CO_2, QUALITY OF LIFE AND ECONOMIC GROWTH IN MENA COUNTRIES

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ABSTRACT

This paper examines the nexus between CO_2 emissions, quality of life and economic growth in 12 MENA countries over the period of 1970–2014. Empirical results show that there is unidirectional causality from CO_2 emissions to economic growth. However, there is unidirectional causality from economic growth to quality of life. There is also bidirectional causality between CO_2 emissions and quality of life. This study shows that environmental policies need to recognize differences in MENA countries in order to increase sustainable economic growth and quality of life.

Keywords: CO_2 Emissions, Quality of Life, Economic Growth, MENA Countries

Mena Ülkelerinde CO_2, Yaşam Kalitesi ve Ekonomik Büyüme

Özet

Bu çalışmanın amacı 12 MENA ülkesini yaşam kalitesi (quality of life), CO_2 emisyonu ve ekonomik büyüme arasındaki ilişkiyi 1970 ile 2014 dönemi boyunca incelemektir. Ampirik sonuçlar göstermektedir ki CO_2 emisyonundan ekonomik büyümeye doğru tek yönlü nedensellik vardır. Bununla birlikte ekonomik büyümeden yaşam kalitesine doğru tek yönlü nedensellik ilişkisi tespit edilmiştir. Ayrıca CO_2 emisyonu ile yaşam kalitesi arasında çift yönlü nedensellik vardır. Çalışma, çevre politikalarının MENA ülkelerinde sürdürülebilir ekonomik büyümeyi ve yaşam standartlarını artırabilmek için farklılıkları tanıması gerektiğini göstermektedir.

Anahtar Kelimeler: CO_2 Emisyonu, Yaşam Kalitesi, Ekonomik Büyüme, MENA Ülkeleri

INTRODUCTION

The relationship between quality of life, CO_2 emissions and economic growth has entered into the literature in recent years. CO_2 emissions have been an important factor in economic growth in the last few decades (Ahmad et al., 2017; Riti et al., 2017). However, the degree and the extent to which CO_2 emissions affect quality of life is an issue yet to be investigated. The motivation of this study is to analyze empirically the relationship between quality of life, CO_2 emissions and economic growth for Middle East and North African (MENA) countries.

At low development levels, environmental pollution is limited in both quantity and density. In such economies, while the growth is limited, there is little damage to the environment by the waste produced that disrupts the environment. Generally recyclable wastes do not pose a threat to the environment. As the economy develops, with the intensification of agriculture and industrialization, the resource consumption rate starts to exceed the resource regeneration rate and the amount of waste generation and toxicity increases. Structural changes to knowledge-intensive industries and services at higher levels of development, increasing environmental awareness of people, enforcing environmental regulations, developing technology and more environmental expenditures result in the gradual reduction of environmental pollution (Panayotou, 1993). The environmental Kuznets curve (EKC) is primarily due to the increase of revenue, and then to a decrease in environmental damage. This inverse U-shaped hypothesis means that growth can be understood as not a threat to global sustainability. Sustainable growth is used to mean that the real

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GDP growth rate per capita for half a century is about 1.5% annually (Easterlin and Angeles, 2012).

Many studies have shown that quality of life plays an increasingly important role in economic growth (Rafiq et al., 2016; Borhan et al., 2013). The fact that economic growth and quality of life affect each other, enables living standards to increase. It is among the priorities of developing societies that they can increase their quality of life together with economic growth.

In the last few decades, MENA countries have grown very rapidly due to agricultural sources and natural resources (crude oil, natural gas, non-mineral resources). In addition, the ecosystem of the region, including the air, water and land, has been severely affected by the intensive use of energy and the rapid increase in population and urbanization (Charfeddine and Mrabet, 2017).

The structure of this study is detailed as follows. A literature review is undertaken in the second part, followed by section three which includes the method description and the sources of information used. An explanatory analysis is given in section four, and finally, chapter five presents the results and policy recommendations.

