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CO_2 Emission, Energy Consumption, Economic Growth and Tourism for Turkey: Evidence from a Cointegration Test with a Structural Break

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Abstract :In this study, two different models were employed by using the data for the period of 1963-2011 in Turkey. In the first model, the effect of CO_2 emission, economic growth, and international tourism on energy consumption was investigated in Turkey. In the second model, the effect of energy consumption, economic growth, and international tourism on CO_2 emission was studied. For this purpose, the stationarity of the series was analyzed by using traditional unit root tests (ADF and PP unit root tests) and unit root tests with structural breaks (Zivot and Andrews (1992), Lumsdaine and Papell (1997), Lee and Strazicich (2003, 2004) and Kapetanios(2005)). Since the series contained unit root at the level and were stationary at the first difference, the process continued with cointegration analysis. The results of the cointegration test developed by Maki (2012), which allows for 5 breaks, showed the presence of a cointegration relationship in both analyses. In the last section of the study, cointegration coefficient estimator DOLS was used. The findings show that an increase in international tourist arrivals decreases energy consumption and CO_2 emission. For this reason, it is necessary for policymakers to develop policies that focus on tourism to decrease environmental pollution.

INTRODUCTION

International tourism mobility is important in terms of not only its effect on economic growth but also energy consumption. Tourism is one of the sectors with the highest energy consumption. Consumption is at high levels in various areas related to the tourism sector, particularly in transportation through airways. Although a relationship between energy consumption and economic growth is mentioned in the energy economy literature, there are studies examining this relationship that present different results.

This study will investigate the tourism sector, which is expected to have a positive effect on economic growth for Turkey, also together with the high amount of energy consumption it causes, that is, carbon emissions.

LITERATURE REVIEW

In the last a few decades, various studies have been conducted on the relationship between economic growth, energy, and environmental pollution. Some of the latest studies were conducted by Wang et al., (2016), Jebli et al., (2016), andAlshehry and Belloumi(2015). At the same time, there is a considerable number of studies on the relationship between economic growth and tourism in the literature ((Seetanah et al., 2015), (Cárdenas-García et al., 2015), (Jaforullah, 2015)). The number of the studies on the relationship between environmental pollution and tourism, which have recently appeared in the literature, has been increasing in recent years (Kai et al., 2014), (Robaina-Alves et al., 2015).

The causality relationship between economic growth and energy consumption is summarized by four hypotheses: i) Feedback hypothesis states that there is a bidirectional causality between the two variables, an increase in energy consumption will have a positive effect on economic growth, and an increase in economic activities will increase energy consumption (Al Mulali et al., 2014), (Ben Jebli et al., 2014). ii) Neutrality hypothesis assumes that the share of energy consumption within the aggregate output is very small, and there is no causality between a change in energy consumption and economic growth (Odhiambo, 2009), (Abosedra et al., 2015). iii) Conservation hypothesis states that a unidirectional causality runs from economic growth to energy consumption, and an increase in real GDP causes an increase in energy consumption (Apergis and Payne, 2009a,b), (Esso, 2010). iv) Growth hypothesis assumes a unidirectional causality from energy consumption to economic growth, and restrictive policies on energy consumption will adversely affect economic growth (Ozturk, 2010), (Belke et al., 2011).

The first study in the literature investigating the relationship between economic growth and energy consumption was conducted by Kraft and Kraft (1978). In their study on the US for the period between 1947 and 1974, they found a causality relationship from economic growth to energy consumption. Following the study by Kraft and Kraft (1978), Granger causality testing approach

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became a popular tool for investigating the relationship between economic growth and energy consumption in several countries (Ignadora, 2010), (Belloumi, 2009).

