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International tourism, growth and environmental quality: the case of three North African countries

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Abstract: This paper examines the interactive relationships between international tourism, economic growth and environmental quality in three countries of North Africa (Tunisia, Maroc, Egypt) over the period 1981 -2019. The study used the ARDL model. The results show that tourism has a direct and statistically significant impact on the level of carbon dioxide) emissions (CO2) and economic growth in the long run. The results also confirm the existence of an inverted U-shaped relationship for Morocco and Egypt between CO2 emissions and income level, while this relationship takes the form of a U- shaped in Tunisia. The error correction models in this study have shown that: (1) CO2 emissions converge towards their long-term equilibrium situation with a speed of the order of 5.8% in Morocco, 20% in Egypt and 27.9% in Tunisia through economic growth channels, of the consumption of energy and tourism. This finding reveals that the growth of tourism allows significantly, climate change to move to higher levels. (2) economic growth converges towards its long-term equilibrium by an adjustment speed of the order of 25.7% in Morocco, 5.8% in Egypt and 2.1% in Tunisia.

Keywords: International tourism; Environmental quality; Economic growth; Energy consumption; ARDL model.

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1.Introduction

Over the past three decades, the study of environmental quality has taken on a major concern in numerous attempts in the environmental economics literature to shed light on the main factors that can affect the quality of the environment. environment. The CO_2 emissions used in the literature as a proxy for measuring climate change are of primary concern to both developing and developed countries. Of particular interest to this debate is the study of the Environmental Kuznets Curve (CEK), which predicts that the quality of the environment deteriorates with economic development at low-income levels but improves with development. economic at high income levels. In this perspective the pioneering work goes back to Grossman and Krueger (1991) who concluded that air pollution increases in the early stages of growth with the level of income, but once the GDP per capita reaches a certain threshold value the relation overturns. This relationship in the form of an inverted U is later justified by various works (Selden and Song 1994, Holtz-Eakin and selden 1995; Dinda S. 2004; Luzzati, T. and Orsini, M. 2009; Costantini, V. and Martini, C. 2010; Fodha, M., & Zaghdoud, O., 2010).

The relationship between growth and environmental quality developed further by introducing other variables other than the level of GDP and the pollutant. This multivariate framework has facilitated the elucidation of both how these factors contribute to environmental degradation and whether the CKE hypothesis still survives after controlling for these relevant variables. Frequently used variables are energy consumption, international trade, urbanization. The inclusion of energy consumption in the study of environmental conditions is an obvious choice, given its impacts on the generation of pollution. Indeed, energy consumption is considered as the main source of pollution and environmental degradation in various empirical works (Ang 2008; Soytas and Sari 2009; Apergis and Payne 2010; Arouri, Ben Youssef, Me Henni and Rault, 2012). A side of the power consumption, trade openness is also seen as a factor determining the quality of the environment, however, its impact is generally less clear. The ambiguity of the impact of trade on the quality of the environment is well reflected in the literature. Indeed, some studies have concluded that trade negatively affects the quality of the environment (Ang, 2009; Jalil and Feridun, 2011; Nasir and Rehman, 2011); others have verified the opposite hypothesis which predicts a positive effect (Birdsall and Wheeler, 1993; Ferrantino, 1997; Grether et al., 2007); while for others, trade negatively affects the quality of the environment in the long term based on ARDL models (Jalil and Mahmoud, 2009; and Javanthakumaran et al., 2012).

In the same perspective, urbanization is taken as a factor influencing the quality of the environment. Results of previous studies have shown mixed effects on environmental conditions. On the one hand, a high level of the urbanization rate increases the quantities of pollutant emitted due to industrial concentration and congestion in urban areas (Panayotou, 1997). On the other hand, urbanization can have a positive effect on environmental quality due to the economies of scale of emission reduction technology in urban areas compared to rural areas (Torras and Boyce, 1998). All the more, this is more conducive to mobilizing the efforts of people in urban areas to influence environmental protection policies (Rivera- Batiz , 2002; Farzin and Bond, 2006). Meanwhile, the role of urbanization turned out to be insignificant in the study by Qu and Zhang (2011) .

