extent of climate change are the main concern of both the developing and the developed countries. The consumption of energy is considered as the main source of pollution and environmental degradation (Ang (2008) , Soytas and Sari (2009), Apergis and Payne (2010), Arouri, Ben Youssef, Me Henni, and Rault (2012)). However, the relationship between energy and climate change by taking into account the sectoral distribution of the economy deserves more attention. In such a perspective, the tourism sector can submit a field of study. In this sense, tourism present in our days one of the largest and most vibrant industries of the world. Besides, the recipe of international tourism in 2012 has reached a total of 1075 Billions of dollars generated by 1035000000 arrivals of international tourists (UNWTO, 2013) . Also, the World Tourism participates in the creation of 1 to 11 jobs and generates loans of 9% of gross domestic product (GDP) (World Tourism and Travel Council (WTTC), 2013). In this regard, any increase in number of international tourists leads not only to economic growth but also requires the consumption of additional quantities of energy (Liu I, Feng T, Yang X 2011). However, the development of tourism is also likely to make changes to the climate. In addition, the increase in tourism activities can contribute to the increase in the demand for energy in various functions, such as transport, catering, accommodation and management of tourist attractions (Becken S, Simmons DG, Frampton C(2003); Becken S, Frampton C, Simmons DG(2001), Gössling S.(2002)), which is also likely to lead to a degradation of environment and pollution. The consideration of the tourist sector as a source of pollution is well confirmed with the World Summit on Sustainable Development in Johannesburg in 2002 which recognized the international tourism as one of the major consumers of energy (Nepal 2008) .

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In general, taking into account of the quality of environment and analysis of the links between energy consumption, economic growth and emissions of CO_2 has been dealt with under various research axis. Some studies have analyzed the relationship between consumption of energy and economic growth (Odhiambo Nm(2009); Abosedra S., Dah, A.and Ghosh, S. (2009); Stern, D.I. (2011); Fuinhas, J.A. and Trademarks, A.C. (2011)), and have verified the role of energy to the contribution of economic growth. Some studies have analyzed the relationship between level of revenues and emissions of CO_2 through the Environmental Kuznets Curve(Dinda S.(2004); Luzzati, T.and Orsini, M. (2009); Costantini, V.and Martini, C. (2010); Fodha, M., & Zaghdoud, O. (2010)). Other studies have analyzed the linked relationship between energy growth and pollution (Zhang X-P, Chen X-M (2009); Arouri, M.H., Ben Youssef, A., M'Henni, H., Rault, C. (2012); SBIA, R., Shahbaz, M., Hamdi, H. (2014)).

In recent years, economists and politicians are concerned with environmental issues, particularly the issues related to tourism sector which witness ourdays a remarkable development. In fact, an increase in tourism activities is delivered with an increased demand for energy within various functions: the importance of energy for the tourism sector is undeniable. As well, the increase in consumption of energy due to development of tourism may have a negative impact on the quality of the environment. It is obvious that the degradation of the environment is likely to occur because of the development of tourism through construction of hotels and other tourist facilities to the detriment of green spaces and also via the additional consumption of energy. The literature of growth has indicated that most of tourist activities contribute to the pressure of the Environment (Day, J., & Cai, L. P 2012 and Duffy, 2001).