In the energy economy literature, there are various studies investing the relationship among CO_2 emission, economic growth, and energy consumption. Studies on testing the environmental Kuznets curve (EKC) hypothesis have recently been highly popular. In their study covering the period between 1968 and 2005 in Turkey, Oztürk and Acaravcı (2010) determined a long term relationship between the variables at a significance level of 5%. They found out that CO_2 emission and energy consumption was not a Granger cause of real production, and the EKC hypothesis was not valid in Turkey. Shahbaz et al., (2014) conducted a study using an ARDL bounds testing approach and the VECM Granger causality test, and found that the EKC hypothesis was valid in Tunisia. Some other studies on the EKC hypothesis can be listed as (Tan et al., 2014), (Leitão and Shahbaz, 2013), (Yavuz, 2014), (Osabuohien et al., 2014), (Govindaraju and Tang, 2013), (Pao et al., 2011), and so forth.

Previous studies on the relationshipbetween tourism and economic growth presented results in the direction that tourism positively contributes to economic growth (Falk, 2010), (Bernini, 2009), (Blackstock et al., 2009), (Tuğcu, 2014), (Liv et al., 2013), (Kadir and Karim, 2012), (Tang and Tan, 2015). The studies aimed to show that tourism is an important factor on economic growth in the long term, and stated that there is a causality from tourism to economic growth. Çağlayan et al., (2012) found bidirectional causality for European countries, unidirectional causality from tourism to economic growth in America, Latin America and the Caribbean region, and unidirectional causality from economic growth to tourism in the remaining regions. Lee and Chang (2008) found that while there was a causality from tourism to economic growth in OECD countries, there was a bidirectional causality between the variables in non-OECD countries. In a study on South Korea and Taiwan, a causality relationship was found between tourism and economic growth in South Korea, and tourism-led economic growth was observed in Taiwan (Chen and Chiou-Wei, 2009). (Arslantürk and Atan, 2012), (Gökovalı, 2010), (Aslan, 2015), (Kaplan and Aktaş, 2015) investigated the effect of tourism on economic growth in Turkish economy. Their results revealed that tourism was a causative of economic growth.

There is a limited number of studies investigating the relationship among tourism, economic growth, and CO_2 emissions using econometric techniques. In their studies, Katırcioğlu et al., (2014), Lin (2010), and Lee and Brahmasrene (2013) found long term relationships among the variables. In their study on Cyprus, Katırcioğlu et al., (2014) determined a positive and significant relationship between international tourist arrivals, and economic growth and CO_2.

DATA AND METHODOLOGY

Thevariablesincluded in theempiricalanalysisareenergyconsumption (E, in kg of oilequivalentpercapita) CO_2emissions(CO_2, in metrictonspercapita), GDP percapita (GDP, current US$) andinternationaltourism(T, total number ofarrivals). Thedata on energyconsumption, CO_2emissionsandGDPweretakenfromtheWordBank Development Indicators, internationaltourism was takenfromthe TURKSTAT.

The present study comprises the period between 1963 and 2011 on annual basis. The variables used in the study are valid for Turkey, and consist of the data for energy consumption (E), carbon dioxide emission (CO_2), economic growth (GDP), and international tourist arrivals (T). Theoretically, in this study, the models used by Katırcıoğlu et al. (2014) were developed by adding the economic growth series. Tourism-induced models are as follows:

$$E_t = f(GDP_t, CO_{2t}, T_t) \quad (1)$$

$$CO_{2t} = f(GDP_t, E_t, T_t) \quad (2)$$

Where$E$ is energy consumption kg of oilequivalentpercapita,CO_2 emissions in metrictonspercapita, GDP is percapita (current US$) and$T$ is international tourist arrivals.
Thenaturallogarithmictransformation of Equation 1 and 2 yieldsthefollowingequations:

$$lnE_t = \beta_0 + \beta_1 lnGDP_t + \beta_2 CO_{2t} + \beta_3 T_t + \varepsilon_t \quad (3)$$

$$lnCO_{2t} = \beta_0 + \beta_1 lnGDP_t + \beta_2 E_t + \beta_3 T_t + \varepsilon_t \quad (4)$$

where at period t, lnE is the natural log of energy consumption, $lnCO_2$is thenaturallog of CO_2 emissions, $lnGDP$ is the natural log of economic growth, and T is the natural log of international tourist arrivals.