However, and despite taking into account various factors that can influence growth and the quality of the environment, a few sectors or variables deserve to be studied. From such a perspective, the tourism sector can present a field of study. In this sense, tourism today presents one of the largest and most dynamic industries in the world. Thus, the international tourism revenue in 2012 reached a total of 1,075 billion dollars generated by 1,035,000,000 international tourist arrivals (UNWTO, 2013). Also world tourism participates in the creation of 1 to 11 jobs and generates 9% loan of the global gross domestic product (GDP) (World Tourism and Travel Council - WTTC, 2013). In this regard, any increase in the number of international tourists not only generates economic growth but requires the consumption of additional amounts of energy (Liu J., Feng T., Yang X., 2011). However, the development of tourism is also likely to bring changes to the climate. Thus, increased tourism activities may contribute to increased energy demand within various functions, such as transport, catering, accommodation and management of tourist attractions (Becken S. et al., 2003; Becken S et al. 2003); Becken S et al. (2001), Gössling S. (2002). This is also likely to lead to environmental degradation and pollution. The consideration of the tourism sector as a source of pollution is well confirmed with the World Summit on Sustainable Development in 2002 in Johannesburg which recognized by international tourism as one of the important consumers of energy (Nepal; 2008).

In this study we intend to make two contributions. First, we looked at the effect of tourism on growth and environmental quality in the North African region. Secondly, we tried to fill r the deficiency relating to the verification of the hypothesis of the environmental Kuznets curve in the region.

To take these contributions listed above, we chose the a next step; after demonstrating the importance of the subject, a second section will be devoted to an e briefly reviewed e literature on tourism relationship, growth and quality of environm ent. The third section will describe the data and methodology used to explore the effect of tourism on the environment and growth. Then, the main results obtained as well as their interpretations will be illustrated in the fourth section . Finally, we will end with the conclusion and the different political implications.

2.Literature

In recent years, environmental issues have been of concern to economists and politicians. In general, the taking into account of the quality of the environment and the analysis of the links between energy consumption, economic growth and CO2 emissions has been dealt with under various research axes. Some studies have analyzed the relationship between energy consumption and economic growth (Odhiambo N . M .,2009; Abosedra S . Et al., 2009); Stern, D., 2011; Fuinhas, JA and Marques, AC, 2011). This work has verified the role of energy in the contribution of economic growth. Some studies have analyzed the relationship between income level and CO2 emissions through the Kuznets environmental 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 joint relationship between energy , growth and pollution (Zhang XP, Chen XM, 2009; Arouri, MH et al., 2012; Sbia, R. et al., 2014).

The issues related to the tourism sector who knows nowadays a remarkable development, are increasingly the attention of economists and of contemporary researchers . Indeed, an increase in tourism activities comes with increased demand for energy within various functions: the importance of energy for the tourism sector is undeniable. Thus, the increase in energy consumption due to the development of tourism can have a negative impact on the quality of the environment. It is obvious that environmental degradation is also likely to occur due to the development of tourism through the construction of hotels and other tourist establishments to the detriment of green spaces and also through additional energy consumption. The growth literature has indicated that most tourism activities contribute to environmental pressure (Day, J., & Cai, L. P, 2012; Duffy, 2001).

Faced with the environmental challenges of tourism, a bit of literature has developed to analyze the effects of tourism on the quality of the environment and climate change. Some studies have looked for the implications of tourism with regard to environmental issues, such as its contribution to greenhouse gas emissions and global warming (Becken S et al. 2003 ; Gössling S. 2002 ; Becken S. 2005 ; Bode S et al. 2003, Nielsen et al. 2010 , Simpson et al., 2008). Some studies have focused on the tourism-energy consumption relationship (Tabatchnaia-Tamirisa N et al., 1997 ; Gössling S 2000; Becken S, Simmons DG, 2002) ; other studies have looked for the effect of the tourism industry on the quality of the environment (Xuchao et al., 2010; Hsin -Jung Hsieh and Shiann -Far Kung, 2013; Jun Liu et al., 2011). So, from the above, we can conclude the effect of the tourism sector in the phenomenon of climate change. Recent literature confirms this finding.

In this sense, Katircioğlu (2015) studied the effects of tourism growth on climate change in the case of Turkey. He found that tourism affects growth not only through a huge increase in energy consumption but also through huge increases in climate change. Referring to data from Cyprus, a tourist destination island in the Mediterranean, Katircioğlu et al. (2010) analyzed the effects of tourism growth on energy consumption and climate change. Their conclusion confirms that the development of tourism is a catalyst for increasing carbon emissions and energy consumption. Lee and Brahmasrene (2013) used data from the European Union (EU) to study the influence of tourism on economic growth and CO_2 emissions using econometric panel data procedures. They noticed that tourism has a negative and significant impact on the increase in CO_2 emissions (Secinaro et al., 2020).

Salih Turan Katircioğlu (2014) examined the relationship between tourism development and carbon emissions in Singapore through environmental Kuznets curve hypothesis testing. The results show that carbon emissions and tourism development are in long-term equilibrium relationship. The CO2 emissions converge towards its long-term equilibrium level with an adjustment speed of 76.0%. The findings confirm that tourist arrivals have a negative and significant effect on carbon dioxide emission levels both in the short term and in the long term.