I. LITERATURE

The causality relationship between environmental pollution and economic growth can be examined in three groups. In the first group, environmental pollution is the cause of economic growth. It is here that the study of the Philippines during the period 1965 to 2010 (Lim et al., 2014), the study of Malaysia during the period from 1975 to 2011 (Azlina et al., 2014), the study of the BRICS countries during the period from 1971 to 2005 (Pao and Tsai, 2010), the study of the 19 developed and developing countries during the period from 1984 to 2007 (Apergis et al., 2010), are listed.

In the second group, economic growth is the cause of environmental pollution. It is in this group that the study of Saudi Arabia during the period from 1960 to 2009 (Kohler, 2013), the study of Iran during the period from 1967 to 2007 (Lotfalipour et al., 2010), the study of BRICS countries during the period from 1990 to 2010 (Cowan et al., 2014), the study of 11 Asian countries during the period from 1990 to 2011 (Azam, 2016), the study of 36 high-income countries during the period from 1980 to 2005 (Jaunky, 2011), and the study of three North African countries during the period from 1980 to 2012 (Kais and Ben Mbarek, 2017), are listed.

In the third group, there is bidirectional causality between economic growth and environmental pollution. Here, the study of MENA countries during the period from 1990 to 2011 (Omri, 2013), the study of Saudi Arabia during the period from 1980 to 2011 (Alkhathlan and Javid, 2013), the study of BRICS countries during the period from 1990 to 2010 (Cowan et al., 2014), and the study of Croatia during the period from 1992 to 2011 (Ahmad et al., 2017), are listed.

Studies examining the relationship between economic growth and quality of life are limited in the literature. Meng and Han (2018) investigated the relationship between Shanghai's transportation infrastructure, economy, population and environment. The cointegration relationship between the variables was analyzed by Johansen cointegration test. In the findings, the cointegration relationship between the variables was determined. According to the Granger causality test, a unidirectional causality from economic growth to population density, economic growth to CO_2 emission was determined. There is also bidirectional causality population density and economic growth.

Ali et al. (2017), studied four countries in South Asia (Bangladesh, India, Sri Lanka and Pakistan) that were investigated during the period from 1980 to 2013. The study used the Larsson panel cointegration and Durbin Hausman causality test, which used environment, renewable and non-renewable energy sources, per capita output and population density variables. In the findings, the per capita output and population density positively affect CO_2 emissions. In addition, there is a bidirectional causality relationship between population density and CO_2 emissions. Rafiq et al. (2016) analyzed 22 emerging economies during the period from 1980 to 2010. According to the findings, population density and economic growth have increased CO_2 emissions.

II. METHODS AND MATERIALS

In this paper, annual data covering the period from 1970 to 2014 were used for 12 MENA countries (Algeria, Egypt, Iran, Israel, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, Sudan, Tunisia and Turkey). Three models were analyzed empirically with economic growth (GDP), CO_2 emission (CO_2) and population density (POP) variables. These models:

Model 1: $POP_{it} = \gamma_1 + \beta_{1i} GDP_{it} + \beta_{2i} CO2_{it} + \varepsilon_{it}$ (1)

Model 2: $CO2_{it} = \gamma_2 + \beta_{3i} GDP_{it} + \beta_{4i} POP_{it} + \varepsilon_{it}$ (2)

Model 3: $GDP_{it} = \gamma_3 + \beta_{5i} POP_{it} + \beta_{6i} CO2_{it} + \varepsilon_{it}$ (3)

where $i = 1,2, \ldots, N$ refers to the number of cross sections in the panel, $t = 1,2, \ldots, T$ is the time dimension. GDP (current US \$), CO_2 (kt) and POP (people per sq. Km of land area) were used in the natural logarithm.