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ECONOMIC FINDINGS AND EMPIRICAL FINDINGS

Unit Root and Structural Break

A nonstationary variable indicates the presence of a unit root in a time series. In the case of a nonstationary variable, the effect of a possible shock or a policy change on the variable would be permanent. In this study, Augmented Dickey and Fuller (ADF), and Phillips and Perron (PP) tests were used to test the unit root and stationarity of the series. If there is a break in the series, the results of the ADF, PP, KPSS and Ng-Perron unit root tests tend to support the hypothesis that the series have a unit root (Perron, 1989:1361). Perron (1989) developed a model that can be used when the break date is known. However, Zivot and Andrews (1992) criticized this model and developed a single break model in which the break date is endogenously determined. Lumsdaine and Papell (1997) stated that when the series used in the study covered long periods and single breaks are taken into account, the series could yield wrong results. They improved Zivot and Andrews (1992) one break model and developed a unit root test with two breaks.

Zivot and Andrews (1992) and Lumsdaine and Papell (1997) models assume that there is no structural break in the null hypothesis that the series have a unit root, and critical values are obtained based on this assumption. To solve this problem, Lee and Strazicich (2003, 2004) developed theminimum Lagrange Multipliers (LM) unit root test introduced to the literature by Schmidt and Phillips (1992). In this model, they developed a test with one and two breaks that allows for a structural break in the null hypothesis and the alternative hypothesis.

Table 2: ADF and PP Unit Root Tests

Variables	ADF		PP	
	with constant	with constant and trend	with constant	with constant and trend
lnE	-1.112	-2.651	-1.125	-2.651
ΔlnE	-6.492***	-6.479***	-6.482***	-6.467***
$lnCO_2$	-2.446	-2.942	-2.600	-2.942
$\Delta lnCO_2$	-6.607***	-6.779***	-6.607***	-6.790***
$lnGDP$	-0.526	-2.534	-0.526	-2.740
$\Delta lnGDP$	-6.922***	-6.844***	-6.922***	-6.844***
lnT	-1.520	-3.307*	-1.520	-3.317*
ΔlnT	-7.358***	-7.454***	-7.359***	-7.452***

Schwarz Information Criteria (SIC) were used in lag selection
*** 1% significance level
** 5% significance level
* 10% significance level

According to the results of the ADF and PP unit root tests shown in Table 2, it can be seen that the energy consumption series was nonstationary at the level with constant, but became stationary after taking the first difference. It was found that the series had a unit root at the level with constant and trend, and became stationary at the first difference.

ADF and PP unit root tests show that the CO_2 series had a unit root at the level with constant. The series became stationary after taking the first difference. ADF and PP unit root tests revealed similar results with constant and trend, that is, the series had a unit root at the level, and became stationary at the first difference.

It can be seen that the GDP series had a unit root at the level both with constant and with constant and trend, and became stationary at the first difference.

In the international tourist arrivals series, both unit root tests used in the study showed the existence of a unit root at the level with constant. According to the ADF and PP unit root tests, the series became stationary after taking the first difference. It was found that with constant and trend the series had a unit root at 5% significance level, and became stationary after taking the first difference.

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Table3: Zivot and Andrews Unit Root Test

Variable	Model	Lag	Break Dates	Test Statistics	Critical Values	
					1%	5%
lnE	A	0	1972	-3.746	-5.34	-4.8
	C	0	1979	-4.103	-5.57	-5.08
$lnCO_2$	A	0	1970	-3.651	-5.34	-4.8
	C	0	1971	-3.642	-5.57	-5.08
$lnGDP$	A	2	1983	-3.69	-5.34	-4.8
	C	2	1980	-3.915	-5.57	-5.08
lnT	A	4	1979	-3.832	-5.34	-4.8
	C	4	1979	-3.952	-5.57	-5.08

Note: Critical values were obtained from Zivot and Andrews (1992).

The results of the Zivot and Andrews unit root test are presented in Table 3. According to the findings, when the stationarity of lnE, $lnCO_2$, $lnGDP$and lnT series were examined considering the structural breaks, the test statistics obtained in both Model A and Model C were smaller (in absolute value) than the critical values. For this reason, it is concluded that all four series had a unit root.