Zaman et al. (2016) examined the relationship between economic growth and CO2 emissions, the development of tourism, domestic investments and health spending in a group of three diverse regions of the world, including Asia O rientale and u Pacific Union E uropean and countries of high income OECD countries and non-OECD on the period 2005-2013 . Their empirical work yielded different results, in particular , i) tourism is determined by economic growth, domestic investment and health spending , ii) tourism and energy induce environmental degradation .

The harmful effect of tourism on the quality of the environment is also confirmed by Saenz - de- Miera and Rossello (2014). In fact, the authors emphasized the negative externality of tourism activities, which leads to climate change and air pollution. The results of their analysis s empirical s also show that the number of tourist arrivals is not the only contributor to increased emissions of carbon dioxide in the atmosphere, but also the pressure of the resident population in Spain a determinant of PM10 emissions in the country. Omri, Shahbaz , Chaibi and R ault (2015) , examined the long-term relationship between tourism, environmental quality, energy consumption, political instability and economic growth in the countries of the region MENA . Their conclusion is that the number of arrival s international tourists is increasing r significant economic growth so that proved the hypothesis which states that economic growth is determined e by tourism in the region.

The previous discussions e s confirmed connections on the nature of the relationship between tourism, economic growth, environmental quality and energy consumption and also on the verification of the hypothesis of the Environmental Kuznets Curve worldwide. This study investigates the relationship between the level of GDP per capita, air pollution, tourist arrivals and energy consumption, in order to determine the effect of tourism on the quality of the environment and the legitimacy of the hypothesis of the environmental Kuznets curve (EKC) in the three countries of North Africa. These findings would help to present sound policy implications for environmental sustainability in the region.

3.Data, econometric model and methodology

3.1. Data

The data used in this document is collected from the development indicators of the World Bank (WDI) and the World Tourism Organization (UNWTO). The do fro m cover the 1981-2019 period . The variables used in our study are the number of international tourism arrivals in logarithm (LNTOURI), gross domestic product per capita in logarithm (LNGDP), energy consumption per capita in logarithm (LNEC) and CO emissions. 2 per capita in logarithm (LNCO2). Our data relate to a sample of three North African countries namely Tunisia, Morocco and Egypt.

3.2. Econometric Model:

In our study, the starting point of the theoretical analysis is to consider international tourist arrivals as a determinant of growth and CO2 emissions. Our presentation will use the model used by Katircioglu et al. (2014). Thus, the following "tourism-induced" functional relationships will be used in this study.

$$CO2_t = f(GDP_t, GDP_t^2, EC_t, TR_t) \quad (1)$$

$$GDP_t = f(EC_t, CO2_t, TR_t) \quad (2)$$

These functional relationships in equation (1,2) can be expressed in logarithmic form to capture the elasticities of our variables in the long term period (Katircioglu, 2010) :

$$\ln CO_{2t} = \beta_0 + \beta_1 \ln GDP_t + \beta_2 \ln GDP_t^2 + \beta_3 \ln EC_t + \beta_4 \ln TOURI_t + \varepsilon_t \quad (3)$$

$$\ln GDP = \alpha_0 + \alpha_1 \ln EC_t + \alpha_2 \ln CO_{2t} + \alpha_3 \ln TOURI_t + \varphi_t \quad (4)$$

Where t is the period of time, lnCO2 is the logarithm of CO2 emissions, lnGDP is the logarithm of the level of GDP, lnEC is the logarithm of the energy used and lnTOURI is the logarithm of the number of international tourist arrivals.

However, the use of the dependent variable in equations (1) and (2) at their long-term equilibrium levels may not be immediately following a change in one of its determinants. Thus, the speed of adjustment between the short and the long term of the levels of the dependent variables can be captured by estimating the following error correction model:

$$\Delta \ln CO_{2t} = b_0 + \sum_{i=1}^{n} b_1 \Delta \ln GDP_{t-i} + \sum_{i=1}^{n} b_2 \Delta \ln GDP_{t-i}^2 + \sum_{i=1}^{n} b_3 \Delta \ln EC_{t-i} + \sum_{i=1}^{n} b_4 \Delta \ln TOURI_{t-i} + \gamma_5 \varepsilon_{t-1} + \mu_t \quad (5)$$

$$\Delta \ln GDP = \alpha_0 + \sum_{i=1}^{n} b_1 \Delta \ln EC_{t-i} + \sum_{i=1}^{n} b_2 \Delta \ln CO_{2t-i} + \sum_{i=1}^{n} b_3 \Delta \ln TOURI_{t-i} + \theta_4 \varphi_{t-1} + \zeta_t \quad (6)$$

Where Δ represents the first difference operator , and respectively represent the error correction terms (ECT) of the two models. The (ECT) in both equations show the speed of the adjustment of the imbalance between the short and the long term of the dependent variable. We expect that the (ECT) will have a negative and significant sign (Gujarati DN. 2003).