A. CROSS SECTION DEPENDENCE ANALYSIS

In this study, it was determined that a cross sectional dependence analysis should be performed. Thus, the unit root test and cointegration test to be used will be selected correctly. In case of cross sectional dependence, the unit root and cointegration test should be selected from the second generation tests. Cross-sectional dependence tests used in the study include; Breusch-Pagan (1980) CD_{LM} test, Pesaran (2004) CD_{LM} test, Pesaran (2004) CD test and Pesaran vd. (2008) Bias Adjusted LM_{ADJ} test. Hypotheses for tests H_0: No cross sectional dependency and H_1: There is a cross sectional dependency. Breusch-Pagan (1980) CD_{LM} and Pesaran (2004) CD_{LM} tests give better results when the time dimension is larger than the cross sectional size (T> N), Pesaran (2004) CD and Pesaran vd. (2008) Bias Adjusted LM_{ADJ} tests give better results when the cross sectional size is larger than the time dimension (N> T). In this study, the results of the four tests were given to show that the results were consistent.

B. UNIT ROOT TEST

In this study, a second-generation panel unit root test, Pesaran (2007) CADF panel unit root test was used. This test is based on the extended Dickey-Fuller (ADF) regression.

$$\Delta x_{it} = z'_{it}\gamma + \rho_i x_{it-1} + \sum_{j=1}^{k_i} \phi_{ij} \Delta x_{it-j} + \varepsilon_{it} \quad (4)$$

where, k_i is the lag length; z_{it} is the determinant terms and ρ_i is the first-order autoregressive parameters specific to the section.

Standard Im, Pesaran and Shin (2003) IPS testing can lead to false inferences in the case of external economies or shocks. Hence, Pesaran (2007) suggested that the cross-sectional expanded IPS test is to be used. This test is the cross-sectional averages of delayed levels and the first difference of individual series and the extended ADF regression (Herzer, 2016). Accordingly, the cross-sectional expanded ADF (CADF) regression;

$$\Delta x_{it} = z'_{it}\gamma + \rho_i x_{it-1} + \sum_{j=1}^{k_i} \phi_{ij} \Delta x_{it-j} + \alpha_i \bar{x}_{t-1} + \sum_{j=0}^{k_i} \eta_{ij} \Delta \bar{x}_{t-j} + \nu_{it} \quad (5)$$

where, $\bar{x}_t$ is the cross sectional mean of x_{it} and $\bar{x}_t = N^{-1} \sum_{i=1}^{n} x_{it}$. Stability is determined by taking the arithmetic mean of CADF statistics calculated for each section.

$$CIPS = t - bar = N^{-1} \sum_{i=1}^{N_i} t_i \quad (6)$$

where, t_i is the OLS t-ratio of ρ_i in equation 5. The critical value is compared with the table values in Pesaran (2007).

C. TESTING SLOPE HOMOGENEITY

Testing slope homogeneity was presented to the literature by Swamy (1970). Pesaran and Yamagata (2008) developed the Swamy (1970) test. According to a general cointegration equation:

$$Y_{it} = \alpha + \beta_i X_{it} + \varepsilon_{it} \quad (7)$$

where, β_i, slope coefficients are analyzed between the cross sections. The null hypothesis of this test is $H_0: \beta_i = \beta$; slope coefficients are homogeneous and the alternative hypothesis $H_1: \beta_i \neq \beta$; slope coefficients are heterogeneous. Pesaran and Yamagata (2008) developed the following tests to test hypotheses:

$$\tilde{\Delta} = \sqrt{N} \frac{N^{-1}\tilde{S} - k}{\sqrt{2k}} \quad (8)$$

$$\tilde{\Delta}_{adj} = \sqrt{N} \frac{N^{-1}\tilde{S} - k}{\sqrt{Var(t,k)}} \quad (9)$$

where, N is the number of cross sections, S is the Swamy test statistic, k is the number of explanatory variables and $\sqrt{Var(t,k)}$indicates the standard error. Equality 8; is used for large samples, however equality 9 is used for small samples (Govdeli, 2019).