Table4: Lumsdaine and Papell Unit Root Test

Variable	Model	Lag	Break Dates	Test Statistics	Critical Values		
					1%	5%	10%
lnE	AA	0	1971 1978	-4.534	-6.74	-6.16	-5.89
	CC	0	1978 2000	-6.154	-7.19	-6.75	-6.48
$lnCO_2$	AA	0	1969 2000	-4.328	-6.74	-6.16	-5.89
	CC	0	1977 2000	-5.581	-7.19	-6.75	-6.48
$lnGDP$	AA	2	1982 1993	-4.666	-6.74	-6.16	-5.89
	CC	2	1982 1998	-4.757	-7.19	-6.75	-6.48
lnT	AA	4	1978 1998	-5.45	-6.74	-6.16	-5.89
	CC	4	1974 1987	-5.635	-7.19	-6.75	-6.48

Note: Critical values were taken from Ben David et al. (2003).

Lumsdaine and Papell test is a unit root test that allows for two breaks. According to the results presented in Table 4, the test statistics of lnE, $lnCO_2$, $lnGDP$ and lnT series for both Model AA, where there is a break in the constant term, and Model CC, which allows for a break both with constant and with trend,are smaller (in absolute value) than the critical values. For this reason, with the break dates observed, the basic hypothesis ofunit root with structural break is accepted. Thus, the series have a unit root.

Table 5: Lee and Strazicich Single Break Unit Root Test

Variable	λ Value	Model	Lag	Break Dates	Test Statistics	Critical Values		
						1%	5%	10%
lnE		AA	0	1998	-2.282	-4.239	-3.566	-3.211
	λ1:0.33	CC	0	1978	-3.103	-5.15	-4.45	-4.18
$lnCO_2$		AA	0	2000	-1.669	-4.239	-3.566	-3.211
	λ1:0.29	CC	10	1976	-3.031	-5.15	-4.45	-4.18
$lnGDP$		AA	3	2000	-3.005	-4.239	-3.566	-3.211
	λ1:0.23	CC	3	2000	-4.126	-5.07	-4.47	-4.2
lnT		AA	4	1998	-3.417	-4.239	-3.566	-3.211
	λ1:0.33	CC	5	1978	-4.857	-5.15	-4.45	-4.18

Note: Critical values were taken from Lee, Strazicich (2004).

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The results of Lee and Strazicich single break unit root test are presented in Table 5. In Model AA, which allows for a break at the level, since the test statistics of lnE, $lnCO_2$ and $lnGDP$ series are smaller (in absolute value) than the critical values at 1%, 5%, and 10% significance level, and the test statistics of lnT series are smaller (in absolute value) than the critical values at 1% and 5%, significance level, the basic hypothesis of unit root with structural break is accepted with the structural break date. Thus, the series have a unit root. Since the test statistics of lnE, $lnCO_2$ and $lnGDP$ series for Model CC, which allows for a break with both constant and trend, are smaller (in absolute value) than the critical values at 1%, 5%, and 10% significance level, and the test statistics of lnT series are smaller (in absolute value) than the critical values at 1% significance level, the basic hypothesis of unit root with structural break is accepted with the structural break dates, and the series are not stationary.

Table6: Lee and Strazicich Two-Break Unit Root Test

Variable	λ Value	Model	Lag	Break Dates	Test Statistics	Critical Values		
						1%	5%	10%
lnE		AA	5	1987 2000	-2.898	-4.545	-3.842	-3.504
	λ1:0.37 λ2:0.75	CC	6	1980 1999	-6.26	-6.42	-5.65	-5.32
$lnCO_2$		AA	1	1987 2000	-2.189	-4.545	-3.842	-3.504
	λ1:0.35 λ2:0.75	CC	7	1979 1999	-6.11	-6.42	-5.65	-5.32
$lnGDP$		AA	8	1979 1993	-4.289	-4.545	-3.842	-3.504
	λ1:0.39 λ2:0.77	CC	3	1981 2000	-5.499	-6.42	-5.65	-5.32
lnT		AA	4	1985 1992	-3.517	-4.545	-3.842	-3.504
	λ1:0.33 λ2:0.94	CC	10	1978 2008	-6.194	-6.42	-5.65	-5.32

Not: Critical values were taken from Lee, Strazicich (2003).