3.3. Methodology

To study the long-term relationship between the variables , the Autoregressive Dynamic Lagging (ARDL) method is used in our study. The ARDL cointegration technique is introduced by Pesaran and Shin (1999) and Pesaran et al. (2001). Thus according to Pesaran et al. (2001), the use of the model jump test (ARDL) is more advantageous than other cointegration techniques based on the tests of Engle and Granger (1987), Johansen (1991) and Johansen and Juselius (1990. The first advantage is that this approach is applicable even if the explanatory variables are perfectly I (0), perfectly I (1) or mutually co-integrated . This method does not require that the series be integrated of the same order to find a possible cointegrating relationship between these variables. The second advantage is that this method has better statistical properties in small samples. The estimators derived from the Johansen and Juselius approach are not robust when the studied sample is small , as in this study.In addition, Pesaran and Shin (1999) show that using an ARDL model, the ordinary least squares estimators of the short-run parameters are -consistent and the estimators of the long-term coefficients of the ARDL model are super-consistent in small samples (Narayan and Peng, 2007).

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

4.Results and discussions

Our study uses the Dickey- Fuller (ADF) and Phillips-Perron (PP) tests to analyze the stationarity and integration levels of our variables. Table 1 presents the results of the ADF and PP unit root test in level and in first difference for the study variables. Our results show that all the variables are non-stationary in level for the three countries of our study, namely Morocco (panel A) Egypt (panel B) and Tunisia (panel C). However, the stationarity of our variables is well justified in the three countries in first difference. Hence we can use the ARDL approach and the application of the jump test to study the long term relationship between growth, environmental quality, tourism and energy consumption is quite valid.

Table 1 : stationarity of variables

panel A (Morocco)					panel B (Egypt)				panel C (Tunisia)			
Variables	ADF Test		PP Test		ADF Test		PP Test		ADF Test		PP Test	
	In level	First difference	in level	First difference	In level	First difference	in level	First difference	In level	First difference	in level	First difference
LN (TR)	-1.52 [9]	-6.51 [7] ***	-1.56 [7]	-4.88 [11] ***	-0.72 [9]	-3.61 [8] ***	-0.8 [10]	-6.96 [38] ***	-0.72 [9]	-3.61 [8] ***	-0.8 [10]	-6.96 [38] ***
LN (CO2)	-0.22 [9]	- 3.62 [8] ***	0.37 [2]	-6.01 [22] ***	-0.24 [9]	-3.6 [8] ***	-1.09 [10]	-9.02 [18] ***	-1.9 [9]	-3.43 [8] ***	-0.65 [20]	-9.76 [82] ***
LN (EC)	1.24 [9]	- 3.43 [8] ***	1.83 [2]	-6.02 [25] ***	- 0.82 [9]	- 3.62 [12] ***	-2.56 [6]	-5.67 [18] ***	-1.09 [13]	-2.9 [12] **	-1.06 [22]	-7.02 [61] ***
L (NGDP)	-0.44 [13]	-7.37 [4] ***	1.13 [42]	-8.1 [37] ***	-1.44 [5]	-3.10 [4] ***	-0.89 [7]	-5.12 [9] ***	0.11 [9]	-3.14 [8] ***	0.61 [1]	-6.19 [20] ***
LN (GDP) 2	-0.33 [13]	-7.32 [11] ***	1.35 [44]	-7.93 [37] ***	-1.32 [5]	-3.02 [4] ***	-0.72 [8]	-5.06 [9] ***	0.18 [9]	-3.08 [8] ***	0.75 [1]	-6.1 [20] ***

SC is used, selecting the optimal number of lags for ADF testing, while " Bandwidh " is used for PP testing. Critical values related to ADF and PP tests were provided by MacKinnon (1996. The numbers in square brackets represent the number of auto-selected lag using the " Bartlett kernel . " Note that only the constant is included in the tests. (** *), (**) and (*) indicate statistical significance at 1%, 5% and 10% respectively