D. COINTEGRATION ANALYSIS

In this part of the study, the cointegration relationships in the models were analyzed by the LM bootstrap panel cointegration test developed by Westerlund and Edgerton (2007). The LM bootstrap panel cointegration test is based on the Lagrange multiplier test developed by McCoskey and Kao (1998). The test of McCoskey and Kao (1998) ignores the cross-sectional dependence, while the LM bootstrap test takes into account the cross sectional dependence.

$$y_{it} = \sigma_i + x_{it}'\beta_i + z_{it} \quad (10)$$

where, $t = 1,2, \dots, T$ and $i = 1,2, \dots, N$ are respectively time series and cross section units. The x_{it} vector has a size K. The regressors are assumed to follow a pure random walk process. Error terms z_{it} are presented as follows:

$$z_{it} = u_{it} + v_{it} \text{ with } v_{it} = \sum_{j=1}^{t} n_{ij} \quad (11)$$

where, n_{ij} is an independent and identically distributed (i.i.d.) process with a zero mean and variance $n_{ij} = \sigma_i^2$.

The vector w_{it} is a a linear process satisfying.

$$w_{it} = \sum_{j=0}^{\infty} \alpha_{ij} e_{it-j}$$

where, e_{it} is i.i.d. zero error during t. The Westerlund and Edgerton (2007) hypothesis of panel cointegration test $H_0: \sigma_i^2 = 0$ for all i against $H_1: \sigma_i^2 > 0$ for some i. The Westerlund and Edgerton (2007) panel cointegration test can be estimated as follows:

$$LM_N^{+} = \frac{1}{NT^2} \sum_{i=1}^{N} \sum_{i=1}^{T} \widehat{\omega}_i^{-2} S_{it}^2 \quad (12)$$

where, S_{it} is the partial sum process of $\hat{z}_{it}$ and $\widehat{\omega}_i^2$ is the estimated long-run variance of u_{it} conditional on Δx_{it}.

E. COINTEGRATION COEFFICIENTS ESTIMATE ANALYSIS

In this study, the method used to estimate the cointegration coefficients of the variables was presented by Eberhardt and Bond (2009) Augmented Mean Group Estimator (AMG). The AMG estimator is a test that can be used when the variables are stationary in I (1) and have cross sectional dependence. In the first stage of this test, a standard FMOLS regression is shown with first T-1 year dummy. In the second stage, the unrevised common effect is replaced by a sequence of estimation coefficients on time puppets and individual regressions are estimated by OLS (Eberhardt and Bond (2009); Guloglu and Bayar (2016); Atasoy (2017).

$$\Delta y_{it} = \gamma_{1i} + \delta_i \Delta x_{it} + \omega_i f_t + \sum_{t=2}^{T} \theta_t \, DUMMY_t + \varepsilon_{it} \qquad (13)$$

where, Δ is the operator of the difference, y is the identical of the time dummies and the common dynamic process. Group-specific model parameters are averaged throughout the panel.

$$AMG = N^{-1} \sum_{i=1}^{N} \tilde{\delta}_i \qquad (14)$$

where, $\tilde{\delta}_i$ is the estimate of the coefficients in equation 13.

F. EMIRMAHMUTOĞLU and KOSE PANEL CAUSALITY ANALYSIS

Emirmahmutoğlu and Köse (2011) causality analysis gives causality relations between the cross sections as well as the causality relationship across the panel.

In the Emirmahmutoğlu and Köse (2011) panel causality test, the LA-VAR approach of Toda and Yamamoto (2005) was expanded by using Meta analysis. The variables stationary I(0) or I (1) are suitable for the implementation of this test. In addition, the cointegration relationship is not considered in this test. Fisher's (1932) test statistic was used to test Granger causality in heterogeneous panels. P values are independent variables of pi (i = 1,…, N). Fisher test statistics (λ):

$$\lambda = -2 \sum_{i=1}^{N} \ln(p_i), \quad i=1,2\ldots N \qquad (15)$$

where, p_i is the p value corresponding to the Wald statistics of the i-th. This test with a chi-square distribution with 2N degrees of freedom applies only if it is fixed to N, T → ∞.