In the face of the environmental challenges of tourism a strand of literature is developed to analyze the effects of tourism on the quality of environment and climate changes. Some studies have sought the implications of tourism in relation to the environmental issues, such as its contribution to emissions of greenhouse gases and global warming (Becken S & al. 2003; Gössling S. 2002; Becken S. 2005; Bode S & al. 2003, Nielsen & al. 2010 , Simpson & al., 2008). Some studies have focused on the relationship between tourism and consumption of energy (Tabatchnaia-Tamirisa N & al. 1997; Gössling S 2000; Becken S, and Simmons DG 2002). Other studies have sought the effect of tourism industry on the quality of the Environment (Xuchao & al. (2010), Hsin-Jung Hsieh and Shiann-Far Kung 2013 and Jun Liu & al. 2011). Previously seen, we can conclude the effect of tourism sector in the phenomenon of climate changes. Recent literature confirms this finding. In this sense, Katircioglu (2014) studied the effects of growth of tourism on climate changes in the case of Turkey.He noted that tourism affects the growth not only through a considerable increase in the consumption of energy but also via considerable increases in climate changes. Referring to the data of Cyprus, an island of tourist destination in the Mediterranean, Katircioglu & al. (2014) have analyzed the effects of tourism's growth on consumption of energy and climate changes. This conclusion confirms that tourism's development is catalyst for carbon emissions and energy consumption is increase. Lee and Brahmasrene (2013) have used data from the European Union (EU) to study the influence of tourism on the economic growth and emissions of CO_2 using the procedures of econometric panel data. They have noticed that tourism brings a negative and significant impact on high emissions of CO_2.

Salih Turan Katircioğlu 2014 has examined the relationship between the development of tourism and emissions of carbon in Singapore by hypothesis tests of Kuznets environmental curve. These results show that carbon emissions and development of tourism are in a relationship of long-term balances. CO_2 emissions converges to its level of long-term equilibrium with an adjustment speed of 76.0%. This conclusion confirms that tourists' arrival has a negative and significant effect on the levels of carbon dioxide emissions in both short and long term.

1). Tourism in Tunisia

Tunisia is situated at the junction of the Eastern and western basin of the Mediterranean to the northern tip of Africa. It enjoys a pleasant climate during a good period of the year. This geographical position, has made Tunisia a crossroads of civilizations in the past. In fact, today it is a hub as well for investment and trade with other nations of Europe, Africa and the Middle East. Investment in tourism sector have experienced a remarkable increase. The average annual growth rate of hotels has reached 5% during the years 2002-2006, and the rate of annual occupation reached 57%. The accommodation capacity has evolved from 231838 beds in 2006 to more than 241.528 beds in 2010. To ensure and structure its market share of the Mediterranean, Tunisia seeks to reach a capacity of 400000 beds in 2020.

In Tunisia, tourism sector has made to increase the number of tourists. Indeed, from the beginning of the year until 20 August 2012, Tunisia has welcomed nearly 3.7 million of tourists of different nationalities against 2.8 million in 2011 and 4.6 million in 2010. This increase in the number of arrived tourists still remains with European dominance by a proportion of 50.6%. The European tourists increased by one million 309 thousand in 2011 to a million 972 thousand tourists in 2012. For the movements of tourists from Arab Maghreb and North America, the data published by the National Office of the Tunisian tourism (ONTT) indicate that they are rising, reaching, respectively, a million 621 thousand tourists in 2012 against 1 239 978 in 2011.

The increase in the influx of tourists, from 1 January to 20 August 2012, towards Tunisia has also concerned the Japanese (169.3% with 4 thousand 379 tourists), Brazilians (76% with a thousand 320 tourists) and Australians (38.5% with 1011 tourists). On the other hand, a decrease was recorded during the same period, at the level of the influx of tourists means- Oriental (-74,9%) with 23 thousand 406 tourists, Africans (-60,6%), or 22 thousand 732 tourists and Chinese (-78,8%), namely 2 thousand 296 tourists.

The development of Tunisian tourist sector increased the entrance of foreign currency from 945 million DT in 1992 to 2340,6 million DT in 2001 and 3471,9 in 2009. From 1st January to 20 August 2012, tourist revenues have improved, rising by 35.3% compared to the same period of 2011. But it falls to 14.9%, in comparison with the first eight months of 2010, as stated in the figures recently published by the Department of Tourism. The data of the Central Bank of Tunisia indicate that the cash receipts from tourism sector have reached 1.804,3 million dinars, during the first eight months of 2012, against 1.333,8 dot in the same period of 2011 and 2.121,4 MDT during 2010.