To study the long-term relationship between the variables of our study, the Bonds cointegration test is used in an autoregressive dynamic delay modeling (ARDL). This approach was developed by Pesaran et al. (2001) and can be applied whatever is the integration variable order (regardless of what the variables are purely I (0), I (1) or mutually co -Integrated). The use of the ARDL model involves estimating the following error correction models:

$$\begin{aligned}\Delta \ln CO_{2t} &= b_0 + \sum_{i=1}^{n} b_1 \Delta \ln GDP_{t-i} + \sum_{i=1}^{n} b_2 \Delta \ln GDP_{t-i}^2 + \sum_{i=1}^{n} b_3 \Delta \ln EC_{t-i} + \sum_{i=1}^{n} b_4 \Delta \ln TOURI_{t-i} \\ &+ \gamma_1 \ln CO_{2t-1} + \gamma_2 \ln GDP_{t-1} + \gamma_3 \ln GDP^2{}_{t-1} + \gamma_4 \ln EC_{t-1} + \gamma_5 \ln TOURI_{t-1} + \mu_t\end{aligned} \tag{7}$$

$$\begin{aligned}\Delta \ln GDP &= \alpha_0 + \sum_{i=1}^{n} b_1 \Delta \ln EC_{t-i} + \sum_{i=1}^{n} b_2 \Delta \ln CO_{2t-i} + \sum_{i=1}^{n} b_3 \Delta \ln TOURI_{t-i} \\ &+ \lambda_1 \ln GDP_{t-1} + \lambda_2 \ln EC_{t-1} + \lambda_3 \ln CO_{2t-1} + \lambda_4 \ln TOURI_{t-1} + \zeta_t\end{aligned} \tag{8}$$

To test the existence of a relationship of co -integration between variables, the procedure under - behind of Statistics is the F statistic of Wald test. The null hypothesis of the F- statistic is established as follows : for Eq. (7) and for Eq . (8). The F-statistic calculated in our study will be compared with the critical values from the table of Peseran et al. (2001). The decision on the existence of a cointegrating relation is confirmed if the calculated F-statistic is above the tabulated upper limit. However, if the F- statistic is between the bounds, no conclusion can be deduced and if the F- statistic is below the lower bound the null hypothesis of no cointegration is accepted. Table (2) shows the results of the hopping test.

Table 2: hop test

Variable dependent	lag selection	F- statistic	Decision
panelA (Morocco)			
F (CO2 \ GDP, GDP2, TR, EC)	(11, 0, 2, 0, 6)	5.498724	cointegrated
F (GDP \ EC, TR, CO2)	(6, 0, 2, 7)	6.871155	cointegrated
panel B (Egypt)			
F (CO2 \ GDP, GDP2, TR, EC)	(6, 6, 9, 1, 1)	6.252141	cointegrated
F (GDP \ EC, TR, CO2)	(3, 1, 4, 0)	6.394991	cointegrated
panel C (Tunisia)			

F (CO2 \ GDP, GDP2, TR, EC)	(3, 2, 2, 1, 3)	8.483235	cointegrated
F (GDP \ EC, TR, CO2)	(2 , 2,1,2)	5.752371	cointegrated
		k = 4	k = 3
Lower-bound critical value at 5%		2.86	3.23
Upper-bound critical value at 5%		4.01	4.35
Lower-bound critical value at 1%		3.74	4.29
Upper-bound critical value at 1%		5.06	5.61

The results of table (3) show that the F- statistic for the two models are strictly greater than the upper limit of the threshold of 5% and 1% and that for the three countries, namely panel (A), panel (B) and panel (C) which brings us back to rejecting the null hypothesis of the absence of a cointegrating relationship between the variables studied. Therefore, we can conclude the existence of at least one cointegrating relationship between CO2 emissions and the other explanatory variables in the first relationship and also the existence of at least one cointegrating relationship between GDP and the other variables in the second relation and that for the three countries studied.

After verifying the existence of at least one cointegrating relation between the variables in the two relations, we study the long term and short term relation using the ARDL model. To determine the optimal delay length of equations (7) and (8) we used the Schwarz information criterion ; the maximum number we took is 12. The results of the delay choice are shown in Table (2). The coefficients of the long-term ARDL models of the three countries are presented in Table (3).