The results of Lee and Strazicich two-break unit root test are given in Table 6. In Model AA, which allows for a break at the level, the test statistics of lnE and $lnCO_2$ series are smaller (in absolute value) than the critical values at 1%, 5%, and 10% significance level, the test statistics of $lnGDP$ series are smaller (in absolute value) than the critical values at 1% significance level, and the test statistics of lnT series are smaller (in absolute value) than the critical values at 1% and 5% significance level. Thus, the basic hypothesis of unit root with structural break is accepted with the structural break dates, that is, the series have a unit root. The results of the test statistics of lnE, $lnCO_2$ and lnT series for Model CC, which allows for a break with both constant and trend, are smaller (in absolute value) than the critical values at 1% significance level. Besides, the test statistics of$lnGDP$ series are smaller (in absolute value) than the critical values at 1% and 5% significance level. Therefore, with the structural break dates, the series have a unit root with structural break.

Table 7: Kapetanios Unit Root Test

lnE			
MODEL	Number of Breaks	Test Statistics	Break Dates
A	1*	-4.368	1971
	2	-5.818	1971, 2000
	3	-6.507	1971, 1980, 2000
	4	-6.877	1971, 1980, 1990, 2000
	5	-6.854	1971, 1980, 1990, 2000, 2006
C	1*	-4.729	1978
	2	-6.35	1978, 2000
	3	-6.491	1967, 1978, 2000
	4	-6.501	1967, 1978, 1990, 2000
	5	-6.926	1967, 1978, 1984, 1990, 2000
$lnCO_2$			
MODEL	Number of Breaks	Test Statistics	Break Dates
A	1*	-3.837	1988
	2	-5.054	1988, 2000
	3	-6.733	1974, 1988, 2000
	4	-7.794	1974, 1980, 1988, 2000
	5	-7.822	1974, 1980, 1988, 1993, 2000
C	1*	-3.642	1970
	2	-4.479	1970, 1998
	3	-5.415	1970, 1978, 1998
	4	-5.432	1970, 1978, 1993, 1998
	5	-5.419	1970, 1978, 1993, 1998, 2005
$lnGDP$			
MODEL	Number of Breaks	Test Statistics	Break Dates
A	1*	-4.62	1990
	2	-4.77	1990, 1999
	3	-5.388	1985, 1990, 1999
	4	-5.298	1972, 1985, 1990, 1999
	5	-5.115	1972, 1985, 1990, 1999, 2006
C	1*	-3.938	1971
	2	-4.941	1971, 1998
	3	-5.178	1971, 1979, 1998
	4	-5.988	1971, 1979, 1988, 1998
	5	-5.571	1971, 1979, 1988, 1998, 2006
lnT			
MODEL	Number of Breaks	Test Statistics	Break Dates
A	1*	-5.296	1978
	2	-6.186	1978, 1998
	3	-6.507	1978, 1998, 2005
	4	-7.956	1978, 1985, 1998, 2005
	5	-7.911	1972, 1978, 1985, 1998, 2005
C	1*	-4.984	1978
	2	-5.569	1978, 1998
	3	-6.291	1978, 1986, 1998
	4	-5.88	1978, 1986, 1998, 2003
	5	-5.803	1967, 1978, 1986, 1998, 2003

Note: Critical values were taken from Kapetanios (2005), and are -5.338 at 1%, -4.93 at 5%5 and-4.661 at10% for MODEL A, and -5.704 at 1%, -5.081 at 5% and -4.82 at 10% for MODEL C.

The results of Kapetanios unit root test can be seen in Table 7. In this test, the value of minimum test statistics gives the optimal number of breaks. The test statistics for lnE, $lnCO_2$, $lnGDP$ and lnT series in MODEL A and MODEL Care minimum for the value where the number of breaks is one. For this reason, the optimal number of breaks for all variables is one.