2) Data sources

Data used in this paper are annual figures covering the period 1972 – 2011, and the variables of the study are CO2 emission in (kt), TR is international tourist arrivals, and EC is energy use (kt of oil equivalent). Data were gathered from World Bank Development Indicators (WDI) and report of Ministry of Trade and Tourism : National Board of Tunisian tourism (2010).

3) Econometric methodology and empirical results

In our study, The starting point of theoretical setting is to consider the international tourist arrivals as a determinant of energy consumption and CO2 emissions too . Thus, the following “tourism-induced” functional relationships have been put forward in the present study.

$$EC_t = f(CO2_t, TR_t) \qquad (1)$$

$$CO2_t = f(EC_t, TR_t) \qquad (2)$$

CO2 is a proxy for climate changes in (kt), TR is international tourist arrivals, and EC is energy use (kt is oil equivalent). Equation (1) and equation (2) will be estimating tourism-induced CO2 emissions and energy consumption, respectively. The concept of proposed functions in Eqs. (1) and (2) of the present study is similar to the literature of Alam and al. (2011) who have adopted dynamic modeling of causal relationship among energy consumption, CO2 emissions, and real income growth. The functional relationships in Eqs (1) and (2) can be expressed in logarithmic form to capture the tourism impacts on the energy consumption and environmental quality in long-term (Katircioglu S. 2010):

$$\ln (EC)_t = \alpha_0 + \alpha_1 \, ln(CO2)_t + \alpha_2 \ln (TR)_t + \varepsilon_t \qquad (3)$$

$$\ln (CO2)_t = \alpha_0 + \alpha_1 \, ln(EC)_t + \alpha_2 \ln (TR)_t + \varepsilon_t \qquad (4)$$

The dependent variables in Eqs (3) and (4) may not immediately adjust to their long-run equilibrium levels following a change in any of their determinants (Katircioglu S. 2010). Therefore, to investigate the long-run relationship between the variables, the Autoregressive Distributed Lag (ARDL) model is used. The ARDL cointegration technique is introduced by Pesaran and Shin (1999) and Pesaran & al. (2001). Pesaran & al. (2001) ARDL bounds test approach is more advantageous than the other tests based on Engle and Granger (1987), Johansen (1991) and Johansen and Juselius (1990) cointegration techniques. For example, The ARDL bounds test is based on the assumption that the variables are I(0) or I(1). Also, The ARDL approach efficiently adapts for possible endogeneity of explanatory variables, and estimates to show desirable small example of properties. Furthermore, the ARDL approach tolerates different optimal lags that the variables may have, while it is impossible with classical cointegration procedures. A final advantage is that the ARDL approach employs a single reduced form of equation, although the classical cointegration models estimate the long-run relationship within a context of system equation.

So, before applying this test, we determine the order of integration of all variables using the unit root tests. The objective is to ensure that the variables are not I(2) to avoid spurious results. In the presence of integrated variables of order two, we cannot interpret the values of F statistics provided by Pesaran & al. (2001).

3.1) Unit roots tests

In time series analysis, before running the causality test the variables must be tested for stationarity. In our study, The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Unit Root Tests are employed to test the integration level and possible co-integration among the variables (Dickey and Fuller 1979; Phillips and Perron 1988)

Table 1 gives ADF and PP unit root test results for the variables of the study. The CO2 emission seems to be stationary in ADF and PP test at level of 5%, but this is not justified at 1% level. Furthermore, EC is stationary at levels I(0). For the international tourist arrivals (TR), both tests reveal that this is non-stationary at the levels but stationary at the first differences I(1). Unit root test confirms that none of the series is integrated of I(2). Therefore, we may apply ARDL bounds testing procedures for establishing the long-run relationship between energy consumption, CO2 emission and tourism.