Table 3 : Long-term relationship

panel A (Morocco)					panel B (Egypt)				
	Dependent CO2 variable		Dependent variable gdp			Dependent CO2 variable		Dependent variable gdp	
variable	Coefficient	T-Ratio	Coefficient	T-Ratio	variable	Coefficient	T-Ratio	Coefficient	T-Ratio
GDP	7,299963	2.874072 **			GDP	5.9698	3.142 ***		
GDP2	-0.466836	-2.97542 ***			GDP2	-0.3262	-2.415 ***		
EC	1.797944	3.794058 ***	0.463774	2.954071 ***	EC	0.3551	3.639 ***	-0.0721	-0.80702
TR	0.214502	1.749531	0.133707	5.858203 ***	TR	-0.1589	-3.133 ***	0.2122	6.3910 ***
CO2			0.197838	1.299729	CO2			0.2919	4.2726 ***

panel C (Tunisia)				
	Dependent CO2 variable		Dependent variable gdp	
variable	Coefficient	T-Ratio	Coefficient	T-Ratio
GDP	-6.164247	-1.836526 **		
GDP2	0.388975	1.915138 **		
EC	0.744024	3.579334 ***	1.170426	2.193419 ***
TR	0.054153	1.976515 **	0.091118	2.344256 ***
CO2			0.322376	0.2299

(***), (**) and (*) indicate statistical significance at 1%, 5% and 10% respectively

The results of the first relationship show that the coefficients associated with GDP are significant in the three countries of our analysis. Any increase in the level of long-term income by 1 point increases the quantities of CO_2 emitted, by 7.29 points in Morocco and 3.14 points in Egypt, while it reduces the quantities of CO_2 by 6.16 point in Tunisia. For the coefficients associated with energy consumption, we note that they are significantly positive in the three countries. Any increase in the levels of energy consumed increases the quantities of the pollutant and worsens the environmental situation. Our results are well compatible with various empirical works (Chebbi HE, 2010, 2011; Mehdi Ben Jebli Slim Ben Youssef 2015; Houda A and Belloumi M., 2016). The coefficient of the GDP2 variable appears to be negatively significant in Morocco and Egypt and positively significant in Tunisia. This finding can inform us about the shape of the curvature between CO_2 emissions and income levels, in other words the verification of the Kuznets environmental curve. The negative sign of GDP2 in Morocco and Egypt confirms that the relationship takes the form of an inverted U-curve while it is U-shaped in Tunisia. This result seems well in line with that of Mehdi B J, Slim SY 2015 in Tunisia. Finally, for the tourism variable, we notice that it admits a significantly negative coefficient in Egypt while this coefficient is significantly positive in Tunisia and positive and neutral in Morocco. A 1 percent increase in tourist arrivals in Egypt reduces the amount of CO_2 emitted by 0.15%. Indeed, tourism in Egypt is characterized by the dominance of cultural tourism through visits to archaeological areas. The positive effect of tourism on the quality of the environment in Egypt can also be explained by its effect on long-term growth. Indeed, the increase in the level of tourism increases the level of income which, for its part, reduces the quantities of the pollutant in the long term since the environment-growth relationship takes the form of a decreasing curve in the long term. According to the logic of the inverted U-shaped Kuznets environmental curve, the increase in income level reduces CO_2 emissions in the long run. However, the growth-environment relationship takes the form of a U in Tunisia. Long-term income growth causes CO_2 emissions to vary in the same direction. Thus, the increase in the number of tourists which increases the income per inhabitant stimulates the degradation of the environment in Tunisia. Also, tourism in Tunisia is characterized by seasonality. The more or less hot periods present the period of high season which requires additional amounts of energy for transport and air conditioning. Tourist arrivals play the role of a catalyst; its increase increases energy consumption, which in turn increases the quantities of CO_2 emitted into the atmosphere.

In the second relationship where the level of income is presented as a dependent variable, we notice that an increase in energy consumption of 1% increases the level of economic growth by 0.46% in Morocco and by 1.17%. in Tunisia. This positive relationship is explained by the fact that these countries are in a growth phase ; all economic development requires additional amounts of energy. For the tourism variable, we notice that it admits positively significant coefficients in the three countries. The 1% increase in tourist arrivals raises long-term income levels by 0.133% in Morocco, 0.212 in Egypt and 0.09 in Tunisia.

In a second step, the conditional ECM regression associated with the level relation in equations (5) and (6) is estimated. The ECM estimates are provided in Tables (4) and (5). The results presented in table (4) show that the ECT term associated with equations (5) is statistically significant and negative, which confirms the jump test on the existence of at least one relationship between the variables of the models in the long term. The ECT values illustrated in table (4) are of the order of ECT = -0.058 for Morocco, ECT = -0.2 for Egypt and ECT = -0.279 for Tunisia, which implies that the emissions of CO_2 converge towards long-term equilibrium at a rate of 5.8% in Morocco 20%, in Egypt and 27.9% in Tunisia through the channels of economic growth, energy consumption and tourism. Tunisia's speed of adjustment to the equilibrium is higher than that of Egypt and Morocco. For the short-term coefficients of energy consumption we notice that they are positive and statistically significant at date (t) while they are negative and statistically significant for previous periods. However, the associated short-term coefficients of economic growth (GDP) are negative and statistically significant in period (t), but become positive in later periods. Finally, we note that the tourist variable admits a negative and non-significant coefficient in Morocco and a positive and statistically significant coefficient in Egypt and Tunisia.