In the energy consumption series, the break date was determined as 1971 for MODEL A, and since the test statistics is smaller (in absolute value) than the critical values at all significance levels, the series have a unit root. The break date for MODEL B is 1978, and the test statistics are smaller (in absolute value) than the critical values at all significance levels. Therefore, the basic hypothesis that the series have a unit root cannot be rejected.

The break date for the CO_2 emission series is 1988 in MODEL A and 1970 in MODEL C. Since the test statistics are smaller (in absolute value) than the critical values at all significance levels in both models, the series have a unit root.

In the economic growth series, the break occurred in 1990 in MODEL A. Since the test statistics are smaller (in absolute value) than the critical values at 5% and 1% significance levels, the basic hypothesis that the series have a unit root cannot be rejected. The break date for MODEL B is 1971, and the test statistics, which is smaller (in absolute value) than the critical values at all significance levels, shows that the series have a unit root.

In the international tourism series, the break date for MODEL A was found as 1978. Since the test statistics are smaller than the critical value at 1% significance level, the series are not stationary. The break date for MODEL B was also 1978, and the test statistics, which is smaller (in absolute value) than the critical values at 5% and 1% significance levels, shows that the series have a unit root.

MAKI (2012) COINTEGRATION TEST WITH MULTIPLE STRUCTURAL BREAKS

Maki (2012) introduced the cointegration test with structural breaks to the literature by using four different models. These models are;

Model 0: A model without trend that allows for a break in the constant term,

Model 1: A model without trend that allows for a break in the constant term and slope,

Model 2: A model with trend that allows for a break in the constant term and slope,

Model 3: A model with trend that allows for a break in the constant term, slope, and trend.

Table8: Results for Maki (2012) Cointegration Test with Multiple Structural Breaks

		Test Statistics	Critical Values			Structural Break Dates
			1%	5%	10%	
Analysis1	MODEL 0	-8.008***	−6.229	−5.704	−5.427	1966, 1988, 1994
	MODEL 1	-7.649***	−6.575	−6.086	−5.820	1965, 1969, 1978, 1982
	MODEL 2	-8.555***	−7.232	−6.702	−6.411	1978, 1990
	MODEL 3	-9.723***	−7.737	−7.201	−6.926	1967, 1985
Analysis 2	MODEL 0	-6.464***	−5.984	−5.517	−5.272	1969, 1984
	MODEL 1	-7.166***	−6.575	−6.086	−5.820	1965, 1969, 1978, 1984
	MODEL 2	-9.045***	−7.232	−6.702	−6.411	1978, 1985
	MODEL 3	-11.575***	−7.737	−7.201	−6.926	1981, 1989

Note: Critical values were taken from Table 1 in Maki (2012).
*** %1 significance level
** %5 significance level

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* %10 significance level

Table 8 shows the results for Maki (2012) cointegration test with multiple structural breaks. In Analysis 1, it can be seen that Models 0-1-2-3 are statistically significant at 1% significance level. For this reason, in Analysis 1 it was concluded that there is a cointegration relationship, and the series would move together in the long term. It can be seen that Analysis 2 gave similar results, and Model 0-1-2-3 are statistically significant at 1% significance level. According to the findings obtained from Analysis 1 and Analysis 2, the problem of spurious regression would not occur in the long term analyses of the series at the level.

It can be seen in Table 7 that the shocks that occur in Turkey generally reflect the dates of structural breaks.

The overvaluation of the Turkish Lira after the year 1964 reached a level of 53% in 1969. In this case, although it was necessary to make a currency readjustment, what was implemented was quantity restriction, freezing liberalization, and tax refund in exports, and premium was paid for workers' remittances and tourist foreign exchange (Şanlı, 1998:189).

The stopping of oil exports to the West by OPEC countries during the Arab-Israeli war in 1967 caused serious fluctuations in international energy markets. The second intervention of OPEC to international energy markets that occurred as an embargo to Western countries during the Yom Kippur War in 1973 resulted in the quadrupling of oil prices. Another oil shock was experienced in 1979 during the Iranian revolution (Sevim, 2012:4383-4384).