In the Emirmahmutoğlu and Köse (2011) test, the heterogeneous mixed panels with ki + d max delayed VAR model are as follows:

$$x_{it} = \mu_i^x + \sum_{j=1}^{k_i+dmax_i} A_{11,ij} x_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} A_{12,ij} y_{i,t-j} + u_{i,t}^x \qquad (16)$$

$$y_{it} = \mu_i^y + \sum_{j=1}^{k_i+dmax_i} A_{21,ij} x_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} A_{22,ij} y_{i,t-j} + u_{i,t}^y \qquad (17)$$

where, $dmax_i$ is maximal order of integration suspected to occur in the system for each i. In equality (16), the focus is on X' to Z causality testing. A similar procedure was applied within the equation (17).

III. RESULTS and DISCUSSIONS

When estimating the three-way bonds between CO_2 emissions, quality of life and economic growth, it is necessary to first determine the cross-sectional dependence of the variables. The cross-sectional dependence of the variables is presented below.

Table 1: Cross Sectional Dependence Tests Results

TESTS	POP Statistic	p-value	GDP Statistic	p-value	CO_2 Statistic	p-value
CD_{LM} (BP,1980)	255.387	0.018	508.546	0.000	128.359	0.000
CD_{LM} (Pesaran, 2004)	16.484	0.009	38.519	0.000	5.428	0.000
CD (Pesaran, 2004)	4.255	0.012	8.005	0.000	-3.681	0.000
LM_{ADJ} (PUY, 2008)	7.320	0.000	14.312	0.000	16.165	0.000

Table 1 shows the cross sectional dependence results of each variable. The null hypothesis was rejected according to the results of four tests. In other words, there is a cross-sectional dependence on population density, economic growth and CO_2 emission. Due to the cross sectional dependence of the variables, the panel unit root test should be selected from the second generation panel unit root tests.

Table 2: Panel Unit Root Test Results

	lnPOP	**lnGDP**	**LNCO₂**	**ΔlnPOP**	**ΔlnGDP**	**ΔlnCO₂**
	CADF-statistic	CADF-statistic	CADF-statistic	CADF-statistic	CADF-statistic	CADF-statistic
Panel	-2.084	-2.329	-2.242	-4.047*	-3.494*	-4.337*

Note: The critical table values N=28 T=34, on pg. 280 on Table IIb constant is -2.55 at 1% and -2.33 at 5%, max lag length is taken as 3 and optimal lag lengths are determined by Schwarz information criterion. * and ** represents the significance level of 1% and 5% respectively.

The Pesaran (2007) CADF panel unit root test results are presented in Table 2. According to the test results, population density, economic growth and CO_2 emission variables are not stable at the level I(0). With the difference of the variables, they became stationary from the first order I(1).

In order to determine the cointegration tests to be used in this study, it is necessary to determine the cross sectional dependence and slope coefficients homogeneity. The results of cross section dependence and homogeneity results of MODEL 1, MODEL 2 and MODEL 3 are presented below.

Table 3: Cross Section Dependence and Homogeneity Tests

MODEL 1		
$POP_{it} = \gamma_1 + \beta_{1i}GDP_{it} + \beta_{2i}CO2_{it} + \varepsilon_{it}$	**Statistic**	**p-value**
Cross-section dependency tests:		
CD_{LM} (BP,1980)	379.912	0.000
CD_{LM} (Pesaran, 2004)	27.323	0.000
CD (Pesaran, 2004)	6.731	0.000
LM_{ADJ} (PUY, 2008)	47.696	0.000
Homogeneity tests:		
$\tilde{\Delta}$	28.358	0.000
$\tilde{\Delta}_{adj}$	29.678	0.000
MODEL 2		
$CO2_{it} = \gamma_2 + \beta_{3i}GDP_{it} + \beta_{4i}POP_{it} + \varepsilon_{it}$	**Statistic**	**p-value**
Cross-section dependency tests:		
CD_{LM} (BP,1980)	344.169	0.000
CD_{LM} (Pesaran, 2004)	24.211	0.000
CD (Pesaran, 2004)	10.601	0.000
LM_{ADJ} (PUY, 2008)	31.392	0.000
Homogeneity tests:		
$\tilde{\Delta}$	37.011	0.000