Table 4 : Short-term relationship of the relationship (CO2 / GDP , GDP2, EC, TOURI)

Panel A (Morocco)				Panel B (Egypt)				Panel C (Tunisia)			
Lag structure: (6, 6, 9, 1, 1)				Lag structure: (11, 0, 2, 0, 6)				Lag structure: (3, 2, 2, 1, 3)			
Variable	Coefficient	t- Statistic	Prob .	Variable	Coefficient	t- Statistic	Prob .	Variable	Coefficient	t- Statistic	Prob .
D (LNCO2 (-1))	0.613307	8,297709	0.0000	D (LNCO2 (-1))	0.74823	9.4071	0.0000	D (LNCO2 (-1))	0.499588	6.403396	0.0000
D (LNCO2 (-2))	0.140828	2.183876	0.0313	D (LNCO2 (-2))	0.35882	3.5266	0.0006	D (LNCO2 (-2))	0.265285	3.156170	0.0020
D (LNCO2 (-3))	0.080637	1.232608	0.2206	D (LNCO2 (-3))	0.1874	2.2752	0.0250	D (LNGDP)	-14.38558	-2.720700	0.0075
D (LNCO2 (-4))	-0.676143	-9.042851	0.0000	D (LNCO2 (-4))	-0.9259	-11.160	0.0000	D (LNGDP (-1))	10.640719	2.036875	0.0439
D (LNCO2 (-5))	0.455094	5.653720	0.0000	D (LNCO2 (-5))	0.72386	6.1430	0.0000	D (LNGDP2)	0.912852	2.676042	0.0085
D (LNEC)	1.216525	14.57762	0.0000	D (LNCO2 (-6))	0.34540	2.6769	0.0087	D (LNGDP2 (-1))	-0.674859	-1.997371	0.0481
D (LNEC (-1))	-0.571452	-3.404386	0.0010	D (LNCO2 (-7))	0.08469	1.1489	0.2532	D (LNEC)	-0.105820	-0.993243	0.3226
D (LNEC (-2))	-0.073619	-0.497660	0.6198	D (LNCO2 (-8))	-0.4948	-6.6577	0.0000	D (LNTOURI)	0.135617	4.674990	0.0000
D (LNEC (-3))	-0.499754	-2.921283	0.0043	D (LNCO2 (-9))	0.36598	4.2834	0.0000	D (LNTOURI (-1))	-0.021625	-0.471517	0.6381
D (LNEC (-4))	0.714049	3.406478	0.0009	D (LNCO2 (-10))	0.17613	2.1286	0.0357	D (LNTOURI (-2))	-0.053228	-2.155370	0.0332
D (LNEC (-5))	-0.320145	-2.778916	0.0065	D (LNEC)	0.07194	3.2584	0.0015				
D (LNGDP)	-5.701172	-3.206264	0.0018	D (LNGDP)	-0.0986	-0.1808	0.8569				
D (LNGDP (-1))	0.121264	1.243510	0.2166	D (LNGDP (-1))	0.9225	2.5121	0.0136				
D (LNGDP (-2))	0.039495	0.408599	0.6837	D (LNGDP2)	-0.0660	-2.4739	0.0150				
D (LNGDP (-3))	0.126298	1.057270	0.2929	D (LNTOURI)	0.07966	2.6743	0.0087				
D (LNGDP (-4))	-0.215218	-1.861903	0.0656	D (LNTOURI (-1))	-0.0684	-1.7670	0.0802				
D (LNGDP (-5))	0.102971	1.128143	0.2620	D (LNTOURI (-2))	0.00830	0.2831	0.7777				
D (LNGDP (-6))	0.031723	0.350230	0.7269	D (LNTOURI (-3))	-0.1421	-3.8997	0.0002				

D (LNGDP (-7))	-0.079846	-0.857440	0.3933	D (LNTOURI (-4))	0.25253	5.2752	0.0000				
D (LNGDP (-8))	0.104426	1.890129	0.0616	D (LNTOURI (-5))	-0.0946	-3.2203	0.0017				
D (LNGDP2)	0.374780	3.072586	0.0027								
D (LNTOURI)	-0.023739	-1.278643	0.2040								
ECT	-0.058984	-2.909441	0.0045	ECT	-0.2025	-4.7835	0.0000	ECT	-0.279655	-6.080513	0.0000

The results presented in table (5) of the estimate of the ECM of equation (6) clearly illustrate negative and statistically significant ECTs at the 5% level, which confirms the existence of at least one relation of long term between the model variables. Economic growth is converging towards its long-term equilibrium with an adjustment speed of around 25.7% in Morocco, 5.8% in Egypt and 2.1% in Tunisia. The coefficients associated with tourism are positive and statistically significant at the 5% threshold at date (t). For the energy consumption variable, its coefficient is positive and statistically significant in Morocco and Tunisia, while it is not significant in Egypt. The economic growth of the countries studied reacts to its long-term trajectory significantly in the model induced through tourism.

