CAUSAL INTERACTIONS BETWEEN CO2 EMISSIONS, FINANCIAL DEVELOPMENT, ENERGY AND TOURISM

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ABSTRACT

Aim of this study is to investigate the casual relationship between tourism, financial development, energy consumptions and carbon emissions in Turkey and four European Union countries France, Spain, Italy and Greece which are the main competitors of Turkish tourism for the 1995-2010 period. According to the results of the study, for the panel as a whole there are statistically significant feedback effects between the variables. One per cent increase in energy consumption will rise CO_2 emission by 3.02 %, a one per cent increase in the financial development will decrease CO_2 emission by 0.12 % and also one percentage increase in tourist arrival will decrease CO_2 emission by 0.11 %. The causality analysis shows uni-directional causal relationship between the tourist arrivals and financial development. And also there is a bi-directional causality relationship between CO_2 emission, financial development, and energy and tourist arrival.

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Keywords: Financial development, CO2 emissions, Cointegration, Panel data analysis, Casuality, Tourism.

JEL Classification: E44, O13, O16.

Contribution/ Originality

This study is one of very few studies which have investigated the dynamic relationship between financial development, energy consumption, carbon emissions and tourism in Turkey and competitive countries using the panel data analysis. The contribution of the paper is to fill these research gaps in the literature.

1. INTRODUCTION

The relationship between economic growth and various variables is frequently analyzed both on country basis and comparatively. Most of these studies consider financial development and energy consumption variables as the fundamental factors. Financial development in an economy is

measured by the development of financial services and financial operations. In this context, factors such as money supply, credits, financial depth can be taken as the indicators of financial development (İmamoğlu, 2013).

A change in financial development can change the level of economic development (De Gregorio and Guidotti, 1995; Arestis and Demetriades, 1997; Levine, 1997; Calderón and Liu, 2003; Aslan and Küçükaksoy, 2006; Kandır *et al.*, 2007; Aslan and Korap, 2011; Zhang *et al.*, 2012). The common outcome of these studies supports that the financial development results economic development and afterwards economic development results financial development.

As a result of financial development and economic development, energy consumption tends to increase. When we look at the studies about the energy consumption and economic development, we can see that energy consumption is a factor of economic development. However as a result of energy consumption together with the economic development, carbon emission levels also increase. Thereby, in order to maintain economic development by financial development, energy consumption must increase. But rising carbon emission ratios arise as a problem at this point. To overcome this problem, rises in tourism income can be seen as an alternative to maintain economic development. In this study, if the rises in tourism income can maintain economic development is tested.

Tourism is a fast growing industry that has demonstrated a high growth potential and a large contribution to economic development in many regions and countries around the world (Lee and Chang, 2008).

Tourism as an economic activity of primary value and importance for many countries is a widely accepted fact. Through tourism, developing countries in particular have seen a potential means to potentially cover their needs in foreign currency. Such a contribution of the tourist sector is beneficial to a country's economy due to its influence on sectors other than the foreign exchange sector, such as:

a. The business sector, through the expansion of industrial and agricultural production, so as to meet the increasing tourist wave, as well as the mobilization of international and domestic trade and the activities of various service-related industries which include transportation, telecommunications, banking, travel agencies, etc.

b. The income sector, through its contribution to the country's aggregate income, the tourist income seems to be distributed throughout a wide population stratum; this constitutes a factor of primary importance towards strengthening the development of the periphery.

c. The fiscal sector, through tourist activity, experiences beneficial results in public economics, particularly at the local level (Dritsakis and Athanasiadis, 2000).

The tourism industry is no longer regarded as a "smokeless" industry accompanying the improvement of environmental consciousness. Tourism often involves travel and accommodations, which rely on fossil fuels for the transportation of tourists to and from as well as within destinations and for hosting tourists (Lee and Brahmasrene, 2013). Transport vehicles (Gössling,

2002) the development of resorts and restaurants (Becken *et al.*, 2001) and a range of tourist activities (Becken and Simmons, 2002; Dawson *et al.*, 2010) consume energy and emit carbon dioxide (Gössling, 2005).

However, tourism is also an industry that involves intensive use of fossil fuels (Gössling, 2005) an important contributor to CO2 emissions and therefore the problem of global climate change. Thus, world tourism faces important challenges to moderate its contribution to CO2 emissions as the industry develops worldwide, with less developed countries focusing on tourism as a useful path for sustainable development (Gössling, 2005).

Tourism was found to contribute at least 7 % to national energy demand, Transport, in particular domestic air and car travel, was identified as the dominant energy consumer. Within the accommodation sun sector, hotels are the largest energy consumer, both in total and on a per visitor- night basis.