$\tilde{\Delta}_{adj}$	38.733	0.000
MODEL 3 $GDP_{it} = \gamma_3 + \beta_{5i}POP_{it} + \beta_{6i}CO2_{it} + \varepsilon_{it}$	**Statistic**	**p-value**
Cross-section dependency tests:		
CD_{LM} (BP,1980)	529.768	0.000
CD_{LM} (Pesaran, 2004)	40.366	0.000
CD (Pesaran, 2004)	19.071	0.000
LM_{ADJ} (PUY, 2008)	34.021	0.000
Homogeneity tests:		
$\tilde{\Delta}$	18.144	0.000
$\tilde{\Delta}_{adj}$	18.989	0.000

In order to select the cointegration test, firstly, a cross correlation analysis is required in regressions. Table 3 shows the cross sectional dependence and homogeneity results of three regressions. According to the findings, the hypothesis of the null hypothesis is rejected. Hence, there is a cross-sectional dependence in all three models. The homogeneity test results are given in Table 3 too. In all three models, the null hypothesis was rejected, and the slope coefficients were found to be heterogeneous in the panel.

Table 4: Panel Cointegration Test Results

	Statistic	**bootstap p-value**
MODEL 1		
LM_N^+	4.415	0.936
MODEL 2		
LM_N^+	3.233	0.139
MODEL 3		
LM_N^+	2.138	0.287

Table 4 shows Westerlund and Edgerton (2007) panel cointegration test results. The test statistics, the hypothesis of the null hypothesis in the panel, which is the null hypothesis can not be rejected in all three models. Thus, there are cointegration relationships in three models. In other words, it is concluded that the series will act together in the long term. No coincidence regression will be encountered in the cointegration analysis.

Table 5: Cointegration Coefficient Estimates Test Results

	MODEL 1 $POP_{it} = \gamma_1 + \beta_{1i}GDP_{it} + \beta_{2i}CO2_{it} + \varepsilon_{it}$	
	Cointegration Coefficient	**p-value**
GDP	0,125*	0.002
CO_2	-0,356*	0.000
	MODEL 2 $CO2_{it} = \gamma_2 + \beta_{3i}GDP_{it} + \beta_{4i}POP_{it} + \varepsilon_{it}$	
	Cointegration Coefficient	**p-value**
GDP	0,224*	0.000
POP	1,101*	0.000
	MODEL 3 $GDP_{it} = \gamma_3 + \beta_{5i}POP_{it} + \beta_{6i}CO2_{it} + \varepsilon_{it}$	
	Cointegration Coefficient	**p-value**
POP	1.021*	0.001
CO_2	0,974*	0.000

Note: *, ** and *** represents the significance level of 1%, 5% and 10% respectively.

After the cointegration relationship was determined between the variables, the cointegration coefficient estimates were estimated by the AMG cointegration estimator method. According to the findings of Model 1, the economic growth coefficient was found 0.125 and is statistically significant. The coefficient of CO_2 emissions was determined as -0.356. In Model 2, economic growth and population density coefficients are positive and significant according to 1%. In Model 3, the elasticity coefficients of population density and emission were positive and significant according to 1% level. The fact that the elasticity coefficients of population density in Models 2 and 3 are greater than 1 indicates that this variable is an elastic variable (Table 5).

Table 6: The causality relationship between GDP and POP

Country	Lag	GDP↛POP	p-value	POP↛GDP	p-value
Algeria	3	1.904	0.592	14.875*	0.002
Egypt	3	2.157	0.541	6.564***	0.087
Iran	3	1.360	0.715	4.225	0.238
Israel	2	2.171	0.338	6.750**	0.034
Jordan	3	2.367	0.500	3.036	0.386
Kuwait	1	0.628	0.428	0.049	0.825
Morocco	3	12.001*	0.007	8.307**	0.040
Qatar	3	3.181	0.365	18.742*	0.000
Saudi Arabia	3	4.698	0.195	10.064**	0.018
Sudan	3	5.112	0.164	4.472	0.215
Tunisia	3	5.637	0.131	8.663**	0.034
Turkey	3	17.398*	0.001	1.745	0.627
Fisher stat.		45.882*	0.005	70.687*	0.000

Note: *, ** and *** represents the significance level of 1%, 5% and 10% respectively.