Table 5 : Short-term relationship of the relationship (GDP / CO2 , EC, TOURI)

Panel A				Panel B				Panel C			
Lag structure: (3, 1, 4, 0)				Lag structure: (6, 0, 2, 7)				Lag structure: (2, 2, 1, 2)			
Variable	Coefficient	t- Statistic	Prob .	Variable	Coefficient	t- Statistic	Prob .	Variable	Coefficient	t- Statistic	Prob .
D (LNGDP (-1))	0.431394	5.227675	0.0000	D (LNGDP (-1))	0.542618	6.261703	0.0000	D (LNGDP (-1))	0.489665	6.432117	0.0000
D (LNGDP (-2))	0.204351	2.253400	0.0260	D (LNGDP (-2))	0.200589	2.178307	0.0315	D (LNEC)	0.278847	6.818410	0.0000
D (LNCO2)	-0.248970	-1.69609	0.0924	D (LNGDP (-3))	0.051345	0.584011	0.5604	D (LNEC (-1))	-0.131959	-2.984630	0.0034
D (LNEC)	0.856470	4.311944	0.0000	D (LNGDP (-4))	-0.375490	-3.875753	0.0002	D (LNCO2)	-0.048952	-1.662522	0.0989
D (LNEC (-1))	-0.084230	-0.29947	0.7651	D (LNGDP (-5))	0.242708	2.905559	0.0044	D (LNTOURI)	0.028212	2.360695	0.0198
D (LNEC (-2))	0.014055	0.051903	0.9587	D (LNEC)	-0.004242	-0.825483	0.4109	D (LNTOURI (-1))	-0.020825	-1.900751	0.0597
D (LNEC (-3))	-0.233166	-1.54848	0.1241	D (LNCO2)	-0.011710	-0.794851	0.4284				
D (LNTOURI)	0.034386	3.760381	0.0003	D (LNCO2 (-1))	0.005022	0.334780	0.7384				
				D (LNTOURI)	0.038510	5.658170	0.0000				
				D (LNTOURI (-1))	-0.006135	-0.452129	0.6521				
				D (LNTOURI (-2))	-0.013227	-1.259856	0.2104				
				D (LNTOURI (-3))	-0.035597	-3.601703	0.0005				

				D (LNTOURI (-4))	0.051533	4.102948	0.0001				
				D (LNTOURI (-5))	-0.009330	-0.742585	0.4593				
				D (LNTOURI (-6))	-0.012447	-1.806518	0.0735				
ECT	-0.257175	-5.095588	0.0000	ECT	-0.058796	-5.018204	0.0000	ECT	-0.021006	-2.147189	0.0337

5.Conclusion

The objective of this study is to examine the role of tourism development on growth and environmental quality in three countries of North Africa (Morocco, Egypt and Tunisia). The study used two major equations, the first is used for the assessment of the environmental Kuznets curve (CEK) by integrating economic growth (square of GDP per capita), carbon emissions, tourism arrivals and energy consumption while the second equation is used to study the impact of energy consumption, environmental quality and tourism arrivals on economic growth. The introduction of energy consumption into the equations is used to clarify the transmission channels of the effects of tourism on the quality of the environment. The results show that tourism has a direct and statistically significant impact on the level of carbon dioxide emissions and economic growth in the long term period of the economies studied. The results also confirm the existence of an inverted U-shaped relationship for Morocco and Egypt between CO_2 emissions and income level, while this relationship takes the form of a U in Tunisia. The error correction models in the present study have shown that (1) CO_2 emissions converge towards their long-term equilibrium situation with a speed of the order of 5.8% in Morocco 20% in Egypt and 27.9% in Tunisia through the channels of economic growth of energy consumption and tourism. This finding reveals that the growth of tourism significantly allows climate change to rise to high levels. (2) economic growth converges towards its long-term equilibrium by an adjustment speed of the order of 25.7% in Morocco, 5.8% in Egypt and 2.1% in Tunisia.

The results of the present study suggest some implications. The degradation of the quality of the environment is reinforced initially with the increase in the level of income, after having reached a certain level of threshold, the quality of the environment improves gradually in a second time with the levels of income.

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