Development in international tourism and an increase in the number of international tourists not only contribute to a country's economy, but also lead to an increase in energy consumption. However, tourism development is also likely to bring about changes to the climate through different channels; for example, an increase in tourism activities comes with an increased demand for energy within various functions, such as transportation, catering, accommodation, and the management of tourist attractions (Becken and Simmons, 2002; Gössling, 2002).

Discussion on tourism and energy is not new, although research in this field had undergone considerable changes within the last few decades. Research on energy use and tourism was slowly reinitiated by increasing environmental degradation, and a resulting environmental awareness among industrialized countries. While already existent in the 1970s (Landsberg, 1974; Runyan and Wu, 1979) environmental thinking was made official with the so-called Brundtland report Our Common Future in 1987. Here, the World Commission on Environment and Development (WCED) took up the concept of sustainability already presented in the World Conservation Strategy in 1980 (Ding and Pigram, 1995).

Following the events in the late 1980s to mid- 1990s, research in the field of tourism and energy increased. Many studies directly investigated the concept of sustainable tourism (Berry and Ladkin, 1997) or sustainable tourism development (McIntyre, 1993) while others focused on the emergence of new concepts and products, such as ecotourism (Boo, 1990; Ceballos and Lascurain, 1996) or attempted to asses environmental impacts from tourism (Butler, 1993).

Nevertheless, the consumption of energy has been recognized as important source of environmental impacts, often in the form of congestion and pollution (e.g. (Stabler and Goodall, 1997)) particularly of air pollution. For example, energy consumption was identified as important factor in a study on the effect of poor air quality on tourism in Hon Kong (Cheung and Law, 2001). Energy has also been as contributor to resource depletion (similar to studies originating in the 1970s), and in this sense has often been discussed along with the use of materials and water.

Since an increase in tourism activities comes with an increased demand for energy within various functions, as mentioned before, the importance of energy for the tourism sector is undeniable. Consequently, it is expected that as the tourism sector develops, it will rely increasingly on energy. Hence, it will lead to an increase in energy consumption. However, the increased energy consumption due to tourism development may have a negative impact on the quality of the environment via climate change. It is evident that environmental degradation is likely to occur also as a result of tourism development through the construction of hotels and other tourist establishments via energy consumption (Katircioglu *et al.*, 2014).

Often neglected in sustainable tourism development studies, the air travel component of tourism has most often been analyzed with regard to climate change. A number of studies investigated tourism as a source of energy use and CO2 emissions, although only rarely has a direct reference to tourism been made.

This is also likely to lead to environmental degradation and pollution. The degradation is, for example, channeled through energy consumption. In this respect, an investigation of the relationship between tourism, the energy sector (that is, energy consumption),and CO2 emission is of immense significance to both policy makers and practitioners (Nepal, 2008).

Simultaneously, economic growth in the tourism industry has occurred along with rising tourism-related CO2 emission levels. There is along-running equilibrium relationship among tourism, energy consumption,CO2 emissions, and economic growth (Lee and Brahmasrene, 2013; Katircioglu *et al.*, 2014). Therefore, it is necessary to explore the link between the tourism economy and tourism-related CO2 emissions.

Against this backdrop, the present study employs panel co integration tests to analyze the relationships, between tourism, energy consumption, financial development and CO2 emission in Turkey and four European Union countries.

2. MODEL AND DATA

Many different factors affecting carbon emission ratios are evaluated in the literature. A wide perspective model including the effect of tourism can be defined as the following equation.

$$\ln CO2_{it} = \alpha_{0i} + \alpha_{1i} \ln energy_t + \alpha_{2i} \ln FD_t + \alpha_{3i} \ln tourist_t + \varepsilon_{it} \quad (1)$$

All the variables above are taken in logarithmic form. $\ln CO2_i$ is defined as the carbon dioxide emissions measured in kilo tons. Lnenergy is the energy consumption. lnFD defined as the financial development of the countries and Lntourist indicates the international tourism of Turkey and four European union countries (France, Spain, Italy and Greece) which are the main competitors of Turkish tourism. The data used in the study consists of annual observations from 1995-2010. Data on per capita electricity consumption is measured in kwh, Carbon emissions measured in kilo tons (kt). Financial development is defined as the broad money supply of the

countries and tourism defined as the total number of arrivals. All the data are obtained from the World Bank Development Indicators (World Bank Development Indicators, 2014).

2.1. Data Description

In this section of the study, the casual relationships between carbon dioxide emissions (CO_2), international tourism (Tourism), financial development (FD) and energy consumption (energy) in Turkey and the four European union countries which are the most competitive of Turkey with in the period 1995-2010 is analyzed using panel data analysis methods of co-integration and Granger Causality.