Table 6 shows the Emirmahmutoğlu and Köse (2011) panel causality results between economic growth and population density. According to the results of causality relationship between cross sections; the hypothesis of "economic growth is not the cause of population density" was rejected in Turkey. For this reason, economic growth is the cause of population density in Turkey. Additionally, the hypothesis of "population density is not the cause of economic growth" was rejected in Algeria, Egypt, Israel, Saudi Arabia and Tunisia. This explains why population density is the cause of economic growth in Algeria, Egypt, Israel, Saudi Arabia and Tunisia. With respect to the causality relation in the panel, bidirectional causality relationship between CO_2 emissions and economic growth was determined.

Table 7: The causality relationship between GDP and CO_2

Country	Lag	GDP↛CO_2	p-value	CO_2↛GDP	p-value
Algeria	1	0.098	0.754	0.339	0.560
Egypt	1	0.062	0.803	4.055**	0.044
Iran	1	3.368***	0.066	0.679	0.410
Israel	1	0.363	0.547	2.099	0.147
Jordan	2	0.557	0.757	0.185	0.912
Kuwait	2	5.694***	0.058	2.830	0.243
Morocco	3	1.682	0.641	12.672*	0.005
Qatar	1	0.251	0.616	1.872	0.171
Saudi Arabia	1	0.169	0.681	1.755	0.185
Sudan	1	3.653	0.056	0.515	0.473
Tunisia	2	2.009	0.366	2.539	0.281
Turkey	1	2.053	0.152	0.258	0.611
Fisher stat.		28.052	0.258	38.398**	0.032

Note: *, ** and *** represents the significance level of 1%, 5% and 10% respectively.

Table 8: The causality relationship between CO_2 and POP

Country	Lag	$CO_2 \nrightarrow POP$	p-value	$POP \nrightarrow CO_2$	p-value
Algeria	3	5.126	0.163	9.184**	0.027
Egypt	3	15.871*	0.001	2.322	0.508
Iran	3	0.687	0.876	6.710***	0.082
Israel	2	5.187***	0.075	1.622	0.444
Jordan	3	4.869	0.182	8.319**	0.040
Kuwait	2	0.049	0.976	0.445	0.801
Morocco	3	8.957**	0.030	10.502**	0.015
Qatar	3	0.667	0.881	1.438	0.697
Saudi Arabia	3	4.147	0.246	7.538***	0.057
Sudan	3	0.658	0.883	1.784	0.618
Tunisia	3	2.456	0.483	5.115	0.164
Turkey	3	7.692**	0.053	0.216	0.975
Fisher stat.		43.649*	0.008	41.635**	0.014

Note: *, ** and *** represents the significance level of 1%, 5% and 10% respectively.

The causality relationship between economic growth and CO_2 emissions is presented in Table 7. According to the results of causality relationship between cross sections; the hypothesis of "economic growth is not the cause of CO_2 emissions" was rejected in Iran and Kuwait. Therefore, economic growth is the cause of CO_2 emissions in these countries. Furthermore, the null hypothesis of "CO_2 emissions are not the cause of economic growth" was rejected in Egypt and Morocco. Thus, CO_2 emissions are the cause of economic growth in Egypt and Morocco. According to the causality relation in the panel, CO_2 emissions are the cause of economic growth.

The panel causality relationship between CO_2 emissions and population density is shown in Table 8. In the findings, the hypothesis of "CO_2 emissions are not the cause of population density" was rejected in Egypt, Israel and Turkey. So, CO2 emissions are the cause of population density in Egypt, Israel and Turkey. Also, the null hypothesis of "population density is not the cause of CO_2 emission" was rejected in Algeria, Iran, Jordan, Morocco and Saudi Arabia. Thus, population density is the cause of CO_2 emissions in Algeria, Iran, Jordan, Morocco and Saudi Arabia. In addition, bidirectional causality relationship between CO_2 emissions and population density was determined.