Table 1: ADF and PP unit root tests

Variables	ADF Test		PP Test	
	In level	First difference	in level	First difference
LN(TR)	-1.63[0]	-6.60[0]***	-1.91[12]	-6.90[7]***
LN(CO2)	-3.51[1]**	-6.80[0]***	-3.40[4]**	-6.78[3]***
LN(EC)	-4.01[1]***	-8.01[0]***	-9.29[38]***	-7.82[2]***

SC is used to choose the number of optimal delays for the ADF tests, whereas « Bandwidh » is used for PP tests. The critical values related to ADF and PP tests were provided by MacKinnon (1996). The bracketed figures represent the delay levels based on the information criterion of Schwarz. Figures between square brackets represent Newey-West bandwidth's automatic selection using the Bartlett kernel. Note that only the constant is included in tests. (***), (**) and (*) denote statistical significance at the 1%, 5% and 10% levels respectively

3.2) ARDL Bounds tests for cointegration

The ARDL model is based on two steps to estimate long-run relationship (M.H. Pesaran, Y. Shin, R.J. Smith 2001). First, we will examine the existence of long-run relationship among all variables in the equation. The ARDL model used in this study is expressed as follows:

$$\Delta\ln(EC)_t = \alpha_{01} + \alpha_{11}\ln(EC)_{t-1} + \alpha_{21}\ln(TR)_{t-1} + \alpha_{31}\ln(CO2)_{t-1} + \sum_{k=1}^{n}\beta_{1k}\Delta\ln(EC)_{t-k} + \sum_{k=1}^{n}\beta_{2k}\Delta\ln(TR)_{t-k} + \sum_{k=1}^{n}\beta_{3k}\Delta\ln(CO2)_{t-k} + \varepsilon_{1t} \quad (5)$$

$$\Delta\ln(CO2)_t = \alpha_{02} + \alpha_{12}\ln(CO2)_{t-1} + \alpha_{22}\ln(TR)_{t-1} + \alpha_{32}\ln(EC)_{t-1} + \sum_{k=1}^{n}\beta_{1k}\Delta\ln(CO2)_{t-k} + \sum_{k=1}^{n}\beta_{2k}\Delta\ln(TR)_{t-k} + \sum_{k=1}^{n}\beta_{3k}\Delta\ln(EC)_{t-k} + \varepsilon_{2t} \quad (6)$$

ε_{it} is white noise term and Δ is the first difference operator ; $\ln(CO2)_t$ is the natural log of carbon dioxide emissions, $\ln(TR)_t$ is the natural log of tourist arrivals; $\Delta\ln(EC)_t$ is the natural log of energy consumption; ε_{1t} and ε_{2t} are serially independent random errors with mean zero and a finite covariance matrix.

The ARDL approach estimates $(p+1)^k$ number of regressions in order to get the optimal lag length for each variable, where p is the maximum number of lags to be used, and k is the number of variables in the equality. An appropriate lag selection is based on a criterion such as Schwarz Bayesian Criterion (SBC).

The bounds test is mainly based on the joint Wald statistic or F-statistic that tested the null hypothesis of no co-integration. The first step in the ARDL bounds approach is to estimate the equations (5 and 6) by ordinary least squares (OLS). The estimation of the two equations by performing an F-test for the joint significance of the coefficients of lagged levels of variables we give, : H0 : $\alpha_{1i}=\alpha_{2i}=\alpha_{3i}=0$ against the alternative one H1 : $\alpha_{1i} \neq \alpha_{2i} \neq \alpha_{3i} \neq 0$ for i = 1 , 2. Pesaran & al. (2001) report two sets of critical values for a given significance level. The first level is calculated on the assumption that all variables included in the ARDL model are integrated of order zero I(0), while the second one is calculated on the assumption that the variables are integrated of order one I(1). If the computed F-statistics lie above the higher critical bounds, the null of no co-integration is rejected regardless of whether the series are I(0) or I(1), indicating co-integration. If the computed F-statistics fall below the lower critical value, we cannot reject the null hypothesis of no co-integration. Finally, if the computed test statistics lie between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors. Table 2 gives the calculated F-statistics.