2.2. Methodology and Empirical Results

Panel data is used in the study in order to discuss the time dimension and the transnational comparison. Panel unit root test, panel co integration and panel causality test are made in the analysis. Panel data econometrics reveals stronger results as it discusses both time dimension and the cross section unlike the time series econometrics. In this context, fundamental equation for panel data analysis can be defined as follows:

$$Y_{it} = \alpha + X'_{it}\beta + u_{it} \quad \text{i=1,2.....,N and t=1,2,.....,T} \tag{2}$$

In the equation above; i indicate households, individuals, firms, countries etc., t indicate time dimension. The t subscript shows the cross section dimension, t subscript shows the time dimension. α is quantitative, β is Kx1 and X'_{it} is the i the explanatory variable of K variables (Baltagi, 2005).

2.2.1. Panel Unit Root Test

The first step of panel cointegration analysis is to investigate the stationary properties and to determine the order of integration of the variables. To this end, we utilize two panel unit root tests developed by Levin *et al.* (2002) and Im *et al.* (2003). The null hypothesis of the tests is that there is a unit root in the panel. However, Levin *et al.* (2002) assume that the cross-sectional units share a common unit root process meanwhile Im *et al.* (2003) assumes that the cross-sectional units have individual unit root process.

Levin *et al.* (2002) introduces the following panel model for the unit root analysis (Nazlioglu and Soytaş, 2012):

$$\Delta y_{it} = \mu_i + \rho y_{it-1} + \sum_{j=1}^{k} \alpha_j \Delta y_{it-j} + \delta_{it} + \theta_t + \varepsilon_{it} \tag{3}$$

In this equation, Δ is the first difference operator, μ_i is the unit specific fixed effects and θ_t is the time effects and, k is the lag length. For all the i, the null hypothesis $\rho=0$ is tested. If the null

hypothesis is rejected it can be concluded that there is a panel stationary process. One disadvantage of unit root test developed by Levin *et al.* (2002) is its diminishing explanatory power if the series has trend. For this reason, Im *et al.* (2003) test is also used in addition to Levin *et al.* (2002) analysis. Unit root test is defined as follows for Im *et al.* (2003) test:

$$\Delta y_{it} = \mu_i + \rho_i y_{it-1} + \sum_{j=1}^{k} \alpha_j \Delta y_{it-j} + \delta_{it} + \theta_t + \varepsilon_{it} \qquad (4)$$

Null hypothesis for the above equation is all the county series have unit root ($\rho_1 = \rho_2 = \ldots\ldots$ $\rho_i = 0$) and the alternative hypothesis is some countries in the panel data has unit root ($\rho_i < 0$ for some i). Unit root test results for the variables are shown in Table 1.

All of the variables except lnfd variables are stationary in the 5 % and 10 % critical value at the level but only lntourist variable is stationary in the 1 % critical value as a result of Levin, Lin and Chu test and Im, Pesaran and Shin test. All of the variables become stationary in the 1 % critical value when their first differences are taken. Therefore, all of the series are first-order integrated I (1). As a consequence, differenced series are used in the analysis. By using first differences data, white noise properties are avoided to a great extent.

The results do not show a uniform conclusion that the null of unit root can be rejected for the levels of the variables. However, the test statistics for the first-differences strongly reject the null hypotheses, which imply that the variables are stationary in the first-difference form. From the unit root analysis, we therefore conclude that the variables are integrated of order one, indicating a possible long-run co integrating relation among the CO_2, tourism, financial development and energy consumption.

Table-1. Panel Unit Root Test Results

Variable	LLC		IPS	
	Constant	Constant and Trend	Constant	Constant and Trend
lntourist	-3.49[0.0002]	-0.56[0.287]	-1.06[0.144]	0.76[0.7790]
lnco2	-1.68[0.0465]	3.26[0.999]	-0.66[0.253]	4.028[1.000]
lnenergy	-2.81[0.0024]	3.92[1.000]	-0.84[0.197]	4.70[1.0000]
lnfd	3.10[0.9990]	-0.73[0.231]	4.81[1.000]	0.76[0.7787]
Δlntourist	-4.67 [0.0000]	-4.35[0.000]	-3.63[0.000]	-3.20[0.0007]
Δlnco2	-5.36[0.0000]	-7.94[0.000]	-3.34[0.000]	-4.93[0.0000]
Δlnenergy	-3.61[0.0000]	-5.57[0.000]	-2.81[0.002]	-2.77[0.0027]
Δlnfd	-2.66[0.0038]	-2.53[0.005]	-2.73[0.003]	-2.77[0.0027]

Δ is the first difference operator. Numbers in brackets are p-values. Newey–Westbandwidth selection with Bartlett kernel was used for the LLC test. The maximum lag lengths were set to automatic selection and Akaike Info Criterion was used todetermine the optimal lag length.