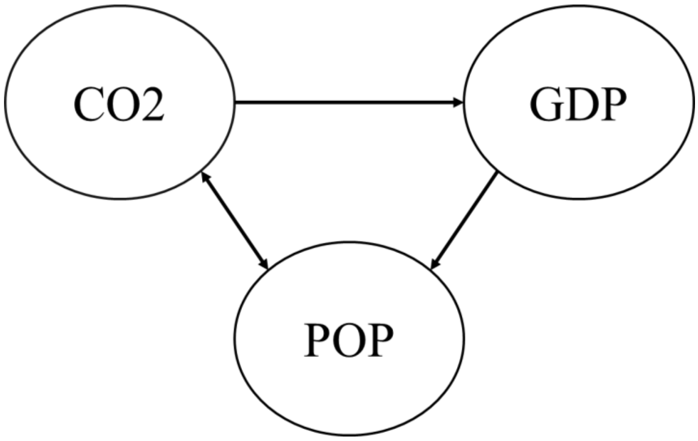

Figure 1: Causality Relationship in MENA

CONCLUSION AND POLICY IMPLICATIONS

In this study, the relationship between quality of life, CO_2 emissions and economic growth of 12 MENA countries (Algeria, Egypt, Iran, Israel, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, Sudan, Tunisia and Turkey) was investigated over the period of 1970–2014. First of all, the cross sectional dependencies of variables were examined. The second generation unit root test Pesaran (2007) CADF panel unit root test was used due to the cross sectional dependence between the variables. Three variables were found to be stationary in I (1).

The Westerlund and Edgerton (2007) panel cointegration tests were applied to the heterogeneous models of cointegration coefficients and the cointegration relationship was determined in all three models. The cointegration coefficients were estimated by Eberhardt and Bond (2009) AMG cointegration coefficient estimator. According to the findings, CO_2 emissions negatively affect the quality of life. CO_2 emissions and quality of life affect the economic growth positively. Moreover, economic growth positively affects the quality of life.

In the last stage of empirical analysis, the causality relation was investigated by the Emirmahmutoglu and Kose (2011) panel causality test. In the findings, a unidirectional causality relationship from CO_2 emissions to economic growth was determined. The results are also supported by several other studies. (Pao and Tsai, 2010; Azlina et al., 2014; Lim et al., 2014). Consequently, CO_2 emissions have a decisive role in economic growth. Therefore, taking measures to reduce CO_2 emissions may adversely affect economic growth. When applying economic growth policies, attention should be carefully given to ensure that environmental quality does not deteriorate human health.

Empirical analyzes also point to a unidirectional causality relationship from economic growth to quality of life. Increasing the quality of life of economic growth is an issue that policy makers should pay attention to. The aim should be to increase social welfare by increasing the quality of life by means of planned and sustainable growth. In addition, a bidirectional causality relationship between CO_2 emissions and quality of life was determined.

The main policy results of the study are as follows. These countries need to better implement environmental policies and take measures to reduce CO_2 emissions. Situations that will negatively affect economic growth should be avoided while reducing CO_2 emissions. In this way, policies that will support alternative growth should be put into effect. The inclusion of new technologies in the system and the awareness of people about environmental pollution are among the necessary measures for a cleaner environment.

In addition, countries need to shift towards alternative energies by reducing the non-renewable energy consumption, which is one of the most important factors that increase CO_2 emissions. For clean energy, resources and investments should be increased and cleaner environmental policies should be applied. With strict CO_2 emission policies being implemented, the environment will be less polluted, and people will be less affected by health problems. High economic growth will further increase environmental pollution. However, it will reduce the unemployment problem. Policy makers need to better analyze this opportunity cost. Policy makers who have to choose between unemployment or environmental problems should take medium and long-term policies and measures to improve the quality of life.

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