Table 2: Results from bound tests

Dependant variable	lag selection	F-statistic	Decision
F(CO2\TR,EC)	(2,2,0)	0,6374	No co integration
F(EC\TR,CO2)	(2,2,2)	6,5498	co integration
Lower-bound critical value at 5%		3,88	
Upper-bound critical value at 5%		5,30	

Lower and Upper-bound critical values are taken from Pesaran & al. (2001), Table CI(i) Case I.

The results of computed F-statistics and critical values suggested by Pesaran and al. (2001) at 5% levels of significance are given in table 2. In equation (5), the F-statistics is well beyond the critical value at 5% level of significance. Therefore, this is an evidence of strong long run relationship among the variables. We also follow the same methodology for the equation (6) : It is evident that the F. calculated values are significantly lower than the lower bound of the critical value of Pesaran and al. (2001). Therefore, we conclude that there is only one co-integration vector from tourism to energy consumption.

We have established that it exists a long run relationship between tourism and egergy consumption in Tunisia. However, the direction of causality is not clear from the ARDL cointegration test. Therefore, we shall conduct the Granger causality test for establishing the direction of causality. It is clear from table 3 that the null hypothesis of tourism does not Granger cause EC is clearly rejected at 5% but the null hypothesis of EC does not Granger cause tourism is accepted. This result concludes that causality runs from tourism to energy consumption and not vice versa in the case of Tunisia. Also the null hypothesis of EC does not Granger cause CO2 is clearly rejected at 5% but the null hypothesis of CO2 does not Granger cause EC is accepted. finally, non causality hypothesis for tourism and CO2 emission is clearly accepted at 5% level.

Table 3: Granger causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
CO2 does not Granger Cause EC	38	2.91303	0.0684
EC does not Granger Cause CO2		3.36559	0.0468
TOURIS does not Granger Cause EC	38	3.38210	0.0461
EC does not Granger Cause TOURIS		2.61372	0.0884
TOURIS does not Granger Cause CO2	38	1.41104	0.2582
CO2 does not Granger Cause TOURIS		2.26003	0.1203

After determining the direction of causality, we estimate equation (5) and equation (6) following the ARDL co-integration technique for long run estimations. We estimated the model using the AIC Criterion and SBC Criterion to find the coefficient of the level of variables. The long run and short run results of all models were almost nearly identical. Therefore, we present only the results of the model that were selected on the basis of AIC criterion as Monte Carlo experiment of Liew (2004) documented that AIC is superior to other criteria, particularly when time span is less than 60 observations.

Table 4: Long run ARDL estimates

variable	Dependent variable EC Coefficient	T-Ratio	Dependent variable CO2 Coefficient	T-Ratio
EC			.86701	1.2901
TR	.51105	1.7094*	.13434	.34413
CO2	.12477	.27244		

	LM Version	F Version	LM Version	F Version
χ2 (serial correlation)[1]	.91514[.339]	.71011[.407]	1.5758[.209]	1.3345[.257]
χ2 (functional form)[2]	.0063429[.937]	.0048009[.945]	4.8826[.027]	4.5607[.041]
χ2 (normality)[3]	.34375[.842]		.82415[.662]	
χ2 (heteroscedasticity)[4]	.0020448[.964]	.0019343[.965]	.84989[.357]	.82285[.371]

(**) and (*) denote statistical significance at the 5% and 10% levels respectively.

1 The Breusch–Godfrey LM test statistic for no serial correlation.

2 The White′s test statistic for homoscedasticity.

3 The Jarque–Bera statistic for normality.

4 The Ramsey′s Reset test statistic for regression specification error.

The results of long run estimations are presented in Table 4. The coefficient of tour, which is 0.511 implies that 1% increase in international tourism arrivals leads to 0.50% increase in energy consumption in long run. This finding confirms tourism-led growth hypothesis, which states that, improvements in the unbound tourism activities may lead to higher level of energy consumption. These results prove that international tourist arrivals to Cyprus are a catalyst for energy consumption, which suggest that a change in tourist arrivals will precede changes in energy consumption in long-term. For example, an increase of tourism activities creates increased demands for energy at various functions such as transportation, catering, accommodation, and management of tourist attractions (Liu J. and al. 2011, Becken S. and al. 2003), which is also likely to lead to environmental pollution and degradation. The results of our study are in line with the empirical study analyzed by Salih T. K. and al.(2014).