In the following section of the study, co integration analysis will be tested in order to present the long term relationship between the variables.

2.2.2. Panel Cointegration

Cointegration analysis has an important role to measure the long term relationship between the variables and whether they move in the same direction or not. Like panel unit root tests, panel co integration tests have better results than the traditional time series analysis.

Long term relationship between the variables is tested co integration tests developed by Kao (1999) and Pedroni (1999; 2004). Pedroni developed tests to evaluate Ho hypothesis that suggest no long term relationship between the variables. Pedroni method allows heterogeneity in co integration vector and in addition allows different dynamic and constant effects for the panel sections and also different co integrated vector sections under the alternative hypothesis.

Consider the following regression:

$$y_{it} = \alpha_i + \delta_{it} + \beta_1 x_{1,it} + \beta_2 x_{2,it} + \ldots\ldots + \beta_{ki} x_{kit} + \varepsilon_{it} \ (5)$$

In equation 5, t=1,….,T; i=1,…..,N; j=1,…..,k; and x and y are first order co integrated variables. Variables α_i and δ_i are individual entity and time effects respectively which may be set to zero if desired.

Results of the analysis developed by Kao and Pedroni are presented in Table 2.

Table-2. Panel Cointegration Tests

	Constant Model		**Constant and Trend Model**	
Tests	**Statistic**	**p-value**	**Statistic**	**p-value**
Kao	-4.57697	0.0000		
Pedroni				
Within-dimension				
Panel v-Statistic	1.2822	0.0999	2.8852	0.0020
Panel rho-Statistic	0.4991	0.6911	0.7226	0.7651
Panel PP-Statistic (non-parametric)	-1.1112	0.1332	-5.7938	0.0000
Panel ADF-Statistic (parametric)	-3.0999	0.0010	-5.4253	0.0000
Between-dimension				
Group rho-Statistic	-1.7198	0.9573	1.5727	0.9421
Group PP-Statistic (nonparametric)	-3.9866	0.0000	-9.2415	0.0000
Group ADF-Statistic (parametric)	-3.2804	0.0005	-5.5539	0.0000

Maximum length are chosen automatically and optimum lag length is chosen by Akaike Information Criteris for Koa and Pedroni tests. Barnett method is used as the Kernel estimator calculating the long term consistent error variance and band width is chosen by Newey West Method.

According to Kao (1999) we reject the null hypothesis (HO: There is no co integration between the variables) and accept the co integration relationship between the variables. Pedroni test analysis 4 result for in-section [Panel v statistics, Panel p statistics, Panel PP-Statistic (non-parametric) and Panel ADF-Statistic (parametric)] and 3 results for inter-sections [Group rho-Statistic, Group PP-Statistic (nonparametric) and Group ADF-Statistic (parametric)]. When we look at the Pedroni cumulative test statistic result, a co integration relationship is supported in the 5

results including test with constant and test with trend. No co integration is supported in the 2 results. In this direction, both Kao and Pedroni test statistics support a co integration results between the variables. When we look at the panel co integration analysis, a long run relationship reveals for the variables. When there is a co integration relationship, Panel Vector Error Correction Model should be estimated instead of Panel VAR model (Agir *et al.*, 2011). After detecting the co integrated relationship, panel co integration parameters should be estimated next. For this purpose, panel fully modified ordering least squares (FMOLS) or panel dynamic ordering least squares (DOLS) can be used. Pedroni (2000) compared the asymptotic properties of various panel co integration estimation methods by pooling along "within" and "between" dimensions of the panel and showed that the between dimension panel FMOLS estimator behaves well even in relatively small samples. We therefore estimate the panel co integration parameters with panel FMOLS estimator developed by Pedroni.

Table-3. Results for panel FMOLS estimation

| | Panel FMOLS | | | | | | | |
| | Constant | | lnenergy | | lnfd | | lntourist | |
Countries	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Turkey	0,303055	1.023801	1.066750	24.48433	-0.026486	-1.964840	0.004705	0.328150
France	11,94465	9.013652	0.777350	6.081523	-0.161469	-3.564251	-0.442716	-5.988893
Spain	-2,746115	-1.338128	1.467643	3.665157	-0.163027	-3.284957	-0.060375	-0.159652
Italy	2,746309	2.586901	1.045490	13.67421	-0.157348	-5.334036	-0.091901	-1.497384
Greece	2,894646	14.98538	0.795004	15.50978	-0.140333	-9.523459	0.063655	1.973770
Panel	3,02851	5,71752	1,03045	28,3601	-0,129733	-10,58624	-0,1181	-3,2726103

Source: Created by Author

After having found a general co integration equation the FMOLS is used. Results for the panel FMOLS estimation of the CO_2 emissions are presented in Table 3.