The stagflation crises that occurred in Turkey between the years of 1978 and 2001 were the crises of 1978, 1979, 1980, 1988, 1989, 1994, 1999, and 2001. The periods in which the general macroeconomic stability deteriorated the most were observed as January 1985 and January 1991, in addition to the periods indicated by the stagflation index. It can be said that 1991 Gulf crisis and the 1999 earthquake played a significant role in the emergence of the crises (Kibritçioğlu, 2001).

ESTIMATION OF LONG TERM COEFFICIENTS

The long term coefficients among the series were estimated by using the DOLS estimator. The structural breaks that occurred in the results of MODEL 2, which is the most popular model in the literature, were included in the model as dummy variable. The obtained results are given below.

Table9. Long-run estimators

Analysis 1		Analysis 2	
ENERGY as Dependent variable		CO2 as Dependent variable	
CONSTANT	6.202***	CONSTANT	-8.210***
$lnCO_2$	0.721***	lnE	1.289***
$lnGDP$	0.116***	$lnGDP$	-0.150***
lnT	-0.061**	lnT	-0.096***
$D1978$	-0.034**	$D1978$	0.061***
$D1990$	0.047***	$D1990$	-0.060***

Not: The DOLSregressionswereestimatedwithoneleadandtwolag.

*** %1 significance level

** %5 significance level

* %10 significance level

The results of DOLS long term coefficient estimator are given in Table 9. In Analysis 1 with energy as dependent variable, according to the results of the DMOLS estimator, a 1% increase in CO_2 emission causes a 0.721% increase in energy consumption. There is a significant and positive relationship between economic growth and energy consumption. A 1% increase in GDP results in a 0.116% increase in energy consumption. International tourism has a negative effect on energy consumption and has an elasticity of -0.047%. It is seen that the break that occurred in 1978 negatively affected energy consumption. It was found that the stagflation crisis that occurred in 1978 had a negative effect on energy consumption. However, the structural break in 1990 had a positive effect on energy consumption. It was found out that the policies implemented to overcome the effects of the

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crisis that occurred in 1989 became functional in 1990, and the improving market conditions had a positive effect on energy consumption.

In Analysis 2 with CO_2 emission as dependent variable, the results of the DMOLS estimator show that a 1% increase in energy consumption causes a 1.289% increase in CO_2 emission. GDP has an elasticity of -0.150, and there is a negative relationship between economic growth and CO_2 emission. A 1% increase in international tourist arrivals causes a 0.096% decrease in CO_2 emission. It is seen that the crisis experienced in 1978 increased CO_2 emission. It was also found that the structural break that occurred in 1990 increased CO_2 emission.

CONCLUSION AND EVALUATION

Two different analysis were used in the present study. In the first analysis, the effect of CO_2 emission, economic growth, and international tourism on energy consumption in Turkey was investigated. In the second analysis, the effect of energy consumption, economic growth, and international tourism on CO_2 emission was examined. In this context, first, the stationarity of the series was tested by using ADF and PP unit root tests, which are traditional unit root tests. In the second stage, the stationarity of the series was analyzed by using Zivot and Andrews (1992), Lumsdaine and Papell (1997), Lee and Strazicich (2003, 2004), and Kapetanios (2005) unit root tests, which are among tests that allow for structural breaks. The findings showed that the series had a unit root with structural breaks, and became stationary after the first differences were taken.

Since the series were stationary at I(1), the cointegration test developed by Maki (2012), which allows for 5 breaks, was implemented. It can be statedthrough an extensive review of literature that the structural breaks observed as the result of Analysis 1 and Analysis 2 in Maki (2012) cointegration test occurred due to the effect of shocks that happened in Turkey or international shocks that affected Turkey.

The findings obtained as the result of the analyses on energy consumption and CO_2 emission make a significant contribution to the literature. The point that draws attention in the present study is that international tourism has a long term relationship with energy consumption and CO_2 emission. Based on the results obtained in the study, it is proposed that tourism cannot be ruled out when developing policies aimed at decreasing CO_2 emissions, and environmental pollution can be decreased owing to the importance that will be given to international tourism.

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