In the next stage, conditional ECM regressions associated with the level of relationship should be estimated. The ECM estimations from Eqs (5) and (6) are provided in Table 5.

Table 5: Conditional error correction estimations under the ARDL approach

Dependent variable: EC				Dependent variable: CO2			
Lag structure: (2, 2, 2)				Lag structure: (2, 2, 0)			
Regressor	Coefficient	T-Ratio	*p*-value	Regressor	Coefficient	T-Ratio	*p*-value
$\hat{u}_{t-1}$	-.13361	-2.1965	.036	$\hat{u}_{t-1}$	-.084438	-.79230	.434
$\Delta \ln E_{t-1}$	-.56032	-4.9508	.000	$\Delta \ln CO_{2t-1}$	-.52440	-3.3285	.002
$\Delta \ln CO_2$	.30401	3.3501	.002	$\Delta \ln EC$	.92462	4.2098	.000
$\Delta \ln CO_{2t-1}$	.38239	4.3514	.000	$\Delta \ln E_{t-1}$	.91010	4.5573	.000
$\Delta \ln TR$	.067277	2.8196	.008	$\Delta \ln T$	.011343	.30716	.761
$\Delta \ln TR_{t-1}$	-.078518	-2.6895	.011				
Adj. R2=.75055				Adj. R2=.52870			
AIC=83.6070				AIC=64.6723			
F-stat.=17.4512, F-prob.=0.000				F-stat.=8.6937, F-prob.=0.000			

The ECT terms in Eqs. (5) are (-.13361) statistically significant and negative. A result of Table 5 implies that energy consumption converges to its long-term equilibrium level by 13.36 percent speed of adjustment through the channels of international tourist arrivals and CO2 emissions. In short-term, any increase in international tourist arrivals by 1% increases the energy consumption by 0.067%. Also an increase in energy consumption by 1% increases the CO2 emissions by 0.924%.

Conclusion:

This study has analyzed the relationship of balance in long term and direction of causality between consumption of energy in tourism and environment's quality in Tunisia. Our analysis proves that the increasing number of arrivals of tourists requires more and more large quantities of energy to meet tourists' needs in the field of transport, air conditioning and leisure, which creates a gradual degradation of the quality of environment. We have used two induced models; the first model analyzes the relationship between consumption of energy as a dependent variable explained by the arrival of tourists and emissions of CO2; in the second model, arrivals of tourists and consumption of energy are in a linear relationship with the dependent variable of carbon dioxide emissions. After you have verified that the order of integration of our variables is strictly less than two, the recourse to the test of hops has confirmed the existence of cointegration relationship in the first model and its absence in the second one. Tourism has a direct impact and statistically significant effect on consumption of energy for the future of the Tunisian economy. The short-term results indicate a bidirectional causality between energy consumption and emissions of CO2 and also between consumption of energy and tourism, while absence of any causal relationship between emissions of CO2 and tourism. Tourism affects the quality of the environment indirectly through consumption of energy. In fact, the increase of the number of tourists requires additional quantities of energy which affect the quantities of CO2 emitted in the atmosphere. Therefore, the main conclusion of the current study of the econometric analysis is that the arrival of tourists is a catalyst for consumption of energy and thus long-term climate changes.

Through the results of the present study, we can draw some involvement: the government must take into consideration the international tourism sector when it establishes measures for the protection of the environment (control of climate changes). The protection measures in the tourism sector should be laid down. Sustainability in tourism sector is one of the major axis of debate on tourism development integrated in the environment. A side of national decisions, governments must take into account the effect of tourism on the consumption of energy and on the quality of the Environment in the international scale.

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