Table-4. Results for Panel Granger Causality

| | Short-run causality | | | | | Long-run causality |
	Δ (lnCO2)	Δ (lnenergy)	Δ (lnfd)	Δ (lntourist)		Ect(-1)
Δ (lnCO2)		0,319 [0,9564]	28,72 [0,000]	24,29 [0.000]		-2,102 [-7,341]
Δ (lnenergy)	1,229 [0.7459]		27,23 [0.000]	25,84 [0.000]		-1,089 [-4,4160]
Δ (lnfd)	4,85 [0.1826]	2.86 [0.4131]		8,64 [0.034]		0,957 [1,4017]
Δ (lntourist)	0,355 [0,9492]	0.656 [0,8834]	22,031 [0,0001]			-1,116 [-1,3558]

The optimal lag length was selected using the Schwarz information criteria. Figures in brackets are p-values.

FMOLS results are clearly shows that 1 percentage increase in energy consumption will increase CO_2 emission by 3.02851 % and 1 percentage increase in the financial development will decrease CO_2 emission by 0.129733 % and also 1 percentage increase in tourist arrival will decrease CO_2 emission by 0.1181 %.

Granger Causality test should be based on a Vector Error Correction Model as cointegration is found. Table 4 above shows the Granger causality test results and clearly shows a short run and long run casual relationship between CO_2 emission energy consumption, financial development and tourist arrival. The short run causality analysis shows uni-directional causal relationship between the tourist arrivals, financial development. And also there is a bi-directional causality relationship between the CO_2 emission, financial development, and energy and tourist arrival. The figure 1 below indicates a short run relationship between the variables;
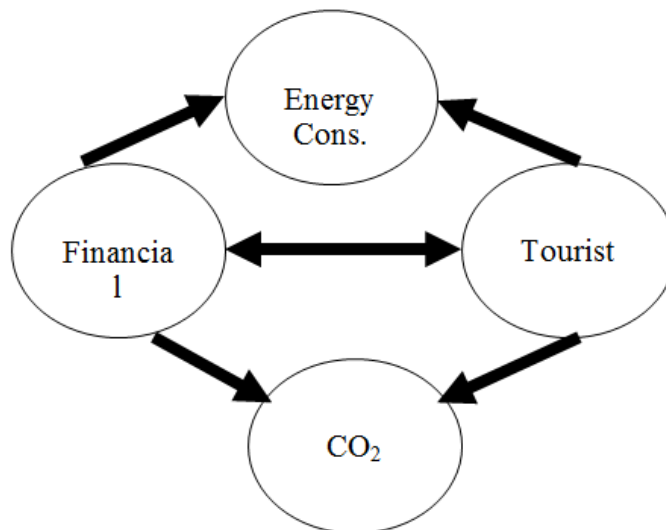

Figure-1. Short Run Causality Analysis

Source: Created by Author

When we look at Figure 1, we can see an interrelationship between financial development and tourist arrival. A one-sided relationship is detected from financial development to energy consumption and to CO_2 levels. Financial development affects energy consumption and CO_2 levels. Tourist variable also affects CO_2 and energy consumption. There is no long run relationship between the variables in the long run.

3. CONCLUDING REMARKS

The relationship between Carbon emissions and other variables has long remained an important issue of debate in the literature. But there is a little study that investigates the relationship between Carbon Emissions and Tourism. Because of this we put tourist arrivals and financial

development for this study. In this paper, empirical results obtained from panel cointegration and panel causality tests for the period 1995-2010 between Turkey and France, Spain, Italy and Greece which are the most competitors of Turkish tourism. Results show that, there is a mutual causality between financial development and tourist arrival. A one-sided relationship is detected from financial development to energy consumption and to CO_2 levels. Tourist variable also affects CO_2 and energy consumption. There is no long run relationship between the variables.

As a result, tourism that is considered a smokeless industry as a factor of economic development, affects financial development and carbon emission levels in the short run and causes air pollution for the countries in all the periods.

Finally, due to limited data availability, Turkey ranks sixth in terms of attracting international tourists, there are precautions in the form of successful energy conservation policies that the Turkish authorities should take in order to avoid further increases in the emission levels resulting from tourism development.

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